University of Southern California

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The USC McNair Undergraduate Scholars Research Journal

Volume V: Fall 2009

THE RONALD E. MCNAIR
POST-BACCALAUREATE ACHIEVEMENT PROGRAM

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THE RONALD E. MCNAIR POST-BACCALAUREATE ACHIEVEMENT PROGRAM

VOLUME V FALL 2009

Manuscripts are accepted from McNair Scholars participating in the program at the University of Southern California, Los Angeles, California 90089, (213) 740-8702.

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While the McNair Program editors have made every effort to assure a high degree of accuracy, rigor and quality in the content of this journal, the interpretations and conclusions found within each essay are those of the author's alone and not the McNair Program. Any errors or omissions are strictly the responsibility of each author. Also, please note that the works represented in the journal are from undergraduates learning to conduct and write about research.

A MESSAGE FROM THE USC MCNAIR SCHOLARS PROGRAM

The Ronald E. McNair Post-Baccalaureate Achievement Program is a federally funded initiative that provides research and graduate preparation opportunities to a select group of first-generation college students, populations from low-income backgrounds, and ethnic minorities underrepresented in higher education. A primary objective of the McNair Program is to provide academically talented students from these backgrounds effective preparation for research experiences and graduate study, particularly for doctoral-level studies. The ultimate goal of the program is to diversify the graduate-level student body and the professoriate through placement of McNair alumni in faculty positions. Currently, McNair programs exist at over 200 colleges and universities nationwide.

Annually, the USC McNair Program receives a record number of applications from a highly competitive pool of faculty-nominated USC undergraduates representing an astoundingly diverse cross-section of majors, graduate school plans, and research interests. Applications are reviewed by a committee comprised of faculty, deans, provosts, staff and students. The program selects between 20 and 26 students annually. Throughout the Spring Semester, the new McNair Scholars begin preparing for graduate school, receive research training and instruction on developing research proposals, and acquire professional development. The Spring program prepares students for the intense Summer Research Institute (SRI), where students implement their research projects under the guidance of faculty mentors, refine their writing and professional skill sets, and continue preparing for graduate school. Scholars present their scholarship orally at a university-sponsored symposium attended by faculty, other students, and staff. Students also receive competitive scholarships and grants. A select group presents their research at national-level conferences. The USC Office of Undergraduate Programs administers the program with funding from a grant awarded by the U.S. Department of Education, Office of Postsecondary Education

USC has been a proud member of the McNair community since 1996, having served more than 260 students to date. More than 140 have gone on to post-baccalaureate study. Sixty-five have earned master's or other professional degrees, and to date 15 have earned the Ph.D. or professional doctorate. Sixty-four McNair alumni are currently pursuing post-baccalaureate studies, with 19 alumni currently enrolled in Ph.D. programs. Many of the degrees earned and programs McNair scholars pursue include the nation's most selective institutions.

This fourth edition of the McNair Undergraduate Research Journal, "Citations," showcases the accomplishments of scholars from the 2007-2008 USC McNair Scholars cohort and reflects work from a variety of academic disciplines. These Scholars have taken on very challenging topics and employed a variety of research methodologies. In the process of conducting research and publishing findings, these Scholars have formed valuable relationships with faculty and advanced graduate student mentors.

Join the USC McNair Staff in congratulating the Scholars on their outstanding undergraduate achievements, research pursuits, and graduate school preparation. We extend our best wishes to this cohort of Scholars as they seek the full membership they have worked hard for and deserve in the academic community and professional sectors.

FIGHT ON!

The USC McNair Staff

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The Jerk 'Movement': Aesthetics and Identity in an Emergent Youth Dance Form

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Arthur Argomaniz

Sociology & American Studies & Ethnicity
Mentor: Leland Saito, Ph.D.
Department: Sociology & American Studies & Ethnicity

Right to the City: LA Live, Elegant Density, and Figueroa Corridor

More than $8 billion is currently invested into the development of Downtown Los Angeles. LA Live is a 2.5 billion dollar project just south of Downtown with a 54 story hotel/luxury residence, as well as high end retail and live entertainment. The key objective of LA Live is to attract business for its struggling neighbor, the LA Convention Center. This study addresses the current trend of elegant density and the re-urbanization of Downtown and the Figueroa Corridor (spanning LA Live on the north and USC on the south). As an alternative to Harvey Molotch's growth machine, the *development industrial complex* will be proposed as a framework to explore the psychological complex of those who see growth, more specifically gentrification, as a tool to revive blighted communities and make Downtown a place where people can "Live Work Play" (a major advertising pitch currently throughout Los Angeles). It also places it in the context of other industrial complexes (i.e. military, prison, healthcare…), in which the privatization and deregulation of industry allows corporations to gain more control. Is gentrification in LA causing the mass displacement of working class minority communities living in the area and if so, why? SAJE, a progressive nonprofit advocacy organization in LA, is waging various campaigns throughout the Figueroa Corridor to fight displacement and to support tenants. One strategy is the use of Community Benefits Agreements, which have helped some major projects in the area gain community support by allowing grassroots organizations and labor unions to collectively sit down with developers to negotiate a package of benefits meant to counteract some of the detrimental effects felt by local residents. SAJE is mounting a new campaign, United Neighbors in Defense Against Displacement or UNIDAD, to prepare for the wave of gentrification that is being unleashed on the Figueroa Corridor.

Shamell Bell

Major: American Studies & Ethnicity
Faculty Advisors: Lanita Jacobs-Huey, Ph.D., Robin Kelley, Ph.D., and Shana Redmond, Ph.D

The Jerk 'Movement': Aesthetics and Identity in an Emergent Youth Dance Form

This project explores, Jerkin', a street dance form that has grown from modest beginnings by inner-city Black youth in Los Angeles, California, to an international cultural phenomenon. I argue that inner-city youth use Jerkin' as a tool to not only perfect their craft, but as a way to contest and mobilize against the negative forces in their community such as gangs and the dominating perceptions of Hip-Hop style and Black masculinity. The theoretical framework of this study borrows from George Lipsitz's theorization of the Gramscian concept of organic intellectuals and exemplifies a term I refer to as corporeal education. Jerks use new media platforms such as You Tube to connect youth in their community and across the world, transforming "blighted" urban spaces, into dance arenas and podiums for social commentary. Through a yearlong ethnographic fieldwork study composed of direct immersion in the Jerkin' community, this research provides critical insight into a phenomenon that may otherwise be overlooked. This study poses the following questions: How do Jerks use style and fashion to differentiate themselves from other forms of dance such as Break Dancing? In what ways do Jerks articulate their organic intellectual analysis? What lessons can be drawn from their formation of Jerk crews and the Battle Circle? Findings from this research reveal how Black youth look for outlets in order to express their artistic talents, display rich cultural traditions, form bonds with peers, release frustrations and combat other stressors, and establish small communities of support. Study results make it clear that beyond representing one of the latest dance forms among today's youth that is hip and appealing, the Jerk 'Movement,' when studied analytically provides important contributions to existing scholarship related to Black youth and Culture and Ethnic Studies.

Apollo Emeka

Anthropology
Mentor: Lanita Jacobs-Huey, Ph.D.
Department: Anthropology & American Studies & Ethnicity

The Dawn of Integration and the Foundation for a Color-Blind Perspective Among Blacks

Civil rights action in the 1960's fostered an environment for robust discussions on race. The resulting legislation sought to promote equality, and end segregation in schools and other public places. As discriminatory language was purged from mainstream U.S. policies and popular discourse, discussion of racial difference gave way to "color-blind" ideologies. This study examines how the effects of integration and early "color-blind" ideologies affect the success and racial perspectives of Blacks raised in integrated environments. The data was collected through the 1982 General Social Survey measuring demographic and attitudinal variables. Four hundred seventy Black respondents were identified as eligible. This sample was bifurcated into two groups, those who attended predominantly White high schools and those who attended predominantly Black high schools. Quantitative methods were employed in order to identify any possible difference in racial attitudes and economic success levels depending on the racial composition of the high school the respondent attended. This study found that Blacks who went to predominantly White high schools displayed color-blind attributes to a greater extent than the respondents who attended predominantly Black high schools. Blacks who went to predominantly White high schools were also more economically successful and less worried about the security of their job. This study illustrates that while integration efforts can be helpful for those who receive direct benefit, they may also take away a minority's ability to talk about racial afflictions and maintain racial inequality under the guise of progressive thought.

Thaimi Fina

Psychology & French
Mentor: Stephen Madigan, Ph.D.
Department: Psychology

Some Wounds Never Heal: A Gender-Specific Analysis of Bullying Effects

Bullying is a serious form of harassment that negatively affects victims long after the incident occurs. Victims can suffer from a lifetime of loneliness, depression, and low self-esteem (Olweus, 1978). This study aims to provide a deeper understanding of bullying effects by integrating a gender-specific analysis. This study investigated what type of bullying (direct physical, direct verbal, or indirect) was most detrimental to the self-esteem and depression levels of male and female victims. An online survey was disseminated to adults, aged 18 to 25. Participants were asked to reflect on a bullying incident that occurred in middle school (grades 6 through 8). Reflection prompts were used to elicit incident-specific emotional responses. Scores on the Positive and Negative Affect Scale (PANAS), the Rosenberg Self-Esteem Scale, and the Beck Depression Inventory-II were correlated with detailed questions regarding a specific bullying incident. Results indicated that bullying conditions were not significantly correlated with self-esteem and depression. In contrast, negative affect was significantly correlated with self-esteem and depression ($p < .01$). High depression scores were strangely correlated with high self-esteem scores ($p < .01$). These abnormal results were labeled a product of defensive self-esteem. These findings may contribute to the development of more effective, empirically-based anti-bullying programs.

Stefanie Gopaul

Health Promotions & Disease Prevention
Mentors: Jean Richardson, Ph.D., & Jennifer Zogg, Ph.D.
Department: Keck School of Medicine

HIV Vaccine Preparedness: A Qualitative Analysis of Motivations and Barriers for Invitation into Vaccine Studies in Order to Facilitate Effective Use of the Social Network Model in HIV Vaccine Trial Recruitment

Recruiting participants that engage in high-risk behaviors is essential to both implementing HIV vaccine trials and assessing the effectiveness of potential vaccines. Although recruitment is successful for certain high-risk groups, other groups such as adolescents, remain highly underrepresented in vaccine trials due to difficulties in recruitment. Previous recruitment strategies, although successful, have significant limitations. Recent findings confirm use of the social network model as a feasible method to develop and recruit adolescents and adult women for vaccine trials. Subjects for this study were enrolled between October 2004 and June 2006. Initial participants (labeled as indexes) were patients recruited from the Maternal, Child, and Adolescent/Adult Center for Infectious Diseases and Virology at the Los Angeles County + University of Southern California Medical Center (MCA). Later participants included the social network members (labeled first-degree alters) that were invited to join via the indexes. One hundred and twenty one indexes and alters participated in the study. Using data collected from open-ended questions, we identified altruistic motivations, a desire to share HIV/AIDS or vaccine knowledge, and other such factors that encouraged participants' willingness to invite network members to participate in an HIV vaccine trial. We also identified concerns regarding unanticipated side effects of a vaccine, receiving negative reactions from network members and other significant barriers that can deter willingness to invite network members. Because willingness to invite determines efficacy of the social network approach in trial recruitment, identifying motivational factors for encouragement can reveal more effective ways to utilize the social network model. Identifying and mitigating barriers that limit willingness to invite can also ensure effective use of the social network method.

Nicole Grant

Psychology
Mentor: Thomas Lyon, J.D., Ph.D.
Departments: School of Law & Psychology

Are We There Yet?: Preschool Children's Understanding of Approximation Using the Word "Almost"

Language acquisition becomes more refined with age, but no research to date addresses children's ability to approximate (i.e. how children use language to distinguish between multiple items which differ in degrees of similarity and differences) or at what age this cognitive ability surfaces. This study investigates children's ability to approximate using the word "almost." Research participants were shown a target image and asked to identify which of three images was "almost the same" and "really different" from the target. Six categories were utilized in this study: number, size, color, location, schematic facial appearance, and realistic facial appearance. The results indicate that the ability to approximate similar and different items is strongly correlated with age. Overall, younger children seem to have an understanding of "same" and "different." However, when it comes to the concept of "almost the same" and "really different", the younger children are simply performing at chance. This sill begins to emerge at age 5 as children demonstrate with relative accuracy their ability to use the word "almost." The findings shed light on children's language development, including verbal capacity and comprehension concerning approximations during the preoperational stage. Furthermore, the findings have implications for forensic interviews involving child witnesses. Lawyers and interviewers may now construct questions that are better suited for the child's cognitive capacity, thus eliminating confusion and frustration for the child witness and legal system alike.

Whitney Griffin

Critical Studies & Cinema
Mentor: Ellen Seiter, Ph.D.
Department: School of Cinematic Arts

The People's Champion: Positioning the Multiracial Actor in the Action Genre

Film stars embody contemporary ideals of racial, ethnic and gender identity. The star image of multiracial actor Dwayne Johnson and his performances in Hollywood action films, demonstrates Hollywood's attempt to reach the growing demographic of mixed race youth in the United States; forty-two percent of youth in the 2000 Census identified with two or more races. Johnson's star image represents the versatility of multiracial actors who exhibit some of the traits of the stereotypical African-American male, a hyper-masculine, physically dominant image that could be threatening to hegemonic culture but tempered by a more humorous presentation of character, and less rigid gender definition. All of these traits are exemplified in the action genre. This study utilizes data from interviews, published biographies, director's commentary, and other media surrounding Dwayne Johnson's success, to analyze how racial identity is negotiated publically and on-screen.

Aissa Llontop

Psychology
Mentor: Anne McKnight, Ph.D.
Department: East Asian Languages & Cultures

From the Bronx to Tokyo: Hip-Hop Dance Connecting Japanese Youth

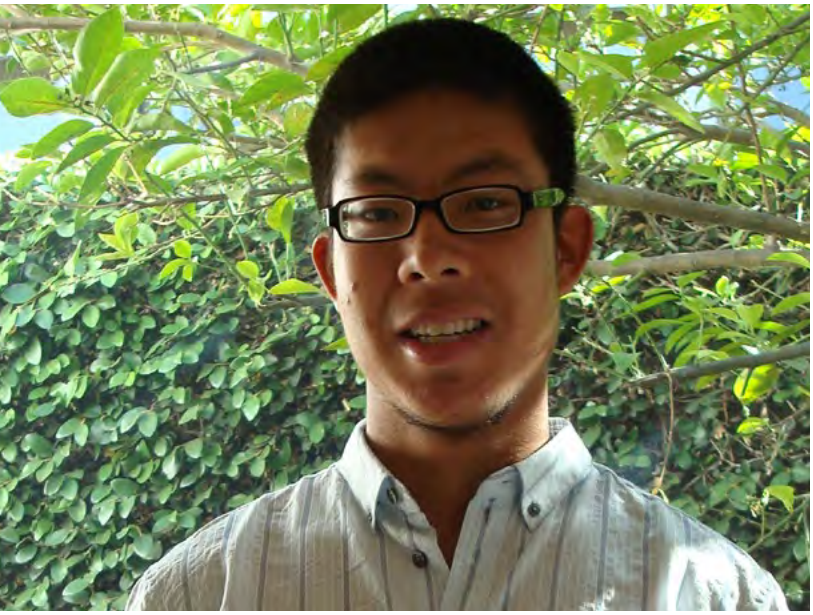
Hip-Hop culture originated in the Bronx during a period when jobs and social programs were scarce and poverty was widespread. Breakdancing, Hip-Hop's physical art form, allowed for individual expression and community narratives. This study explored breakdancing's global appeal by investigating native-born Japanese dancers and their relationship with Hip-Hop. Academic scholars have reinforced Hip-Hop as an African American art form and argue that Hip-Hop's cultural appropriation has directed youth to portray stereotypical images of Black culture. Ten native-born Japanese Hip-Hop dancers were interviewed from Debbie Reynolds Studio during a one-to-one, forty-five to ninety minute, session. A translator was present to facilitate communication. Participants were asked to reflect on their personal history with Hip-Hop culture and what drove their participation in Hip-Hop dance. Results indicated that the dancer's initial interest in Hip-Hop started with their fascination in the culture's stylish fashion and then grew into a deeper understanding and appreciation of Hip-Hop music, dance, expression and culture. The findings imply that through the dance community, Hip-Hop fosters multi-racial social networks, cross-cultural communication, and cultural understanding.

Ray Martin

History
Mentor: Peter Mancall, Ph.D.
Department: History & Anthropology

Tolowa History 1983 to Now

There has already been one published history of the Tolowa nation. However, like many histories written about the first peoples of the United States, *Understanding Tolowa Histories* by James Collins is written by a non-member. Though it is great that some effort has been taken to study the Tolowa and their unique history, Collin's study lacks the perspective of a member of the Tolowa nation. This study focuses on the Tolowa's struggle to adapt to the federal government's new policy of self determination and to preserve its cultural identity and ensure its survival. Highlighted in the study are three events occurring in the 1980s which led to the Tolowa's current situation. It explores the impact that these three events had on the Tolowa people, and the effect that these three events will continue to have if the Tolowa nation continues down its present course. Implications for the future of the Tolowa people are discussed and the first look at Tolowa history through the lens of a tribal member is offered.



Brian Nguyen

Biological Sciences & Kinesiology
Mentor: Jill McNitt-Gray, Ph.D.
Department: Kinesiology

Satisfying the Laws of Motion by Analyzing Human Movement Dynamics: A Kinematic Comparison Between Segmental Analysis and the Force Platform Method

Human movement dynamics are governed by Newton's laws of motion, which form the basis for classical mechanics. The purpose of this study is to determine if kinematic and kinetic data acquired during segmental and force data analyses satisfy the laws of motion. The horizontal velocity of the center of mass at force plate contact was computed and compared using segment kinematics and force based methods. Segmental analysis has been the primary kinematic method for this study in the field of biomechanics. However, when forces acting on the system can be measured using a force plate, the center of mass trajectory using measured ground reaction forces can be computed using the relationship between the net impulse and the change of momentum. In theory, the kinematic and kinetic based measures of the center of mass velocity at an instant are hypothesized to be equal. To test this hypothesis 9 female participants (ages 18-23) volunteered to participate. Each participant performed a three-step blocking motion along a volleyball net as quickly as possible. A pair of force plates measured the force generated by each foot during contact as the subjects converted their horizontal momentum to vertical momentum during the task. This showed that with the resulting digitization of the subjects in which the total body center of mass (TBCM) was calculated, the horizontal velocity at jump take off varied among participants and between methodologies. Since the results do not comply with the Newtonian laws of motion, the experiment requires further investigation. In research that investigates human movement, these laws must always be satisfied during the initial step. The comparison between the two processes enables one to verify at the beginning of the study that the kinematic and kinetic data used to characterize human motion fulfills the laws of motion.

Natali Nunez

Health Promotion & Disease Prevention
Mentor: Charisse L'Pree Corsbie-Massay, Ph.D. Candidate
Department: Psychology

The Efficacy of Dental Sealants - A Meta-Analysis

Considering the existing disparities in cavity experience and access to oral healthcare among people of different races and income levels, the efficacy of potential preventative care treatments must be evaluated. A meta-analysis was conducted using the data from seven studies to determine the efficacy of dental sealants. All the studies employed a half-mouth design, applied sealants to first permanent molars, and ranged between 1 to 4 follow up years. Data was summarized using the Mantel-Haenszel method and odds of decay, odds ratio, and the correlations with the follow up year were calculated. Sealants were found to be 81.43% effective. Odds of experimental and control teeth developing decay were correlated with the follow up year. A homogeneity test revealed that the studies are heterogeneous and this can be attributed to the method of polymerization. Sealants polymerized by ultra-violet light showed less efficiency than self-polymerizing sealants. This study concluded that sealants should be utilized. However, further research is required to assess factors influencing sealants including isolation method and level of fluoride exposure. Additional studies may analyze the influence of socioeconomic status and cultural competency of the health care provider when applying the sealants as possible factors affecting the heterogeneous nature of sealant efficacy.

Abisola Oseni

Psychology
Mentor: Stanley Huey, Ph.D.
Departments: Psychology &
American Studies & Ethnicity

Differences in Perceptions Regarding Parent Child Interaction

There is extensive research that addresses the effects of parental behavior on children. However, the role of the child's perception regarding the parent-child interaction has received limited attention. This research investigates the discrepancy between parent and child reports of parental behavior and the effects of parents' positive expectations, commitment to education, creation of a supportive environment, modeling of positive behavior, self-care, and persistence on their child's behavior and academic attainment. The participants included 17 African American parent-child pairs selected from the Los Angeles area; participants reported the parents' adoption of the six principles of the Successful African American Parenting Questionnaire (SAAPQ) as well as other measures of child behavior issues. A difference score was calculated by subtracting the parents' rating of their behavior from the child's rating. Analyses were then conducted on the difference score to determine its relationship with the child's academics and behavior. Various levels of discrepancy were found between the parents' reporting and their children's reporting of the parental commitment to education. The greater the discrepancy between parent and child, the higher the child's aggressive or delinquent behavior. The study also found that a supportive environment fostered by parents, and parent and child congruent perspectives, resulted in lower levels of the child's aggression and delinquent behaviors. Findings emphasize the importance of the discrepancy between parent-child perceptions, and this has implications for fostering effective interventions for families with youth suffering from behavioral or academic difficulties.

Jose Rios

Psychology
Mentor: Miranda Barone, Ph.D.
Department: Psychology

Beyond Teacher Expectations: The Role High School Curriculum Plays in Regards to Different Academic Performances

Using the stereotype threat model (Steele, 1997; Steele et al., 2002), this pilot study investigated the phenomenon of fundamental schooling in Santa Ana California since its emergence in 2005. The author hypothesized that there is an association between lower college expectations among traditional versus fundamental high school students due to different teacher expectations and school curriculum. Using self-efficacy, self-esteem, and life orientation surveys the analysis found that on average, traditional high school students have lower college expectations and lower self-efficacy/self-esteem beliefs compared to fundamental high school students. Teacher interviews at both school types also found that fundamental high school teachers have greater student expectations in regards to career development and college pursuit. Deeper evaluation of the findings suggests that the difference in school curriculums, mission statements, and teacher expectations might be the cause for this educational inequality. Due to these differences, there are negative stereotypical views among the two types of students. The implications of this study suggest a re-evaluation of the educational policy in Santa Ana in regards to giving the entire community of students an equal chance to pursue higher education.

Benjamin Rodriguez

Theatre & Classics
Mentor: David Roman, Ph.D.
Departments: English & American Studies & Ethnicity

Theatre and the City: How Los Angeles affects its contemporary stage

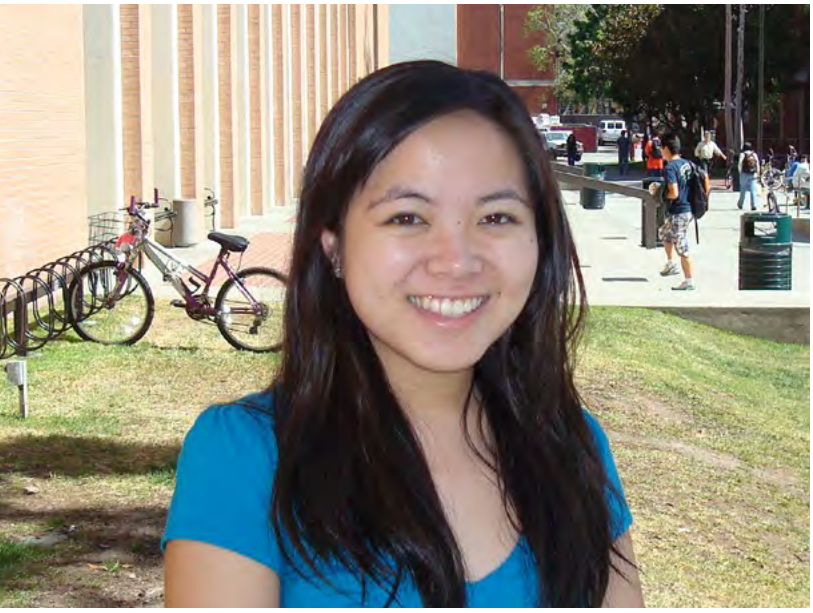
Though theatre has been present throughout the U.S. for centuries, Broadway in New York has been the championing theatre district. But over the past 40 years, that has undoubtedly changed as American Theatre culture has shifted beyond the popular musicals to a nationwide dispersal of theatre. Los Angeles theatre culture has yet to be defined and detailed; the city's large landscape and demographics make for a decentralized, geographically dispersed theatre culture lacking a shopping district for its patrons. This study explores how components of the city of Los Angeles, known as the Hollywood film town, affect its contemporary live theatre culture. By viewing five theatre productions from five different regions of Los Angeles and analyzing the productions' story and plot lines, cast diversity, as well as several other key components, a better understanding of how the contemporary stage functions within the city was acquired. Interviews with directors and playwrights also served to define the contemporary theatre culture and to determine similarities throughout Los Angeles theatre. Results showed that the success rate of a venue can be correlated to demographic marketing of audiences native to the region. The results of this study may identify tactics to strengthen theatre in American society as well as improve communication and marketing strategies between productions and the population of Los Angeles.

Mychael Solis-Wheeler

Theatre & Musical Studies
Mentor: Larry Gross, Ph.D.
Department: Communication

Turning a New Leaf: A Pilot Study of Sexual Minorities within the Armed Forces of U.S. and Canada

Why can sexual minorities who are gay, lesbian, and bisexual not serve openly within U.S. Armed Forces? Canada already allows sexual minorities to serve within their armed forces but the U.S. has not been so immediate in allowing open integration. Rather, steps towards the equality of sexual minorities have been gradual. Now is the most relevant time for the U.S. Armed Forces to openly integrate sexual minorities. In the U.S. military, discrimination is still being exercised by denying sexual minorities the opportunity to serve openly. This pilot study was based on sexual minorities that self-identify as gay, lesbian, and bi-sexual within the Armed Forces of U.S. and Canada. I wanted to examine the experiences of sexual minorities during their military service in order to better understand their lives in the U.S. Armed Forces, despite the "Don't Ask, Don't Tell" policy. My methods were qualitative based; I gathered data through anonymous interviews of retired, reserve, and active U.S. service members. In this study, I did not succeed in locating Canadian service members. However, the experiences recounted by U.S. respondents were very informative as to the way they live and work within the U.S. Armed Forces. They demonstrated how important it is for the U.S. to abandon the "Don't Ask, Don't Tell" policy and to adopt non-discriminatory policies on sexual orientation like those in Canada and other countries such as Australia, Israel, and the UK. This study would greatly benefit the U.S. and its citizens in further considering a better system for the military to openly integrate sexual minorities in the near future.



Lisa Tran

Health Promotions & Disease Prevention
Mentors: Olga Solomon, Ph.D.
Departments: Occupational Sciences & Occupational Therapy

Sensory Integration and Autism: A Cross-over Analysis between the Clinical Research and Autobiographical Accounts

Problems in sensory integration and processing have been seen in many children with autism, and have been corroborated in clinical research studies (Rogers & Ozonoff, 2005; Blanche, Roley, & Schaff, 2001). Furthermore, sensory integration problems have been described in first-person accounts by highly accomplished individuals with autism (Grandin, 1986, 1995; Williams, 1992; Prince-Hughes, 2004). This study critically analyzes how clinical research matches against autobiographical accounts of autism, examining comparisons and contrasts between the two. For this cross-over analysis, a review of the literature was conducted that investigated sensory integration and processing issues in autism. In addition, two autobiographical accounts, *Emergence: Labeled Autistic* and *Thinking in Pictures* by Temple Grandin, a high-functioning person with autism, were critically reviewed and evaluated for sensory integration and processing issues. By analyzing both the clinical research and autobiographical accounts, a better understanding of the conceptualization of sensory experiences in autism was established. Seeing sensory integration problems from the eyes of an individual with autism provided an empirical view that was lacking from clinical research. This cross-over analysis study emphasizes the importance for researchers in this field to look at both clinical research and autobiographical accounts to gain a better conceptualization of sensory processing issues that are characteristic of autism.

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Is TOD D.O.A? A Demographic Analysis Examining 2000 – 2008 Los Angeles Transit Oriented Development (TOD)

The triple threat of California's housing crisis, global climate change, and urban poverty has spurred hundreds of millions of dollars of investments into Transit Oriented Developments (TOD) in Los Angeles. As an application of Smart Growth planning, TOD is considered an alternative form of urban development that may counteract this triple threat. Despite these large investments, however, current TOD literature has provided limited attention both on disaggregated demographic patterns and on the issue of equity, particularly how the impacts of TOD have affected some populations more than others. This limited attention is reflected in the lack of discussion not only about race and class, but also about inner-city TODs, such as the Red and Blue line. This limited attention is especially significant because of Los Angeles' racist history of sprawl, particularly with sprawl's relationship to urban poverty. If equity is not considered, TOD may mirror historical patterns of development that simply recreate racialized poverty within Los Angeles. By realizing the significance of equity, this study seeks a holistically disaggregated approach to demographic analysis around TOD stations. By individually analyzing a half mile "sphere of influence" around 35 rail transit stations along the Red and Blue Lines, this study surveys disaggregated demographic patterns from 2000 to 2008 around specific population characteristics—specifically race, income, and occupation. The analysis involves a comparison among the Red and Blue lines and Los Angeles City by analyzing median percentages and percent changes and identifying significant outliers. The analysis finds demographic patterns that exhibit warning signs, specifically around significant decreases in minority populations and low-income communities, which may be of relevance to policy-makers and local communities. Based on the results of this study, future directions include in-depth case studies of selected outliers, policy discourse, process analysis, and methodological improvements. This study will thus be important for community-based organizations, neighborhoods, local government, developers, educators and transit agencies perhaps to create more balanced, equitable TOD.

READING KOREATOWN COFFEEHOUSES: HYBRIDITY AND HETEROGENEITY IN A KOREAN AMERICAN CULTURAL SPACE

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The concept of assimilation is significant in the discussion of immigration in the United States. Ethnic neighborhoods, specifically insular enclaves, have been described as detrimental to the full assimilation of immigrant groups into American culture (Portes and Manning, 1986). The literature on ethnic entrepreneurship, however, has generally focused on the economic causes and effects of the creation of ethnic enclaves and middleman minority businesses rather than on cultural aspects. This study examines Los Angeles' Koreatown as a space in which Korean American culture is produced and performed and questions the relevance of assimilation theories in this space. Research was conducted through participant observation at four coffeehouses in Koreatown, combined with customer reviews collected from the Internet. The analysis of these observations is based on theories of immigrant assimilation and acculturation (suggesting movement between homogenous and absolute cultures) as well as critiques of these theories based on concepts of cultural hybridity and colonization of consciousness. The results show that these coffeehouses, while primarily ethnically insular in terms of customer and worker populations, exhibit many cultural influences from American and European traditions. The hybridity and heterogeneity observed at these coffeehouses is used to challenge the characterization of "Korean" and "American" cultures suggested by theories of immigrant assimilation. Implications and areas for future research are discussed.

INTRODUCTION

On the February 11, 2004 episode of Lou Dobbs Tonight, one of the topics of discussion was assimilation (Philips et al., 2004). Specifically, Dobbs posed the question of whether the United States was "doing enough" to "assimilate culturally distinct immigrants into our society." He debated with colleagues John Fonte and Tamar Jacoby about the success of assimilation for the growing Latino American population. In their discussion, they cited self-identification as an "American" and use of English as markers of successful immigration. Dobbs described Spanish language media in the United States and the presence of Chinese and Korean languages on the streets of New York as signs of failed assimilation. Both Fonte and Jacoby observed that "learning English is not enough." Dobbs then brought up the banning of headscarves in France as an act "fully directed at the unassimilated population Muslim population" in that country. Again, he asked, "Are we doing enough?"

The Korean language described by Dobbs is found not only in New York City but also in Los Angeles' Koreatown. In fact, about 15% of the approximately 1.4 million Korean Americans live in Los Angeles County (U.S. Bureau of the Census 2000; U.S. Bureau of the Census 2005). As the immigrant population of the United States reaches record highs (37.9 million in 2007) (Camarota, 2007), the issue of assimilation, especially as it occurs in ethnic neighborhoods like Koreatown, becomes more significant. Dobbs and other proponents of immigrant assimilation seem to envision a homogeneous American culture and an equally homogeneous yet foreign Korean (or Chinese or Mexican) culture. They see the survival of such foreign cultures within the United States as a threat to American cultural homogeneity. Furthermore, citizenship and language, while important, are not seen as enough to define an individual as an "American."

In my observations of Koreatown, I sought to understand what "American culture" and "Korean culture" meant to these Korean Americans. Do they perceive a struggle to overcome their "Korean-ness" in order to become more American? Alternatively, do they seek to preserve Korean culture despite relocation to a new nation? Observation and analysis showed that neither of these questions truly addressed the realities and complexities of the Korean American experience. This experience was more accurately understood through a vision of Korean and American culture that recognized the hybridity and heterogeneity of both.

REVIEW OF LITERATURE

ETHNIC ENTREPRENEURSHIP:

Ivan Light was one of the first scholars to study Korean American entrepreneurship in Los Angeles, and articulated many influential theories in ethnic entrepreneurship research. Light and Karageorgis (1994) helped develop the ethnic economy concept, in which employers and employees of a group of businesses come from the same ethnic group. This kind of coethnic labor force was seen as economically beneficial for immigrants who would otherwise struggle in the mainstream economy. The ethnic economy concept can encompass any business owned by a minority ethnic group, but the diversity of such businesses led to two models of ethnic economy: one of the middleman minority and one of the ethnic enclave.

In the middleman minority concept, a minority ethnic group engages in a high rate of entrepreneurship in which they facilitate trade "between a society's elite and the masses" (Zhou, 2004, p. 1041). This model clearly has relevance in the history of Los Angeles, where Korean immigrants opened their businesses in traditionally black neighborhoods, thus "bridging big corporations and minority customers" (Min and Bozorgmehr, 2000, p. 726). The middleman minority role is economically viable because establishing businesses in poorer urban areas allows immigrant entrepreneurs to fill a niche in the market that is abandoned by the mainstream (Bonacich, 1988) and find economic success despite language or cultural barriers. The middleman role also creates opportunities of entrepreneurship to those who lack the capital to open businesses in more affluent areas (Min and Bozorgmehr, 2000, p. 726). The concept of the Korean American entrepreneur as a middleman minority suggests that relationships between Korean Americans proprietors and non-coethnic customers are highly significant in the daily workings of the businesses.

The other model of ethnic entrepreneurship articulated

by Portes and Manning (1986), is that of the ethnic enclave economy. An enclave emerges if an immigrant population is large enough to provide sufficient capital and labor. Enclave businesses are distinct from middleman minority businesses because they have a greater range of activity (not limited to abandoned niches) and because they create a spatially concentrated and identifiable ethnic neighborhood. Furthermore, in contrast to the importance of non-coethnics in middleman minority businesses, the growth of ethnic enclaves is far more dependent on coethnic relationships. In their typology of "modes of incorporation," Portes and Manning (1986) suggest the cultural impact of these relationships, stating that ethnic enclaves allow immigrants to succeed economically "despite very limited knowledge of the host culture and language", while middleman minorities generally come to have high knowledge of the host culture and language (pp. 64-65).

Though the middleman minority and enclave models are useful theoretical tools, the reality of Los Angeles' Koreatown is too complex to be fully encapsulated by either model. Recently, the growth of businesses that cater specifically to Korean Americans has made Koreatown more closely resemble an enclave. However, the Latinos who make up the majority of Koreatown's residents and who are often employed by Korean-owned businesses make non-coethnic relationships more important than they are in the traditional enclave model. Furthermore, for Latinos who patronize Korean-owned businesses, any Koreatown business can act as a middleman (Zhou, 2004). The recent popularity of the neighborhood within mainstream culture (generally affluent Whites) also complicates the ethnic insularity of the so-called enclave.

Both the middleman minority and enclave literatures focus on how ethnic entrepreneurship is related to immigrant economic mobility. However, little work has been done to address the non-economic elements of ethnic entrepreneurship – specifically, its relationship with culture. Kyeyoung Park's (1997) study of the Korean American community in Queens found that methods of entrepreneurship impacted cultural change, particularly in regard to domestic structure and gender roles. However, her descriptions of this community suggest that it was more of a middleman minority group, characterized by a high degree of contact with other ethnic groups. The Koreatown of Los Angeles, which has come to more closely resemble an enclave, is likely to have a different cultural impact. Min Zhou and Min and Bozorgmehr's (2000) work on Los Angeles' Koreatown has continued to focus on the topic of economic mobility, specifically looking at the benefits of social networks, community building (Zhou, 2004) and "ethnic resources". Portes and Manning's (1986) typology of modes of incorporation addresses the issue of "knowledge of host culture and language", but does so in a very general, theoretical way (p. 64). There is no acknowledgement of the complex interethnic relationships that can occur in an enclave, or of the complexities inherent in the process of gaining knowledge of "host culture." The latter issue is one that can be further explored within the literature on immigrant and Asian American culture.Asian American culture:

Past studies of immigrant lives have often focused on the concept of assimilation or acculturation. Milton Gordon (1964) articulated the process of assimilation in his highly influential work Assimilation in American Life. He claimed that ethnic minorities inevitably adopt the "cultural patterns" of the host society – which includes language, dress, and values – in the process of "acculturation" (p. 79). He considered acculturation to be a stage of assimilation, which could be accompanied by "structural assimilation", wherein the minority group enters into "the social cliques, clubs, and institutions of the core society at the primary group level" (Gordon, 1964, pp. 80-81). His vision of assimilation is one of a linear process, in which immigrants who are initially unfamiliar with the host culture understand and adopt it over time.

More recent work has adapted Gordon's concept to better address the complexities of the process he describes (Alba and Nee, 1997). Drawing partly on the work of Levitt (2001), Portes and Rumbaut (2006) discuss how globalization and technological innovations have led to more stable transnational communities, in which connections to the culture of the home country are kept strong. Furthermore, they found that the social environment of immigrants or those of subsequent generations could make assimilation undesirable for those groups. However, they insist that the passage of time "brings about relentless acculturation" (Portes and Rumbaut, 2006, p. 282), and they

provide a typology of acculturation paths in which those groups who do not assimilate in the first generation can achieve "full acculturation" in the second generation. Those who engage in "selective acculturation" in the second generation – meaning that they become a part of the mainstream culture while still holding onto essential elements of their parents' culture – achieve "full acculturation and integration into the mainstream" by the third generation (Portes and Rumbaut, 2006, p. 265).

These theories of immigrant and intergenerational assimilation all assume a binary relationship between the culture of origin and the host culture. Whether discussing immigrants who quickly assimilate, immigrants who do not assimilate but whose children do, or those of the second generation who engage in "selective acculturation," individuals are described as navigating between two distinct and opposed cultural worlds. In her study of Asian American identity, Immigrant Acts, Lisa Lowe (1996) questions the very notion of such a binary relationship. She uses the concept of hybridity, which she defines as "the formation of cultural objects and practices that are produced by the histories of uneven and unsynthetic power relations" (Lowe, 1996, p. 67), as a critique of traditional theories of assimilation. For Lowe, the binary relationship between the Asian and American cultures that is suggested by the theories of assimilation represents a "hegemonic relationship between 'dominant' and 'minority' positions" (Lowe, 1996, p. 67). The concept of hybridity challenges this notion, because it suggests that neither the country of origin nor America constitutes a "pure" cultural environment. In fact, Lowe asserts that these cultural spaces have "syncretic, composite qualit[ies]… particularly in the era of transnational capital" (Lowe, 1996, p. 80). The creation of Asian American identity is not based on a decision to adopt either an "Asian identity" or an "American identity." Rather, it consists of an

Uneven process through which immigrant communities encounter the violences of the U.S. state, and the capital imperatives served by the United States and by the Asian states from which they come, and the process through which they survive those violences by living, inventing, and reproducing different cultural alternatives. (p. 82)

Lowe's focus on the role of Western colonialism in the shaping of Asian culture is echoed by Chungmoo Choi's use of the concept of "colonization of consciousness" to describe the evolution of Korean culture. Colonization of consciousness is "the imposition by the dominant power of its own world view, its own cultural norms and values, on the (colonized) people so that they are compelled to adopt this alien system of thought as their own" (Choi 1993). Choi is referring to the way in which Western culture has become valued within Korean society. As a result, Korean cultural values may often be not so different from American ones. Many Koreans learn English, watch American movies and television programs, follow American sports, eat American food, wear American clothes, and listen to American music. Furthermore, even products of Korean culture that are made in Korea – pop music, architecture, fashion – often have strong Western influences. Choi and Lowe both see the dynamic relationship between cultural worlds as a result of Western colonialism, one that can lead to "cultural alternatives" which may not necessarily be reconcilable with theories of assimilation.

RESEARCH QUESTIONS

The goal of this project is to observe and report the nature of Korean American culture as represented through Los Angeles' Koreatown. These observations will shed light on the non-economic aspects of the neighborhood while also providing a site of empirical observation of the theoretical issues of Asian American culture. A topic of particular interest will be whether or not Korean American culture as it is observed in these coffeehouses conforms to traditional models of assimilation.

METHODS

Four Koreatown coffeehouses were chosen as sites of participant observation. They were chosen based on a high volume of reviews on the restaurant review website Yelp.com and also based on their mention in articles in The Los Angeles Times and LA Weekly. The four coffeehouses were A) Loft, located on 6th and Oxford, B) Koffea, located on Berendo and 6th, C) Heyri Coffeehouse, located on Hobart and 8th, and D) Café

Jack, located on Western and 5th. Coffeehouses were chosen as sites for observation because they allowed for long periods of participant observation as a customer. Observations took place in June and July of 2008. Each coffeehouse was observed 4 times for about 3-4 hours at a time (at various times of the day). Observations were combined with customer reviews from Yelp.com, so that a higher volume of customer opinions could be incorporated.

FINDINGS

Why Coffeehouses?

Coffehouses were chosen as sites of observation due to analytical assumptions about them that changed greatly throughout the course of the project. Articles in the Los Angeles Times and LA Weekly described Koreatown as in the process of transformation into a "hip" neighborhood. These journalists also emphasized the importance of coffeehouses as places of social interaction in Seoul (Song, 2008), and how they were starting to play a similar role in Koreatown. My understanding of Koreatown at the time led me to believe that these coffeehouses would be places of interaction between "Korean culture" and "mainstream culture." This interaction, as I imagined it, would have an impact on immigrant acculturation that was similar to that of the middleman minority role. Portes and Manning (1986) describe the higher level of contact between the immigrant and other minority groups as leading to greater knowledge of the host country's language and culture. I imagined that the mainstream popularity of Koreatown would likewise lead to greater knowledge of English and "American culture" among the Korean immigrant entrepreneurs.

Initial observations showed that Korean Americans made up a vast majority of the customers, and that non-Koreans were a small minority (many of whom were accompanying Koreans). Furthermore, it was surprising to see that these coffeehouses were not only populated by young, hip, 20-somethings, but also by Korean Americans of various ages. In fact, many customers were elderly Koreans or families with young children. At the same time, everything from the décor to the music to the menus displayed the strong influence of "Western culture". I realized that this familiarity with Western culture was not necessarily a result of targeting non-Korean customers. In fact, elements of "Western culture" found in these coffeehouses could often be identified as indigenously Korean. In other words, "Korean culture" was being represented in these coffeehouses, but it was a "Korean culture" that was more dynamic and complex than was suggested by the theories of immigrant entrepreneurship and assimilation.

OBSERVATIONS

Because four different sites were observed, it will be useful to briefly describe the environment of each coffeehouse before beginning a larger analysis.

LOFT: The name of the café is written in thick, sans-serif English on a sign above the door. A chalkboard easel advertises their desserts. A large television hangs from high on the wall, either turned off or playing ESPN on mute. Full-length mirrors hang from the opposite side, and the wooden rafters are visible above. Brick walls stand side-by-side with walls painted a dark maroon, and big black curtains cover some sections. The coffeehouse consists of a lower level, an upper level that overlooks it (thus the name "Loft"), and an outside area. Christmas lights hang along the edge of the loft and a disco ball spins and shines unapologetically from the center of the ceiling, day or night. Most of the tables have small candles that are lit by the servers come sunset. In general, the lighting at Loft is dim. The music selection is eclectic. The majority of it consists of easy listening covers of songs by the Beatles and Elton John, but what sounds like Italian opera music can also be heard. The spiral bound, laminated pages of the menu list all items in English. Only shaved ice desserts and some of the teas are listed also in Hangul (Korean writing). In addition to the standard coffee and espresso drinks, Loft sells cakes, sandwiches, salads, and ice cream.

KOFFEA: At Koffea, both the sign above the door and the tall windows are inscribed with a stylized logo of a coffee cup, and, in italic type, the words, "Koffea: Coffee and Bakery." Koffea consists of three indoor rooms and an outside patio area. Each of the indoor rooms has a big screen television, also usually playing ESPN on mute. Earth tones dominate the walls and furniture in the entrance room. The booths that line the wall are each separated by long black curtains. Further inside, one room features more of the same while another, described by a passing customer as resembling "a hotel lobby", features a checkerboard pattern on the ceiling, a chandelier, and tall chairs covered in white fabric. Several Korean language newspapers lie on a table between these rooms. Paintings, some of mountain landscapes and some more abstract, are displayed on easels throughout the café. Many of them have cards on the frame providing the name of the artist, the title of the painting (both in Hangul), and its price. In the bathroom, a humorous sign taped above the toilet reminds men to be mindful of their aim. It is written in Korean, as is the poster next to the sink advertising a local Korean church. The menu listed almost all items in both Korean and English, but the smoothies, shakes, desserts, sandwiches, and salad were all listed only in English.

HEYRI: Heyri is unique architecturally because the building used to be a house, with two floors and a backyard. The sign above the door features the name of the café in both Hangul and English. Banners hanging around the parking lot list the hours of operation and menu items primarily in Hangul, but with occasional English words mixed in. Inside, Korean pop and rap music plays loudly over the speakers. In the corner, a big screen television is on mute. Usually it is turned to ESPN, but sometimes a cable movie or Korean news will be playing. The whole indoor area is dimly lit from several lamps hanging about the counter. The color scheme is mostly black and red. The young Korean servers are dressed in red polo shirts. A door leads to a patio and a backyard, where a giant palm tree (from which Christmas lights are hung), a small pool, and tents over tables suggest an island theme. The leather-bound menu has a short description of the coffeehouse, in Hangul, on the first page. Most items are listed in both Hangul and English, but desserts, smoothies, sandwiches, and breakfast items are listed only in English.

JACK: The décor at Café Jack has a theme: the 1997 film Titanic. The entire coffeehouse is shaped like a boat, and framed photos of cast and crew from the movie line the walls. The adherence to this theme is curiously less than rigid, however, with Christmas and Valentine's Day decorations (Christmas lights, large candy canes, heart shaped pillows and lights) appearing both indoors and out. On the tables outside, past customers have carved both Korean and English letters (seemingly names and initials) into the wood. In the middle of the tables outside is a billiards table, which I never observed anyone playing with. The music is usually Korean pop and rap, but sometimes this soundtrack is interrupted when someone takes the microphone of the karaoke machine in the corner.

The menu is bound in thick leather, and laminated pages list the offerings in a grungy, distressed typeface. The first page describes the inspiration behind the theme of the café in Hangul, and the rest of the menu is written mostly in both Hangul and English. "Fusion Sushi Rolls", cake, yogurt, ice cream are listed only in English. There are a few typos, such as the one in the advertising sandwiches, which are "comming" soon, or the one in the listing for "Hozelnut Coffee." A small collection of Korean language newspapers and GQ magazines can be found at the counter.

ANALYSIS

HYBRIDITY AND DÉCOR:

Yelp.com is a website that allows customers to submit reviews and ratings of restaurants and various other businesses which can be publicly searched and read. Recently, Yelp has become increasingly influential in the success of many businesses (Gaither, 2006). All four of the coffeehouses observed had at least 20 reviews. These reviews provide the customer's point-of-view in a way that highlights what they perceive as the positive and negative elements of the environment and service experience.

On the review page for Loft, one customer writes,

i like this place the most because it resembles me the cafes in korea the most.

There is this one cafe in korea that is my favorite all time spot and although i am not sure, i swear loft has copied the idea of my favorite cafe. overall loft is my second best from here because it reminds me of my number one favorite cafe in korea.

Similar comments were made about Koffea, which was seen as "a touch of modern Seoul" that "makes you feel like you're in a Korean drama." For these customers, going to Loft and Koffea was a way of reliving the memory of urban Korean life. Other customers, however, perceived the same spaces differently. To one customer, one of the rooms at Koffea looked like "a living room of Ikea," while another proclaimed the cafe "a little slice of Melbourne in L.A." One reviewer said of Loft, "It feels like a little slice of New York City," echoing the comments of another reviewer, who felt it was "very 'manhattan.'" Other reviews of Loft described "somewhat of a rustic-Bostonian feel to it, with a glaze of cozy-contempo," or take the comparisons across the pond, saying, "It looks like you have entered Paris!" The spaces that were reminiscent of urban Korea for some customers were, for others, reminiscent of American and European urban traditions. These different perceptions and definitions of the same space suggest cultural hybridity between Korean and Western cultures. That is, even though coffeehouses such as Loft do represent "Korean culture", this culture is not "pure" and is heavily influenced by elements of American and European culture. This influence could be seen in the art on display at Koffea, which strongly showed Western aesthetic traditions. The influence is even more direct at a place like Café Jack, where the theme is based completely on a Hollywood film, with Christmas and Valentine's Day elements mixed in. Even beyond these specific elements of décor within the coffeehouses, the very idea of a coffeehouse itself is a Western invention that has become an important part of Korean cultural life.

To say that immigrants must acculturate or assimilate into American culture suggests that these immigrants are unfamiliar with that culture when they arrive. However, décor is only one of many aspects of contemporary Korean culture that has been influenced by the West. Korean entertainment, art, and language have all been transformed by American and European traditions as well. In a way, the process of "assimilation" to Western culture takes place transnationally, even among Koreans who remain in Korea. This "transnational assimilation" does not necessitate certain political loyalties or citizenship, but rather extends beyond nation-state boundaries.

LANGUAGE AND "KOREAN CULTURE":

In Lou Dobbs' discussion of immigrant assimilation, the presence of foreign languages on urban streets was seen as a problem, a detriment to assimilation. Though many businesses in Koreatown still do display signs in Hangul, the coffeehouses observed used a great deal of English. In fact, some portions of menus and signs were exclusively in English. Though some minor miscommunications due to a server's lack of English fluency did occur, it never reached the point of complete misunderstanding. In fact, it was not uncommon for servers to use American and Korean colloquialisms and speak very comfortably in English as well as in Korean.

Following Portes and Manning's (1986) logic, the ethnic insularity of the coffeehouse would suggest a low level of English fluency. What their model does not take into account, however, is heterogeneity. Even though all of the servers and almost all the customers at these coffeehouses were Korean American, heterogeneity within that larger ethnic group led to different levels of English fluency and knowledge of American culture. Portes and Rumbaut (2006) address this issue, claiming that generations succeeding immigrant generations can have increased knowledge of the "host" language and culture. In other words, time spent in the United States, leads to a greater familiarity with American culture and a better grasp of the English language. This model defines heterogeneity across generational lines ("generational" in this case referring more to time spent in the United States than on age). Though this model may have some validity, it is flawed because it suggests that "Korean culture" is homogeneous and free of influence from American culture. It suggests that all Koreans come to the United States with low levels of English fluency and low knowledge of American culture, and that subsequent generations become more fluent and become more knowledgeable.

A major implication of "transnational assimilation" is that

familiarity with American culture and English language cannot be understood merely as the result of time spent in the United States. In Korea, English language is a prerequisite for many jobs, and knowledge of Western culture is also very important (Rose, 2007). The Korean pop music that played in these cafes is an example of this influence – not only is it musically influenced by American genres, but entire sections of these songs are often sung completely in English. The influence of the English language has two implications: First, because this influence has grown stronger in more recent years, younger Koreans are more likely to have greater knowledge of English and of Western culture. Second, because public education in Korea is ill-equipped to provide adequate English language education, greater fluency comes at a price, and is usually earned through spending tuition to send students to hagwons (private academies supplementing public schooling) (Sabio, 2007) or to schools abroad. This means that English fluency is also related to socioeconomic status in Korea. In fact, immigration to the United States in itself is a sign of economic resources and ability. Therefore, greater knowledge of "American culture" and the English language is not only a result of time spent in the United States, but also can be reflective of age and economic resources, or one's position within the transnational Korean community.

ENTERTAINMENT AND HETEROGENEITY OF "AMERICAN CULTURE":

The popularity of Western culture in Korea not only impacts how "Korean culture" is defined but also makes "American culture" more dynamic and complex.

I was at Koffea during Game Six of the 2008 NBA Finals between the Los Angeles Lakers and the Boston Celtics. About 10 young (in their 20's to 30's) Korean men were sitting around one of the televisions, watching the game. As might be expected during an important basketball game, they shouted at the players on the screen. What surprised me was that in addition to yelling out "We need a miracle here," and "Take the shot!" in English, they shouted out just as many phrases in Korean.

Just as Western traditions of décor are popular in contemporary Korean culture, American sports are enjoyed and followed by many in Korea. It makes sense that this enjoyment of American sports would follow Korean Americans to the United States. The televisions at these coffeehouses almost always were playing ESPN, and a look at the Korean language newspapers often shows American sports dominating the headlines of the sports sections. Because of the international popularity of American sports, they could be seen as part of a "Korean culture" under Western influence. However, the familiarity with and interest in local sports might also suggest the kind of assimilation and integration desired by proponents of immigrant assimilation. The Lakers are a basketball team that is tied to the specific locality of Los Angeles, and watching their games implies a connection to that team and that locality. It implies that following the Lakers means embracing "American culture."

Neither of these explanations, however, fully captures the reality of the situation. Though these Korean American men were embracing "American culture", so to speak, they were doing so in a unique and specific context. They chose to watch the game with Korean American friends at a Korean-owned coffeehouse in Koreatown, and talked about the game in Korean as well as in English. They chose to watch the game in a uniquely Korean American environment. In other words, "American culture" is in fact heterogeneous and the same "American" basketball game can be experienced in multiple ways.

CONCLUSIONS

In this study, four coffeehouses in Koreatown were used as places to gather empirical evidence about the nature of Korean American culture. Evidence was found to support the following: (1) Transnationally, Korean culture is heavily influenced by Western culture, (2) Korean culture is not homogeneous and individual Koreans are influenced by Western culture differently based on numerous factors, and (3) American culture is not homogeneous and can be experienced in multiple ways. A view of Korean American culture that recognizes the hybridities and hetereogeneities involved in the movement between two nations provides a more accurate and useful understanding than one that assumes a linear process of assimilation between two distinct and homogeneous cultures.

Future research should involve more participant observation combined with interviews of owners, employees, and customers. These methods should be used to study other kinds of businesses in Koreatown in order to realize a richer and more accurate depiction of Korean American culture as found in the neighborhood. Incorporating research on coffeehouses and other cultural spaces in Korea would help support the claims made about Korean culture. Research that focuses more strongly on second and subsequent generations of Korean Americans would do the same for the claims made about the hetereogeneity of American culture. The theoretical background of this study could be applied to research in other ethnic neighborhoods, or even to the general study of immigration and ethnic groups.

REFERENCES

Alba, Richard, and Victor Nee. 1997. Rethinking assimilation theory for a new era of immigration. International Migration Review 31, (4): 826-74.

Bonacich, Edna. 1988. The social costs of immigrant entrepreneurship. Amerasia Journal 14, (1): 119-28.

Choi, Chungmoo. 1993. The discourse of decolonization and popular memory: South korea. Positions 1, (1): 77-102.

Gaither, Chris. 2006. Where everyone is a critic. The Los Angeles Times, August 25, 2006.

Gordon, Milton M. 1964. Assimilation in american life. Oxford University Press New York.

Levitt, Peggy. 2001. Transnational migration: Taking stock and future directions. Global Networks: A Journal of Transnational Affairs 1, (3): 195-216.

Light, Ivan, and Stavros Karageorgis. 1994. The ethnic economy. The Handbook of Economic Sociology: 647-71.

Lowe, Lisa. 1996. Immigrant acts: On asian american cultural politics. Duke University Press.

Min, Pyong Gap, and Mehdi Bozorgmehr. 2000. Immigrant entrepreneurship and business patterns: A comparison of koreans and iranians in los angeles. International Migration Review 34, (3): 707-38.

Park, Kyeyoung. 1997. The korean american dream: Immigrants and small business in new york city. Cornell University Press.

Philips, Eric, David Mattingly, Elaine Quijano, Bill Tucker, Peter Viles, Lou Dobbs, and Casey Wian. 2004. Interview with ed gillespie; congress looks to end outsourcing. Cnn, February 11, 2004.

Portes, Alejandro, and Robert D. Manning. 1986. The immigrant enclave: Theory and empirical examples. In Competitive ethnic relations., eds. S. Olzak, J. Nagel, 47-68. Orlando, FL: Academic Press.

Portes, Alejandro, and Rubén G. Rumbaut. 2006. Immigrant america: A portrait. University of California Press.

Sabio, Rafael. 2007. English education in korea: It's time for accountability. The Korea Times, August 1, 2007.

Song, Jason. 2008. Java perks up koreatown . The Los Angeles Times, February 14, 2008. HYPERLINK "http://articles.latimes.com/2008/feb/14/local/me-koreancoffee14" \t "_blank" http://articles.latimes.com/2008/feb/14/local/me-koreancoffee14 (accessed July 28, 2008).

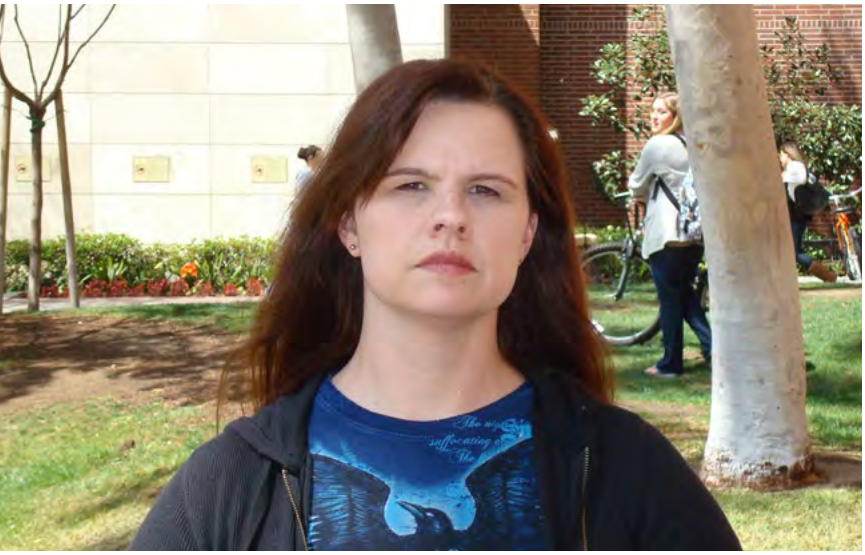
U.S. Bureau of the Census. S0201. selected population profile in the united states (korean alone or in any combination). in American FactFinder [database online]. 2005 [cited July 28 2008]. Available from HYPERLINK "http://factfinder.census.gov/servlet/IPTable?_bm=y&-geo_id=01000US&-qr_name=ACS_2005_EST_G00_S0201&-qr_name=ACS_2005_EST_G00_S0201PR&-qr_name=ACS_2005_EST_G00_S0201T&-qr_name=ACS_2005_EST_G00_S0201TPR&-ds_name=ACS_2005_EST_G00_&-reg=ACS_2005_EST_G00_S0201:042;ACS_2005_EST_G00_S0201PR:042;ACS_2005_EST_G00_S0201T:042;ACS_2005_EST_G00_S0201TPR:042&-_lang=en&-redoLog=false&-format=" \t "_blank" http://factfinder.census.gov/servlet/IPTable?_bm=y&-geo_id=01000US&-qr_name=ACS_2005_EST_G00_S0201&-qr_name=ACS_2005_EST_G00_S0201PR&-qr_name=ACS_2005_EST_G00_S0201T&-qr_name=ACS_2005_EST_G00_S0201TPR&-ds_name=ACS_2005_EST_G00_&-reg=ACS_2005_EST_G00_S0201:042;ACS_2005_EST_G00_S0201PR:042;ACS_2005_EST_G00_S0201T:042;ACS_2005_EST_G00_S0201TPR:042&-_lang=en&-redoLog=false&-format=

(accessed July 28, 2008).

———. Los angeles county, california. in American FactFinder [database online]. 2000 [cited July 28 2008]. Available from HYPERLINK "http://factfinder.census.gov/servlet/SAFFIteratedFacts?_event=&geo_id=05000US06037&_geoContext=01000US|04000US06|05000US06037&_street=&_county=los+angeles&_cityTown=los+angeles&_state=04000US06&_zip=&_lang=en&_sse=on&ActiveGeoDiv=&_useEV=&pctxt=fph&pgsl=050&_submenuId=factsheet_2&ds_name=DEC_2000_SAFF&_ci_nbr=042&qr_name=DEC_2000_SAFF_R1050®=DEC_2000_SAFF_R1050%3A042&_keyword=&_industry=" \t "_blank" http://factfinder.census.gov/servlet/SAFFIteratedFacts?_event=&geo_id=05000US06037&_geoContext=01000US|04000US06|05000US06037&_street=&_county=los+angeles&_cityTown=los+angeles&_state=04000US06&_zip=&_lang=en&_sse=on&ActiveGeoDiv=&_useEV=&pctxt=fph&pgsl=050&_submenuId=factsheet_2&ds_name=DEC_2000_SAFF&_ci_nbr=042&qr_name=DEC_2000_SAFF_R1050&reg=DEC_2000_SAFF_R1050%3A042&_keyword=&_industry= (accessed July 28, 2008).

Zhou, Min. 2004. Revisiting ethnic entrepreneurship: Convergencies, controversies, and conceptual advancements 1. International Migration Review 38, (3): 1040-74.

ESTABLISHING A FEAR MASKING INDEX TO DETERMINE EFFICACY OF ONE-SESSION TREATMENT FOR SPECIFIC PHOBIAS



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Specific phobias have debilitating effects on sufferers, and can potentially impair their ability to function in daily life. The fear response occurs when a specific object or situation is presented that has no obvious connection to dangerous or anxiety-inducing circumstances. While treatment options are available, there are questions about the effectiveness of such therapies as results depend on self-reports. This study evaluates the success of a one-session treatment (OST) process for specific phobias in controlling panic reactions to phobic stimuli over extended periods of time. It also evaluates whether there is a discrepancy between self-reporting and the observation of nonverbal cues indicating fear. The original figures from an OST pilot study are analyzed for conflict between self-reported reaction and those observed by the researcher. An index that rates nonverbal cues split into four categories is assessed from the filmed Behavioral Assessment Tests (BATs) to determine potential fear masking displayed by the subject during the tests. The figures are statistically compared to the self-reported results to establish any biases or conflict that could impact the treatment's efficacy. The results offer insight about how fear masking from phobic individuals can indicate efficacy levels of desensitization treatments.

INTRODUCTION AND PURPOSE

The field of psychology specifies that there are six basic emotions: fear, anger, disgust, happiness, sadness, and surprise. Emotions are expressed similarly in all cultures, through physiological response, facial and vocal cues (Ekman, 1992). As a result, these specific patterns of expression allow us to identify fear in another individual regardless of cultural differences, which ultimately alerts us to the potential presence of danger. In comparison, moods are variations of basic emotions and they usually do not have specific vocal or facial cues that separate them from one another. For example, nervousness, apprehension and dread would be considered moods based on fear (Harrigan et al., 2004). The problem with fear is that it is difficult to measure accurately through self-report. This can be attributed to subjective differences, such as what constitutes a strong reaction versus a mild reaction, to external factors that cause the individual to mask fear for cultural or social reasons. This study seeks to establish a way of measuring fear levels in phobic subjects that does not rely on self-report and thus offers a supplementary method of detecting discrepancies between reported data from the subject compared to physical response.

Fear-based disorders, more commonly referred to as anxiety disorders, are a common problem in the United States. It is estimated that 10 to 35 percent of the national population suffers from a form of anxiety disorder (Purves et al., 2008). Anxiety is identified as a condition that combines the physiological responses of fear, such as elevation of cardiovascular function and the decline of digestive responses, with one or more of the fear-based moods for a prolonged period of time (Harrigan et al., 2004). Anxiety disorders are difficult to treat, as it is complicated to determine the basis of the initial fear. In many cases, a phobia can be the root cause of the individual's symptoms and develop into more disruptive behavior patterns. This includes instances in which an individual has a fearful reaction to an isolated circumstance, and the concern of losing control over one's reactions in that circumstance can result in exaggerated avoidance behavior. In time, a social phobia may develop and impair the individual's ability to function in daily life (Brown & Barlow, 1992; Foa & Kozak, 1986). Therefore, effective treatment methods for specific phobias are crucial in order to prevent further anxiety disorders from emerging.

Exposure therapy is a type of treatment that has been utilized in a variety of forms in treating phobias. It involves putting the subject in direct contact with the phobic stimuli in attempts to reduce the fear reactions through desensitization. One-session treatment (OST) is a form of exposure therapy used to treat specific phobias. Like other anxiety treatments, a significant part of evaluating the success of the OST relies on self-reporting from the subject. However, there are a number of reasons why subjects may conceal the intensity of their reactions to a phobia. First, the subject needs to be in the presence of the phobic stimulus. Subjects may downplay their reactions to the stimulus in order to shorten the time period of exposure to the object or circumstance. Second, some ethnic groups hold a greater social stigma to anxiety disorders, causing subjects to deny their condition out of concerns of being ostracized within their community. Third, subjects often report results contrary to their reactions when in the presence of a perceived authority figure, including doctor, clinicians, and researchers.

An index was formulated for this study to determine potential fear masking in subjects who have undergone OST therapy for specific phobias. The pilot study included 30 subjects split into three groups, two receiving a form of OST therapy and the last group acting as a control by utilizing a self-help manual. The original Behavioral Assessment Tests (BATs) were videotaped, allowing for comparison in behavior before and after the treatment. The videos were content coded for specific nonverbal cues, such as vocalization, posture, muscle rigidity in movement and repetitive nervous gestures. A score was assigned and the results were measured against the self-reported scores given by the subjects to reveal any discrepancy between the sets of results. Four hypotheses were explored in this study, which will be mentioned at the end of the literature review.

LITERATURE REVIEW

An estimated 36 million adults in the United States suffer from phobias, and roughly 15 million of them have a "specific phobia" (Kessler et al., 2005). According to the Diagnostic and Statistical Manual of Mental Disorders, "the essential feature of a specific phobia is marked and persistent fear of clearly discernible, circumscribed objects or situations" (American Psychiatric Association, 1994, p. 443). It is easy to confuse the difference between a panic disorder and phobic response since most patients would report feelings of panic in a phobic response. Panic includes a sense of overwhelming terror or apprehension that is usually connected with a sense of catastrophe (Barlow et al., 1985). While this same description applies to one who is experiencing a phobic reaction, a phobic response dissipates when the object or situation that results in these symptoms is removed. In a panic disorder, there is the absence of a specific stimulus that triggers the response, and the reaction tends to take longer to dissipate. It is easy for misdiagnosis to occur between these two conditions, especially if the patient is not aware of a distinct pattern of their attacks.

The Center for Stress & Anxiety Disorders suggested that 50% of patients who suffer from an anxiety-based condition are usually suffering from more than one disorder, a pattern referred to as comorbidity (Brown & Barlow, 1992). Some of these circumstances include social and specific phobias. If left untreated, phobic reactions can carry over into other areas of the psyche. For instance, anxieties based on lack of control over a given situation may result in depression and avoidant behaviors that interfere with daily functioning (Foa & Kozak, 1986). Unfortunately, the disorders that rank as more severe in their impact on an individual will receive the attention of doctors, so smaller core problems at the foundation of an emotional disturbance are often overlooked (Brown & Barlow, 1992). Most phobias rank lower than general panic disorders and are not considered unless the client brings direct attention to the matter.

CHARACTERISTICS AND BARRIERS IN TREATMENT OF PHOBIAS

Lars-Goran Ost noted two particular patterns in specific phobia patients. One group had a direct experience with the object or situation that resulted in panic, while the other group had never experienced direct contact with the fear object but still expressed anxiety and avoidance strategies to a given circumstance (Ost, 1987). This implies that some phobias are generated from sources other than direct experience, perhaps in the form of cultural traditions or as the result of a psychological association between two unrelated objects or circumstances. It was also acknowledged that the majority of specific phobias, especially animal-based fears, have an onset from the age of four to six years (Ost, 1987). It is questioned whether or not parents played a role in the formation of childhood fears. This made it more difficult to determine how a phobia developed and limits treatment options for the clinician.

There are key characteristics seen in phobic patients. "Catastrophic self-talk" is the tendency of the individual to anticipate disaster upon encountering the object or situation that invokes panic (Bernstein, 1999). The assumption of impending disaster provokes heightened reactions until the individual is incapable of controlling their responses. Anxiety builds as the individual perceives an improbable chain of damaging events occurring, with each consequence more dire and severe than the prior. The more often this style of thought is invoked, the more habituation occurs and panic disorders may develop over time.

Johnstone and Page conducted a study that illustrated the importance of self-efficacy in coping mechanisms. Coping strategies refer to behaviors and habits people incorporate in their daily lives to manage emotional distress. An example would be going to a comedy film to alleviate stress. When an individual experiences an irrational fear or uncontrolled reaction, coping strategies are compromised and the individual is more inclined to avoid situations that may trigger such a response (Johnstone & Page, 2004). While this may be a type of coping strategy, avoidance may restrict the individual from accomplishing responsibilities that are mandatory, such as going to work or engaging in social activities.

Avoidance and suppression of emotional reactions are some of the biggest contributors to misdiagnosis or failed treatment of phobias. Stigma regarding psychological disorders can pressure

phobics to deny their anxiety and avoid clinical help. In these situations, they attempt to reduce potential contact with phobic stimuli, which can exacerbate anxiety as opposed to alleviating it. Acceptance and Commitment Therapy (ACT) is a form of cognitive-behavioral therapy designed to enhance mindfulness of one's behavior and develop flexibility in reaction and coping. ACT studies revealed that psychological disruptions occur when ineffective, and often counterproductive, methods to reduce negative emotions are employed (Hayes et al., 1999). Cultural stigmas of certain emotional reactions encourage suppression and result in greater complications for the individual (Campbell-Sills et al., 2006). This suppression is one of the greatest problems clinical psychologists contend with when administering phobia treatment. This pattern makes it uncertain whether phobia treatments are as effective as they appear. Such methods rely on self-reporting from the patients to determine success rate, which may be compromised by suppression tendencies.

ONE-SESSION TREATMENT METHOD

One-session treatment (OST) is a form of exposure therapy that attempts to quell anxiety symptoms by presenting the object or situation that creates distress (Koch et al, 2004). The treatment is administered in a three-hour session in which the patient confronts the fear stimulus in proximal increments until they make direct physical contact with the object (Ost, 1987). Koch et al. found that reactions from animal-based phobias are significantly reduced by the end of the session (2004). However, it was noted that the treatment did not suit certain ethnic groups based on the preliminary assessments made before the initial treatment.

In 2006, Huey and Pan devised a "culturally adapted" version of one-session treatment (OST-CA). Pilot studies with Asian-American students featured seven changes to the treatment procedure made in terms of cultural patterns to better suit the subjects being treated (Huey & Pan, 2006). One-session treatment was devised in Europe; accordingly, it caters to relations between physicians and clients from a European perspective. Huey noted that Asian cultures do not maintain the same type of clinician-patient rapport as seen in Europe or the United States. For example, patients in the United States believe in full disclosure and ask questions of their physicians freely. Clear explanation of procedures and methods must be offered, with the understanding that the patient can choose to forego specific treatments if they feel the proposed methods are problematic. However, Asian cultures are more inclined to accept the physician as having greater authority and tend to question the physician's capability if they confer too much information or request the client's permission excessively. Therefore, the language used in guiding the patient through the one-session treatment process was adapted to reduce this reaction. A more authoritative tone was employed in OST-CA to ensure the patient has complete confidence in the procedure.

Huey's pilot study divided subjects into three groups for treatment purposes. The control group received a self-help manual which they read on their own to cure their phobias. The second group received the standard OST without any cultural modification to the procedure, while the third group received the culturally-adapted OST. While both OST conditions showed a statistically significant difference when compared to the self-help approach ($p < .05$), there was only a slight improvement in results between CA-OST and standard OST ($p < .10$). It was impossible to determine if the culturally adapted version of therapy made a significant difference in terms of efficacy. The pilot study had a small sample size, which may have impacted the results.

MASKING AND THE USE OF NONVERBAL CUES TO ASSESS FEAR

The Asian-American population is a group that illustrates the greatest level of suppression due to cultural pressures (Huey & Pan, 2006). Assessments from one-session treatments are based on the answers given by the subject. The amount of anxiety suppressed is difficult to determine. Fear masking may occur for the benefit of the researcher or in attempts to avoid further contact with the feared stimulus. It is important to determine how much emotional masking may impact the results of a study.

Considerable research on facial expression and vocal cues has been conducted, but there has been less focus on nonverbal body cues. Movement such as clasping the hands, crossing the arms over the torso, or weight shifting was not analyzed in such

a way as to establish an index. Certain aspects of nonverbal cues have been studied in terms of reading a subject's emotional state, but there are limitations. One of the most studied areas of body language is posture. Coulson analyzed postures depicted in performance art and also recorded how individuals translated body postures in photographs. He noted that shifting the weight forward and protruding out the chin and chest were often noted as an aggressive or angry posture, while fidgeting gestures and shifting one's weight backwards indicated fear and discomfort (Coulson, 2004). The limitation with this study was that the analysis was done with static pictures that did not allow movement, thus combinations of gestures would not be considered upon examining the photographs.

Another study used the Diagnostic Analysis of Nonverbal Accuracy-2 Posture Test (DANVA2-POS), an adaptation of the Diagnostic Analysis of Nonverbal Accuracy-2 Test, which indexes facial expressions correlating to the six basic emotions. The test utilized cards that represented 32 different postures. Subjects viewed the cards and stated what emotion they believed was represented by the posture (Pitterman & Nowicki, 2004). The test was also limited to static postures and does not focus on any one specific emotion. Most importantly, the majority of nonverbal cue research focuses on one aspect of body language at a time. They do not appear to combine multiple levels of signals, such as posture in relation to gestures.

RESEARCH METHODS

Videotapes from Huey's original 2006 pilot sessions were observed to compare the extent of nonverbal fear cuing demonstrated by the subjects between Behavioral Assessment Tests (BATs). Two BATs were administered, one prior to the OST or self-help therapy, and the other a week after therapy. The process of the BAT is outlined below, along with the establishment of the nonverbal cue index and the statistical analysis of the results.

BEHAVIOR ASSESSMENT TEST

Prior to treatment, subjects were given a task to enter a room with the phobic stimuli (spiders, crickets or dead fish) and approach the cage or container holding the object. A "highstep" measurement, a scale ranging from 1 to 8, was used to determine how far the subject was willing to approach the stimuli. If the subject scored an 8, it indicated the subject was able to accomplish all of the tasks required, while a score of 1 indicated the subject refused to take part in any of the tasks. The ideal completion of tasks required the subject to approach the cage, remove the lid, touch the stimuli, and hold the object for 20 seconds. Subjects were asked to rate their level of anxiety on a scale of 100, referred to as the "subject units of distress" (SUD), before and after approaching the stimuli. A score of 1 indicates no presence of fear, and a score of 100 indicated extreme levels of fear. The BAT was administered after the subject's questionnaire session, prior to the administration of therapy. The subjects were randomly assigned to three different treatment groups. The first group received standard one-session treatment (OST), the second group received culturally adapted OST, and the third group was given a self-help manual. The follow-up BAT (post-treatment) was given the first week after therapy to determine if the subjects were still desensitized to the phobic stimuli.

NONVERBAL CUE INDEX OF FEAR

Four key categories of nonverbal cues were established for analysis: vocalization, posture, gesturing and locomotion. Each of the four categories were rated on a scale of 1 to 8, 1 showing no presence of the nonverbal cue, 4 indicating moderate presence of the nonverbal cues and 8 representing consistent nonverbal cueing. In this study, facial expression was not calculated as suppression of facial expressions is one of the key components in fear masking. For example, many of the subjects that exhibited fear cues were smiling during the BATs, despite their physical cues indicating they were afraid. Furthermore, a measurement of vocalization was employed, but not verbalization. Verbalization is the direct use of words to state fear. Such behavior would not be demonstrated during fear masking. Instead, inarticulate utterances or exclamations of disgust were often present. Therefore, the index is referred to as a Non-Verbal Cue Index to refer to the lack of direct verbal communication by the subject in relation to his or her fear

response. However, vocalization was taken into consideration. The four cue categories observed and recorded are as follows:

The vocalization measurement gauges disruption in breathing and speech patterns often induced in the presence of fearful stimuli, including shortness of breath, nervous laughter, and vocalizations of fear or disgust. On the masking scale, a score of 1 represents no presence of nervous or fearful vocalization, while 8 indicates strong and persistent vocalization.

The posture measurement rates adjustments made in the posture of the subjects upon approaching the stimuli. A score of 1 represents an upright posture with weight shifted forward toward the phobic stimuli, and 8 indicates a lowered posture with a tendency to shift weight backwards or to the side.

The gesturing measurement records the presence of repetitive nervous motion, including hand-clasping, hand-wringing, grasping the arms or shoulders in a protective posture, and fidgeting with clothing or accessories. A score of 1 represents no presence of fearful gesturing, while 8 indicates repetitive gesturing.

The locomotion measurement indicates resistance in approaching the phobic stimuli. A score of 1 represents fluid, direct steps toward the stimuli with no variation in speed or length of stride, while 8 indicates choppy, timid steps with frequent hesitation.

An average is determined between the four categories to establish a base Cue Score that ranges from 0 to 8.

STATISTICAL ADJUSTMENTS FOR NORMALIZATION

In the original pilot study, the SUDs ratings were given on a scale of 1 to 100. For the purpose of statistical analysis, the cue score was converted to a similar scale called the Non-Verbal Cue Index (NVCI). The NVCI was compared to the self-reported SUDs ratings on the individuals during the BATs to determine if there was a conflict between the self-reported results from the subject and observational scores from the clinician. The NVCI was normalized to match the 1-100 scale used in the SUDs ratings by multiplying the number by 12.5. The SUDs were subtracted from the normalized NVCI to create a final Masking score. Both univariate and multivariate analysis of variance (ANOVA) were used to determine statistical significance between the NVCI and SUDs ratings, as well as differences in the Masking score between subject groups.

RESEARCH QUESTIONS AND HYPOTHESES

The Masking score is an indication of a discrepancy between the self-reported scores given by the subjects (SUDs) in relation to fear cues demonstrated during the Behavior Assessment Test. Positive Masking scores indicate a discrepancy while zero to negative Masking scores demonstrate a lack of fear masking. Four research questions were considered in this study.

Does the Nonverbal Cue Index show a significant difference between groups?

Is there a significant difference in the rate of fear cueing between the pre-treatment and post-treatment BATs?

Was there a significant difference overall in the OST groups compared to the control group?

Was there a significant difference between genders?

Four hypotheses were considered in relation to the research questions.

H1 – There will be a statistically significant difference in the NVCI between groups in post-treatment scores and no significant difference in the pre-treatment scores.

H2 – There will be a statistically significant difference in Cue Scores between the pre-treatment and post-treatment results for the groups that received treatment and no significant difference in the control group.

H3 – There will be a statistically significant difference in the NVCI overall when comparing the OST groups to the control group.

H4 – There will be a statistically significant difference between gender groups in the Masking score with the male group demonstrating higher masking than the female group.

RESULTS

Does the Nonverbal Cue Index (NVCI) show a significant difference between the groups?

The variables were analyzed using a univariate ANOVA. There was no statistically significant difference in the pre-test NVCI (NVCI1) scores between the three groups. There were no significant differences between groups, $F(3, 12) = 2.372$, $p = 0.125$, while post-test NVCI (NVCI2) moved towards significant differences between groups, $F(3, 12) = 3.460$, $p = 0.056$. This lends some support to H1 that a difference would be measured in the non-verbal cue index between the pre and post-treatment BATs between the three groups.

Figure 1

Is there a significant difference in the rate of fear cueing between the pre-treatment and post-treatment BATs?

An analysis of the cue scores revealed a bimodal pattern across all groups for low levels of fear cueing and high levels of fear cueing. The NVCI scores for pre- and post-treatment were dichotomized at the medians (NVCI1 median = 65 and NVCI2 median = 13). The difference between times (pre/post test) was evident in the drop in medians. Further investigation showed that this difference was primary demonstrated by the groups receiving OST treatment; the control group consistently demonstrated high cueing rates (See Figure 2b). Upon examining the NVCI, controlled subjects increased fear cueing from pre-treatment to post-treatment. This supported the second hypothesis that a difference would be found in the fear cues between groups. There difference between the groups may potentially result from knowledge of the treatment conditions which were issued before the pre-test BAT. These differences will be addressed in the discussion.

Figure 2a

Figure 2b

Was there a significant difference overall in the OST groups compared to the control group (Figure 3)?

An ANOVA was conducted to determine if there was a significant difference between groups on the NVCI score. The variables were analyzed using a one-way ANOVA, while controlling for gender, age and birth place (i.e., American or international-born). The difference between the pooled OST groups and the control group approached significance in the pre-treatment NVCI scores, $F(2, 20) = 4.134$, $p = 0.056$ (OST Mean = 4.717, Self-Help Mean = 6.09). The difference between groups on the post-treatment NVCI also approached significance, $F(2, 20) = 4.206$, $p = 0.056$ (OST Mean = 2.73, Self-Help Mean = 5.875).

Figure 3

Was there a significant difference between genders?

A one-way ANOVA was used to investigate the difference between male and female Masking scores. Masking prior to treatment (Masking 1) showed no significant difference between genders, $F(2, 20) = 2.021$, $p = 0.16$ (Female Mean = 7.656; Male Mean = 6.49). Masking scores after treatment (Masking 2) approached a significant difference, $F(2, 20) = 2.998$, $p = 0.078$ (Female Mean = 13.1667; Male Mean = 0). Woman masked more than men at post-treatment (see Figure 4). Women increased while men decreased in fear cues, illustrating a difference in response between gender groups. This was counter to the third hypothesis, which predicted men would be inclined to mask more than women after treatment. Reasons for this difference will be discussed below.

Figure 4

DISCUSSION

In this study, there was no statistically significant difference established between the groups for fear cueing. This indicates that any fear masking demonstrated by the subjects had

little impact on the results of the study. However, the numbers demonstrate that the NVCI approached a statistical significance between the groups with the highest levels of fear cueing taking place within the control group. Therefore, it is necessary to develop an index to confirm if the self-reported scores of the subjects coincide with the external reactions of the subject to prevent potential discrepancies in self-reported scores. Further studies with a larger sample size may reveal a more defined pattern in terms of non-verbal cueing and masking between the three groups. Furthermore, the reductions in the NVCI in the OST groups between post- and pre-treatment suggests the one-session therapy assisted in reducing anxiety in the subjects when confronting phobic stimuli.

In the pilot study, OST was to be significantly better as a specific phobia treatment than self-help. While there was not a statistical significance between culturally adapted OST and standard OST at post-treatment, there was a greater reduction in fear cueing in the culturally adapted OST. This could be interpreted as an increase in the effectiveness of the treatment based on cultural adjustments to the treatment's procedure. Furthermore, it was revealed that OST-CA may have a greater impact on the reduction of the subjects' fear as seen through the comparison of the dichotomized scores to identify high non-verbal cueing and low non-verbal cueing. Subjects in the OST-CA group showed little to no cueing at post-treatment, while almost half of the subjects in the OST-S group maintained cueing. This suggests the OST-CA subjects were experiencing less fear than the OST-S group after treatment. Furthermore, all subjects in the self-help (control) group displayed high levels of cueing in the post-treatment assessments. This indicates, through objective measurement, that OST may be an effective option for treating specific phobias.

Finally, there was a difference in the masking scores between gender groups. Males and females appeared to be masking at a similar rate prior to treatment. Post-treatment masking scores illustrated a change in the masking rates with the males masking less and the female subjects masking more. It was hypothesized that the males would increase in fear cues due to greater social stigmatization of demonstrating fear amongst males. There was a sample size difference between gender groups as two-thirds of the subjects were female. This may have altered the numbers. If there had been an even number of males and females in the study, the outcome may have reflected a stronger masking rate among males than females prior to the treatment. While there was no significant difference statistically, there was a considerable shift in the means. Observational analysis of the BATs revealed that female subjects seemed more aware of the presence of the camera in the room than the male subjects. They looked at the camera and the clinician more frequently than the males. Subjects may have felt the clinician expected a change in their behavior and tried to accommodate the clinician.

Potential limitations in the study include a small sample size and restricted video recording angles during filming. As mentioned previously, there were 30 subjects in the pilot study with 10 subjects assigned to each of the three groups. The drop-out rate was approximately 16%; five subjects did not return for treatment or the second behavioral assessment. Another five subjects refused to be videotaped, making it impossible to assess their non-verbal cues during the BAT sessions. As a result, only 20 subjects of the original 30 were available for analysis in this study. It should also be noted that the study focused on Asian-Americans only, which indicates the sample is not representative of the United States populace. Further studies with other ethnic groups and larger sample sizes should be conducted with modification to filming protocol. Placing one or more stationary cameras in less conspicuous locations around the assessment room could be helpful, as a cameraman makes the camera salient.

IMPLICATIONS

The use of the nonverbal cue index appears to be a helpful measure in assessing potential inconsistencies in self-reported scores by subjects. The use of objective observation in treatment methods for any emotion-based disorders is necessary to determine efficacy of therapy. This study focused on the use of a masking index in the treatment of specific phobias, but it can be utilized in various treatment studies, including anxiety-based, anger-based and depression-based disorders. Development of a non-verbal cue index could offer guidelines and a scoring

mechanism to compare to the subject report to confirm the effectiveness of therapeutic methods, particularly those requiring self-reporting from the subjects.

Determining the proper efficacy level of treatment methods is critical. The success of OST in treating phobias would offer a low-cost and readily accessible form of therapy. It is an excellent option to counter the restriction of psychological treatment in most insurance policies, as well as offer an affordable service to patients without insurance. Furthermore, the use of cognitive therapy reduces costs incurred by insurance companies in long-term prescription use and removes the risk of side effects that patients may experience from pharmaceuticals. The reduction of healthcare costs would be beneficial to both patients and businesses.

Further research will add psychophysiological tests to confirm the possibility of fear masking within the subjects. Certain psychophysiological measurements have been employed to gauge physical levels of fear within the subject, primarily through startle reflex tests (Dawson et al., 1993). A startle reflex can be defined as response in the skeletomuscular system, often in multiple regions, that occur rapidly and connect with other avoidant or protective behaviors to ensure survival (Cook, III et al., 1991). Three main approaches to startle reflex include measuring heart rate, skin conductance and eye blink startle. Heart rate and skin conductance record activation of the sympathetic nervous system signifies fight-or-flight response. Heart rate indicates an increase in blood pressure and oxygen utilization in preparation of physical response to a stimulus, while the skin conductance measures the increase in eccrine sweat gland response, which is associated with arousal, attention and heightened emotional response. The eye blink startle measures intensity of blink response upon encountering visual stimuli that elicits an emotional response.

It should be noted that there are potential complications in the use of certain reflex startle parameters. Any number of stimuli can result in elevation of heart rate unrelated to fear induced response. Increase in heart rate can be the result of excitement and positive anticipation as opposed to fear. Furthermore, skin conductance can be disrupted by individual physiological differences. Some individuals have obstructed and less active eccrine glands, which can interfere with the accuracy of the results. Therefore, these measurements need to be held in comparison to a more specific psychophysiology index that can help determine the type of emotional response elicited in the subject. The next phase of this project will include the use of the heart rate, skin conductance and eye blink startle tests during a one-year follow-up with the subjects to further evaluate the presence of fear masking and assess the effectiveness of OST for treating phobias.

REFERENCES

American Psychiatric Association. (1994). Diagnostic and statistical manual of mental disorders (Fourth edition). Washington, DC.: American Psychiatric Association.

Barlow, D. H., Vermilyea, J., Blanchard, E. B., Vermilyea B. B., Di Nardo, P. A., & Cerny, J. A. (1985). The phenomenon of panic. Journal of Abnormal Psychology, 94(3), 320-328.

Bernstein, S. (1999). A time-saving technique for the treatment of simple phobias. American Journal of Psychotherapy, 53, 501-512.

Brown, T. A. & Barlow, D. H. (1992). Comorbidity among anxiety disorders: implications for treatment and DSM-IV. Journal of Consulting and Clinical Psychology, 60, 835-844.

Campbell-Sills, L., Barlow D. H., Brown, T. A., & Hofmann, S. G. (2006). Acceptability and suppression of negative emotion in anxiety and mood disorders. Emotion, 6, 587-595.

Cook III, E. W., Hawk, Jr., L. W., Davis, T. L., & Stevenson, V. E. (1991). Affective individual differences and startle reflex modulation. Journal of Abnormal Psychology, 100, 5-13.

Coulson, M. (2004). Attributing Emotion to Static Body Postures: Recognition Accuracy, Confusions and Viewpoint Dependence. Journal of Nonverbal Behavior, 28(2), 117-139.

Dawson, M. E., Rissling, A. J., Schnell, A. M., & Wilcox, R. (2007). Under what conditions can human affective conditioning occur without contingency awareness? Test of the evaluative conditioning paradigm. Emotion, 7, 755-766.

Dawson, M. E., Hazlett, E. A., Filion, D. L., Nuechterlein, K. H., & Schnell, A. M. (1993). Attention and Schizophrenia: Impaired Modulation of the Startle Reflex. Journal of Abnormal Psychology, 102, 633-641.

Ekman, P. (1992.) Are there basic emotions? Psychological Review, 99, 550-553.

Foa, E. B., & Kozak, M. J. (1986). Emotional processing of fear: exposure to corrective information. Psychological Bulletin, 99(1), 20-35.

Harrigan, J. A., Wilson, K. & Rosenthal, R. (2004). Detecting State and Trait Anxiety from Auditory and Visual Cues: A Meta-Analysis. Personality and Social Psychology Bulletin, 30(56), 56-66.

Hayes, S. C., Strosahl, K., & Wilson K. G. (1999). Acceptance and commitment therapy: An experience approach to behavior change. New York: Guilford Press.

Huey, S. J., Jr., & Pan, D. (2006). Culture-responsive one-session therapy for phobic Asian Americans: A pilot study. Psychotherapy: Theory, Research, Practice and Training, 43 549-554.

Johnstone, K. A., & Page, A. C. (2004). Attention to phobic stimuli during exposure: the effect of distraction on anxiety reduction, self-efficacy and perceived control. Behaviour Research and Therapy, 42, 249-275.

Kessler R. C., Chiu W. T., Demler O., Walters E. E. (2005). Prevalence, severity, and comorbidity of twelve-month DSM-IV disorders in the National Comorbidity Survey Replication (NCS-R). Archives of General Psychiatry, 62(6):617-27.

Koch, E. I., Spates, C. R., & Himle, J. A. (2004). Comparison of behavioral and cognitive-behavioral one-session exposure treatments for small animal phobias. Behaviour Research and Therapy, 42, 1483-1504.

Ost, L. (1987). Age of Onset in Different Phobias. Journal of Abnormal Psychology, 96(3), 223-229.

Pitterman, H. & Nowicki, S. (2004). A Test of the ability to identify emotion in human standing and sitting postures: The diagnostic analysis of nonverbal accuracy-2 posture test (DANVA2-POS). Genetic, Social and General Psychology Monographs, 130(2), 146-162.

Purves, D., Augustine, G. J., Fitzpatrick, D., Hall, W.C., LaMantia, A., McNamara, J. & White, L.E. (2008). Neuroscience (Fourth edition). Sutherland, MA: Sinauer Associates, Inc, 136.

UNDERSTANDING HSK1'S MULTIFACETED ROLE IN MAINTAINING GENOME INTEGRITY IN FISSION YEAST THROUGH IDENTIFYING PROTEINS THAT INTERACT WITH THE HSK1-DFP1 COMPLEX

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Cell Division Cycle 7 (CDC7), a gene conserved in eukaryotes, encodes for the protein Cdc7. The fission yeast Cdc7 kinase homologue is Hsk1 (*h*omologue of Cdc7 (*s*even) *k*inase *1*). Hsk1 forms a complex, in which Hsk1 is the catalytic kinase and Dfp1 (*d*bf4 *f*our in *p*ombe) is the regulatory subunit. Dfp1 binds to Hsk1 to give specificity to Hsk1's functions by causing it to phosphorylate critical substrates. Hsk1 plays a crucial role in DNA replication, S-phase checkpoint control, cellular recovery from DNA damage, centromere cohesion, meiotic recombination, and formation of meiotic dsDNA breaks. However, detailed mechanisms by which Hsk1 asserts its functions during the cell cycle are still not fully understood; this project aimed to characterize the functions and activities of Hsk1 in fission yeast by identifying novel proteins that interact with both Hsk1 and Dfp1. The project used fission yeast, *Schizosaccharomyces pombe*, since it is a simple model system whose genome has been completely sequenced. Two-hybrid screening was used to identify proteins that interact with Hsk1 and Dfp1 during mitosis and meiosis, respectively, and DNA sequencing of the proteins helped us to determine whether they had been previously identified. The results from this project will ultimately shed light on Hsk1's various roles in maintaining genome integrity during cell division. This is significant since understanding more about the genes and proteins involved in the cell cycle of yeast will allow us to learn more about the control of cell division in humans and the relationship between genome stability and cancer.

INTRODUCTION

Cell biology is essential to cancer research. Because cancer is the uncontrolled division of cells, understanding cell division will help us to understand more about cancer. The work of the 2001 Nobel Prize winners Lee Hartwell, Paul Nurse, and Tim Hunt has shed light on the cell division cycle. Hartwell discovered that the "start" gene Cell Division Cycle (CDC) 28 in budding yeast Saccharomyces cerevisiae (S. cerevisiae) controls the first step of the cell division cycle and that "checkpoints" within the cell cycle ensure that cells pass through cell division in the correct manner. It is now thought that defective cell cycle control causes chromosomes to pass inadequately from parent to daughter cells and for cancer cells to develop. This project investigates how the factors involved in cell division are linked to chromosome remodeling and genome stability. More specifically, the research here focuses on identifying novel protein interactions of a gene that regulates the cell cycle of fission yeast Schizosaccharomyces pombe (S. pombe).

Cell Division Cycle 7 (CDC7), a gene that encodes for the protein CDC7, is conserved in all eukaryotes, from yeast to humans. Cdc-related kinases identified in S. pombe, Homo sapiens, and Xenopus laevis [25, 13, 12] share approximately 45% identity with the budding yeast CDC7 gene across kinase domains. The Cdc7 protein is a serine/threonine kinase that is activated by the binding of a regulatory subunit protein called dumb-bell former 4 (Dbf4) in budding yeast or activator of S phase kinase (ASK) in mammals [24, 19, 3, 14]. The Cdc7p-Dbf4 complex is also known as Dbf4 dependent kinase (DDK) [19].

DDK activity initiates DNA synthesis [5]. Specifically, Dbf4p activates the Cdc7p protein kinase and targets it to the origins of replication. At the origins of replication the DDK complex phosphorylates the mini-chromosomal maintenance (MCM) proteins to begin origin unwinding and/or progression of replication forks [15]. Studies have shown that DDK activity in fission yeast also phosphorylates MCM proteins and that these MCM proteins are well conserved in eukaryotes. This has led to the conclusion that Dbf4p, Cdc7p, and MCM proteins play crucial roles in initiating DNA replication in eukaryotes. DDK also protects cells during the intra S phase checkpoint by maintaining replication fork stability. Specifically, DDK targets fork-associated factors to allow for reactivation of replication at stalled forks. Fork-associated factors identified as DDK substrates include MCM 2, Cdc45, and pola-primase complex [25, 3, 31, 22].

Since DDK activity is essential for DNA replication and cellular checkpoint response, it can be concluded that DDK plays an important role in maintaining genome stability in cells. Studying the DDK complex can shed more light on how genome stability is related to cancer. In fact, recent research has shown that inhibition of DDK activity affects specific phosphorylation sites on MCM2 in cancer cells [26].

As mentioned earlier, Cdc7 and Dbf4 homologues have been identified in other eukaryotes with those of fission yeast having been the most extensively characterized [7, 18]. In fission yeast the Cdc7 homologue is homologue of Cdc7 (seven) kinase 1 (Hsk1) and the Dbf4 homologue is dbf4 four in pombe (Dfp1). The fission yeast gene Hsk1 and budding yeast gene Cdc7 share approximately 50% gene identity and 70% similarity in kinase domains; Hsk1 and Cdc7 also share three kinase sequences at conserved positions [28], (see Appendix for details).

The aim of this project is to identify novel proteins that interact with the Hsk1-Dfp1 complex in fission yeast in order to better understand Hsk1's various roles in maintaining genome integrity during cell division. As Hsk1 is well conserved in eukaryotes, understanding more about the genes involved in the cell cycle of yeast will enable us to better understand the control of cell division in humans and the relationship between genome stability and cancer.

LITERATURE REVIEW

AN OVERVIEW OF HSK1 AND DFP1

Purified Hsk1 has protein kinase activity and is capable of autophosphorylation [3]. Hsk1 exists as two active forms: a monomer and a heterodimer consisting of Hsk1 and Dfp1 [3]. Dfp1 is the fission yeast homologue of Dbf4 in budding yeast [3]. As a binding partner of Hsk1, Dfp1 encodes a regulatory subunit

of the Hsk1-Dfp1 complex, and its transcription is regulated by the cell cycle. Dfp1 level is low during the G1 phase and is elevated at the G1/S boundary and throughout S phase [29]. Dfp1 guides Hsk1 to phosphorylate critical substrates such as MCM 2 in order to initiate DNA replication [3]. Association of Dpf1 with Hsk1 also allows for regulation of S phase checkpoint control and recovery from DNA damage [29]. Overall, the regulation of DNA replication by Cdc7 family proteins related to Hsk1 is conserved in all eukaryotes [16, 25, 12, 10].

RECENT DISCOVERIES ON STRUCTURE AND MORE SPECIFIC FUNCTIONS OF HSK1 AND DFP1:

A. The C-terminal Conserved Region of Dfp1 is Critical for Maintenance of Chromosome Stability during S phase

Dfp1 has three highly conserved regions: motifs N (N-terminal of Dfp1 gene sequence), M (middle of Dfp1 gene sequence), and C (C-terminal of Dfp1 gene sequence) [29, 17]. To determine the roles of these conserved regions in Dfp1's functions, Dfp1 alleles with mutations in these regions were created. Mutations in motif N caused cells to become sensitive to a broad range of DNA damaging agents and replication inhibitors; however, these proteins were still capable of activating Hsk1 kinase in vitro [8]. Meanwhile, mutations in motif C caused cells to become sensitive to methyl methanesulfonate (MMS) especially during S phase due to impaired ability to recover from DNA damage [8]. The Dfp1 motif C mutants treated with MMS displayed nuclear fragmentation, chromosome instability, early recombination, and persistent checkpoint activation. These results demonstrate that Dfp1 plays a vital role in maintaining genome integrity; specifically, the region of Dfp1 containing motif C inactivates intra-S checkpoint and recombination in order to allow for recovery from alkylation damage [8].

B. Swi1, Swi3, and Hsk1 Cooperate in a Novel Response Pathway that Contributes to Cellular Recovery from Alkylation Damage during S phase

To determine whether SWITCH 1 (Swi1) and SWITCH 3 (Swi3) play general roles at replication barriers in S phase, Swi1 and Swi3 mutant strains were observed for increased levels of instability. The mutant stains showed chromosome fragmentation, increased levels of single-stranded DNA, increased recombination, and unstable replication forks stalled in the presence of hydroxyurea (HU). Furthermore, cells with Swi1, Swi3, and Hsk1 mutations were unable to slow progression of S phase in response to alkylation damage. The results indicate that during S phase, Swi1, Swi3, and Hsk1 cooperate in a damage response pathway responsible for the detection of stalled replication forks and decreased rate of passage through S phase in order to allow for cellular recovery from alkylation damage [28].

C. Hsk1-Dfp1 Activity Establishes Centromere Cohesion through Promoting Heterochromatin Formation

Cohesin, a conserved four-subunit complex found in the centromeres of fission yeast and higher eukaryotes, establishes cohesion between sister chromatids and maintains proper orientation of sister kinetochores, allowing for accurate chromosome segregation [2, 20]. Additionally, heterochromatin-associated factors such as Swi6 also play an important role in promoting cohesion at centromeres [2, 21].

Through two-hybrid screening, Dfp1 was identified as a protein that interacts with Swi6 [1]. In budding yeast, similar to mutants with ΔSwi6, DDK mutants with a mutant of cohesin called Rad21-K1 displayed increased rates of chromosome loss and synthetic lethality [30, 27, 8, 2, 6]. Seventy-five percent of the Swi6 and DDK mutants displayed a defect in centromere cohesion, in which the sister centromeres separated during metaphase. This in turn suggests that in fission yeast, Hsk1, Dfp1, and Swi6 function in the same pathway to promote centromere cohesion [1].

Additionally, co-immunoprecipitation confirmed that Hsk1 and Dfp1 interact with Swi6. Specifically, the Hsk1-Dfp1 complex binds to Swi6 via Dfp1's carboxyl terminus [28]. Furthermore, findings show that the Hsk1-Dfp1 complex phosphorylates Swi6 to promote Swi6's association with other factors to form the heterochromatin necessary for cohesion [1]. Overall, these findings suggest that Hsk1, Dfp1, and Swi6 maintain genome integrity during S phase by establishing chromosome structures essential for accurate mitosis [1].

D. Hsk1 Initiates dsDNA breaks during Meiosis without the Aid of Checkpoint Kinases

Hsk1 plays a critical role during meiosis [11]. Experiments showed that Hsk1-89 mutants, temperature sensitive strains of Hsk1+, failed to complete meiosis since most of the mutant cells remained arrested with one nucleus. Broken chromosomes were not detected in the mutants, indicating that formation of dsDNA breaks (DSBs) was impaired. The results confirm that Hsk1 kinase is required for the formation of DSBs preceding meiotic recombination as well as for accurate nuclear and cellular division during the early stages of meiosis [23]. Interestingly, Hsk1 alone is responsible for initiating DSBs without the involvement of checkpoint kinases such as Cds1, Chk1, and Mek1 [23].

E. Maintenance of Genome Integrity via Cds1p Dependent Hsk1-Dfp1 Activity

A study isolated and characterized a new temperature sensitive mutant allele Hsk1ts [27]. After exposure to HU, the Hsk1ts mutant cells completed DNA synthesis but underwent an abnormal mitosis, resulting in elongated cells with fragmented nuclei. This reflected the inability of the cells to restart S phase and complete a normal cell cycle after replication arrest, indicating that Hsk1 is required for recovery from replication arrest [27]. It was also determined that the mutant Hsk1 protein is a direct substrate of the replication checkpoint Cds1p in vitro, suggesting that in addition to Dfp1, Cds1p may also regulate Hsk1's activities [27]. Previous studies have also shown that Dfp1 is phosphorylated in a Cds1p dependent manner in response to HU [29, 4]. In conclusion, as potential substrates of Cds1 kinase, both Hsk1 and Dfp1 maintain genome stability during S phase by regulating cellular response to replication arrest [27].

RESEARCH QUESTION/ PURPOSE

Although previous studies have confirmed that Hsk1 plays a crucial role in a number of cellular functions, the detailed mechanisms by which Hsk1 asserts these functions during the cell cycle are still not fully understood. By studying Hsk1, we hope to better understand the mechanisms through which it works as well as discover novel functions previously unassociated with Hsk1. Thus, the main questions to be answered are: what additional roles does Hsk1 play during the cell cycle, and how does Hsk1 help to maintain genome integrity in cells?

The purpose of this research project was to characterize Hsk1's functions during the cell cycle through identifying novel proteins that interact with both parts of the Hsk1-Dfp1 complex: Hsk1 and Dfp1. Thus, the project was split into two parts. One part focused on identifying proteins that interact with Hsk1 amino acids (aa) 252-507 during mitosis. The other part focused on identifying proteins that interact with both the full length and the C-terminus region of Dfp1, also known as Dfp1 aa454, during meiosis.

In essence, we hope to better understand Hsk1's roles in maintaining genome integrity during cell division through identifying the different proteins that work together to give specificity to Hsk1's functions.

METHODS

STRAINS, MEDIA, AND MANIPULATION

Hsk1 aa252-507: Yeast (AH109) transformations were carried out by heat shock. A serial transformation of the bait (Hsk1 aa252-507) and mitotic library plasmids (pGAD GH) was used to maximize yeast intake of plasmids for the yeast two-hybrid screening. Bait plasmid transformants were grown on Synthetic Dextrose (SD)-Tryptophan (Trp) plates for 3 days at 30°C. Bait plasmid transformants re-transformed with mitotic library plasmids (pGAD GH) were grown on low stringency plates (SD -Trp -Leucine (Leu)) for 4 days at 30°C and later replica-plated onto high stringency plates (SD -Leu -Trp -Adenine (Ade) -Histidine (His)) for 2 days at 30°C.
Dfp1: Bacterial (DH5alpha E. coli) transformations were carried out by heat shock. Bacterial transformants with C-terminus Dfp1 plasmid were grown on LB + 0.02 mg/mL

Kanamycin plates at 36ºC. Yeast (AH109) transformations were carried out by heat shock. A serial transformation of the bait (C-terminus Dfp1) and meiotic library plasmids (pEXP-AD502) was used to maximize yeast intake of plasmids for the yeast two-hybrid assay. Bait plasmid (C-terminus Dfp1) transformants were grown on SD-Leu plates for 2 days at 30ºC. Bait plasmid transformants re-transformed with meiotic library plasmids (pEXP-AD502) were grown on low stringency plates (SD -Trp -Leu) for 4 days at 30ºC and later replica-plated onto high stringency plates (SD -Leu -Trp-Ade -His) for 2 days at 30ºC.

PLASMIDS AND CONSTRUCTIONS

Hsk1 aa252-507: The bait plasmid Hsk1 aa252-507 was previously cloned by Brian Fowler.

Dfp1: The full length and C-terminus region of Dfp1 were amplified by Polymerase Chain Reaction (PCR) and cloned using the following primers: Full Length Dfp1 Forward (AAG TCG ACC ATG AAC CTA GGA GAT GTC), C-terminus Dfp1 at aa454 Forward (AAG TCG ACC GCT ATT CGC TCC GGT AGT), and Full Length Dfp1 Reverse (TAG CGG CCG CTC AAT CTG GGC CTT AAG).

PCR products were cut with NotI (New England BioLabs) and SalI (New England BioLabs). Products were ligated using T4 DNA Ligase (New England BioLabs) into vector plasmid pDBLeu. Ligation products were transformed into DH5alpha E. coli cells and selected by plating on LB + 0.02 mg/mL Kanamycin media grown at 36ºC. Ligation products that grew were re-isolated using Plasmid Miniprep Kit (Bioland) and then restriction digested again for confirmation. Plasmids positive for the full length Dfp1 and Dfp1 aa454 were sent for sequencing using primers specific to the plasmid pDBLeu outside of the multiple cloning site used to insert the cloned Dfp1 fragment: pDBLeu Forward (GAA TAA GTG CGA CAT CAT CAT C) and pDBLeu Reverse (GTA AAT TTC TGG CAA GGT AGA C).

TWO-HYBRID SCREENING

Detailed protocols for the commercial Matchmaker 3 Yeast Two-Hybrid System were followed (Clontech, Mountain View, CA).

Hsk1 aa252-507: Briefly, the bait plasmid (Hsk1 aa252-507) was transformed into AH109 S. cerevisiae cells and grown on SD-Trp plates for 3 days at 30ºC. Bait plasmid transformants were then transformed with mitotic library plasmids (pGAD GH) and grown on low stringency plates for 4 days at 30ºC. These new transformants were transferred to high stringency plates to select for colonies that harbor interactions between the Hsk1 aa252-507 bait and mitotic library plasmid (pGAD GH). Desirable colonies were light pink colored; streaking and patching of these colonies onto high stringency media reconfirmed protein-protein interactions. Mitotic library plasmids (pGAD GH) were isolated using Miniprep Kit (Bioland), transformed into DH5alpha E. coli cells, and grown on Luria–Bertani broth (LB) + 0.01 mg/mL Ampicillin plates at 36ºC. Mitotic library plasmids (pGAD GH) were re-isolated using Miniprep Kit (Bioland), restriction digested, and sent for gene sequencing.

Dfp1: Briefly, the bait plasmid Dfp1 aa454 was transformed into AH109 S. cerevisiae cells and grown on SD-Leu plates for 2 days at 3ºC. Bait plasmid transformants were re-transformed with the meiotic library plasmid (pEXP-AD502) and grown on low stringency plates for 4 days at 30ºC. The transformants were transferred onto high stringency plates in order to select for yeast colonies that have interactions between the C-terminus Dfp1 and meiotic library plasmid (pEXP-AD502). Desirable colonies were light pink colored. These colonies were streaked and patched onto high stringency plates to reconfirm the protein interactions.

GENE SEQUENCING

Gene sequencing was used to identify the mitotic protein interaction partners of Hsk1 aa252-507. 100-300 ug of each of the twenty-one extracted candidate mitotic plasmids was sent to Laragen for sequencing together with 0.010uM Matchmaker 5 AD LD Primer (GAT AAC CTA CTA CTT CTA TGG GGT TTG GGT) or Matchmaker 3 AD LD Primer (GTG AAC TTG CGG GGT TTT TCA GTA TCT ACG ATT).

RESULTS

HSK1 AA252-507

Mitotic Protein Interaction Partners of Hsk1 aa252-507

Twenty-one colonies transformed with the bait plasmid (Hsk1 aa252-507) and mitotic library plasmid (pGAD GH) remained the desirable color of light pink after being replicated from low to high stringency media (Figure 1), indicating that Hsk1 aa252-507 interacted with the mitotic library to activate the ADE2 and HIS3 genes (see Appendix for details). Activation of the ADE2 gene prevented the yeast colony from turning a dark reddish color indicative of adenine starvation. The interaction between Hsk1 aa252-507 and the mitotic library also activated the HIS3 gene since the colony was able to survive on high stringency media lacking histidine. All twenty-one yeast colonies were further streaked and patched onto high stringency media to reconfirm the positive protein-protein interactions. Gene sequencing of the isolated mitotic proteins indicated that protein interaction partners of Hsk1 aa252-507 may include: pyruvate decarboxylase, threonine synthase, elongation factor 1 alpha-B, and glyceraldehyde-3-phosphate dehydrogenase (Figure 2). However, this is only four out of the twenty-one identified proteins from the vegetative cell cycle; future works will identify the rest of these proteins.

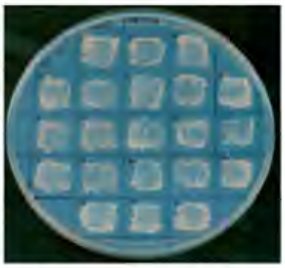


Figure 1. Yeast Colonies that Contain Protein Interactions between Hsk1 aa252-507 Bait Plasmid and Mitotic Libraries (pGAD GH). The bait plasmid (Hsk1 aa252-507) was transformed into AH109 *S. cerevisiae* cells and grown on SD-Trp plates. Yeast colonies with the transformed bait plasmid were then re-transformed with mitotic library plasmids (pGAD GH) and grown on low stringency plates, SD-Leu -Trp. These new transformants were transferred to high stringency plates, SD-Leu-Trp-Ade-His, in order to select for colonies that harbor interactions between the Hsk1 bait and mitotic library plasmid (pGAD GH). Desirable colonies were light pink colored; patching of these 21 colonies onto the high stringency plate above reconfirmed the protein interactions.

Protein	Function
pyruvate decarboxylase	converts pyruvate to acetaldehyde and carbon dioxide during alcoholic fermentation
threonine synthase	catalyzes the last step in threonine biosynthesis
glyceraldehyde-3-phosphate dehydrogenase (GAPDH)	catalyzes the conversion of glyceraldehyde-3-phosphate during glycolysis in cellular respiration; initiates transcription and apoptosis; has functions in vesicle transport
elongation factor 1 alpha-B	mediates the activation and inhibition of transcriptional elongation; maintains stability of the RNA polymerase II elongation complex on the chromatin template

Figure 2. Protein Interaction Partners of Hsk1 aa252-507. Twenty one yeast colonies showed positive interactions between the Hsk1 aa252-507 bait plasmid and the mitotic library (pGAD GH). 100-300 ug of each of the twenty one extracted candidate mitotic plasmids was sent to Laragen for gene sequencing together with 0.010uM Matchmaker 5 AD LD Primer (GAT AAC CTA CTA CTT CTA TGG GGT TTG GGT) or Matchmaker 3 AD LD Primer (GTG AAC TTG CGG GGT TTT TCA GTA TCT ACG ATT). Analysis of the gene sequencing results revealed that some of the mitotic proteins that interact with Hsk1 aa252-507 are: pyruvate decarboxylase, threonine synthase, glyceraldehyde-3-phosphate dehydrogenase, and elongation factor 1 alpha-B. The identified proteins suggest that Hsk1 aa252-507 may be involved in maintaining genome integrity within the cell through multiple pathways such as: metabolism, protein biosynthesis, protein transport. Further work will be done to confirm and characterize these protein interactions at the molecular level.

DFP1

A. Successful C-terminus Dfp1 Bait Plasmid Construct

Both gel electrophoresis and gene sequencing confirmed the successful construction of the C-terminus Dfp1 bait plasmid (Figure 4). DH5alpha E. coli cells containing the C-terminus Dfp1 bait plasmids were grown in LB + 0.02mg/ml Kanamycin liquid media. The bait plasmids were extracted from the E. coli cells, cut with restriction enzymes NotI and SalI, and prepared for gel electrophoresis. The gel of the restriction digest products for the C-terminus Dfp1 bait plasmids confirmed that the C-terminus Dfp1 insert was ligated into the pDBLeu vector plasmid since the gel bands for the pDBLeu vector plasmid and the C-terminus Dfp1 insert matched their expected sizes of approximately 10,000 bp and 300 bp, respectively (Figure 3). The remaining bait plasmids were sent to Laragen along with primers specific to the pDBLeu plasmid outside of the multiple cloning site where the cloned C-terminus Dfp1 fragment was inserted: pDBLeu Forward (GAA TAA GTG CGA CAT CAT CAT C) and pDBLeu Reverse (GTA AAT TTC TGG CAA GGT AGA C). The forward and reverse gene sequencing results for the C-terminus Dfp1 plasmid were each aligned to the published full length Dfp1 sequence using the Blast program from NCBI. The perfect alignments of the base nucleotides confirmed that the bait plasmid was successfully constructed without any mutations (Figure 5).

B. Full Length Dfp1 Construct

The full length Dfp1 bait plasmid is still in the process of being cloned. The gene sequencing results from the first attempt to clone the full length Dfp1 plasmid revealed that there was a point mutation in the construct. Since then, efforts have been made to re-clone the full length Dfp1 bait plasmid.

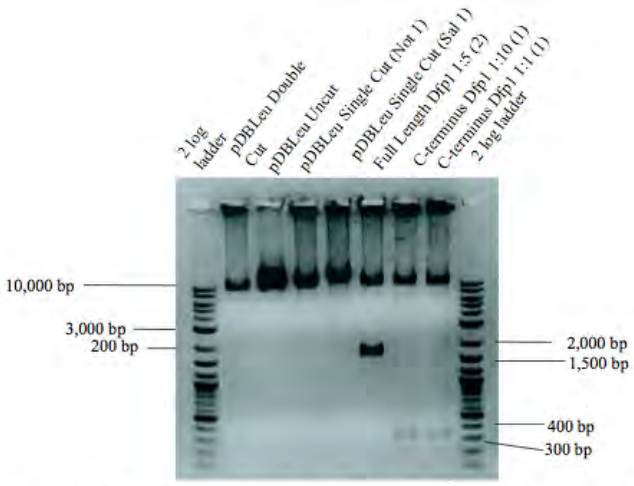


Figure 3. Gel Run for Plasmid Cloning of Full Length and C-terminus Dfp1. PCR products of full length and C-terminus Dfp1 were cut with Not 1 and Sal 1 (New England Biolabs) and ligated into the pDBLeu backbone vector. Ligation products were transformed into DH5alpha *E. coli* cells and grown on LB + 0.02 mg/mL Kanamycin plates. Plasmids were extracted and cut with the restriction digest enzymes Not 1 and Sal 1. The gel of the restriction digest products (Full Length Dfp1 1:5 (2), C-terminus Dfp1 1:10 (1), and C-terminus Dfp1 1:1 (1)) confirmed that full length and C-terminus Dfp1 clones contained the correct inserts because the full length Dfp1 insert matched its expected size of ~1600 base pairs and the C-terminus Dfp1 insert matched its expected size of ~300 base pairs.

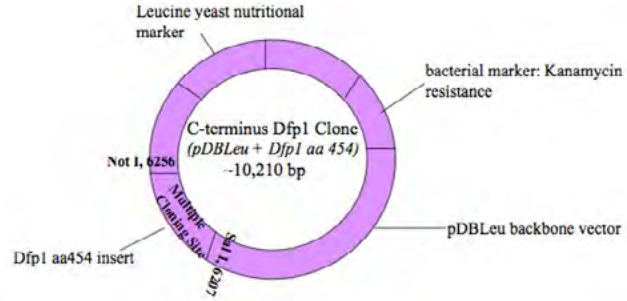
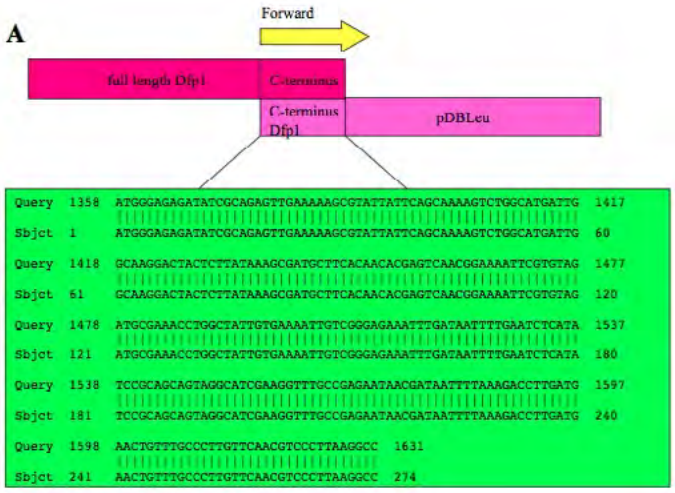


Figure 4. Plasmid map for C-terminus Dfp1 Clone. The C-terminus Dfp1 plasmid is approximately 10,210 base pairs. It is composed of a Dfp1 aa454 insert ligated into the multiple cloning site of the pDBLeu backbone vector at the restriction enzyme sites Not 1 and Sal 1. The C-terminus Dfp1 plasmid has a Leucine yeast nutritional marker and a bacterial marker for Kanamycin resistance. The C-terminus Dfp1 bait plasmid was used in a yeast two-hybrid screen to identify protein interaction partners of C-terminus Dfp1.



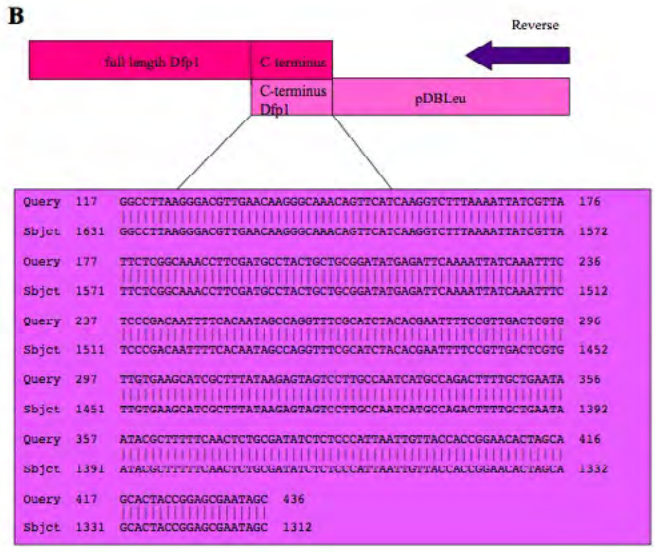


Figure 5. A. Alignment of C-terminus Dfp1 Forward to Published Full Length Dfp1. (Query: Published Full Length Dfp1 Sequence. Subject: C-terminus Dfp1 Forward Sequence). B. Alignment of C-terminus Dfp1 Reverse to Published Full Length Dfp1. (Query: C-terminus Dfp1 Reverse Sequence. Subject: Published Full Length Dfp1 Sequence). C-terminus Dfp1 clone was sent to Laragen for gene sequencing using primers specific to the plasmid pDBLeu outside of the multiple cloning site where the cloned Dfp1 fragment was inserted: pDBLeu Forward (GAA TAA GTG CGA CAT CAT CAT C) and pDBLeu Reverse (GTA AAT TTC TGG CAA GGT AGA C). The forward and reverse gene sequencing results for the C-terminus Dfp1 clone were aligned to the published full length Dfp1 sequence using NCBI's Blast program (*http://www.ncbi.nlm.nih.gov/blast/bl2seq/wblast2.cgi*). These alignments confirmed that the C-terminus Dfp1 insert was correctly ligated into the pDBLeu vector backbone.

C. Meiotic Protein Interaction Partners of the C-terminus region of Dfp1

After replica-plating the C-terminus Dfp1 and meiotic library (pEXP-AD502) AH109 S. cerevisiae transformants from low to high stringency media, only one yeast colony was light pink colored, indicating that the colony harbored a positive protein-protein interaction between the C-terminus Dfp1 bait plasmid and the meiotic library (pEXP-AD502). After reconfirming the single positive result by streaking and patching the yeast colony onto high stringency media, it was determined that the colony was a false positive result.

DISCUSSION

HSK1 AA252-507

Analysis of the gene sequencing results revealed that the following mitotic proteins may interact with Hsk1 aa252-507: pyruvate decarboxylase, threonine synthase, elongation factor 1 alpha-B, and glyceraldehydes-3-phosphate dehydrogenase.

Both pyruvate decarboxylase and glyceraldehyde-3-phosphate dehydrogenase (GAPDH) share similar functions since pyruvate decarboxylase converts pyruvate to acetaldehyde and carbon dioxide during alcoholic fermentation while GAPDH catalyzes the conversion of glyceraldehyde-3-phosphate during the sixth step of glycolysis in cellular respiration. However, GAPDH has additional functions like initiation of transcription [32], apoptosis [9], and transport of vesicles from the endoplasmic reticulum to the Golgi apparatus during protein secretion. Threonine synthase catalyzes the last step in threonine biosynthesis. Elongation factor 1 alpha-B mediates the activation and inhibition of transcriptional elongation and also maintains stability of the RNA polymerase II elongation complex on the chromatin template.

The results suggest that Hsk1 aa252-507 may be involved in maintaining genome integrity within the cell through multiple pathways such as: metabolism, protein biosynthesis, protein transport. However, further confirmation of these protein interaction partners of Hsk1 aa252-507 will be needed before we can characterize how Hsk1 interacts with these proteins at the molecular level.

DFP1

This is the first time that the C-terminus Dfp1 clone was constructed with the purpose of being used for yeast two-hybrid screening in order to determine the meiotic protein interaction partners of the C-terminus region of Dfp1. The C-terminus Dfp1 construct has a Leucine nutritional marker, which allows the experimenter to distinguish colonies containing the C-terminus Dfp1 bait plasmid apart from those containing the meiotic library (pEXP-AD502), which has a Tryptophan nutritional marker.

Although the yeast two-hybrid yielded no meiotic protein interaction partners of the C-terminus region of Dfp1, the fact that the yeast two-hybrid only screened for interactions from a total of 7,000 colonies made it understandable that there was no positive result. The general rule of thumb is to screen ten times the actual number of total genes to get a 90-95% chance of covering the entire genome. Since S. pombe has a total of 4,800 genes, a screen for approximately 50,000 colonies is needed to cover the entire meiotic library. Thus, two-hybrid screening of the remaining 43,000 colonies for meiotic protein interaction partners of the C-terminus region of Dfp1 will have to be done in the future in order to cover the entire genome of S. pombe at least once. Gene sequencing will be used to identify the proteins, and co-immunoprecipitation will be used to confirm the protein-protein interactions. Although the first attempt to construct the full length Dfp1 plasmid was unsuccessful, the experience of cloning the plasmid allowed for a better cloning strategy to be developed. Future works will clone the full length Dfp1 bait plasmid and conduct the yeast two-hybrid assay to screen for meiotic protein interaction partners of the full length Dfp1 protein. Gene sequencing will be used to identify the proteins, and co-immunoprecipitation will serve to confirm those interactions. The identified meiotic protein interaction partners of the full length Dfp1 protein would serve as a good reference in order to confirm that the number of identified protein interaction partners of the C-terminus region of the Dfp1 protein is within reasonable range.

LIMITATIONS

Two-hybrid screens are commonly used in molecular biology to identify protein-protein interactions. However, this assay has a high error rate; because it investigates over expressed, fusion proteins in the yeast nucleus, a large source of error is false positive and false negative interactions. False positive interactions are created when two proteins that are normally never found in the same cell compartment are brought together through two-hybrid screening; although the proteins may interact when they are together, the interaction may not be biologically meaningful. This project has tried to reduce the amount of errors by using the Matchmaker 3 Yeast Two-Hybrid System, which has two reporter gene constructs, Histidine 3 and Adenine 2. However, the Matchmaker System still cannot control for false results, making it necessary to use high confidence in vivo techniques such as co-immunoprecipitation to confirm the identified proteins interactions in future works.

FUTURE WORKS

Future works for both the Hsk1 and Dfp1 aspects of my project will not only confirm the identified protein-protein interactions but will also seek to further characterize these interactions by finding answers to the following questions: when do these interactions occur during the cell cycle, and what happens when one of these mitotic or meiotic proteins is mutated? The goal is to understand the molecular mechanisms behind these protein interactions in order to better understand the multiple pathways through which the protein kinase Hsk1 maintains genome stability in fission yeast.

CONCLUSION

Although previous studies have linked Hsk1's activities to critical events that happen during S phase, M phase, and meiosis, more work needs to be done in order to fully characterize Hsk1's various roles in the cell cycle. This project continued to characterize the protein kinase Hsk1 by examining both aspects of the Hsk1-Dfp1 complex: Hsk1 and Dfp1. Thus, the project was split into two parts: one part focused on identifying novel proteins that interact with Hsk1 aa252-507 during mitosis while the other part focused on identifying novel proteins that interact with the C-terminus region of Dfp1 during meiosis.

For the Hsk1 part of the project, twenty-one positive interactions between Hsk1 aa252-507 and the mitotic library (pGAD GH) were identified. Analysis of gene sequencing results of the mitotic library plasmids (pGAD GH) revealed that four possible interaction partners of Hsk1 aa252-507 are: pyruvate decarboxylase, threonine synthase, glyceraldehyde-3-phosphate dehydrogenase (GAPDH), and elongation factor 1 alpha-B. These identified proteins suggest that Hsk1 may be involved in maintaining genome integrity in fission yeast through pathways such as: metabolism, protein synthesis, protein transport. Future works will identify and confirm all the mitotic protein interaction partners of Hsk1 aa252-507.

For the Dfp1 part of the project, the C-terminus Dfp1 (Dfp1 aa454) bait plasmid was constructed for the first time specifically with the purpose of being used for the yeast two-hybrid to identify meiotic protein interaction partners of the C-terminus region of Dfp1. It is understandable that the yeast two-hybrid did not yield any positive interaction between the meiotic library (pEXP-AD502) and C-terminus Dfp1 plasmid since the two-hybrid only screened for 7,000 out of 50,000 colonies needed to cover the meiotic library of S. pombe. Future works will finish the two-hybrid screen and confirm the identified meiotic protein interaction partners of the C-terminus region of Dfp1. The full length Dfp1 plasmid will be constructed and used for two-hybrid screening; the meiotic protein interaction partners of the full length Dfp1 protein will be used as a reference to confirm that the number of identified meiotic protein interaction partners of the C-terminus region of Dfp1 is within reasonable range.

Most exciting, future works will characterize the molecular mechanisms behind the identified protein interactions; in doing so, we will have a greater understanding of how the protein kinase Hsk1 maintains genome integrity in fission yeast through its multiple pathways in the cell cycle. Because Hsk1 is well conserved in eukaryotes, our knowledge of Hsk1's roles in fission yeast will provide us with a more detailed picture of how the cell cycle is regulated in humans so that we may establish a better definition and understanding of cancer at the molecular level.

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REFERENCES

1. Bailis, J.M., Bernard, P., Antonelli, R., Allshire, R.C., and Forsburg, S.L., "Hsk1-Dfp1 is required for heterochromatin-mediated cohesion at centromeres," Nature Cell Biology, 12, pp. 1111-1116, 2003.

2. Bernard, P., et al., "Requirement of heterochromatin for cohesion at centromeres," Science, 294, pp. 2539-2542, 2001.

3. Brown, G.W., and Kelly, T.J., "Purification of Hsk1, a minichromosome maintenance protein kinase from fission yeast," J. Biol. Chem., 273, pp. 22083-22090, 1998.

4. Brown, G.W., and Kelly T.J., "Cell cycle regulation of Dfp1, an activator of the Hsk1 protein kinase," Proc. Natl. Acad. Sci. USA, 96, pp. 8443-8448, 1999.

5. Dowell, S. J., Romanowski, P. and Diffley, J.F., "Interaction of Dbf4, the Cdc7 protein kinase regulatory subunit, with yeast replication origins in vivo," Science, 26, pp. 1243-1246, 1994.

6. Ekwall, K., et al., "The chromodomain protein Swi6—a key component at fission yeast centromeres," Science, 269, pp. 1429-1431, 1995.

7. Forsburg, S.L., "The art and design of genetic screens: yeast," Nature Reviews, 2, pp. 659-668, 2001.

8. Fung, A.D., Ou, J., Bueler, S., and Brown, G.W., "A conserved domain of Schizosaccharomyces pombe dfp1+ is uniquely required for chromosome stability following alkylation damage during S phase," Mol. Cell. Biol., 22, pp. 4477-4490, 2002.

9. Hara, M.R., Agrawal, N., and Kim, S.F., "S-nitrosylated GAPDH initiates apoptotic cell death by nuclear translocation following Siah1 binding," Nat. Cell Biol., 7, pp. 665-74, 2005.

10. Hess, G. F., Drong, R. F., Weiland, K. L., Slightom, J. L., Sclafani, R. A., and Hollingsworth, R. E., "A human homolog of the yeast CDC7 gene is overexpressed in some tumors and transformed lines," Gene, 211, pp. 133-140, 1998.

11. Iino, Y., and Yamamoto, M., "Negative control for the initiation of meiosis in Schizosaccharomyces pombe," Proc. Natl. Acad. Sci. USA, 82, pp. 2447-2451, 1985.

12. Jiang, W. and Hunter, T., "Identification and characterization of a human protein kinase related to budding yeast Cdc7p," Proc. Natl. Acad. Sci. U.S.A., 94, pp. 14320-14325, 1997.

13. Kim, J. M. et al., "Growth Regulation of the Expression of Mouse cDNA and Gene Encoding a Serine/Threonine Kinase Related to Saccharomyces cerevisiae CDC7 Essential for G1/S Transition," J. Biol. Chem., 273, pp. 23248-23257, 1998.

14. Kumagai, H. et al., "A novel growth and cell cycle-regulated protein, ASK, activates human Cdc7-related kinase and is essential for G1/S transition in mammalian cells," Mol. Cell. Biol., 19, pp. 5083-5095, 1999.

15. Lei, M. et al., "Mcm2 is a target of regulation by Cdc7-Dbf4 during the initiation of DNA synthesis," Genes Dev., 11, pp. 3365-3374, 1997.

16. Masai, H., Miyake, T. and Arai, K., "Hsk1+, a Schizosaccharomyces pombe gene related to Saccharomyces cervisiae CDC7, is required for chromosomal replication," EMBO J., 14, pp. 3094-3104, 1995.

17. Masai, H., and Arai, K., "Dbf4 motifs: conserved motifs in activation subunits for Cdc7 kinases essential for S-phase," Biochem. Biophys. Res. Commun. 275, pp. 228-232, 2000.

18. Masai, H. and Arai, K., "Cdc7 kinase complex: a key regulator in the initiation of DNA replication," J. Cell Physiol., 190, pp. 287-296, 2002.

19. Nasmyth, K., "At the heart of the budding yeast cell cycle," Trends Genet.,12, pp. 405-412, 1996.

20. Nasmyth, K., "Disseminating the genome: joining, resolving, and separating sister chromatids during mitosis and meiosis," Annu. Reve Genet, 35, pp. 673-745, 2001.

21. Nonaka, N., et al., "Recruitment of cohesion to heterochromatic regions by Swi6/HP1 in fission yeast," Nature

Cell Biology, 4, pp. 89-93, 2002.

22. Nougarede, R., Della Seta, F., Zarzov, P., and Schwob, E., "Hierarchy of S-phase-promoting factors: yeast Dbf4-Cdc7 kinsae requires prior S-phase cyclin-dependent kinase activation," Mol. Cell. Biol., 20, pp. 3795-3806, 2000.

23. Ogino, K., Hirota, K., Matsumoto, S., Takeda, T, Ohta, K., Arai, K., and Masai, H., "Hsk1 kinase is required for induction of meiotic dsDNA breaks without involving checkpoint kinases in fission yeast," Proc. Natl. Acad. Sci. USA, 21, pp. 8131-6, 2006.

24. Patterson, M. et al., "Molecular characterization of cell cycle gene CDC7 from Saccharomyces Cerevisiae," Mol. Cell. Biol., 206, pp. 1590-1598, 1986.

25. Sato, N., Arai, K. and Masai, H., "Human and Xenopus cDNAs encoding budding yeast Cdc7-related kinases: in vitro phosphorylation of MCM subunits by a putative human homologue of Cdc7" EMBO J., 16, pp. 4340-4351, 1997.

26. Sipiczki, M., "Where does fission yeast sit on the tree of life?" Genome Biol.,1, pp. 1011.1-1011.4, 2002.

27. Snaith, H.A., Brown, G.W., and Forsburg, S.L., "Schizosaccharomyces pombe Hsk1 is a potential Cds1p target required for genome integrity," Molecular and Cellular Biology, 21, pp.7922-7932, 2000.

28. Sommariva, E., Pellny, T.K., Krahan, N., Kumar, S., Huberman, J.A., and Dalgaard, J.Z., "Schizosaccharomyces pombe Swi1, Swi3, and Hsk1 Are Components of a Novel S-Phase Response Pathway to Alkylation Damage," Mol. Cell. Biol., 7, pp. 2770-2784, 2005.

29. Takeda, T., Ogino, K., Matsui, E., Cho, M.K, Kumagai, H., Miyake, T., Arai, K., and Masai, H., "A fission yeast gene, him1+l/dfp1+, encoding a regulatory subunit for Hsk1 kinase, plays essential roles in S-phase initiation as well as in S-phase checkpoint control and recovery from DNA damage," Mol. Cell Biol., 19, pp. 5535-5547, 1999.

30. Takeda, T, Ogino, K., Tatebayashi, K., Ikeda, H., Arai, K., and Masai, H., "Regulation of checkpoint signaling, and maintenance of mitotic chromosome structures during S phase by Hsk1," Mol. Cell Biol.,12, pp. 1257-1274, 2001.

31. Weinreich, M., and Sillman, B., "Cdc7p-Dbf4p kinase binds to chromatin during S phase and is regulated by the APC and the RAD53 checkpoint pathway," EMBO J., 18, pp. 5334-5346, 1999.

32. Zheng, L., Roeder, R.G., and Luo, Y., "S phase activation of the histone H2B promoter by OCA-S, a coactivator complex that contains GAPDH as a key component," Cell, 2, pp. 255-66, 2003.

APPENDIX: METHODS BACKGROUND INFORMATION

S. pombe was used in this project since it is a simple model system commonly used for studies in eukaryotic cell growth, division, and chromosome dynamics [7]. The S. pombe genes Hsk1 aa252-507, full length Dfp1, C-terminus Dfp1, and mitotic and meiotic libraries of cDNA were cloned into plasmids for the yeast two-hybrids in this project. However, the actual transformations of the bait plasmids (Hsk1 aa252-507 and C-terminus Dfp1) and libraries of cDNA from S. pombe were made using budding yeast, S. cerevisiae, since the tools for the yeast two-hybrid screen were originally designed in budding yeast.

Figure 6. ***Schizosaccharomyces pombe.*** Hsk1 aa252-507, full length Dfp1, C-terminus Dfp1, and the meiotic and mitotic libraries of cDNA from *S. pombe* were used in this study to identify novel protein interactions. *S. pombe* is commonly used in studies of cell division and chromosome dynamics since it is a simple model organism for understanding eukaryotic cell biology.

CLONING

Cloning was used to create the bait plasmids necessary for the two-hybrid screens. Cloning involves inserting a foreign fragment of DNA into a vector plasmid. The vector plasmid contains an origin of replication, a selectable marker gene, and a multiple cloning site. (The origin of replication allows the plasmid to replicate in the host cell; the drug resistant gene allows for selective growth of the host cell on media; and the multiple cloning site allows the foreign DNA fragment to be inserted into the vector plasmid.) Restriction enzymes are used to cleave the vector plasmid at the multiple cloning site in order to open up the vector and create single stranded sticky ends. The foreign DNA fragment is cleaved with the same restriction enzymes to create sticky ends and is mixed together with the vector plasmid. DNA ligase glues both the vector and insert together to form a new recombinant plasmid. This recombinant plasmid is transformed into E. coli, and the transformants are plated on media containing a particular antibiotic in order to select for the cells containing the recombinant plasmid.

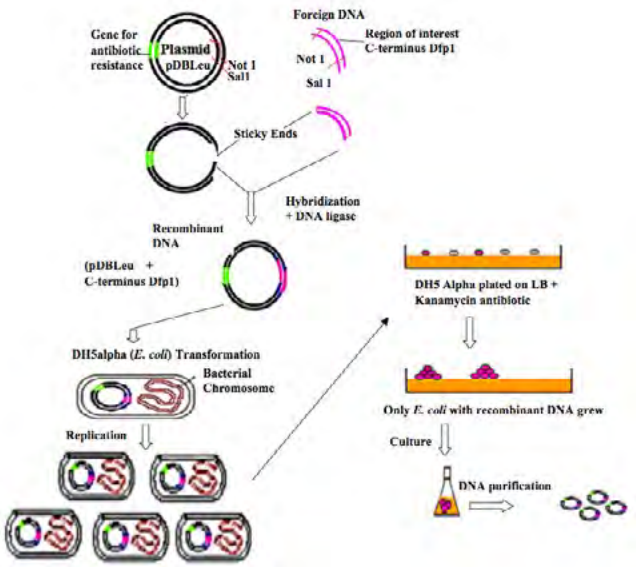


Figure 7. Cloning Process Demonstrated for the C-terminus Dfp1 Plasmid

TWO-HYBRID SCREENING

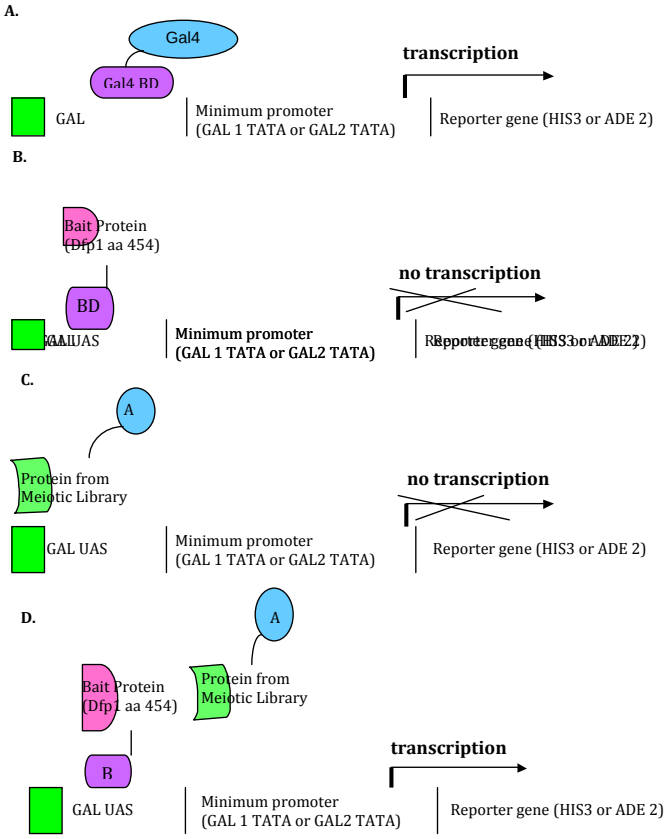
The two-hybrid screen was used to determine the proteins that interact with Hsk1 aa252-507 and the C-terminus region of Dfp1 during mitosis and meiosis respectively. This method is based on the idea that a transcriptional factor binds onto an upstream activating sequence in order to activate the reporter gene. The transcriptional factor consists of two separate domains: the binding domain (BD) and the activating domain (AD). The BD binds to the upstream activating sequence while the AD activates the reporter gene by recruiting factors that promote transcription.

This project used the commercial Matchmaker 3 Yeast Two-Hybrid System from Clontech Laboratories. The main advantage of using the Matchmaker 3 Yeast Two-Hybrid System is that it contains two reporter gene constructs Histidine 3 (HIS3) and Adenine 2 (ADE2), which allows for the reduction of false positive results and greater stringency in selecting for positive protein-protein interactions.

For the Hsk1 part of this project, two-hybrid screening was carried out as follows: Hsk1 aa252-507 was fused to the BD while the mitotic library was fused to the AD. If Hsk1 aa252-507 interacted with the mitotic protein bound to the AD, then the reporter genes HIS3 and ADE2 would be activated, allowing AH109 (S. cerevisiae) to make Histidine and Adenine. Two-hybrid screening was carried out in the same manner for the Dfp1 part of this project.

GENE SEQUENCING AND IDENTIFICATION OF CANDIDATES

DNA sequencing was used to obtain the gene sequences of the protein interaction partners of Hsk1 aa252-507. By comparing the gene sequences of the proteins in question with those from known and putative genes, it can be determined whether the proteins have already been identified.



BIOMECHANICAL EFFECTS OF AN ACL INJURY PREVENTION PROGRAM ON LOWER EXTREMITY LANDING MECHANICS

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Differences in the performance of athletic maneuvers are a contributory factor to the disproportionate incidence of non-contact anterior cruciate ligament (ACL) injuries in female athletes. One mechanism of a non-contact ACL injury is described as occurring just after foot contact during a maneuver that includes a sharp deceleration and change in direction. The biomechanical variables thought to increase an athlete's risk for an ACL injury include decreased knee and hip flexion angles, increased quadriceps activation, increased knee valgus angles, and increased knee adductor moments when compared to males. The purpose of this study was to determine the effects of an ACL injury prevention program on lower extremity landing mechanics and to evaluate the effect of an ACL Injury Prevention Program on knee and hip kinetics and kinematics during a drop landing task. Three-dimensional kinematics, ground reaction forces (1500 Hz) and electromyographic activity (surface electrodes) was recorded during the deceleration phase of a drop land in thirty soccer players. Subjects then participated in the Prevent Injury Enhance Performance (PEP) Training Program 2 times a week for 12 weeks and returned for a re-test. Differences in hip and knee joint kinematics, average moments, and average muscle EMG intensity were evaluated with paired tests. Following participation in an ACL injury prevention program, the athletes demonstrated increased hip flexion (73.84° ± 13.09 vs 78.84 ± 14.15) and total flexion, decreases in quadriceps activity and knee valgus (6.75° ± 4.56 vs. 5.33 ± 3.95) and ratio of knee to hip (2.31 ± 1.82 vs. 1.74 ± .86) and increases of average hip extensor moments (-.69 Nm/kg ± .22 vs. -.79 ± .23). The above results are concurrent with previous work demonstrating that changes in these actions decrease the risk for an ACL injury and can serve as effective prevention techniques. The results are promising because they reinforce the danger of "stiff landings" and establish that movement patterns can be changed to prevent documented 'at-risk' ACL rupture conditions.

INTRODUCTION

Studies comparing the injury rates between male and females participating in the same sport have shown a greater incidence of anterior cruciate ligament (ACL) injuries in female athletes compared to their male counterparts (Arendt and Dick, 1995; Malone et al, 1993; & McNair et al, 1990). Assessment of ACL injuries in 893 men's and women's National Collegiate Athletic Association (NCAA) soccer and basketball programs from 1989 to 1993 found the rate of ACL injury per exposure for female athletes was greater than that of their male counterparts (2.8 and 4.1 times, respectively) (Arendt and Dick, 1995). Over the past decade considerable attention and research has focused on understanding why females incur this disproportionate number of ACL injuries. What is particularly perplexing in the case of female athletes is that the majority of these ACL injuries are non-contact, suggesting that females are interacting with their environment in a way that may be putting them at increased risk for ACL injury. From a qualitative standpoint, one vulnerable position of a non-contact ACL injury has been described as occurring just after foot contact to the ground during a maneuver that includes a sharp deceleration and change in direction, i.e., cutting or landing from a jump (Boden et al., 2000). Here, the knee is described as being in a position of internal rotation, valgus, and relative extension (i.e., 0-30 degrees) (Kirkendall and Garrett, 2000). Further work on non-contact ACL injury is supported by the in vitro work of Markolf, which identified that a valgus moment placed on a relatively extended knee (i.e. 0-40 degrees) increased the strain on the ACL and loads the knee. Hip internal rotation and adduction are thought to influence the position (i.e, increase valgus) and the torque experienced at the knee leading to an increased risk of ACL injury (Pollard, C. Sigward, S., 2007).

In an effort to better understand and prevent ACL injuries, numerous studies have examined gender differences in lower extremity mechanics during athletic tasks. Such investigations have consistently reported that lower extremity mechanics differ between genders. In regard to kinematics, females have been shown to demonstrate greater knee valgus angles (Malinzak et al., 2001; McLean et al. 1999), decreased knee and hip flexion angles (Malinzak et al., 2001; Decker et al., 2002; Lephart et al., 2002), increased quadriceps activation, and increased knee adductor (valgus) moments when compared to males. Taken together, this biomechanical profile is thought to put females at an increased risk for ACL injury.

It has also been demonstrated that contraction of the quadriceps muscle at relatively small knee flexion angles (less than 45 degrees) strains the ACL. Furthermore, Hewett et al. (2005) reported that increased knee adductor moments predict ACL injury. Although females who exhibit sagittal and frontal plane mechanics are thought to contribute to ACL injury, the underlying reasons for this movement strategy are not known. It has been hypothesized that females demonstrate a greater reliance on the frontal and transverse planes at the hip when performing dynamic activities. Pollard et al examined gender differences in hip kinematics and kinetics during cutting and found the only difference in hip mechanics to be relatively less hip abduction in female athletes. Since frontal and transverse plane knee motion and moments are most likely influenced by hip mechanics and largely controlled by passive knee structures, abnormal proximal movement patterns may place female athletes at a higher risk for ACL injury. Due to poor strength of the sagittal plane musculature (i.e. hamstings) females limit the amount of knee and hip flexion during dynamic tasks, and instead, rely more on their passive restraints in the frontal plane (i.e. ligaments) to decelerate the body center of mass. Hewett et al. have referred to this movement pattern as "ligament dominance (2002)." Changes in plane movements may help explain the forces that the PEP Program is working to correct and are thus important when analyzing the success of such Training Programs.

Recently, Pollard and colleagues followed Hewetts' studies of ligament dominance and suggested that individuals who performed a drop land with a "stiff" strategy (average combined peak knee and hip flexion angle of 152) may be at greater risk for ACL injury than those who utilized a "soft" landing strategy (average combined peak knee and hip flexion angle of 190). A "stiff" landing pattern is characterized by decreased hip extensor moments, increased knee extensor moments and increased vastus lateralis muscle activation. In contrast, a "soft" landing pattern is characterized by increased hip extensor moments, decreased

knee extensor moments and decreased vastus lateralis muscle activation. Pollard and colleagues demonstrated that individuals who employed the previously described "stiff" landing pattern experienced greater plane loading at the knee and are thus over utilizing their knee frontal passive restraints which support the concept of ligament dominance thus placing the "stiff" landers at a greater risk for ACL injuries. Dr. Pollard's study demonstrated that decreased hip and knee flexion found in drop-landings is associated with increased knee valgus and knee adductor moments which are both related to an increased incidence of ACL injury. Dr. Pollard suggests that ACL injury prevention programs that emphasize a "soft landing" pattern are promoting more of a hip strategy which is in turn decreasing frontal plane loading at the knee and therefore reducing the risk of ACL injury (Pollard et al. 2008).

Additionally, evaluation of muscle activation patterns using electromyography (EMG) suggests that females demonstrate more quadriceps and less hamstring activity than males during cutting and landing tasks (Malinzak et al., 2001). The "position of no return" describes a collective posture of foot pronation, tibial external rotation, femoral internal rotation, and an awkward or excessively anteriorly flexed trunk position that theoretically results in an ACL injury. Although authors have examined lower extremity biomechanical and neuromuscular strategies inherent to males and females in landing, research on factors contributing to EMG muscle activation in hard and soft landing between males and females has been limited (Kulas et al., 2006). Given that each of these components is likely an important aspect of the mechanism of ACL injury, such an investigation is needed to better understand injurious movement patterns and muscle contractions that could put females at greater risk and to find possible ways of preventing that action from occuring. Analysis of landing preparation could advance our understanding of neuromuscular control in movement patterns and be applied to the development of prevention strategies for non-contact anterior cruciate ligament injury. (Chappell, 2006).

Valgus moments (torques) at the knee have been reported to be significant predictors of peak ground reaction force (GRF). Measures of dynamic valgus (valgus knee angles and moments) during a drop vertical jump predict noncontact ACL injury risk in female athletes with high sensitivity and specificity. Hewett et al also demonstrated that differences between lower extremities in those valgus knee angles and moments were key predictors of ACL injury risk. Computer simulation modeling reveals that lower extremity valgus moments at the knee are high enough to rupture the ACL, whereas knee extension moments and anterior shear forces alone are not sufficient to rupture the ligament. Therefore, the GRF, knee valgus moments, and knee valgus angles appear to play an important role in the identification of ACL injury risk in female athletes and should be investigated during dynamic movements (Cowley et al., 2006).

The purpose of this study was to determine the effects of an ACL injury prevention program, which was found to be successful in reducing incidence of ACL injuries, on lower extremity landing mechanics. Our assessment was accomplished by evaluating changes in knee and hip kinetics and kinematics in thirty female athletes during a drop-landing task. Subjects were pre-tested to obtain control measures, then participated in the Prevent Injury Enhance Performance (PEP) Program under the supervision of Competitive Athlete Training Zone (CATZ) trainers and returned to the lab for a replicated post-test to chart biomechanical differences in movement. It is hypothesized that after training quadriceps: activity will decrease, knee flexion moments will increase, hip extension moments will increase, and knee valgus and knee valgus moments will decrease.

METHODS

SUBJECTS:

Subjects consisted of 30 healthy female club soccer players ranging in age from 11-17 years (average age 13.5 yrs). Subjects were excluded from this study if they reported any of the following: (1) history of previous ACL injury or repair (2) previous injury that resulted in ligamentous laxity at the ankle, hip, or knee, or (3) presence of any medical or neurological condition that would impair their ability to perform a drop-landing task; or, (4) participation in an ACL injury prevention program.

TABLE 1. SUBJECT CHARACTERISTICS

Age Range	10-17
Mean Age	12.166
Height (cm)	152.77
Weight (kg)	45.557
Maturation Level* (considered Pubertal)	1.83
Soccer Experience (Yrs)	7.033
Pre-Test and Post-Test (same as group was re-tested)	

PROCEDURES AND INSTRUMENTATION:

All testing took place at the Musculoskeletal Biomechanics Research Laboratory at the University of Southern California. Prior to participation, all procedures were explained to each subject and informed consent was obtained as approved from the University Institutional Review Board for the University of Southern California Health Sciences Campus.

Three-dimensional motion analysis was performed using a computer aided video, 6 camera (Vicon) motion analysis system (Oxford Metrics Ltd., Oxford, England) at a sampling frequency of 250 Hz. Kinematic data was recorded on a dual Pentium III 1 GHz personal computer. Cameras were interfaced with the microcomputer and positioned around a force plate embedded within the floor so that each marker was detected by at least 2 cameras throughout the task. Ground reaction forces were collected using a calibrated and leveled AMTI force plate (Model#OR6-6-1, Newton, MA, USA) embedded in the floor at a rate of 1500 Hz. This force plate was interfaced with the same microcomputer that was used for kinematic data collection via analog to digital converter allowing for synchronization of kinematic and kinetic data.

Reflective markers (14mm spheres) placed bilaterally on specific boney landmarks were used to calculate motion of the pelvis, hip, knee and ankle in the sagittal, frontal and transverse planes. The anatomical landmarks included: the 1st and 5th metatarsal heads, medial and lateral malleoli, medial and lateral femoral epicondyles, greater trochanters, iliac crests, and a single marker on the joint space between the fifth lumbar and the first sacral spinous process (Kadaba et al., 1989). In addition, triads of rigid reflective tracking markers were securely placed bilaterally on the lateral surfaces of the subject's thigh, leg and heel counter of the shoe. To control for the potential influence of varying footwear, subjects were fitted with the same style of cross-training shoe (New Balance Inc., Boston, MA, USA).

(Figure 1. Lab Design of the Vicon Motion Analysis System)

(Fellin, 2005)

EMG activity was recorded from the dominant lower extremity of the vastus lateralis and of the medial and lateral hamstring muscles at 1560 Hz, using pre-amplified bipolar, grounded, surface electrodes (Motion Control, Salt Lake City, UT USA). EMG signals were telemetered to a 12-bit analog to digital converter using an FM-FM telemetry unit. Differential amplifiers were used to reject and amplify the remaining signal (gain=1000).

Surface EMG electrodes were then placed over the quadriceps (vastus lateralis), lateral hamstrings (biceps femoris) and medial hamstrings (semi-membranosis and semitendinosis) of the dominant leg in accordance with procedures described by Cram et al. (1998). These muscles represent the knee flexors and extensors. Electrodes were secured with tape and an elastic sleeve to minimize motion artifact. The EMG telemetry unit was worn in a pack secured to the subject's back during testing.

To allow for comparison of EMG intensity between subjects and muscles, and to control for variability induced by electrode placement, EMG obtained during the drop-landing maneuver was normalized to the highest magnitude of EMG activity acquired during a maximal voluntary isometric contraction (MVIC). Uniform testing positions were used to

ensure reproducible isometric contractions in positions that allowed for the generation of maximum EMG signal output. The MVIC for the medial and lateral hamstrings was performed with the subject attempting maximal effort knee flexion in a supine position while the dominant lower extremity was flexed to 30 degrees at the hip and the knee and on a stool. The MVIC for the vastus lateralis was performed with the subject attempting maximal knee extension effort against a knee extension machine locked at 60 degrees of knee flexion. All MVIC contractions were held for 5 secs.

(Figure 2. Jump Landing Sleeves Securing the EMG electrodes and triad of Markers can be seen on participants left thigh and shank).

Each participant performed three trials of the drop-landing maneuver (3). The participants were instructed to stand on a platform with a height of 46 cm and step off with their dominant limb first allow both feet to contact separate neighboring force plates, and then proceed to immediately jump as high as they could after landing. It is thought that the quick deceleration along with small knee joint flexion is what accounts for the increased incidence of ACL injury and therefore our results are focused on the downward motion and EMG activity of the feet contacting the box into the returning jumping position. Subjects were not given any verbal cues on landing or jumping technique. Practice drop landing trials allowed the subjects to become familiar with the procedures and instrumentation.

(Figure 3. Jump-Landing Task. Location of feet on separate force plates can be clearly noted).

This first set of collected data was marked as Control data. All participants in the study then participated in PEP Training for 12 weeks, 2 times a week during their team practices in lieu of a warm up. This ACL Injury Prevention Program is a highly specific 15-minute training session originally developed by the Santa Monica Orthopedic and Sports Medicine Group. The subjects were led by trainers from the Competitive Athlete Training Zone (CATZ) and were instructed through exercises such as warm-ups, stretching, strengthening, plyometrics, and sport specific agilities in order to address potential deficits in the strength and coordination of the stabilizing muscles around the knee joint. The CATZ trainers emphasized correct posture, straight-up-and-down jumps without excessive side-to-side movement, and reinforced soft landings. Specific to deceleration, athletes are shown a technique called the '3-step-stop' that spreads the forces that occur at the knee on deceleration over 3 steps instead of 1, thus reducing the stress on the ACL. More information about detailed exercises can be found at the ACL PEP Training Program website: http://pt.usc.edu/ACLprojectprevent/pep_tr.htm

DATA ANALYSIS

Visual 3D software (C-Motion, Rockville, MD) was used to quantify knee and hip motion in the sagittal plane and knee motion in the frontal plane. Markers were identified within the Vicon Workstation software and then imported into Visual 3D. The trajectory data from the reflective markers combined with the ground reaction force data were used to determine the joint motion as well as the joint moments. To facilitate comparison of moment data between groups, all kinetic data were normalized to body mass and net joint moments (internal) were calculated with standard inverse dynamics equations.

The processed EMG data were transmitted to an analog-to-digital converter using an 8-channel hardwired EMG unit. Differential amplifiers were used to reject the common noise and amplify the remaining signal (gain= 2000). EMG signals were then filtered with a band pass Butterworth filter (20-500Hz) and a 60 Hz notch filter was applied. Full wave rectification and smoothing of the EMG signal was accomplished using root-mean-square (RMS) values over a 75 ms interval. The EMG intensities were expressed as a percentage of EMG obtained during the MVIC. EMG processing and smoothing were performed using EMG Analysis Software (Motion Lab Systems, Baton Rouge, LA).

All the data were normalized to 100% of the drop-landing cycle. A drop-landing cycle was identified as the period from initial contact of the feet on the force plates to toes-off, as further documented by force plate recordings. The dominant lower extremity was evaluated for all subjects. For the purposes of this study and due to previous knee loading

research, only the early deceleration phase of the drop-landing cycle was considered as this is the time in which the majority of non-contact ACL injuries are reported to occur (Boden et al., 2000). Early deceleration was defined as the first 50% of the drop-landing cycle. Averaged normalized EMG intensity was used to characterize the contributions of the selected muscles to the knee joint moments and kinematics during this phase. For each subject, all dependent variables represented the mean of the three trials collected.

STATISTICAL ANALYSIS

Paired t-tests were used to determine the effect of the PEP Program on hip mechanics, knee mechanics and EMG data between the Pre-test and the Post test. Variables of interest included changes in peak knee valgus angle, average knee adductor moment, average knee extensor moment, average hip extensor moment, and average EMG for the vastus lateralis and hamstrings during the deceleration phase of landing. Statistical analyses were performed using SPSS statistical software (Chicago, IL). Significance levels were set at P (less than/ equal to) .05.

RESULTS

Data collected from 30 subjects was analyzed from Pre-Training to Post-Training after a 12 week intensive ACL Prevention Program and the results are visually displayed below. It is important to take into consideration that the error bars displayed on each graph are representative of the standard deviation of the 30 subjects, not the Standard Error of the Mean. Subjects exhibited a significant increase in peak hip flexion post training (73.84 13.09 vs 78.84 14.15, p=0.01; Figure 1)

P= .01

No differences were found in peak knee flexion angle following training (89.94 13.10 vs 92.52 13.86, p=0.09; Figure 2).

P= .09

Total Flexion as seen in Figure 3 from Pre-Test to Post-Test significantly increased (163.78 22.65 vs. 167.46 26.26, p=.01)

Figure 3. Total Flexion

Figure 4 represents the Peak Valgus Angle from Pre-Test to Post-Test. A significant decrease in valgus angle was found after the ACL Prevention Program Training (6.75 4.56 vs. 5.33 3.95; P= .07)

Figure 4. Peak Valgus Angle

Subjects were not found to have significant changes in Average Valgus Moments from Pre-Test to Post-Test (-.14 Nm/kg .18 vs. -10 .18; P=.19).

P= .19

Figure 6 represents average Knee Extensor Moments before and after Prevention Training. There is a trend toward significance from Pre-Test to Post-Test (-1.3 Nm/kg .27 vs. -1.2 .26; P= .06).

P= .06

Subjects exhibited a significant increase in peak hip flexion post training (-.69 Nm/kg .22 vs. -.79 .23; P= 0.00); Figure 7.

P= .00

Figure 8 represents the ratio of the Knee to the Hip from Pre-Test to Post-Test. A significant decrease in ratio was found after the ACL Prevention Program Training (2.31 1.82 vs. 1.74 .86; P= .03).

Figure 8. Ratio from Knee to Hip

These biomechanical results give us a clearer understanding of the underlying mechanisms to success in ACL Prevention Programs and will be further analyzed in the discussion section.

DISCUSSION

The results of our study revealed that landing mechanics can be changed after participation in an ACL Prevention Program. Previous work has shown that participation in the PEP Program may reduce risk for ACL injuries. A 74% decrease in non-contact ACL injuries was reported in following training in girls aged 14-18 and a 72% decrease in collegiate soccer players (Silvers, 2008). Despite the high success rate of the PEP Program in female athletes, the exact mechanism(s) for success were not known. The results of this study demonstrate that after training the participants demonstrated a decreased hip flexion and knee valgus, and an increase in total flexion and average hip extensor moments. In addition, the participants exhibited a smaller knee-to-hip moment ratio. This data demonstrates that ACL Prevention Programs, such as PEP, can change landing mechanics and that there are in fact modifiable factors that should be explored as possible preventative measures for ACL injury risk.

The results of the study are consistent with our hypothesis as the results suggest that subjects employed a greater hip strategy (increased hip flexion and hip extensor moments). In addition to increasing the contribution of the hip, training appeared to decrease loading of the knee in the frontal plane. An increase of knee flexion from Pre-Test to Post-Test demonstrates a better distribution along the sagittal plane and that in general, the participants were accepting their weight during deceleration producing a "softer" land. Also suggestive of this increase in hip strategy was the significant increase in hip flexion, which prior to training is often found seen as a proximal control weakness in females. Increased hip flexion has been shown to transfer shear forces from the weak female knee joint to the more stable hip, which work to de-stress the load placed on the joint during a landing task and reduces the risk of loading and consequently tearing the ACL.

Knee valgus is characterized by abnormal outward turning of a bone, especially of the lower extremities (Agel, 2005). In layman's terms, persons with this condition are typically referred to as "bow-legged" or "knock-kneed". The amount of knee valgus from Pre-Test to Post-Test significantly decreased, which is indicative of individuals landing with their knees more in alignment with the hips and ankles. Increased valgus can create torque and place high forces and undue stress on the knee during deceleration tasks. It is important to reduce valgus in order to reduce the occurrence of injuries, and the exercises practiced in the PEP program were shown to be effective in this area.

Perhaps the best result from the study that supports our hypothesis of a knee-hip connection in landing mechanics and injury prevention came from the change in knee-to-hip extensor ratio. This ratio was calculated using the average hip extensor moment and the average knee extensor moment during deceleration. After the ACL Prevention Training, results showed that participants used less knee extensor moment and increased hip extensor moment resulting in a decreased ratio. This Ratio confirmed that Prevention Programs targeting the knee inversely affect the hip joint by increasing its activity during landing in order to absorb the stresses placed upon the ACL in deceleration. Subjects were less likely to use their knee passive restraints and instead employed a more controlled landing with improved hip extension.

Overall, the analysis reconfirmed the previous notion that "stiff" landers (decreased knee flexion; increased knee extensor moments) are at an increased risk for ACL injury as they exhibit the conditions placed upon the joint known to cause injury. After training, more of the participants exhibited "soft" landing techniques (seen as increased knee flexion and decreased knee extensor moments) and therefore decreased their risk of placing a force upon their knee great enough to cause harm.

Previous studies have noted that females exhibit increased quadriceps activity in relation to their male counterparts during a landing task and are therefore considered quad dominant (Silvers). It is believed that the hamstrings (quadriceps antagonist) are underdeveloped in females. The PEP Program includes a strength building component specifically targeting this group of muscles in an effort to enhance joint stability and control. Therefore, upon completion of the training program we are speculating that the activity of the quadriceps will decrease and the hamstrings will increase. Additionally, females have slower muscle reaction times than males, and studies have also found that females have less gluteus medius activation

than males. In order to keep the body in the right place at the right time, nervous system adaptations must occur. Training to improve neuromuscular patterning will also enhance dynamic joint stabilization of the ankle, knee, and hip, and in essence, reduce the likelihood of injury.

It is important to note that ALL ACL Injury Prevention Programs, including PEP, have been designed to address altered movement patterns of some sort or from a one mechanism perspective. Prior to this study, the connection between the knee and hip joint mechanisms had not been analyzed after a training program was implemented. Overall, it was noted that biomechanical mechanisms were changed from Pre-Test to Post-Test as a result of preventative training. The effects noted were suggestive of a decreased risk of ACL injury and as a result these changes indicate possible mechanisms by which the PEP Program was successful in reducing ACL injury. From this study we suggest that Prevention Programs continue to teach sagittal plane control ("soft" landing) and should place particular focus on teaching hip strategy as success in lowering ACL "at-risk" conditions increases dramatically when hip and knee mechanisms are evaluated concurrently.

IMPLICATIONS/ LIMITATIONS

The results of this study are important in that they demonstrate that previously documented 'at-risk' movement patterns can be changed by Prevention Programs (like PEP) in order to further protect athletes from ACL rupture. This is not only important information for athletes but for coaches, trainers, therapists, and ACL program designers. In addition, this study reconfirms the dangers found in "stiff landings" as suggested by Pollard and colleagues. Prevention programs that advocate "Soft Landings" teach athletes to accept and distribute the movement across varying muscle groups and promote deep hip and knee flexion as opposed to landing with a 'flat foot'.

Since the advent of Title IX in 1972, females have been competing in athletics like never before. The Executive Secretary of Education's Commission on Opportunity in Athletics contains this fact: "In 1971, 294,015 girls participated in high school athletics. Today over 2.7 million participate in high school athletics. This represents an 847% increase." At the 2000 Summer Olympics, women accounted for more than half the US team. The surge in female sports has rewarded women with significant social and health benefits, but at the same time it carries special health concerns. It is vital to continue working to prevent ACL injuries because currently they are greater than a $1 billion dollar problem for the United States, and a $625 million dollar problem in women's varsity sports alone (Arendt and Dick, 1995). ACL tears can not only ruin a season or career but can be devastating years later when many women need medications or total knee replacements to manage the pain.

Prevention strategies developed for the toughest of female athletes can transcend to all physical levels so that even the average women looking to improve their health can benefit from them. Billions of dollars are spent on health clubs and diets, and a 15-minute prevention program at the beginning of a work-out designed to protect this weak part of the female anatomy can only complement a healthy regime. Therefore, this study is vital not only to athletes but trainers, coaches, and the average everyday woman.

Due to the constraints found in any training program, the need to maintain consistency was vital to the study. Therefore, our study involved subjects who were already athletes competing on club teams and were recruited in this fashion. In lieu of a warm-up, the teams participating in the study had CATZ trainers lead the 15-minute PEP designed warm-up during their normal practice sessions. Other obstacles involve analyzing the EMG data during a landing task in which electrodes had the tendency to move and produce artificial 'noise'. Every attempt has been made to secure the electrodes via sleeves worn by the subjects during testing to minimize this effect. Additionally, this study compared a Pre-test group who was later Re-tested after PEP Training. This eliminated comparison against a control group as one would find in traditional quantitative studies of this subject matter.

REFERENCES

Arendt, E., & Dick, R. (1995). Knee Injury Patterns Among Men and Women in Collegiate Basketball and Soccer. NCAA Data and Review of Literature. Am. J. Sports Med. Vol 23, 694-701.

Arendt, E., Agel, J., & Dick, R. (1999). Anterior Cruciate Ligament Injury Patterns Among Collegiate Men and Women. J. Athletic Train. Vol. 34, 86-92.

Agel,J., & Arendt, E. (2005). Anterior Cruciate Ligament Injury in National Collegiate Athletic Associate Basketball and Soccer: A 13 Year Review. Am. J. Sports Med. Vol. 33, 524-531.

Boden, B.P, Dean, G.S., Feagin, J.A., & Garrett, W.E. (2000). Mechanisms of Anterior Cruciate Ligament Injury. Orthopedics Vol. 23, 573-578.

Chappell, J.D., Yu, B., Kirkendall, D.T., & Garrett, W.E. (2006). A Comparison of Knee Kinetics between Male and Female Recreational Athletes in Stop-Jump Tasks. Am. J. Sports Med. Vol. 30, 261-267.

Cowley, H., Ford. H., Myer, G., Kernozek, T., & Hewett, T. (2006). Differences in Neuromuscular Strategies between Landing and Cutting Tasks in Female Basketball and Soccer Athletes. Am. J. Sports Med. Vol. 41, 67-73.

Cowling, E.J., & Steele, J.R. (2001). Is Lower Limb Muscle Synchrony during Landing Affected by Gender? Implications for Variations in ACL Injury Rates. J. Electromyogr. Kinesiol. Vol. 11, 263-268.

Fagenbaum, R., & Warren, M.S. (2003). Jump Landing Strategies in Male and Female College Athletes and the Implications of such Strategies for Anterior Cruciate Ligament Injury. Am. J. Sports Med. Vol. 31, 233-240.

Fellin, R. (2006). Fatigue and Gender Effects on Lower Limb Movements During Jump Landings. Clinical Biomechanics. Vol. 23, 81-92.

Hewett, T. E. (2000). Neuromuscular and Hormonal Factors Associated with Knee Injuries in Female Athletes: Strategy for Intervention. Am. J. Sports. Med. Vol. 29, 313-327.

Hewett, T. E. et al. (1999). The Effect of Neuromuscular Training on the Incidence of Knee Injury in Female Athletes: A Prospective Study. Am. J. Sports Med. Vol. 27, 699-706.

Kirkendall, D.T, & Garrett, W. (2000). The Anterior Cruciate Ligament Enigma. Clinical Orthopedics. Vol. 372, 64-68.

Kulas, A., & Shultz S. (2006). Intratester and Intertester Reliability of Clinical Measures of Lower Extremity Anatomic Characteristics: Implications for Multicenter Studies. Clin. J. Sports Med. Vol. 16, 155-161.

Lephart, S.M, Ferris, C.M., Riemann, B.L., Myers, J.B., & Fu, F.H. (2002). Gender Differences in Strength and Lower Extremity Kinematics During Landing. Clin. Sports Med. Vol. 401, 162-169.

Malinzak, R.A., Colby, S.M., Kirkendall, D.T., Yu, B., & Garrett, W.E. (2001). A Comparison of Knee Joint Motion Patterns between Men and Women in selected Athletic Tasks. Clin. Biomech. Vol. 16, 438-445.

McLean, S.G., Neal, R.J., Myers, P.T., & Walters, M.R. (1990). Knee Joint Kinematics during the Sidestep Cutting Maneuver: Potential for Injury in Women. Med. Sci. Sports Exercise Vol. 31, 959-968.

Pollard, C.D., Davis, I.M., & Hamill, J. (2004). Influence of Gender on Hip and Knee Mechanics during a randomly cued Cutting Maneuver. Clin. Biomech. Vol. 19, 1022-1031.

Pollard, C.D., Sigward, S.M., & Powers, C.M., (2008). Stiff Landing Increases Frontal Plane Loading of the Knee. Jour. of Athletic Training. Vol. 43, 544.

Silvers, KneeGURU. (2008). http://www.kneeguru.co.uk/KNEEnotes/node/1099

To find out more about the Prevent Injury Enhance Performance (PEP) ACL Prevention Program, please see http://pt.usc.edu/ACLprojectprevent/pep_tr.htm

ARE WE THERE YET?: PRESCHOOL CHILDREN'S UNDERSTANDING OF APPROXIMATION USING THE WORD "ALMOST"

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Language acquisition becomes more refined with age, but no research to date addresses children's ability to approximate (i.e. how children use language to distinguish between multiple items which differ in degrees of similarity and differences) or at what age this cognitive ability surfaces. This study investigates children's ability to approximate using the word "almost." Research participants were shown a target image and asked to identify which of three images was "almost the same" and "really different" from the target. Six categories were utilized in this study: number, size, color, location, schematic facial appearance, and realistic facial appearance. The results indicate that the ability to approximate similar and different items is strongly correlated with age. Overall, younger children seem to have an understanding of "same" and "different." However, when it comes to the concept of "almost the same" and "really different", the younger children are simply performing at chance. This sill begins to emerge at age 5 as children demonstrate with relative accuracy their ability to use the word "almost." The findings shed light on children's language development, including verbal capacity and comprehension concerning approximations during the preoperational stage. Furthermore, the findings have implications for forensic interviews involving child witnesses. Lawyers and interviewers may now construct questions that are better suited for the child's cognitive capacity, thus eliminating confusion and frustration for the child witness and legal system alike.

INTRODUCTION

Children tend to be the only witnesses in abuse cases. Many of the questions asked require them to recall an event by approximating when the event took place, the frequency at which it occurred, and the length of time the situation was going on for. However, with relational terminology beyond their cognitive understanding (e.g., "almost," "approximately," "about"), young children often get confused and provide contradicting and conflicting information. As a result, the child witness, who may the victim as well, is deemed as uncredible and the testimony is dismissed as irrelevant (Berliner & Kay, 1984; Saywitz & Camparo, 1998). Without their key witness, the prosecution is left without a case, and perpetrators are able to walk free, unpunished for their criminal behavior. In order to reduce such occurrences, questioning must be clear and related to a child's knowledge base, verbal capacity, and stage of cognitive development. Limited research has explored children's understanding of approximations; This study aims to gain a better understanding of the age at which children are able to appropriately use approximations, such as the word "almost." This is significant not only in child witness testimony, but also amongst interactions of parent and child along with teacher and pupil.

CHILD COGNITIVE BEHAVIOR

According to Piaget, cognitive development and progression occur through changes in one's mental schemas—the categories and concepts which provide structure and organization to an individual's environment and guide one's understanding of the world. This occurs in one of two ways: through assimilation, where the child integrates new words and concepts into an already existing schema (e.g., A child has a prior knowledge of dogs. The child sees a cat and classifies it as a dog because they both have four legs) and the second is through accommodation, where the child creates a new schema or modifies the old one, so the new word or concept fits (e.g., Instead of classifying the cat as a dog, the child creates a new category for cat based on size and color) (Kart, Metress, & Metress, 1992, p. 46).

Piaget divided cognitive development model into four stages: sensorimotor, preoperational, concrete operational, and formal operational, and language acquisition occurs rapidly during the toddler years of the preoperational period (Bernstein, 2006, p. 459, 464). Siegel (1978) notes that children at this stage are not linguistically mature and cannot systematically utilize their language to convey their conceptual knowledge. Children have difficulty with linguistic production and lack the necessary words to communicate about topics they do not yet understand. Siegel defined the preoperational stage as "the absence of certain cognitive operations, such as seriation, conservation, transitivity, and class inclusion, among others"; children at the preoperational stage have difficulty with cognitive tasks, such as logical thinking that come easily to adults. The concept of conservation serves as Piaget's prime example. In this task, Piaget would show children two identical, short fat glasses filled with equal amounts of water. Children in the preoperational period tend to believe a tall, skinny glass holds more water than a short, fat glass despite prior knowledge that both glasses had the same amount of water. These cognitive functions (i.e., seriation, conservation, transivity, class inclusion, etc.) consist of tasks that have two critical features: the child must understand terms related to the task (e.g., almost, more, same, and different) and demonstrate successful performance, which is classified as the child's ability to appropriately verbalize the response. It is assumed children's responses reflect their understanding of how the world works at any point in time. Therefore, preoperational children's failures on a verbal task suggest (a) a lack in cognitive operation, (b) the inability to comprehend or produce the required language, or (c) both (Siegel, 1978).

LANGUAGE ABILITY

Gleitman, et al. (1998) noted that around 1;0, children begin to understand and produce their first words. By 1;6, their vocabulary multiplies with the child learning an estimated two words every hour— a rate they maintain through adolescence. At this point, they form two-word sentences to describe the world

around them (e.g., "Give doggie," "Mommie put"). By late-twos and mid-threes, language develops into fluent sentences with increased length and grammatical conversation. While normal children can differ by a year or more in their rate of language development, language is generally acquired before the age of four (Gleitman, Fridlund, & Reisberg, 1998).

GENDER DIFFERENCES

In an overview of the literature, Joseph (2000) noted that in addition to larger vocabularies, women are also superior in clarity of language, word knowledge, articulation, and are more likely to improve at a faster rate. Many introductory psychology and developmental psychology textbooks tend to agree, citing gender differences in children's language ability as "fact" (Hyde & Linn, 1988). However, the research on gender differences is inconsistent. Some studies indicate girls outperform boys in verbal and linguistic tasks with females saying their first word sooner, and articulating their speech more fluently and clearly at a younger age than their male counterparts (Anastasi , 1958; Maccoby, 1966; Tyler, 1965). Other researchers claim that female superiority in verbal ability is prevalent until age two (Doran, 1907; Huttenlocher, et al., 1991; Nelson 1973), while others contend that female superiority in language does not appear until age eleven (Denno, 1982; Maccoby and Jacklin, 1974). Alternative findings were also suggested by Wolf and Gow (1985), who claimed that both genders were superior, each at a different verbal task. They tested 87 five- and six- year olds on their verbal ability and found that while girls were superior to boys in their rate of recall, boys were superior to girls in their knowledge of vocabulary. Conversely, Halpern (1986) declares that gender differences in language ability do not exist at all. She explains away such findings by pointing out that the results are confounded by the prevalence of learning disabilities in the male population (e.g., stuttering and dyslexia). She further asserts that gender differences in language ability decline when a "normal" range of verbal abilities is considered. Further research has determined that there are more differences within genders than there are between genders, (Chall, 1983; Wittig & Petterson, 1979).

In an attempt to sort out the contradicting findings, Hyde and Linn (1988) performed a meta-analysis of 165 studies researching gender differences in language ability. They found that overall females outperformed males. However, the effect size of such differences in verbal performance was so small that gender differences in linguistic aptitude do not seem to exist. The researchers also examined the effect of age on gender differences in verbal performance and concluded age trends have no effect on gender differences in language skill. Recent studies indicate gender differences do not exist in linguistic ability, so boys and girls should perform equally well on tasks assessing their ability to approximate.

SOCIOECONOMIC STATUS (SES)

SES appears to be strongly correlated with lower cognitive skills during childhood, including that of language ability. Rescolora (1989) administered a 240-word version of the Language Development Survey (LDS) to 351 children ages 22 to 26 months. The children with low SES had a mean vocabulary of 126.67 words compared to the children from a high SES background who had a mean vocabulary of 168.53 words. Rescolora (1993) conducted a similar project, which surveyed 200 children from two middle class communities who ranged in age from 16 to 30 months using a 305-word version of the LDS. He found the first middle-class community had a mean vocabulary of 195.57 words and the second one had a mean of 184.40 words. These results indicate children from lower SES families tend to have a smaller vocabulary than those raised in a more affluent environment. Further research supports the discrepancy between SES and verbal ability (Fish & Pinkerman, 2003; Hart and Risley, 1992; Hart and Risley, 1995). The causes behind this differences are extensive and beyond the scope of this paper. (For further descriptions, see Fish & Pinkerman, 2003; Hart and Risley, 1992; Hart and Risley, 1995).

LANGUAGE AQUISITION

CONCEPT VERSUS WORK MEANING

Murphy (2002) distinguished between concept and word meaning: Concept is "the knowledge of what things there are

in the world;" word meaning is "the aspect of words that give them significance and relates them to the world" (385). The significance of words is derived from the expectations and descriptions people use to identify examples of a word and understand it when they hear it. Furthermore, a child learns which concepts correlate with which words through the process of socialization and adult interaction (Murphy, 2002). While children may have a concept of approximation, the words needed to communicate about the topic may be absent. With time and exposure, children come to understand the words associated with certain concepts.

IMPORTANCE OF ANALOGY IN LANGUAGE AQUISITION

Analogy, or the comparison of two objects that are otherwise unlike, is the key to conceptual understanding and is central to human cognition. It is the driving force in children's learning and enables them to notice common relations across different situations and project inferences (Gentner, 2003). Similarly, Rattermann and Gentner (1998) noted that children have the ability to reason about the unknown based upon their knowledge of the familiar. Twelve 4-year olds and twelve 5-year olds were shown colored pictures of the stimuli and asked to complete analogies such as "bread : slice of bread :: lemon : ?? " The participants were then given answer choices of (A) slice of lemon (i.e. correct), (B) slice of yellow cake (i.e. wrong object, correct transformation), (C) squeezed lemons (i.e. right object wrong transformation, and (D) yellow Nerf football (i.e. mere appearance). The results indicated the degree of causal knowledge— an intuitive explanation as to why— predicted children's performance on the analogy task (Ratterman and Gentner, 1998; Simon, 1982).

Ability to analogize is relevant to the acquisition of word meaning. Nelson (1983) defines language as "a system of using words as symbols that can be recombined in different ways to stand for different relations between things in the world" (185). In order to adequately use a word, the child must be able to analyze similarities of the word within different events and categorize it accordingly. The emergence of such behavior is evident in the use of early spatial language in which children overextend meanings to a variety of contexts to be perceived similar in nature. E. V. Clark (1973a) uses the example of an apple, which is small and round in shape. In some instances, children extend the word to other objects similar in shape and size, such as doorknob, balls, paper weights, and round light switches. She further proved such analogous behavior in young children is crucial when learning the definitions of new, more ambiguous words such as "under." 70 children ranging in age from 1;6 to 5;0 were given a series of directions, instructing them to place an object "in," "on," or "under" another object. In some contexts children treated the novel word "under" as having the same meaning as "on," while in other situations treating it as "in." Upon hearing a new word in a novel setting, children make an immediate inference about the set or group of words it fits with; conventional meanings are continually added and contrasted with the previous acquired meanings (E.V. Clark 1973a). Therefore, when a child hears the word "almost," they will equate it with words such as "same," which are similar in nature.

AQUISITION OF MEANING

Metaphorically, the lexicon is described as a person's mental dictionary, and there are two rules which govern it: (1) The principle of conventionality states that words have conventional meanings, while (2) the principle of contrast notes that words have different meanings (E. V. Clark, 1983). Likewise, there are two gaps in the mental lexicon. A momentary gap occurs when an individual has "trouble retrieving a conventional word." A chronic gap occurs "there is no conventional word to express the meaning." Children have many more chronic gaps, because their vocabulary is smaller than adults (E. V. Clark, 1983). From these theories, it is hypothesized that such is the case with "almost." While the word exists in the English language, younger children will have difficulty expressing answers involving "almost" because it is not a part of their vocabulary.

AQUISITION AND NON-LINGUISTIC STRATEGIES

Understanding of the terms "in" and "on" first emerges between the ages of 2;0 and 2;4. Then, children begin to understand the word "under" (2;0-2;9) along with directional

terms such as "up," "down," "beside," and "between" (3;0-3;8), followed by "in front of" (4;0-4;6) and "behind" (after 4;8). "Left" and "right" are usually the last to be acquired (Newcombe & Huttenlocher, 2000, p. 197-98; Johnston, 1985, p.199). These tendencies provide evidence of a specific order in which children begin to acquire words and concepts.

E. V. Clark (1973a, 1973b) hypothesized that children only have a partial understanding of the meaning of a word when they begin to use it. They gradually learn the meaning of words through non-linguistic strategies by forming rules based upon their understanding of relationships in the environment. In E.V. Clark's (1973a) study of 70 children ranging in age from 1;6 to 5;0, the participants were instructed to place an object "in," "on," and "under" a second object. The outcomes indicated that age correlated with a greater ability to distinguish and appropriately use the three prepositions. There was a low error rate and no significant difference between groups for children over three. However, the age groups between 1;6 and 3;0 revealed a consistent pattern in their errors: when the second object was a container, the children treated all instructions as "in." If the second object had a supporting surface (e.g., a table), the participants acted as if all the directions were "on." "Under" was rarely correct, with the child's answer reflecting the condition they were in (i.e., "on" or "in") despite the "under" instructions. Her findings suggested the first two prepositions are more easily understood than the latter, and she attributes this to non-linguistic rules which compensate for a lack of complete understanding: (1) If it is a container, X is inside it; (2) If it is a surface, X is on it. Words such as "under" are harder to comprehend because they do not fit with the child's schema for either "in" or "on." Likewise, one would expect a word like "almost" to follow a similar pattern of difficulty.

Along similar lines, H. H. Clark (1973) attributes the order of language acquisition to the complexity hypothesis. He suggests that the order of acquisition is limited by the constricting rules of application, or "a condition that must be met before a word can be applied to a perceptual event" (29). The complexity hypothesis claims that when a person is given two terms, A and B, where B has all the rules applicable to A plus one more rule, A will typically be acquired before B. This rule can be most clearly illustrated with the words "in" and "into." The word "in" dictates an enclosed three-dimensional space. The term "into" includes this rule, but in addition it also requires movement in a particular direction. Therefore, "in" will be acquired before "into" because it is less cognitively complex. This suggests that children will understand absolutes (e.g., same and different) before they will comprehend approximations (e.g., "almost the same" and "really different")

UNDERSTANDING OF RELATIONAL TERMS

Relational terms are words which allow a speaker to describe an object with respect to another object (Pickett, 2000). Plumert and Hawkins (2001) describe additional biases in 3- and 4-year-old children's development of relational terminology, specifically comparing children's understanding and use of "in" with that of "next to." In Experiment 1, sixteen 3-year old and sixteen 4-year old children were asked to tell a troll doll where a mouse was hiding based on his location in relation to the surrounding environment (i.e., "under the bear in the crib" versus "under the bear next to the crib"). The results indicated that both groups of children had an easier time remembering and articulating "in" than "next to," supporting the order of acquisition theory which claims that children have a bias for support (i.e., "in," "on," and other words which involve a surface providing support to an object through direct contact) over proximity (i.e., "next to" and other words used to describe nearness in relation to another object). In Experiment 2, the researchers tested a different group of sixteen 3-year old and sixteen 4-year old children on their ability to follow directions using the above mentioned spatial terminology (i.e., "The mouse is in the bag by the playpen."). A search was considered to be correct if the child retrieved the mouse on the first try. While there was no difference in children's accuracy with containment terminology (i.e. "in" and "on"), there was a significant difference in the amount of time it took a 3-year olds to respond to a proximity stimuli. They were frequently prompted by the researcher because they sat still for quite some time without initiating any action towards finding the object. However, 4-year old children performed equally well on both containment and proximity stimuli. From these results, one can

conclude ability to use relational terms involving proximity and containment increases with age. More importantly, children have a greater difficulty with proximity relations than they do with situations involving containment.

Plumert and Hawkins (2001) noted that the dichotomous basis is one possibility for the containment bias (e.g., either an object is "in" or it is "not in" the container). "Next to," however, is not dichotomous; it lies on a continuum with the definition varying depending on the context of the situation and the speaker and listener's own personal discretion. Difficulty with comprehension and production is explained by the predicament of when an individual should no longer consider an object to be "next to" another object. "Almost" is similar in nature and is defined as "nearly; not quite; slightly short of" (Pickett, 2000). If an object is almost the same size, it is a little bigger or a little smaller than the target object. But, at what point is the object no longer the same size as the original object? Furthermore, when does the object lose its status of being almost the same and becomes classified instead as a completely different size altogether?

In a longitudinal study, Clark & Carpenter (1983) examined an extensive diary with recordings of the linguistic utterances of a toddler during the time period from age 1;0 to 6;0. The data also included the transcripts of six other children who were recorded for 30-60 minutes in weekly or biweekly sessions over the age range of 1;6 to 5;1. They found the use of "by" was extremely low and it was first produced to indicate proximity in space or in combination with self (e.g., by myself). Overall, children seemed to have a tendency to substitute "from" for "by" (e.g., He isn't going to get hurt from those bad guys). To test these errors, children were asked to "repair" various types of sentences (both grammatical and ungrammatical) which used the words "from," "by," and "with" to "make them better." The results showed that nine of ten 2-year olds frequently substituted "from" for "by," while only two of the ten 5-year olds made the same error. At three years of age, children would repair the ungrammatical "from" to "by" 44% of the time. Clark & Carpenter (1983) concluded that children's over-regulation of words indicates an assumption that language is more regular and structured than it truly is, resulting in prescribed rules which assist them in making sense of meaning. One such rule assumes that "from" marks a source (i.e., originating from a person, place, etc.); the child then assumes "with" and "by" cannot mean the same thing as "from", and must contrast with it. Since all three prepositions have several meanings and uses, it takes time for children to acquire and understand the sense of overlap. Similarly, "almost" can have multiple, abstract meanings relative to both the speaker's judgment and the situation at hand, making the acquisition of the appropriate conventional meaning quite difficult.

ESTIMATION

Siegel (1977) tested E. V. Clark's (1973a) non-linguistic hypothesis (i.e., this hypothesis claimed that children form rules based upon their understanding of relationships in the environment) using the words "big," "little," and "same number" (Siegel 1977). According to the cognitive complexity theory, an understanding of such relational terms should depend on the degree to which the comparison requires the coordination of length, density, and number. A child should be able to understand "big," "little," and "same number" when there is a length cue available (e.g., a row of five is longer in length than a row of four). However, if the opposite is true (e.g., a row of four is longer in length than a row of five), the concept is more difficult to comprehend. In this study, 168 three and four year old children were shown a 5x7 card with a number of dots at the top, and two answer choices below. They were then asked to point to the answer choice that had the same number of dots as the row at the top. The results demonstrated the 3-year olds performed at chance where 4-year olds demonstrated a better understanding. However, 4-year olds experienced difficulty when the correct answer was not equal in length with the number of dots at the top of the card. This indicates preschool children lack a full adult understanding when comparing numbers using "same number."

Donaldson and Balfour (1968) illustrated children also have difficulty in their interpretation of "more" and "less," treating them as interchangeable. Fifteen young children between the ages of 3;5 and 4;1 were asked to indicate which tree had "more" or "less" apples. The results illustrated that a majority of the children answered questions concerning which tree had "less" by

pointing to the apple tree which actually had more. Of all the children questioned, only one was correct in all of the answers concerning the word "less." The other children demonstrated a marked tendency to respond with "more" despite the instruction given. While children correctly interpret the meaning to have a quantitative connotation, they interpret both words to have a meaning equivalent to "more." This indicates that numerical terminology, like spatial terminology, also presents difficulties for young children. These findings would suggest that preschool aged children should also demonstrate a lack of understanding regarding the word "almost," which is similar in meaning to the comparative terms "more" or "less." If something is "almost," it is either a little less or a little more than the quantity desired.

CURRENT STUDY

There is a gap in the literature regarding children's acquisition and understanding of approximations with limited attention given to inquiring about children's ability to approximate and at what age such a cognitive ability becomes present. The current study examines children's use of the word "almost" and determines at what age they are able to approximate using the word. Children's acquisition of linguistic knowledge is important because this is how they communicate their perceptions and thoughts about the world around them. In the case of child witness testimony, this is significant because the conviction or acquittal of the accused depends on the sole testimony of a young child's answers to questions which are sometimes phrased above their cognitive capacity. Sayowitz (1998) recalls an instance when a preschool child responded no when asked if he saw a weapon. Later when asked more specifically if he saw a gun, the child responded in the affirmative. This demonstrates how the simple changing of one word to fit a child's cognitive capacity allows the child to convey a more complete and accurate report of their experiences. To eliminate the instances in which children do not understand the terminology used in questioning or comprehend the abstract concepts the questions are addressing, it is important to gain a better understanding of children's cognitive abilities across various concepts. This study focuses solely on children's ability to approximate using the word "almost."

A substantial body of evidence exists to support the idea that young children lack the understanding of relational comparisons. Craton, Elicker, Plumert, and Pick (1990) made the important distinction that even if children do understand the concept of spatial location, they have difficulty putting the concept into words. Such a task requires children to coordinate two different tasks—spatial and verbal. The lack of specificity often present in linguistic command and conceptual representation (i.e. It's over there; It's the close one) influences children's communication. With location in particular, interpretation is relative and therefore difficult to comprehend and communicate about.

METHODS

PARTICIPANTS

61 English speaking (30 males; 31 females), upper-middle class, preschool aged children (age 2;11 to 5;10; M= 4;3) were recruited at several local preschools in the Los Angeles area (St. James' Preschool, Robin's Nest, and Sunshine Day Dreams). The preschools were chosen based on a pre-existing list associated with the research group and their location in upper-middle class neighborhoods. The study specifically targeted a higher SES to avoid the possible confound of a mixed SES sample. Children's participation in the study was contingent upon their parents' consent and their assent (For Parent Consent Form and Child Assent Form, see Appendix 1 and Appendix 2).

PROCEDURE

The researcher met with the director of each preschool to describe the study and provide a copy of the proposal and consent forms. Consent forms were distributed to parents to sign and return to the preschool. Prior to the experiment the researcher spent time at the various preschools talking and playing with children to build a relationship of trust and rapport. The director and researcher described the study to the children as a group, encouraging participation, but emphasizing they did not have to take part if they do not want to. Afterwards,

the researcher invited the children individually to come "play a game." If the children agreed, they were taken to the designated area—a quiet place within the preschool, where the child was in full view of teachers, but could only see the researcher.

For each category, the researcher handed the child a laminated card with the image pertaining to one of the six categories (e.g., number, size, color, location, schematic facial appearance, and realistic facial appearance) and then placed the answer choices in a random circular arrangement (For stimuli, see Appendix 3). One answer choice was exactly the same as the target object. The other two answer choices differed from the target object based on category in question (e.g., for the size category, the answer choices were an enlargement and reduction of the target object). The researcher then began the pretest by asking the child: "Look at this boy. I want to see a boy who is the SAME size. Look at your picture and show me a boy who is the SAME size," (For Script, see Appendix 4). The child's final answer was recorded. The researcher then asked the next question in the set: "Now, I want to see a boy who is a DIFFERENT size. Look at your picture and show me a boy who is a DIFFERENT size." If the child answered either of these two pre-test questions incorrectly, the researcher moved onto the next category, skipping the "almost the same" and "really different" task. Without the essential background of the words "same" and "different," the children would not be able to understand "almost the same" or "really different." If the child answered both "same" and "different" questions correctly for the specific category, the researcher moved to "almost the same" and "really different" task. These questions are similar in nature to the "same" and "different" task, but involved the phrases "almost the same" and "really different." (i.e., "Look at this boy. I want to see a boy who is ALMOST the SAME size. Look at your picture and show me a boy who is ALMOST the SAME size").

The order of the categories was randomized to control for chance guessing on the part of the child. In addition, the order of the questions (same and different; almost and really different) alternated with each participant. The researcher used a random numbers table to determine whether same or different came first. One set of pre-test questions (i.e., same and different) and two sets of test questions (i.e., almost the same and really different) were asked for each category, making a total of thirty-six questions. The different categories create a variety of questions with different supplemental pictures to minimize subject boredom. No positive or negative feedback was given to ensure neutrality and prevent experimenter bias from influencing children's answers.

MEASURES

Freidman/Lyon Scale of Approximation

A measure named the Friedman/Lyon Scale of Approximation was developed to assess children's ability to accurately discriminate between objects using the word "almost." The scale utilized visual stimuli in order to compare the child's knowledge of and ability to vocalize differences between the stimuli using the words "same," "different," "almost the same," and "really different." For each of the six categories (i.e., number, size, color, location, schematic facial appearance, and realistic facial appearance), there are two questions for the pre-test and four questions for the actual task. Six different versions of the scale with the order of the categories and questions within each category (same/different and almost the same/really different) rotating. This helps prevent chance guessing by the child. The scale was piloted prior to the actual study to ensure the reliability and validity.

DATA ANALYSIS

For both same/different and almost same/really different, a series of repeated measures ANOVAs were conducted with age as a between subjects factor and "same"/"different" and "almost the same"/ "really different" as a within subjects factor.

SAME/DIFFERENT

Number, Size, and Schematic Facial Appearance. The test for number, size, and schematic facial appearance "same"/ "different" by age did not reveal any significant effects by age (For the same/different means for each category and age group, see Table 1). Hence, there were no age differences in understanding of "same" and "different" for these concepts, nor did children

perform differently depending on whether they were asked to choose the same item or a different item. This indicated number, size, and schematic facial appearance conceptualization and expression for "same"/ "different" was equivalent for children across all age groups.

Color. The "same"/ "different" test for color (i.e., pre-test) found a significant effect due to age group, ($F(4, 54) = 3.36$, $p = .02$, partial eta squared = .19). Furthermore, there was a significant difference in understanding of same and different, ($F(1,54)$ 6.48, $p = .01$, partial eta squared = .10), as well as an interaction between age and understanding of "same" and "different," ($F(4,54) = 3.49$, $p = .01$, partial eta squared = .20). Examination of the means revealed that although children improved in their ability to select the same color with age, with a noticeable improvement occurring among the young 4s, there were no clear age trends with respect to their ability to choose a different color. The interaction between age and understanding of "same"/ "different" indicated that the young 3s performed at ceiling for "different" ($M = .93$), but as age increased to 3;6 and 4;0 children's understanding of "different" decreased. By 4;5 ($M = .93$) and 5;0 + ($M = 1.00$) children are once again performing at ceiling. This indicated color conceptualization and expression for "same"/ "different" is dependant upon the child's age. The 3s understand "different" better than the 4s; however, the 4s have a higher performance rate with "same." The 5s perform at ceiling for both terms.

Location. The "same"/ "different" test for location found a significant effect due to age group, ($F(4,54) = 5.94$, $p < .001$, partial eta squared = .30). Examination of the means revealed children improved in their ability to select the same and the different location with age, with a noticeable improvement occurring among the 4s. The 3s showed a general understanding, but by age 5 + children demonstrated a full adult understanding. This indicated location conceptualization and expression for "same"/ "different" improved over time.

Realistic Facial Appearance. The "same"/"different" test for realistic facial appearance found a significant difference in understanding of "same" and "different," ($F(1,54)$ 9.91, $p = .003$, partial eta squared = .15), as well as an interaction between age and understanding of same and different, ($F(4,54) = 3.25$, $p = .02$, partial eta squared = .19). Examination of the means revealed that although children improved in their ability to select the same realistic facial appearance with age, with a noticeable improvement occurring among the older 4s, there were no clear age trends with respect to their ability to choose a different color. The interaction between age group and understanding of "same" / "different" indicated that young 3s, young 4s, and 5 +s understand "different" at a higher accuracy rate than "same." The opposite is true for the older 3s who demonstrated a better understanding of "same." The older 4s however demonstrated an equal understanding of both terms ($M = .86$). Overall, "different" was understood more frequently than "same" across all age groups. This indicated that the rate of accuracy for realistic facial appearance conceptualization and expression for "same"/ "different" depends on the age of the child. However, a ceiling was not found for "same" within these age groups, indicating a lack of understanding. Furthermore, these findings suggest that as the stimuli and question material become more realistic and hence more complicated, children struggle with the ability to articulate an understanding "same."

Total. The "same"/ "different" test for total correct found a significant effect due to age group, ($F(4, 54) = 3.65$, $p = .01$, partial eta squared = .10). Furthermore there was a significant difference between understanding of "same" and "different," ($F(1,54) = 5.19$, $p = .03$, partial eta squared = .09). Examination of the means revealed there was an age trend for both same and different. Overall, children improved in their ability to select the same object with age, with a noticeable improvement occurring among the young 4s. Likewise, children's performance when selecting a different object also increased with age, with a noticeable improvement occurring in the older 4s. When it came to indicating which object was the same and which was different, children understood "different" at a younger age and maintained that bias throughout with 5 +s successfully answering more questions pertaining to "different" as compared to "same."

Almost the Same/ Really Different

The "almost the same"/"really different" test for number, size, color, and location revealed children did not perform differently depending on whether they were asked to choose the same item or a different item.

Number. The "almost the same"/ "really different" test for number found a significant effect due to age group ($F(4,54) = 5.36$, $p = .001$, partial eta squared = .28). Examination of the means revealed that children improved in their ability to select "almost the same" number with age, with a noticeable improvement occurring in the older 4s. Likewise, children improved in their ability to select "really different" number with age, with a noticeable improvement occurring in the 5+s. There was no significant difference in understanding between "almost the same" and "really different." This indicated that number conceptualization and expression for "almost the same"/ "really different" improved over time.

Size. The "almost the same"/ "really different" test for size found a significant effect due to age group ($F(4,54) = 7.00$, $p = <.001$, partial eta squared = .33). Examination of the means revealed that children improved in their ability to select both "almost the same" and "really different" size with age, with a noticeable improvement occurring for both in the 5+s. This indicated that size conceptualization and expression for "almost the same"/ "really different" improved over time.

Color. The "almost the same"/ "really different" test for color found a significant effect due to age group ($F(4,54) = 6.16$, $p < .001$, partial eta squared = .31). Examination of the means revealed that children improved in their ability to select both "almost the same" and "really different" color with age, with a noticeable improvement occurring for "almost the same" in the older 4s and "really different" in the 5+s. This indicated that color conceptualization and expression for "almost the same"/ "really different" improved over time.

Location. The "almost the same"/"really different" test for location found a significant effect due to age group ($F(4,54) = 4.35$, $p = .004$, partial eta squared = .24). Examination of the means revealed that children improved in their ability to select both "almost the same" and "really different" color with age, with a noticeable improvement occurring for "almost the same" in the 5+s and "really different" in the older 4s. However, the 5+s were still performing at chance (M = .50 ("almost the same"); M = .58 ("really different")). This indicated that although location conceptualization and expression for "almost the same"/ "really different" improved with time, the oldest age group did not hit ceiling and were still struggling with the concept of approximation. Even children ages 5+ lacked an adult understanding and were simply performing at chance. This could be due in part to the difficulty of location itself. As Plumert and Hawkins (2001) concluded, the concept of proximity is hard for children to grasp because it lies on a continuum. The category of location is more cognitively complex because it requires a comparison that is always relative to another location.

Schematic Facial Appearance. The "almost the same"/ "really different" test for schematic facial appearance found a significant effect due to age group ($F(4,54) = 4.40$, $p = .004$, partial eta squared = .24), as well as an interaction between age group and understanding of "almost the same" and "really different," ($F(4,54) = 2.49$, $p = .05$, partial eta squared = .15). Examination of the means revealed that children improved in their ability to select both "almost the same" and "really different" schematic facial appearance with age, with a noticeable improvement occurring for both at age 5+. The interaction between age group and understanding of "almost the same"/ "really different" indicated that 3s and young 4s demonstrated a better understanding of "almost the same." However, the older 4s had a higher accuracy rate for "really different." By age 5+, these differences disappeared and children performed equally for both terms (M = .81). The older 4s however demonstrated an equal understanding of both terms (M = .86). This indicated that realistic facial appearance conceptualization and expression for "almost the same"/ "really different" depends on the age of the child. Though younger children struggled with a concept of approximation in general, they did show a bias in understanding that favored "almost the same" over "really different." With time, this bias faded and children performed equally well for both terms.

Realistic Facial Appearance. The "almost the same"/ "really different" test for realistic facial appearance did not reveal any significant effects. Hence, there were no age differences in understanding of "almost the same" and "really different" for these concepts, and there was no significant difference in children's understanding of "almost the same" and "really different." All age groups were performing below chance. This indicated that children struggle with realistic facial appearance

conceptualization and expression for "almost the same"/ "really different." As the stimuli become more complicated, and more realistic in terms of courtroom interaction, even the children who demonstrate an understanding of "almost the same"/ "really different" for other categories will falter.

Total. The "almost the same"/ "really different" test for total correct found a significant effect due to age group ($F(4,54) = 9.18$, $p < .001$, partial eta squared = .40). Examination of the means revealed that children improved in their ability to select both "almost the same" and "really different" items with age, with a noticeable improvement occurring for both in the 5+. This indicated that overall, conceptualization and expression for "almost the same"/ "really different" improves over time with a noticeable improvement in the older 4s and 5+. However, children appear to lack a full adult understanding of approximations for the more cognitively complex categories (i.e. location and realistic facial appearance).

DISCUSSION

Even the youngest children are able to recognize and comprehend "same" and "different." By age 5;0 children are able to identify "almost the same" and "really different. Furthermore, the children's understanding of "same"/ "different" in a category determined their understanding of "almost the same"/ "really different" within the same category. If the children hit ceiling for "same"/ "different" (i.e., number, size, color, and schematic facial appearance), they also demonstrated a high understanding of "almost the same"/ "really different" for the same category. However, if the children had difficulty with the concept of "same"/ "different" within a category (i.e., location and realistic facial appearance), the struggle was then reflected in their understanding of "almost the same"/ "really different" for that category. This indicated that absolutes (i.e., "same" and "different") emerge before relatives (i.e. "almost the same" and "really different").

For the quantitative categories (i.e., number size, and location), children excelled in both number and size "same"/ "different" and "almost the same"/ "really different," with the 5;0 to 5;11 group demonstrating an 80 percent accuracy rate. However, children proved to have a more difficult time answering questions about location. This is believed to be due to the cognitively complex nature of location. The description of where an object is in space is dependant upon its relation to the other surroundings (i.e. under the bear next to the crib). In order to determine which girl is at "almost the same" place, the child must consider the girl's relationship to other places (e.g., the position of the girl in the target object along with the position of the girl in the "really different" stimuli).

A similar trend was found for the visual processing categories (i.e., color, schematic facial appearance, and realistic facial appearance). Children did relatively well in answering "same"/ "different" and "almost the same"/ "really different" questions for color and schematic facial appearance with children once again hitting ceiling for all the questions in both categories. However, children's ability to approximate for realistic facial appearance fell drastically with even the oldest children simply performing at chance. The difficulty with comprehension and production in this category is attributed to the cognitive complexity involved in more realistic stimuli. The realistic facial appearance task shows that as the stimuli become more complicated— and more realistic, if one is thinking in terms of courtroom interactions— even children who understand the concept of "almost the same" and "really different" falter.

These findings suggest children struggle with a concept of approximation they can articulate and have difficulty communicating about this aspect of their world. They cannot adequately understand nor accurately answer some of the more cognitively complex questions, such as those concerning approximations or the use of the word "almost," which are pertinent when attempting to portray a complete and accurate description of events. This is frustrating not only for the child, but also for the interviewer and other adults and family members who are trying to understand the details of the situation. As Sayowitz (1998) remarked, "Problems arise when questions are asked in language too complex for young children to comprehend about concepts too abstract for them to understand. Children try to answer questions they do not fully understand, and adults misinterpret the meaning of children's responses," (p. 826).

These young children need to be given a voice, a voice that will ring loud and clear, reverberating their story. By enabling children to accurately describe the events that have happened to them, they can be removed from unhealthy environments which could further prove to be detrimental to their cognitive development and self-esteem. The best way to accomplish this is through more research examining children's understanding of words and the corresponding concepts.

FUTURE WORK

It is recommended that future work expand this study by increasing the age range in order to establish a ceiling as well as looking at other socioeconomic groups to see if they have an equal understanding of approximations or if they differ in their understanding of the word "almost" as past research would suggest. Also, this study was limited to the word "almost," so it is suggested that future work delve deeper into examining the emergency and rate of accuracy for other approximation words such as "close to," "nearly," and "about."

It would also be useful to explore the categories which proved to be difficult for young and old children alike. Future research should investigate the wording involved in specific questions to see if different words yield a more accurate response (i.e., within the location category, "spot" could be substituted for "place"). For the realistic facial category, other studies should further explore the hypothesis that increased detail and complexity causes children who demonstrate an understanding of "almost the same" and "really different" to falter in real world settings. Actual photographs should be incorporated along with the realistic facial sketch to determine if there is a difference in children's ability to distinguish between "almost the same" and "really different." This is further significant in child witness testimony because it is necessary for the child to identify the suspect. By establishing which medium (i.e., sketch or picture) is most efficient, child witnesses are further enabled to adequately relay their tale with increased accuracy.

In addition, researchers should consider other concepts outside of approximations that prove to be problem areas for young children, such as sequencing (i.e. "first" and "last" in comparison with "before" and "after"). By gaining this understanding, the techniques used to interview child witnesses can be improved and questions can be created to correspond with the cognitive ability and comprehension of the child being interviewed. In addition, child interviewers, along with teachers and parents, can better communicate and understand young children.

REFERENCES

Anastasi, A. Differential Psychology (3rd ed.). New York: Macmillian.

Berliner, L. & Barbieri, M. K. (1984). The testimony of the child victim of sexual assault.

Journal of Social Issues, 40, 123-137.

Bernstein, D.A. (Ed.). (2006). Psychology (7th ed.). Boston, MA: Houghton Mifflin

Company.

Clark, E. V. (1973a). Non-linguistic strategies and the acquisition of word meanings.

Cognition, 2, 161-182.

Clark, E. V. (1973b). What's in a word? On the child's acquisition of semantics in his

first language. In T. E. Moore (Ed.), Cognitive development and the acquisition

of language (pp. 65-110). New York: Academic Press.

Clark, E. V. (1983). Convention and contrast in acquiring the lexicon. In T. B. Seiler &

W. Wannenmacher (Eds.), Concept development and the development of word

meaning (pp. 67-89). New York: Springer-Verlag.

Clark, H. H. (1973). Space, time, semantics, and the child. In T. E. Moore (Ed.),

Cognitive development and the acquisition of language (pp. 27-63). New York: Academic Press.

Chall, J. (1983). Reading ability in boys and girls. Harvard Educational Review, 53, 439-443.

Craton, L. G., Elicker, J., Plumert, J. M., & Pick, H. L. (1990). Children's use of frames

of reference in communication of spatial location. Child Development, 61, 1528-

1543.

Denno, D. (1982). Sex differences in cognition: A review and critique of the longitudinal

evidence. Adolescence, 17, 779-788.

Donaldson, M. & Balfour, G. (1968). Less is more: a study of language comprehension in

children. British Journal of Psychology, 59, 461-471.

Doran, E. W. (1907). A study of vocabularies. Pedagogical Seminary, 14, 401-438.

Fish, M. & Pinkerman, B. (2003). Language skills in low-SES rural Appalachian children:

normative development and individual differences, infancy to preschool. Applied Developmental Psychology, 23, 539-565.

Gentner, D. (1988). Metaphor as structure mapping: The relational shift. Child

Development, 59, 47-59.

Gentner, D. (2003). Why we're so smart. In D. Gentner & S. Goldin-Meadow (Eds.),

Language in mind (pp. 195-235). Cambridge, Massachusetts: MIT Press.

Gleitman, H., Fridlund, A. J., & Reisberg, D. (1998). Baby born talking— describes

Heaven. Basic Psychology (Fifth Edition) (pp. 262-296). New York: W. W.

Norton and Company.

Halpern, D. F. (1986). Sex differences in cognitive ability. Hillsdale, NJ: Erlbaum.

Hart, B., & Risley, T. (1992). American parenting of language-learning children: persisting

differences in family-child interactions observed in natural home environments.

Developmental Psychology, 28, 1096-1105.

Hart, B., &Risley, T. (1995). Meaningful differences in the everyday experience of young

American children. Baltimore: Brookes.

Pickett, J. P. et al. (Eds.) (2000). "Almost." American Heritage Dictionary of the English

Language (4th ed.). Boston: Houghton Mifflin Company.

Huttenlocher, J., Haight, W., Bryk, A., Seltzer, M., and Lyons T. (1991). Early vocabulary

growth: relation to language input and gender. Develpomental Psychology, 27, 236-248.

Hyde, J. S. & Linn, M. C. Gender differences in verbal abilitiy: A meta-analysis. Psychological

Bulletin, 104, 53-69.

Johnston, J. R. (1988). Children's verbal representation of spatial location. In J. Stiles-

Davis, M. Kritchevsky, and U. Bellugi (Eds.), Spatial cognition: Brain bases and development (pp. 195-206). Hillsdale, NJ: Lawrence Erlbaum.

Joseph, R. (2000). The evolution of sex differences in language, sexuality, and visual-

spatial skills. Archives of Sexual Behavior, 29, 35-66.

Kart, C. S., Metress, E. K., & Metress, S. P. (1992). Human aging and chronic disease. Boston,

MA: Jones and Bartlett.

Maccoby, E. E. Sex differe4nces in intellectual functioning. In E. E. Maccoby (Ed.), The

development of sex differences. Stanford, CA: Stanford University Press.

Maccoby, E. E. & Jacklin, C.N. (1974). The psychology of sex differences. Stanford, CA:

Stanford University Press.

Murphy, G. L. (2002). The big book of concepts. Cambridge, Massachusetts: MIT Press.

Nelson, K. (1973). Structure and strategy in learning to talk. Monographs of the Society for

Research in Child Development, 38(1-2, Serial No. 149).

Nelson, L. (1983). The conceptual basis for language. In T. B. Seiler & W.

Wannenmacher (Eds.), Concept development and the development of word

meaning (pp. 173-188). New York: Springer-Verlag.

Newcombe, N. S. & Huttenlocher, J. (2000). Making Space. Cambridge, Massachusetts:

MIT Press.

Plumert, J. M., & Hawkins, A. M. (2001). Biases in young

children's communication

about spatial relation: containment versus proximity Child Development, 72, 22-

36.

Rattermann, M. J., & Gentner, D. (1998). More evidence for a relational shift in the

development of analogy Children's performance on a casual mapping task. Cognitive Development, 13, 453-478.

Rescorla, L. (1989). The language development survey: A screening tool for delayed language

in toddlers. Journal of Speech and Hearing Disorders, 54, 587-599.

Rescorla, L., Hadicke-Wiley, M., & Escarce, E. (1993). Epidemiological investigation of

expressive language delay at age two. First Language, 13, 5-22.

Saywitz, K. & Camparo, L. Interviewing child witnesses: A developmental perspective.

Child Abuse & Neglect, 22, 825-843.

Siegel, L. S. (1977). The cognitive basis of the comprehension and production of

relational terminology. Journal of Experimental Child Psychology, 24, 40-52.

Siegel, L. S. (1978). The relationship of language and thought in the preoperational child:

a reconsideration of nonverbal alternatives to Piagetian tasks. In L. S. Siegel & C. J. Brainerd (Eds.), Alternatives to Piaget (pp. 43-67). New York: Academic Press.

Simon, H. A. (1982). Models of bounded rationality. Cambridge, MA: MIT Press.

Tyler, L. E. (1965). The psychology of human differences. New York: Appleton-Century-Crofts.

Wittig, M. A., & Peterson, A. C. (Eds.) (1979). Sex-related differences in cognitive functioning.

New York: Academic Press.

Wolf, M. & Gow, D. A longitudinal investigation of gender differences in language and reading

development. First Language, 6, 81-110.

Table 1

Descriptive Statistics for Number Same/Different Correct by Age

	age grouped by 6 month categories	Mean	Std. Deviation	N
NumSc	Lowest (35) to 41	.60	.507	15
	42 to 47	.88	.354	8
	48 to 53	.91	.302	11
	54 to 59	.86	.363	14
	60 and higher	1.00	.000	13
	Total	.84	.373	61
NumDc	Lowest (35) to 41	.87	.352	15
	42 to 47	.88	.354	8
	48 to 53	.73	.467	11
	54 to 59	.86	.363	14
	60 and higher	.92	.277	13
	Total	.85	.358	61

Descriptive Statistics for Size Same/Different Correct by Age

	age grouped by 6 month categories	Mean	Std. Deviation	N
SizeSc	Lowest (35) to 41	.73	.458	15
	42 to 47	.75	.463	8
	48 to 53	.73	.467	11
	54 to 59	.93	.267	14
	60 and higher	.92	.277	13
	Total	.82	.388	61
SizeDc	Lowest (35) to 41	.73	.458	15
	42 to 47	.88	.354	8
	48 to 53	.73	.467	11
	54 to 59	1.00	.000	14
	60 and higher	.92	.277	13
	Total	.85	.358	61

Descriptive Statistics for Color Same/ Different Correct by Age

	age grouped by 6 month categories	Mean	Std. Deviation	N
ColorSc	Lowest (35) to 41	.47	.516	15
	42 to 47	.38	.518	8
	48 to 53	.82	.405	11
	54 to 59	.86	.363	14
	60 and higher	.92	.277	13
	Total	.70	.460	61
ColorDc	Lowest (35) to 41	.93	.258	15
	42 to 47	.75	.463	8
	48 to 53	.64	.505	11
	54 to 59	.93	.267	14
	60 and higher	1.00	.000	13
	Total	.87	.340	61

Descriptive Statistics for Location Same/ Different Correct by Age

	age grouped by 6 month categories	Mean	Std. Deviation	N
LocSc	Lowest (35) to 41	.53	.516	15
	42 to 47	.50	.535	8
	48 to 53	.73	.467	11
	54 to 59	1.00	.000	14
	60 and higher	.77	.439	13
	Total	.72	.452	61
LocDc	Lowest (35) to 41	.73	.458	15
	42 to 47	.50	.535	8
	48 to 53	.73	.467	11
	54 to 59	.93	.267	14
	60 and higher	1.00	.000	13
	Total	.80	.401	61

Descriptive Statistics for Schematic Facial Appearance Same/ Different Correct by Age

	age grouped by 6 month categories	Mean	Std. Deviation	N
SchemFaceSc	Lowest (35) to 41	.67	.488	15
	42 to 47	.75	.463	8
	48 to 53	1.00	.000	11
	54 to 59	.79	.426	14
	60 and higher	.92	.277	13
	Total	.82	.388	61
SchemFaceDc	Lowest (35) to 41	.67	.488	15
	42 to 47	.88	.354	8
	48 to 53	.82	.405	11
	54 to 59	.93	.267	14
	60 and higher	.92	.277	13
	Total	.84	.373	61

Descriptive Statistics for Realistic Facial Appearance Same/ Different Correct by Age

	age grouped by 6 month categories	Mean	Std. Deviation	N
FacerealSc	Lowest (35) to 41	.53	.516	15
	42 to 47	.62	.518	8
	48 to 53	.64	.505	11
	54 to 59	.86	.363	14
	60 and higher	.46	.519	13
	Total	.62	.489	61
FacerealDc	Lowest (35) to 41	.87	.352	15
	42 to 47	.50	.535	8
	48 to 53	.91	.302	11
	54 to 59	.86	.363	14
	60 and higher	1.00	.000	13
	Total	.85	.358	61

Descriptive Statistics for Total Same/Different Correct by Age

	age grouped by 6 month categories	Mean	Std. Deviation	N
SameTot	Lowest (35) to 41	.5889	.37726	15
	42 to 47	.6458	.31418	8
	48 to 53	.8030	.14564	11
	54 to 59	.8810	.15231	14
	60 and higher	.8333	.19245	13
	Total	.7541	.27320	61
DiffTot	Lowest (35) to 41	.8000	.16903	15
	42 to 47	.7292	.21708	8
	48 to 53	.7576	.36027	11
	54 to 59	.9167	.18199	14
	60 and higher	.9615	.09986	13
	Total	.8443	.22540	61

Table 2

Descriptive Statistics for Number Almost the Same/Really Different Correct By Age

	age grouped by 6 month categories	Mean	Std. Deviation	N
NumASTot	Lowest (35) to 41	.3667	.44186	15
	42 to 47	.3125	.45806	8
	48 to 53	.5455	.47194	11
	54 to 59	.7143	.42582	14
	60 and higher	.8077	.32522	13
	Total	.5656	.45162	61
NumRDTot	Lowest (35) to 41	.1333	.22887	15
	42 to 47	.4375	.32043	8
	48 to 53	.4091	.43693	11
	54 to 59	.5000	.39223	14
	60 and higher	.8077	.38397	13
	Total	.4508	.41538	61

Descriptive Statistics for Size Almost the Same/Really Different Correct By Age

	age grouped by 6 month categories	Mean	Std. Deviation	N
SizeASTot	Lowest (35) to 41	.2333	.37161	15
	42 to 47	.1250	.23146	8
	48 to 53	.4091	.43693	11
	54 to 59	.6429	.45694	14
	60 and higher	.8077	.38397	13
	Total	.4672	.45524	61
SizeRDTot	Lowest (35) to 41	.2333	.31997	15
	42 to 47	.1875	.37201	8
	48 to 53	.3636	.45227	11
	54 to 59	.3571	.41271	14
	60 and higher	.8077	.32522	13
	Total	.4016	.42642	61

Descriptive Statistics for Color Almost the Same/Really Different Correct By Age

	age grouped by 6 month categories	Mean	Std. Deviation	N
ColorASTot	Lowest (35) to 41	.2000	.25355	15
	42 to 47	.1875	.37201	8
	48 to 53	.5000	.50000	11
	54 to 59	.6071	.44629	14
	60 and higher	.7308	.43853	13
	Total	.4590	.44995	61
ColorRDTot	Lowest (35) to 41	.1333	.29681	15
	42 to 47	.2500	.37796	8
	48 to 53	.4545	.47194	11
	54 to 59	.3571	.45694	14
	60 and higher	.8462	.31521	13
	Total	.4098	.45192	61

Descriptive Statistics for Realistic Facial Appearance Almost the Same/Really Different Correct By Age

	age grouped by 6 month categories	Mean	Std. Deviation	N
FaceRealASTot	Lowest (35) to 41	.1333	.29681	15
	42 to 47	.1875	.37201	8
	48 to 53	.3636	.45227	11
	54 to 59	.4286	.47463	14
	60 and higher	.2692	.43853	13
	Total	.2787	.41357	61
FaceRealRDTot	Lowest (35) to 41	.2333	.41690	15
	42 to 47	.1875	.37201	8
	48 to 53	.3182	.40452	11
	54 to 59	.5357	.45844	14
	60 and higher	.4615	.51887	13
	Total	.3607	.44843	61

Descriptive Statistics for Location Almost the Same/ Really Different Correct By Age

	age grouped by 6 month categories	Mean	Std. Deviation	N
LocASTot	Lowest (35) to 41	.1000	.20702	15
	42 to 47	.0625	.17678	8
	48 to 53	.3182	.40452	11
	54 to 59	.3929	.40089	14
	60 and higher	.5000	.45644	13
	Total	.2869	.38143	61
LocRDTot	Lowest (35) to 41	.1000	.28031	15
	42 to 47	.1250	.35355	8
	48 to 53	.3182	.40452	11
	54 to 59	.5000	.43853	14
	60 and higher	.5769	.44936	13
	Total	.3361	.42545	61

Descriptive Statistics for Total Almost the Same/ Really Different Correct By Age

	age grouped by 6 month categories	Mean	Std. Deviation	N
ASTot	Lowest (35) to 41	.2333	.20940	15
	42 to 47	.1875	.24296	8
	48 to 53	.4697	.29172	11
	54 to 59	.5595	.29676	14
	60 and higher	.6538	.22269	13
	Total	.4344	.30471	61
RDTot	Lowest (35) to 41	.1889	.16507	15
	42 to 47	.2396	.24168	8
	48 to 53	.3788	.29194	11
	54 to 59	.4821	.28151	14
	60 and higher	.7179	.25581	13
	Total	.4098	.30931	61

Descriptive Statistics for Schematic Facial Appearance Almost the Same/ Really Different Correct By Age

	age grouped by 6 month categories	Mean	Std. Deviation	N
FaceSchemASTot	Lowest (35) to 41	.3667	.39940	15
	42 to 47	.2500	.37796	8
	48 to 53	.6818	.40452	11
	54 to 59	.5714	.47463	14
	60 and higher	.8077	.32522	13
	Total	.5492	.43498	61
FaceSchemRDTot	Lowest (35) to 41	.3000	.36839	15
	42 to 47	.2500	.26726	8
	48 to 53	.4091	.37538	11
	54 to 59	.6429	.41271	14
	60 and higher	.8077	.38397	13
	Total	.5000	.41833	61

APPENDIX

CONCEPTUAL DEVELOPMENT IN YOUNG CHILDREN

We are asking to include your child in research on children's ability to answer questions about sequences of events. I am Nicole Grant, a psychology honors student at the University of Southern California. I am working under the direction of Thomas D. Lyon, J.D., Ph.D., who is a professor and researcher at the University of Southern California. A child can be in the research if he or she is between 2 and 6 years of age. You and your child can decide if you want to be in this research. A total of approximately 500 children will be in this research.

PURPOSE OF STUDY

We are interested in a variety of abilities that children appear to develop during the preschool years, including their understanding of terms referring to time, to sequence, to approximation, to location, to number, and other simple concepts that allow children to talk about their experiences. What we find out will allow us to give advice to people who interview children.

PROCEDURES

If you agree to let your child be in this study, we will then ask your child. A researcher will visit your child's school and will be introduced to all the children. The researcher will take your child to a separate room, and will tell your child stories that will include either a series of events or a series of pictures depicting different collections of common everyday objects or different routine actions.. The researcher will then ask your child questions about the pictures. For example, in order to examine children's understanding of approximation, the child will choose which of several story children is "almost" the same size as a target story child. Everything will be either audio recorded or videotaped, and will take no more than thirty minutes. During the course of the school year, we may ask your child to participate in up to 3 additional sessions, which will both allow us to ask additional questions and to examine changes in children's answers over time.

POTENTIAL RISKS AND DISCOMFORTS

There is little to no risk to your child in this experiment. Your child may not want to answer some questions. Your child can stop being in the study at any time. If your child seems distressed or anxious, we will stop the study, reassure your child, and take him or her back to the classroom immediately.

POTENTIAL BENEFITS TO SUBJECTS OR SOCIETY

Your child may not benefit from being in the study, although we have found that children enjoy talking to and playing with the adults in the study.

By being in the study, your child may benefit society, because what we find in the study will help us to give advice to people who interview children.

PAYMENT FOR PARTCIPATION

Your child will not be given money for being in the study. Your child will get a sticker or small toy, which s/he can keep even if s/he wants to stop.

CONFIDENTIALITY

We will not use children's names when talking about our study. Everything your child says will be kept a secret, and will not be shown to anyone who isn't working on the study. We will give your child's answers a number, so that we don't have to use your child's name when looking at our results. Anything that might make it possible to figure out who a child is will be kept in a locked research room at U.S.C., or on a computer with a password. The videotapes and audiotapes won't have the last names of any children on them. We will not destroy any of the information from the study. If we want to use any of the videotapes for teaching people about our study, we will edit the tape so that one can't tell who the children are.

PARTICIPATION AND WITHDRAWAL

It is totally up to you whether you let us ask your child to be in the study. Your child can also say yes or no. Your child can

say yes, but then not answer some questions, or decide to stop, and there will be no penalty.

IDENTIFICATION OF INVESTIGATORS

If you have any questions or want to talk about the research, you can reach Dr. Lyon at (213) 740-0142, tlyon@law.usc.edu, USC Law School, 699 Exposition Blvd., Los Angeles, CA 90089-0071, or Nicole Grant, at 480-326-5961, grantn@usc.edu.

RIGHTS OF RESEARCH SUBJECTS

Your participation in this research study is voluntary. Even if you say yes now, you can change your mind and decide you don't want your child to be in the study. You are not waiving (giving up) any legal claims, rights or remedies because of your child's participation in this study, which means that by signing this form, you do not give up any rights to complain about the study to anyone. If you have any questions about your rights, you can call or write the University Park IRB, Office of the Vice Provost for Research, Stonier Hall, Room 224a, Los Angeles, CA 90089-1146, (213) 821-5272, or upirb@usc.edu.

HIV VACCINE PREPAREDNESS

STEFANIE GOPAUL

Health Promotions & Disease Prevention
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Recruiting participants that engage in high-risk behaviors is essential to both implementing HIV vaccine trials and assessing the effectiveness of potential vaccines. Although recruitment is successful for certain high-risk groups, other groups such as adolescents, remain highly underrepresented in vaccine trials due to difficulties in recruitment. Previous recruitment strategies, although successful, have significant limitations. Recent findings confirm use of the social network model as a feasible method to develop and recruit adolescents and adult women for vaccine trials. Subjects for this study were enrolled between October 2004 and June 2006. Initial participants (labeled as indexes) were patients recruited from the Maternal, Child, and Adolescent/Adult Center for Infectious Diseases and Virology at the Los Angeles County + University of Southern California Medical Center (MCA). Later participants included the social network members (labeled first-degree alters) that were invited to join via the indexes. One hundred and twenty one indexes and alters participated in the study. Using data collected from open-ended questions, we identified altruistic motivations, a desire to share HIV/AIDS or vaccine knowledge, and other such factors that encouraged participants' willingness to invite network members to participate in an HIV vaccine trial. We also identified concerns regarding unanticipated side effects of a vaccine, receiving negative reactions from network members and other significant barriers that can deter willingness to invite network members. Because willingness to invite determines efficacy of the social network approach in trial recruitment, identifying motivational factors for encouragement can reveal more effective ways to utilize the social network model. Identifying and mitigating barriers that limit willingness to invite can also ensure effective use of the social network method.

INTRODUCTION

The Human Immunodeficiency Virus (HIV) and Acquired Immune Deficiency Syndrome (AIDS) epidemic is entering its 25th year in existence leaving behind about 20 million deaths since the virus was first identified in 198311. Fortunately, continued research and medical advances have made it possible to contain the spread of the virus in many aspects of public health. Public health officials have been successful in curbing vertical transmission (mother-to-child) of HIV as well as virtually eliminating transmission via blood transfusions28. Similar statistics however, have not yet been achieved in the area of sexual transmission of HIV, as it is now the dominant form of transmission9,27. Given the private and independent nature of one's sexual lifestyle, in which public health officials have less influence, it has been a more arduous task to convince people to practice safer sexual behaviors. Despite knowledge and behavioral change intervention efforts to increase safer sexual behaviors along with increases in HIV prevention knowledge among the general population, the epidemic has worsened in many groups28.

Advances in medical treatment and the development of anti-retroviral therapies (ART) have also served to prolong millions of lives, attesting to the remarkable capabilities of today's scientists, researchers and physicians. Because of such advances, the number of deaths due to AIDS has begun to level out and gradually decrease within the last four years after a twenty five year pattern of steady increase32. However, ART is economically unavailable in poverty-stricken regions, eliminating this option for those who need it the most31. Although these treatments are positive news for HIV and AIDS patients, there is also the concern that better treatments, by increasing the number of people living with the virus, allow for a greater chance of transmission if those infected knowingly continue to engage in risky behaviors. Thus, a building concern among the public health community is the negative contributions that such advances can have.

While knowledge and behavioral change interventions along with ART have contributed to significant gains in decreasing transmission rates in many populations, they have not been successful in penetrating other groups, namely that of adolescent populations27. Our shortcomings in previous prevention efforts has led researchers to focus their efforts on vaccine development, as it may be the only "promising and feasible" strategy to stop further infection10,11. In recent years, researchers have developed over twenty different prototypes which are all in different stages of testing11. Since the first HIV vaccine trial was carried out in 1987, there have since been thirty-eight different preventative vaccine candidates tested in over 19 countries25. In 1993, the HIV Prevention Trials Network (HIVNET) was established as a network for HIV vaccine clinical trials worldwide, followed by the formation of the HIV Vaccine Trials Network (HVTN)31. Such establishments attest to the global commitment to finding a vaccine and international cooperation necessary to make vaccine development effective.

The search for an HIV vaccine has been time-consuming for a number of reasons, primarily due to the complex nature of the virus. However, despite this challenge, researchers have developed several methods for vaccine implementation, one of which stimulates cellular immunity and has shown substantial antibody, CD4 cell and CD8 cell production11. Although vaccine development requires a large time commitment, this is expected since vaccine development is generally difficult and has proven to be so in the past. It took forty-seven years to develop a vaccine for polio and forty-two years to develop one for measles, illustrating that such a process has been traditionally difficult, but not impossible for researchers17.

Vaccine research and development has in turn highlighted the problem of recruiting committed, willing and eligible participants for clinical trials. While participation in clinical trials is common within some groups, it is nearly non-existent in others. The under-representation of adolescents has recently become of major concern because this group is severely affected by the epidemic in the United States19,26,30. The first studies on HIV vaccine preparedness were conducted in the early 1990's. Research in this field is fairly new and growing at an incredible pace. Researchers are in the beginning stages of assessing barriers to participation in underrepresented groups and proposing solutions for making recruitment efforts

successful.

LITERATURE REVIEW

A universal HIV preventative vaccine may be the only successful and economically plausible way to slow and eventually stop the HIV/AIDS epidemic worldwide. However, in order to continue vaccine testing in clinical trials, recruitment of willing, well-informed and committed participants are necessary. Recently, much of HIV vaccine preparedness research has been directed towards recruiting high-risk and under-represented populations.

High-risk and under-represented populations are necessary participants in these trials for several reasons. Efficacy testing is dependent upon the use of a large group of high-risk individuals. Specifically in phase III of clinical trials, a high-risk population of as many as 3,000 participants, with an annual seroconversion rate of at least 2% is necessary in order to have a 95 percent chance to evaluate a 60 percent effective vaccine.25,29 In addition, including under-represented populations and thus diversifying samples will be significant in assessing how a vaccine may behave across different populations. The effectiveness of such HIV therapies are determined by surrogate markers such as CD4 count and viral load, which may differ across racial groups, risk groups, age groups, or between men and women. Knowing and acknowledging these differences can be essential in effectively treating members of those groups.20

Furthermore, involvement among under-represented groups can aid in establishing secure and trusting relationships between community members and researchers. In the past, controversy over the AIDSVAX B/B vaccine trial fueled beliefs among community members that the vaccine was being suppressed because it was efficacious in African Americans only.26 Such conspiracy theories only widen the gap between these communities and researchers. Diversifying samples and establishing participation from these underrepresented groups can initiate the process of developing trust, hopefully leading to a greater willingness to participate in vaccine studies within high-risk communities. Having a diverse sample also ensures that all people are receiving the same benefits and treatment that HIV vaccine research has to offer. For example, before protease inhibitors were available to the general population, they were only available through clinical trials and so only certain groups had access to treatments initially.20 Previously HIV vaccines have been evaluated on adults,15 pregnant women37 and infants.8 Recently research has been aimed towards enhancing adolescent participation in HIV clinical trials, which has been problematic for many reasons, including consent requirements and a general unwillingness to participate.19 Vaccine testing on young people and the problem of developing groups of participants began to emerge as a significant issue in 2004, during which time no vaccines had been evaluated on this group.23 Expert consultants at the Center for Disease Control and Prevention suggest that adolescent participation in clinical trials should be a priority in HIV vaccine implementation.6,19 In 2003, approximately 50% of all new infections worldwide were among 15-24 year olds with 12.4 million teenagers living with HIV/AIDS and approximately 6000 people infected daily.12,14 Given the unfortunate presence of adolescents in the epidemic, preventing HIV transmission in adolescent populations will be significant in slowing the spread of HIV. Additionally, research on adolescents is important for authoritative purposes of distribution. The US Food and Drug Administration and other licensing facilities are likely to require safety and immunogenicity information on young adults for a vaccine before they approve it for safe distribution. By enrolling adolescents into these clinical trials at an earlier period, this can save both time and resources.3 Thus, adolescent participation in clinical HIV vaccine trials is currently of great concern among researchers.

Advances in the field of HIV vaccine preparedness have allowed researchers to identify critical barriers deterring participation in trials. In one study, adolescents expressed concerns about vaccine-induced contraction of HIV, distrust of researchers and/or the government, fear of unwanted or unanticipated side effects, and access to healthcare if one were to become ill because of the vaccine. Some participants also expressed wanting to observe the effects of the vaccine

on others before they decided to be vaccinated while others wanted more information about the vaccine before they made the decision to participate. Overall, this study found that adolescents shared many of the same concerns that adults expressed in previous studies.19 Unpublished data by H. Jaspen and L-G. Bekker confirmed adolescents' concern regarding fear of unknown side effects and HIV infection and also discovered a fear of needles as a significant predictor of willingness to participate in vaccine trials.3 Another study conducted by G. Giocos, A. Kagee and L. Swartz (2007)14 found subjective norms and attitudes towards participation in an HIV vaccine trial as significant predictors in willingness to participate. The risk of being stigmatized or discriminated against was important in determining willingness to participate. Identifying and addressing such barriers will be crucial to reaching these underrepresented yet highly critical populations.

Previously, researchers have attempted numerous methods to recruit high-risk populations, one of which includes a venue-based time/space approach.1,4,7,21,22,29 This approach requires researchers to identify potential participants at venues where they are likely to be present. An example would be recruiting men who have sex with men at gay bars or other gay-identified venues. This approach is advantageous in that it allows researchers to easily identify the desired populations. However, it is a limited approach because behaviors in these high-risk populations may still be quite variable and thus not provide a sufficient number of participants. Also, this type of targeted sampling may fuel feelings of discrimination within the targeted group, deterring participation.38 Furthermore, this approach may only provide coverage to populations that are easily accessible.

High-risk populations that engage in stigmatized or illegal behaviors such as drug use may be difficult to reach via a venue-based approach.1 Thus, another common approach for recruitment is through community or clinic-based programs.24 An example would be recruiting participants through syringe exchange programs (SEP) or drug treatment programs. However, for recruitment of high-risk intravenous drug users, this method is limited given decreases in the number of SEP, the number of localities with SEP and public funding for SEP nationwide, directly limiting the use of these programs for recruitment purposes.24 Other studies have shown that people may actually be less willing to participate when recruited from clinics or community-based programs.4 A third approach utilizes mass media or other community outreach for recruitment.4,22,29 This approach, while providing the opportunity to reach large populations, does not guarantee that one will be able to recruit a significant number of eligible or targeted participants.38

Given the limitations of previous recruitment strategies, we propose the social network model as a feasible and efficacious method to obtain eligible, willing and committed participants. The social network analysis, which is based on interactions between members of a network, allows for the flow of resources or information throughout the network.36 Given the importance of social contacts, social interactions, and interpersonal communication in influencing the adoption of new behaviors, it can be expected that one's social network is likely to influence one's behavior.33 The social network model has been utilized in a number of health promotion studies and initiatives. Specifically it has been successful in analyzing the sexual behaviors of high-risk populations13 as well as facilitating the use of family planning services via one's personal networks.34 The social network theory has also proven to be successful in increasing condom use and AIDS risk reduction knowledge in samples of men who have sex with men.2 In other studies, the social network approach was more successful than a standard street-based outreach program with regard to accessing more people, reducing self-reported HIV risk behaviors, and was also less expensive.16

The social network model has not previously been applied to recruitment strategies for HIV vaccine preparedness studies, but it is expected to be successful in recruiting high-risk populations for a number of reasons. Past epidemiological findings suggest that a person's risk for HIV and other communicable diseases is influenced by that person's social network members.35 Numerous studies have shown that adolescents' beliefs and attitudes about their friend's behaviors or self-reported behaviors are influential in their decision making.13 Furthermore, adolescents tend to evaluate

themselves in the context of what their peers may think.14 One study confirmed that high-risk women were more likely to be enrolled in a vaccine clinical trial if recruited via other participants in the study as opposed to recruitment through clinics or other community-based organizations.4 This research indicates that people, especially young people, are likely to rely on the attitudes and beliefs of people in their social network when making decisions. Such findings are key in illustrating how vaccine trial recruitment can work via the social network approach.

Use of the social network model in influencing adolescent behaviors is not a novel idea. Previously, researchers have speculated that since risk behaviors such as sexual practices or drug use can be social network processes, using a social network methodology would be appropriate for assessing these behaviors.35 Furthermore, the social network approach may have the advantage of identifying other at-risk persons, thereby creating a network of names of high-risk potential participants. An example of this would be recruiting high-risk individuals for vaccine trials and then using social network analysis to obtain contact information for network members that the initial respondents engage in risky behaviors with. Additionally, allowing the initial participants to contact or recruit these network members may make these new "recruitees" more likely to participate given that they are being recruited by a fellow community member, friend or even family member. This method utilizes the snowball effect by which participating community members can act as either recruiters or sources that allow for dissemination of information.33,35 Unpublished data by Thomas Valente, Jennifer Zogg, Jean Richardson, Eva Operskalski, Andrea Kovacs and Shawna Christensen analyzing the feasibility and effectiveness of using social network relationships to recruit at-risk youth for an HIV vaccine preparedness study showed that high-risk participants can be used to generate large networks of adolescents from which to recruit. The study also confirmed that participants were willing to invite their social network members if certain concerns were addressed. Although, the social network model can provide an effective way to develop large groups of adolescents and recruit at-risk groups, adolescents did reveal several factors that would either encourage or deter them from inviting network members. Using qualitative data collected in open-ended questions from the aforementioned study,38 we will identify reasons why participants would be willing to recruit network members. We will also identify significant barriers to inviting social network members to participate in clinical vaccine trials.

METHODS

POPULATION

The Los Angeles County + Maternal Child Adolescent Center for Infectious Diseases and Virology (MCA) provides comprehensive medical and psychosocial care to HIV-positive infants, children, adolescents and adults. The multi-disciplinary approach of the clinic allows patients access to a number of services including medical care, reproductive care, prenatal and perinatal care, mental health care, acute care and hospitalization, and assistance and reference to specific services such as housing, child care, legal help or counseling. Since it was first established in 1988, the MCA has served over 3,000 HIV-infected women. Currently, the center provides its services to 300 families that include 880 patients. Of these patients, 165 are between the ages of 12-24 years and 282 are over the age of 24. The demographic representation of the clinic is 70% Hispanic/Latino, 25% Black, 2% White, 2% Asian, and less than 1% Native American.

From October 2004 to June 2006, HIV-infected adolescents and adult women were recruited from the Maternal Child Adolescent Center for Infectious Diseases and Virology (MCA) to participate in a prospective cohort study. Adolescents were between the ages of 12 and 24 years, while adult females were over the age of 24. Adult females were enrolled at a later period in the study because anecdotal evidence suggested that they would be willing to allow their adolescent children to enroll. The study protocol and questionnaire forms used were approved by the local institutional review board and informed consent was obtained for all participants. For patients who were minors, consent from a parent or legal guardian was received.

STUDY DESIGN

The initial HIV-infected patients were recruited from a random-ordered list via telephone or during their clinic visit and were designated as an index case. In order to identify the patient's social network members, during the first interview patients were asked to name individuals in their social network, designated as first-degree alters. Index cases named up to five people in the following categories: (1) family members; (2) closest friends; (3) sexual partners in the past six months; (4) people with whom they drank alcohol, smoked marijuana, or took drugs in the past six months; and, (5) others with whom they spend time. For each alter named, the index gave specific information about the relationship with that person (i.e., neighbors, school friends, work friends), the alter's age, residential proximity, whether they had knowledge of the index's HIV status and whether the index would be willing to invite them to participate in the study. The indexes were then asked to invite their listed alters to participate in the study and received a small monetary fee for each alter they recruited. The first-degree alters that agreed to participate and were enrolled then provided the same information about their social network members. Their listed social network members were designated as second-degree alters but were not recruited for this study. Participants were required to make four study visits. The first was a baseline analysis, followed by a two week visit, three month visit and six month visit. They also received two interim calls/contacts to verify or update contact and location information.

DATA COLLECTION INTRUMENTS:

The baseline questions about socio-demographic characteristics, health history, alcohol and non-prescription drug use, and sexual behavior were adapted from the HIV Network for Prevention Trials (HIVNET) Vaccine Preparedness Study.5 Assessments of knowledge about HIV vaccines, willingness to participate or ask social network members to participate in future vaccine trials, and motivations and barriers to participating in future vaccine trials (for alters only) were obtained from the HIVNET Vaccine Preparedness Study as well.

For this study, we used a subset of the data collected at baseline which consisted of open-ended questions that allowed both the indexes and alters to write their own responses. For alters, we assessed their comfort level in participating in a future HIV vaccine study. Comfort level for participating was assessed on a four-point scale, with 1 indicating 'very comfortable', 2 indicating 'sort of comfortable', 3 indicating 'not very comfortable', and 4 indicating 'not comfortable at all.' For both indexes and alters, we also collected numerical data on their comfort level with inviting social network members. Social network members were divided into three categories: family members, friends, and risk partners. Comfort level for inviting social network members was assessed on a four-point scale, with 1 indicating 'definitely yes', 2 indicating 'probably yes', 3 indicating 'probably no', and 4 indicating 'definitely no.' Both indexes and alters were asked to suggest things that would make them want to invite family members, friends and risk partners to participate in a future HIV vaccine trial. They were also asked to suggest concerns that they had about inviting social network members to participate. Since indexes were HIV-positive, making them ineligible for participation in HIV vaccine studies, only alters were asked to suggest things that would make them want to participate in future vaccine studies as well as concerns that they would have about participating.

QUANTITATIVE ANALYSIS OF DATA:

Quantitative data was obtained from the four-point scale questions analyzing comfort levels for participation in HIV vaccine studies (for alters only) and analyzing comfort levels for inviting social network members to participate in HIV vaccine studies. Participants who indicated either a 1 or 2 response were considered willing to participate in a future vaccine trial or willing to invite social network members to participate in a vaccine trial. Participants who indicated either a 3 or 4 response were considered not willing to participate in a future vaccine trial or not willing to invite social network members to participate. For analysis of risk partners only, respondents were allowed to choose '0' as a response indicating that they either did not have any risk partners or would not list any risk partners. The number of participants who responded

with 1 and 2 or 3 and 4 were tallied in an excel file and reported as a percentage of the population. Qualitative Analysis of Data: In the open-ended section of the questionnaire, both indexes and alters were asked to submit "things" that would encourage them to invite different social network members. They were also asked to share their concerns about inviting network members. Responses were transcribed into an excel file. Transcripts of the responses were reviewed in order to identify emerging themes across the broad range of responses received and primary coding categories were established. Many of the coding categories were modified to model categories established in past studies5,18,19,26 that employed qualitative analysis of motivations and barriers to participation in HIV vaccine studies. The categories were then reviewed again to confirm that each response was placed in a category that accurately represented that response. The number of responses for each category was tallied and expressed as a percentage of the sample in order to allow for a quantitative understanding of the data as well. Graphs were constructed to illustrate the categories that individual responses were grouped into as well as the number of responses contained in each category.

RESULTS

COHORT CHARACTERSTICS:

A total of 59 indexes and 62 alters were enrolled in the study and submitted responses to open-ended questions regarding willingness to invite social network members. Table 1 summarizes key characteristics of the enrolled indexes and alters. Of the 59 indexes, 12 were male and 46 were female and of the 62 alters, 30 were males and 32 were female. The percentage of adolescents and adults was similar across index and alter populations. For the indexes, 41 (69.5%) participants were adolescents and 18 (30.5%) were adults. For alters, 39 (63%) participants were adolescents and 23 (37.1%) were adults. Race/Ethnicity was similar for both the indexes and alters, with Black participants representing ~47.9% of the sample, Latino participants representing ~42.1% of the population and ~9.9% of the sample was characterized as other.

REASONS FOR INVITING NETWORK MEMBERS TO PARTICIPATE IN A VACCINE STUDY FOR INDEXES AND ALTERS

Table 2 summarizes willingness to invite different social network members for both indexes and alters. After analyzing the reasons given for inviting different network members for both indexes and alters, we identified prominent themes expressed for all network members, reasons given for inviting certain network members, as well as reasons expressed by specific groups.

Themes Expressed Among Indexes and Alters for Inviting All Social Network Member Groups:

For both indexes and alters, one common reason expressed for inviting family, friends and risk partners was to share knowledge about HIV/AIDS or vaccine research with these network members. Responses placed in this category explicitly stated or expressed a desire to give information or knowledge to social network members only. An example of a response in this category was "so they (family members) can know about HIV and vaccines." Another reason given for both indexes and alters for willingness to invite all social network members was for the personal benefit of one's network member. Respondents who expressed this sentiment were willing to invite network members for the sole benefit of that network member, with the exception of giving them knowledge or information. Responses in this category included, "for their (family member) own safety, for their health." Altruism also served as a major motivator for index and alter willingness to invite different social network members. However, no altruistic responses were observed for willingness to invite risk partners among the alter population.

Altruism incorporated responses that showed a desire to help people outside of the one's social network, to help find a cure or to contribute to society in a positive way. An example of an altruistic response was "to help stop the spread of HIV." Participants would also invite social network members who they believed would be willing to participate or would be comfortable participating in a vaccine study. Responses in this category exhibited the same trend observed

for altruism. Again, both indexes and alters expressed this reason for inviting all social network members except for alters willing to invite risk partners. These indexes and alters seemed comfortable inviting their listed social network members and in many cases identified network members as being "open-minded" or "understanding." Responses placed in this category included, "They have an understanding about HIV. They have good hearts and want to help and they may be interested in participating in something like that."

Themes Expressed Among Indexes and Alters for Inviting Family and Friends Only:

Both indexes and alters would invite family and friends if the indexes and alters were comfortable with the research environment and safety of the vaccine themselves. Responses in this category included, "There is no risk of actually getting it (HIV)." This participant was aware that their family and friends could not contract HIV from the vaccine and so they felt comfortable about their participation. Also, some indexes and alters generally viewed vaccine studies in a positive light and would invite family and friends because they had a desire to involve these network members in something they perceived as important and good. One respondent said, "just to give them (family members) the opportunity", indicating that he or she may have felt that their family's participation in a vaccine study was a good opportunity for them.

Themes Expressed Among Indexes and Alters for Inviting Friends:

One common reason for inviting friends to participate in a vaccine study for both indexes and alters was because the index or alter was comfortable inviting their friends into the study. Participants who expressed this sentiment often stated having close relationships with friends which contributed to their willingness to invite them.

Themes Expressed Among Indexes and Alters for Inviting Risk Partners Only:

One common reason for inviting risk partners to participate in a vaccine study for both indexes and alters was because the index or alter had a desire to be honest with their partner or they wanted find out the sexual history of that risk partner. Responses placed in the former category included, "You and your partner shouldn't have any secrets - this is something a couple should do together." Only one person expressed wanting to find out the sexual history of their partner and reported "if she is doing anything behind my back; want to know if she has HIV."

Other Themes Expressed Among Indexes and Alters for Inviting Social Network Members:

Additional themes were observed for inviting different social network members, however no trend was observed for these themes. Participants expressed a desire to observe vaccine efficacy as a potential motivator for inviting network members. One participant stated, "so they (family members) can see if it (HIV vaccine) works." Finally, another common reason for inviting network members was because index and alter participants perceived their network members as high-risk or were aware that their network members were engaging in certain high-risk behaviors.

CONCERNS ABOUT INVITING NETWORK MEMBERS TO PARTICIPATE IN A VACCINE STUDY FOR INDEXES AND ALTERS

After analyzing the concerns reported for inviting different social network members for both indexes and alters, we saw some trends regarding prominent themes expressed for all network members, concerns given for inviting certain network members, as well as concerns expressed by specific groups.

Concerns Expressed Among Indexes and Alters About Inviting All Social Network Member Groups:

For both indexes and alters, common concerns expressed for inviting family, friends and risk partners included receiving negative reactions from one's network members in response to being invited into a vaccine study. Some participants in this category felt that their social network members would not be willing to participate, would not be

comfortable participating, or would be too scared to participate. Others felt that they would be treated differently or badly. One person responded, "what they (family members) would think about me when I explain it (HIV vaccine study) to them." A large majority of participants were also concerned about any unanticipated side effects of the vaccine or vaccine safety offering responses like, "I don't want my family to get sick." Lastly, a large percentage of the index and alter populations were not comfortable inviting their family, friends or risk partners into the study. These participants often did not have close relationships with their social network members further adding to their discomfort in inviting them. Responses representative of this theme included "Not close enough to family to ask" and "They wouldn't want to. It would make me uncomfortable to ask them."

Concerns About Inviting Social Network Members for Indexes Only:

We found that indexes were concerned about maintaining HIV status confidentiality among all social network member groups and offered responses such as "Some of them don't know my HIV status." Maintaining confidentiality was the number one concern for indexes when inviting friends.

Concerns About Inviting Social Network Members for Alters Only:

Only alters had concerns about having their social network members "tested on," indicating some distrust of researchers. One participant expressed his skepticism of the treatment of his or her network members by saying "wouldn't want them to be a guiny (sic) pig."

Concerns Expressed by Indexes and Alters for Inviting Family Members Only:

Index and alter samples wanted to make sure network members received adequate information about trial participation before they enrolled. This was only expressed for inviting family members, however, and included responses such as "I would want them to go through the whole interview and information process so they understand what they are getting into." Additionally, indexes and alters were also concerned that their family members would not have time to commit to the study or were not located within the residential proximity of the study.

Other Themes Expressed Among Indexes and Alters for Inviting Social Network Members:

One additional concern that was prominent within both populations, yet followed no particular trend, was that social network members would have a fear of needles and thus would be reluctant to participate.

REASONS FOR INVITING SOCIAL NETWORK MEMBERS FOR COMFORTABLE AND UNCOMFORTABLE ALTERS

Alters were asked to rate their level of comfort for participating in a future vaccine study. Table 3 summarizes important characteristics for these enrolled alters regarding their willingness to invite social network members. Of the 62 alters, 44 were comfortable participating in a future vaccine study and 16 participants were not comfortable participating. Two of the alters did not submit responses.

Themes Expressed Among Comfortable and Uncomfortable Alters for Inviting All Social Network Member Groups:

Only one theme was expressed among both comfortable and uncomfortable alters for all social network member groups. Both groups of alters would invite network members to share knowledge about HIV/AIDS or vaccine research with them. This was the only theme expressed among uncomfortable alters for willingness to invite risk partners.

Themes Expressed Among Comfortable Alters for Inviting All Social Network Member Groups:

Some reasons for invitation that were exclusive to comfortable alters included a desire to observe vaccine efficacy and comfortableness with the research environment and vaccine safety. Another theme expressed that was more common among comfortable alters, but was not exclusive to comfortable alters, included a desire to involve social network members

in something that the alters generally felt was important or positive. Also, the comfortable alters expressed altruistic motivations more often.

Other Themes Expressed Among Comfortable and Uncomfortable Alters for Inviting Social Network Members:

Other prominent themes were observed, but did not follow any particular trends. Some reasons for invitation were for the personal benefit of one's network member, because they perceived network members as high-risk, and because they believed that their network members would be willing to participate or would be comfortable participating.

CONCERNS ABOUT INVITING NETWORK MEMBERS TO PARTICIPATE IN VACCINE STUDY FOR COMFORTABLE AND UNCOMFORTABLE ALTERS

Concerns Expressed Among Comfortable and Uncomfortable Alters About Inviting All Social Network Member Groups:

We found that common concerns among comfortable and uncomfortable alters were concerns regarding receiving negative reactions from social network members as well as not being comfortable inviting social network members.

Concerns Expressed Among Comfortable Alters About Inviting All Social Network Member Groups:

Only the comfortable alters expressed concerns about making sure that network members received adequate information about the study before participating. Also, concerns about side effects and vaccine safety were also more common among the comfortable alters, but not exclusive to this group.

Concerns Expressed Among Uncomfortable Alters About Inviting All Social Network Member Groups:

Although there was no trend observed in the responses given for uncomfortable alters, we did observe that uncomfortable alters cited concerns about network members being "tested" on more often than the comfortable alters.

REASONS FOR INVITING SOCIAL NETWORK MEMBERS FOR ADOLESCENTS AND ADULTS

There was a total of 79 adolescents and 42 adults in the sample. Table 4 summarizes information on the percentage of adolescents and adults willing to invite their social network members.

Themes Expressed Among Adolescents and Adults for Inviting All Social Network Member Groups:

Some themes observed among both adolescents and adults for all social network members included sharing knowledge about HIV/AIDS or vaccine research and for the personal benefit of one's social network member. Other common motivations for invitation included altruistic motivations, a desire to involve network members in HIV and vaccine research, because they believed that their network members would be willing and because they perceived network members as high-risk. However, there was no trend observed for these themes.

Themes Expressed Among Adolescents for Inviting All Social Network Member Groups:

Adolescents offered a larger variety of reasons for inviting social network members than did adults. Adolescents would invite network members if the adolescents themselves were comfortable with the research study and the safety of the vaccine. One adolescent stated that he/she would invite network members for the personal benefit of his/herself. Specifically, the person would invite their risk partner so that they would not contract HIV from them. Additionally, one adolescent would invite social network members because it would make the adolescent feel more comfortable about participating and another person would invite friends who they knew were HIV-positive.

CONCERNS ABOUT INVITING NETWORK MEMBERS TO PARTICIPATE IN VACCINE STUDY FOR ADOLESCENTS AND ADULTS

Concerns Expressed Among Adolescents and Adults About Inviting All Social Network Member Groups:

Themes common to both adolescents and adults for inviting all social network member groups included concerns about negative reactions from network members as well as not being comfortable inviting network members. Other prominent themes emerged, but followed no trend. Both adolescents and adults expressed concerns about unanticipated side effects from the vaccine, concerns that network members might have a fear of needles and maintaining HIV-status confidentiality (for indexes only).

Concerns Expressed Among Adults About Inviting All Social Network Member Groups:

Only adults expressed concerns about social network members being "tested" on. Also, a much higher percentage of adults than adolescents expressed concerns about making sure that network members received adequate information about the study before they participated. Finally, one adult stated that most of his friends were HIV-positive and thus were ineligible to participate.

DISCUSSION

Our findings suggest that our sample was willing to invite certain social network members to participate in potential vaccine studies. Participants were most willing to invite family members, less willing to invite friends and were least willing to invite risk partners. We also identified several motivational factors that might encourage or influence one's decision to invite their social network members. The reasons given were similar to reasons observed in past HIV vaccine preparedness studies analyzing people's willingness to participate in vaccine studies. The most cited reasons for inviting social network members was to share knowledge about HIV/AIDS and vaccine research with network members, for altruistic reasons (excluding helping someone within the participant's social network), for the personal benefit of the one's social network members (excluding giving them information), and because they felt that network members would be willing to participate or would be comfortable participating.

Other motivations for invitation into the study included a desire to involve network members (i.e., participants perceived trials as important or good), comfort with study and safety issues, close relationships with network members (i.e., participants were comfortable inviting them), to observe vaccine efficacy, and because participants perceived their network members as high-risk. We also found that motivations for invitation did not differ greatly across risk groups. However, a desire to be honest with one's social network member was a frequent reason for inviting risk partners. Participants who had a desire to be honest with their risk partner often appeared to be in a relationship with that partner.

Overall, participants were most motivated to invite network members in order to give them knowledge about HIV/AIDS and vaccine research. This indicates that one's participation in a vaccine trial can and should include access to knowledge and information regarding HIV risk reduction and vaccine research. By acknowledging that participants in vaccine studies will have the opportunity to enhance not only their own knowledge and well-being, but also that of their social network members, participants may be more willing to invite network members. Additionally, participants were very willing to invite network members for the personal benefit of that network member, such as helping them to remain HIV-negative. Again, by emphasizing a person's opportunity to better themselves through their participation, we can encourage people to both invite network members and to participate themselves. Further, such incentives may make people more committed to a vaccine study and thus less likely to withdraw from the study.

Altruism was also a significant motivator for willingness to invite network members. Participants would invite network members in order to help find a cure or to contribute positively to society in some way. By emphasizing specifically how one's recruitment of their social network members can have positive effects on others, participants may be more willing to invite network members. Additionally, by allowing participants to realize that their efforts have significant and positive implications and by acknowledging or rewarding their efforts, we may be able to enhance those altruistic motivations for invitation.

Our findings also suggest that participants had several concerns regarding inviting their social network members to participate in vaccine trials. Identifying these concerns was important because they can serve as potential barriers to inviting one's network members into vaccine studies. Again, the barriers to participation that were identified in this study were similar to those observed in past HIV vaccine preparedness studies analyzing people's willingness to participate in vaccine studies. Major concerns identified by participants included concerns regarding receiving negative reactions from social network members, unanticipated side effects or safety of the vaccine, not being comfortable inviting social network members, and that social network members may have a fear of needles. Themes that were less common included concerns about time commitments required for the study and that social network members were not located within the residential proximity of the study location.

Overall, participants were mostly concerned about receiving negative reactions from social network members. Participants were often worried that network members would be offended, would treat them differently or badly, or would not be comfortable participating. Also, a significant number of participants were not comfortable inviting network members, many times because they did not have close relationships with them. This illustrates that HIV and AIDS continues to be a sensitive issue and people may still be uncomfortable discussing it with others, especially those they are not close with. Concerns regarding negative reactions and uncomfortableness with inviting network members along with findings from past research studies indicate that HIV stigma still persists. It is important to raise awareness of individual and community risk for HIV among minority populations in order to reduce HIV's stigma. Strategies should also be developed to protect participants from stigmatization and prejudice.

Additionally, participants were very concerned about unanticipated side effects from the vaccine along with vaccine safety. One person expressed explicit concerns about contracting HIV from the vaccine. Again, educating communities about the processes of conducting HIV vaccine trials including the necessary safety information, can allow participants to make more knowledgeable decisions about participating and can allow them to feel more secure in their decision to participate or not to participate. Participants who feel more comfortable and more secure may also be more likely to commit fully to the requirements of the study and may be more willing to recruit their network members for the study. Additionally, exploring ways to provide medical access and treatment to participants if side effects were to occur might make people more comfortable with participating.

We also found that a major concern for indexes in the study was maintaining confidentiality of their HIV-status. Given the existing stigma that is attached to HIV, it is easy to understand why HIV-positive persons were concerned about maintaining confidentiality. In order to ensure that all participants can feel comfortable with inviting their social network members, it is essential to ensure that the personal information of all potential participants will remain confidential, especially for those who are HIV-positive. Additionally, we found that alters only were concerned about having network members "tested" on, indicating some distrust of researchers. Ethical concerns about research among minority populations is not uncommon and has been documented and explored in a number of studies. It is possible that indexes did not express this concern because they were HIV-positive patients from the MCA clinic and thus may have been more aware of the ethical requirements for research and thus more comfortable with research in general. Still, this was a prominent concern among alters. Educating communities about vaccine research should include information about the ethical standards of research and the precautionary methods that are taken to prevent misconduct. Additionally, researchers should acknowledge that past errors in research experiments have occurred, but that additional measures are now being taken to ensure that such errors do not happen again.

LIMITATIONS

The small sample size and the nature of the sample limits our ability to generalize our findings. In addition, there

was a much higher number of female than male participants. Further, qualitative analysis of open-ended responses leaves room for researchers to interpret these responses differently.

However, such problems can be alleviated by allowing several trained coders to analyze and discuss responses together so as to include many different perspectives. Another limitation was that respondents were not asked to explain their answers in depth, thus, in a few instances, answers were vague and it was difficult to interpret the respondent's intent. Again, for future studies this problem can be addressed by conducting more in depth interviews so as to accurately determine the respondent's responses and intentions.

CONCLUSION

Findings from this study can be used to develop better recruitment strategies for HIV vaccine trials using the social network approach. A social network approach can allow researchers to generate large networks of adolescents, identify potential participants, and conduct recruitment based on existing network relationships. However, understanding the personal perspectives of this population, especially significant barriers that they face, will enable researchers to tailor recruitment and procedural methods for vaccine studies to their individual needs and potentially enhance willingness to invite social network members to participate in HIV vaccine trials.

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TABLES

TABLE 1. Enrollment Characteristics of Enrolled HIV-infected Patients (Indexes) and Patient Social Network Members (Alters)

	Index (n=59)	Alters (n=62)
Years at MCA, median (range)	5.6 (0.2, 17.0)	N/A
Route of HIV infection		
Heterosexual	28 (47.5%)	N/A
Homosexual	3 (5.1%)	
Perinatal	16 (27.1%)	
Transfusion/hemophilia	10 (16.9%)	
Injection drug use	1 (1.7%)	
Undetermined/other	1 (1.7%)	
Gender		
Male	12 (20.3%)	30 (48.4%)
Female	46 (78.0%)	32 (51.6%)
Transgender	1 (1.7%)	0 (0.0%)
Age in years, mean	24.0	26.2
Age categories (years)		
12-24	41 (69.5%)	38 (61.3%)
25+	18 (30.5%)	24 (38.7%)
Race/ethnicity		
Black	27 (45.8%)	31 (50.0%)
Hispanic	26 (44.1%)	25 (40.3%)
Other	6 (10.2%)	6 (9.7%)

TABLE 2. Willingness to Invite Alters to Participate in a HIV Vaccine Study

	Willing to invite Social Network Members	Not willing to invite Social Network Members	No Response Given/ No social network members given
Index Population (n=59)			
Family	39 (66.1%)	16 (27.1%)	4 (6.8%)
Friends	31 (52.5%)	26 (44.1%)	2 (3.4%)
Risk Partners	14 (23.7%)	11 (18.6%)	34 (57.6%)
Alter Population (n=62)			
Family	42 (67.7%)	18 (29.0%)	2 (3.2%)
Friends	30 (48.4%)	27 (43.5%)	5 (8.1%)
Risk Partners	5 (8.1%)	11 (18.0%)	46 (74.2%)

TABLE 3. Willingness to Invite for Alters who are Comfortable Participating in a Vaccine Trial vs. Alters who are Not Comfortable Participating in a Vaccine Trial

	Willing to invite Social Network Members	Not willing to invite Social Network Members	No Response Given/ No social network members given
Alters Comfortable (n=44)			
Family	30 (68.2%)	14 (31.8%)	0 (0.0%)
Friends	25 (56.8%)	17 (38.6%)	2 (4.5%)
Risk Partners	10 (22.7%)	14 (31.8%)	20 (45.5%)
Alters Not Comfortable Participating (n=16)			
Family	12 (75%)	4 (25%)	0 (0.0%)
Friends	5 (31.3%)	10 (62.5%)	1 (6.3%)
Risk Partners	1 (6.3%)	6 (37.5%)	9 (56.3%)

REFERENCES

1. Abdul-Quader AS, Heckathorn DD, Sabin K, et al. Implementation and Analysis of Respondent Driven Sampling: Lessons Learned from the Field. Journal of Urban Health: Bulletin of the New York Academy of Medicine. 2006;83(7):i1-i5.

2. Amirkhanian YA, Kelly JA, Kabakchieva E, et al. Evaluation of a Social Network HIV Prevention Intervention

Program for Young Men Who Have Sex With Men in Russia and Bulgaria. AIDS Education and Prevention. 2003;15(3):205-220.

3. Bekker L, Jaspan H. Adolescents and HIV Vaccine Trials: What are the Clinical Trial Site Issues. Journal of International Association of Physicians in AIDS Care. 2005;4(4):93-97.

4. Brown-Peterside P, Chiasson MA, Ren L, Koblin BA. Involving women in HIV vaccine efficacy trials: Lessons learned from a vaccine preparedness study in New York. Journal of Urban Health. 2000;77:425-437.

5. Buchbinder SP, Metch B. Determinants of Enrollment in a Preventative HIV Vaccine Trial: Hypothetical Versus Actual Willingness and Barriers to Participation. Journal of Acquired Immune Deficiency Syndromes. 2004;36(1):604-612.

6. Center for Disease Control and Prevention. HYPERLINK "http://www.cdc.gov/hiv/topics/surveillance/resources/reports/2006report/default.htm" HIV/AIDS Surveillance Report: Cases of HIV Infection and AIDS in the United States and Dependent Areas, 2006. 2006;18:1-55.

7. Choi K-H, McFarland W, Neilands TB, et al. Prevalence, Incidence, and Sexual Risk for HIV Among Young Asian and Pacific Islander Men Who Have Sex With Men, San Francisco. American Sexually Transmitted Diseases Association. 2004;31(8):475-480.

8. Cunningham CK, Wara DW, Kang M, et al. Safety of 2 recombinant human immunodeficiency virus type 1 (HIV-1) envelope vaccine in neonates born to HIV-1-infected women. Clinical Infectious Diseases. 2001;32:801-7

9. Department of Public Health. HIV Epidemiology. Retrieved March 7, 2008, from HYPERLINK "http://www.lapublichealth.org/hiv/hivpresentations.htm" \t "_blank" http://www.lapublichealth.org/hiv/hivpresentations.htm

10. Duan N. Listening to consumers and HIV vaccine preparedness. The Lancet. 2005;365:1119-1120.

11. Duerr A, Wasserheit JN, Corey L. HIV Vaccines: New Frontiers in Vaccine Development. Clinical Infectious Diseases. 2006;43:500-11.

12. D'Angelo LJ, Samples C, Rogers AS, et al. HIV infection and AIDS in adolescents: An update of the position of the Society for Adolescent Medicine. Journal of Adolescent Health. 2005;38(1):88-91.

13. Ellen JM, Dolcini MM, Bir ND, et al. Social Network Centrality and Sexual Experience Among a Household Sample of Urban African American Adolescents. Connections. 2001; 24(2):76-81.

14. Giocos G, Kagee A, Swartz L. Predicting Hypothetical Willingness to Participate (WTP) in a Future Phase III HIV Vaccine Trial Among High-Risk Adolescents. AIDS and Behaviors. 2007. Retrieved June 5, 2008, from http://www.springe rlink.com/content/p620q60503w57154/

15. Graham BS, Wright PF. Candidate AIDS Vaccines. New England Journal of Medicine. 1995; 333:1331-39.

16. Heckathorn DD, Broadhead RS, Anthony DL, et al. AIDS and Social Networks: HIV Prevention Through Network Mobilization. Sociological Focus. 1999;32(2):1-20.

17. HIV/AIDS; AIDS Action Urges Everyone to Help End the AIDS Epidemic by Being Part of the Search for an HIV Vaccine. AIDS Weekly & Law. 2008;35. Retrieved June 8, 2008, from Law Module database.

18. Koblin BA, Heagerty P. Readiness of high-risk populations in the HIV Network for Prevention Trials to Participate in HIV vaccine efficacy trials in the United States. Journal of the International AIDS Society. 1998;12:785-793.

19. Koniak-Griffin D, Nyamathi A, Tallen L, et al. Breaking the Silence: What Homeless 18- to 24-Year-Olds Say about HIV Vaccine Trials. Journal of Health Care for the Poor and Underserved. 2007;18:687-698.

20. Lynn LA. AIDS Clinical Trials: Is there Access for All? Journal of General Internal Medicine. 1997;12:198-199.

21. MacKeller DA, Valleroy LA, Karon J, et al. The Young Men's Survey: Methods for Estimating HIV Seroprevalence and Risk Factors Among Young Men Who Have Sex With Men. Public Health Report. 1996;111(S1):138-144.

22. MacKeller DA, Valleroy LA, Secura GM, et al. Repeat HIV Testing, Risk Behaviors, and HIV Seroconversion Among Young Men Who Have Sex With Men: A Call to Monitor and Improve the Practice if Prevention. Journal of Acquired Immune Deficiency Syndromes. 2002;29(1):76-85

23. McClure CA, Gray G, Rybczyk K, et al. Challenges to Conducting HIV Preventative Vaccine Trials With Adolescents. Journal of Acquired Immune Deficiency Syndromes. 2004;36:726-733.

24. MMWR Morbidity and Mortality Weekly Report, July 15, 2005. Update: Syringe Exchange Programs --- United States, 2002, 54(27), 673-676.

25. Murphy DA, Hoffman D, et al. Improving comprehension for HIV vaccine trial information among adolescents at risk of HIV. AIDS Care. 2007;19(1):42-51.

26. Newman PA, Naihua D, et al. HIV Vaccine Trial Participation Among Ethnic Minority Communities: Barriers, Motivators, and Implications for Recruitment. Journal of Acquired Immune Deficiency Syndromes. 2006;41(2):210-217.

27. Osmond, DH. Epidemiology of HIV/AIDS in the United States. HIV Insite. Retrieved March 10, 2008, from HYPERLINK "http://hivinsite.ucsf.edu/InSite?page=kb-01-03" \l "S2.3X" \t "_blank" http://hivinsite.ucsf.edu/InSite?page=kb-01-03#S2.3X

28. Richens J, Imrie J, Weiss H. Human Immunodeficiency Virus Risk: Is it possible to dissuade people from having unsafe sex? Journal of the Royal Statistical Society: Series A (Statistics in Society), 2003;166(2):207-215. Retrieved February 25, 2008, from HYPERLINK "http://eprints.ucl.ac.uk/1187/1/Sex_&_death_revised_2.pdf" \t "_blank" http://eprints.ucl.ac.uk/1187/1/Sex_&_death_revised_2.pdf

29. Seage III GR, Holte SE, Metzger D, et al. Are US Populations Appropriate for Trials of Human Immunodeficiency Virus Vaccine? The HIVNET Vaccine Preparedness Study. American Journal of Epidemiology. 2001;153:619-627.

30. Sengupta S, Strauss RP, et al. Factors Affecting African-American Participation in AIDS Research. Journal of Acquired Immune Deficiency Syndromes. 2000;24:275-284.

31. Strauss RP, Sengupta S, Kegeles S, et al. Willingness to Volunteer in Future Preventative Vaccine Trials: Issues and Perspectives From Three U.S. Communities. Journal of Acquired Immune Deficiency Syndromes. 2001;26:63-71.

32. United Nations Programme on HIV/AIDS (UNAIDS). 2007 AIDS epidemic Update. 2007. Retrieved June 2, 2008, from HYPERLINK "http://data.unaids.org/pub/EPISlides/2007/2007_ep iupdate_en.pdf" http://data.unaids.org/pub/EPISlides/2007/2007_ep iupdate_en.pdf

33. Valente TW, Davis RL. Accelerating the Diffusion of Innovations using Opinion Leaders. The ANNALS of the American Academy of Political and Social Science. 1999;566(1):55-67.

34. Valente TW, Saba W. Mass media and interpersonal influence in a reproductive health communication campaign in Bolivia. Communication Research. 1998;25:96-124.

35. Valente TW, Vlahov D. Selective Risk-Taking Among Needle Exchange Participants: Implications for Supplemental Interventions. American Journal of Public Health. 2001;91(3):406-411.

36. Wasserman S, Faust K. Social Network Analysis. Cambridge: Cambridge University Press; 1994.

37. Wright PF, Lambert JS, Gorse GJ, et al. Immunization with envelope MN rgp 120 vaccine in human immunodeficiency virus-infected pregnant women. Journal of Infectious Diseases. 1999;180:1080-8.

38. Valente TW, Zogg J, Richardson J, et al. Using Social Networks to Recruit an HIV Vaccine Preparedness Cohort. From the Department of Preventative Medicine and Department of Pediatrics, Keck School of Medicine, University of Southern California. 2008. (Unpublished Data).

BEYOND TEACHER EXPECTATIONS: THE ROLE HIGH SCHOOL CURRICULUM PLAYS IN REGARDS TO DIFFERENT ACADEMIC PERFORMANCES

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Using the stereotype threat model (Steele, 1997; Steele et al., 2002), this pilot study investigated the phenomenon of fundamental schooling in Santa Ana California since its emergence in 2005. The author hypothesized that there is an association between lower college expectations among traditional versus fundamental high school students due to different teacher expectations and school curriculum. Using self-efficacy, self-esteem, and life orientation surveys the analysis found that on average, traditional high school students have lower college expectations and lower self-efficacy/self-esteem beliefs compared to fundamental high school students. Teacher interviews at both school types also found that fundamental high school teachers have greater student expectations in regards to career development and college pursuit. Deeper evaluation of the findings suggests that the difference in school curriculums, mission statements, and teacher expectations might be the cause for this educational inequality. Due to these differences, there are negative stereotypical views among the two types of students. The implications of this study suggest a re-evaluation of the educational policy in Santa Ana in regards to giving the entire community of students an equal chance to pursue higher education.

INTRODUCTION

Santa Ana California is a medium size city known for its high percentage of residents from Mexican descent. But can any one believe that in the heart of this city its school district wrongfully differentiates its students in regards to academic achievement? The latter is happening and to the pleasure of the current local politicians it is working. Educational inequality has been a topic studied by important sociology and education scholars. Mainly comprised in longitudinal studies, these studies have associated this segregation with lack of school performance within a subordinate group. But most if not all of the studies conducted have been in regards of a racial group in relation to another racial group. However, there are limited studies with regards to school segregation between the same ethnic groups (as seen among Latinos in Santa Ana Ca.) but will associate the main ideas with Santa Ana's current problem. John U. Ogbu's (UC Berkeley) longitudinal study did shed a light on the causes of school under-performance within African Americans and Chicanos. He stated that, "There are thus three sources contributing to the school failure of the minorities who are not doing well in school, namely, society, school, and community". (14) Ones own community and school infrastructure is what causes many minority groups to perform under par.

To further understand the phenomenon of educational inequality we must first understand Santa Ana's demographics. There are many paths a high school student living in Santa Ana can take to further enhance his/her future. Within the boundaries of the author's community there are five schools. Two are public high schools, one is a private Catholic school serving grades K-8, one is a public intermediate school, and one is a private Catholic high school. However, the children residing within the community are not likely to attend the two private schools due to its high cost. For example, tuition for a year's education at Mater Dei High School (the private Catholic school) is $8,725 for Catholic students and $9,950 for non-Catholic students (www.materdei.org). Plus, approximately $500 a year is also needed for books and uniforms, an entrance exam fee of $60, and a $350 registration fee (www.materdei.org). This means that a first year student will need to pay a total of $9,635 if Catholic and $10,860 if non-Catholic. Considering the statistics (a median income of $48,806, a median family size of 5.4 people, and 75.3% of two-parent families have children under the age of 18), most families would not be able to send their children to a private school like Mater Dei (www.census.gov). An average sized two-parent family would need to invest $28,905 a year to send all of their children to Mater Dei and $32,580 if they are non-Catholics. These costs are not feasible for the majority of the families in this community. Therefore, these children must attend the public high schools surrounding the community.

As recent as 2005 the Santa Ana Unified School District started building new facilities of education called fundamental schools. These schools were design to give the top high school students an opportunity to learn from the best the district has to offer. The District recruits the top 10% of students from every traditional high school and their most experienced teachers (based on annual reviews) and places them under contract at these new institutions. It obviously seems that it is a great opportunity for a select few to advance their education. But what about the rest of the students that are not selected? These other students are left at their traditional high schools with teachers and administration that generally have lower academic expectations on the general population. It becomes "sort of a continuation school" as one guidance counselor puts it. But besides these structural disparities there is a much bigger problem. Some kids that did not make it to a fundamental school are stigmatized and made fun of at their neighborhoods by a new dominant group: the overachieving Latino.

Through quantitative and quantitative empirical analysis, the present research will look at the demographics of Santa Ana California as a new form of educational inequality has emerged called fundamental schooling. This new form of education has split residents from the same neighborhood that used to go to the same school on the basis of intelligence test scores (GPA). Due to this form of splitting, many students who are not in fundamental schooling get teased and oppressed by their own neighbors and peers that do attend these schools. Is there an association between lower college expectations among traditional versus fundamental high school students due to

different teacher expectations and school curriculum? If so, is there a stigma attached to being from a traditional high school which can lead to lower self-efficacy and self-esteem?

Both school types (fundamental and traditional) are public high schools who get funded through state and local tax revenues. The differences are that fundamental schools recruit the "gifted" students, teachers, & administration from the traditional high schools.

LITERATURE REVIEW

THE ACHIEVEMENT GAP AND TEACHER EXPECTATIONS

Ferguson et al. have proposed that a teacher expectation is one contributor to the ethnic achievement gap. (2004) Baron, Tom, and Cooper also go on to suggest that teachers sometimes base their expectations for student achievement on student ethnicity. Teachers "expect more from European American and Asian American than from their African American and Latino peers. (1985) Children from groups that benefit from higher expectations will therefore benefit from higher quality instruction. This said, Santa Ana Unified School District does not have this problem since 94% of its 51,000 students are Latinos. (www.sausd.us) But there still exist different teacher expectations among the same ethnic group because Santa Ana has created a Fundamental School system (although still public) designed to teach the best students of the city. Since different ethnic academic expectations are not the problem, stereotype threat is.

Marshall and Weinstein (1984) have also proposed that teacher and school expectations affect a student's ambition to perform well in academics. They said, "Teachers who form expectations based on inappropriate data, are rigid and unchanging in their expectations, and treat low-expectation students in inhibiting ways are generally not aware of their harmful thinking and behaviors…Expectations, as communicated school-wide and in classrooms, can and do affect student achievement and attitudes."

STEREOTYPE THREAT

Stereotype threat (Steele, 1997; Steele et al., 2002) is the fear that one's behavior (academic performance) will confirm an existing stereotype of a group with which one identifies. This fear may lead to a deficiency in that performance. Today in Santa Ana there exist this notion of "we are better than you" mentality through out the eight traditional and two fundamental high schools. To some extent this notion is true. Fundamental high schools every year recruit the best 9-12 grade kids, guidance counselors and teachers. Knowing this, students left at the traditional high schools transcribe to the stereotype threat model. Thinking that they are not as academically proficient as their fundamental peers, they confirm to this belief.

METHODS

PARTICIPANTS

The students being surveyed consists of 40 high school sophomores and juniors from 4 public high schools (2 Fundamental and 2 Traditional) in Santa Ana Ca. The researcher did not have direct contact with the student sample. Four different guidance counselors volunteered to hand out the surveys during a counselor session.

Materials

Through personal interviews, Rosenburg's self-esteem scale, Jerusalem/Schwarzer's general self-efficacy scale, teacher expectation surveys, and data analysis I will be certain to say that there is an association between the different levels of self-esteem and different academic expectations in the Santa Ana Unified School District.

Another method I will use is census data recollection. This is needed in order to better understand the demographics of Santa Ana as of the year 2000. The 2000 census data is one of the primary forms of gathering statistics because it allows researchers to view demographics in a macro or micro level.

To measure the self-efficacy beliefs in students I will administer Jerusalem /Schwarzer's General Self-Efficacy Scale. This scale has been successfully used for the past two decades as it is a scale used to predict adaptation after life changes (in this case the splitting of students in Santa Ana). I will also administer Rosenberg's Self-Esteem Scale. It is a 10 item measure to

predict the overall self-worth and self-acceptance. They will have 4 options to choose from (strongly disagree, disagree, agree, strongly agree).

RESULTS

COUNSELOR INTERVIEWS

The findings of the counselor interviews (qualitative method) allowed a better understanding of the association between academic expectations and different levels of self-esteem and self-efficacy among students in Santa Ana. The first school the author went to was Godinez Fundamental High. The staff who was interviewed was an 11th grade guidance counselor. The first question the author asked was: In what ways has fundamental schooling help mold a student to become a better person that a traditional school cannot give? She answered, "Well, Godinez High is a place where we build better academic and social skills because our intense academic curriculum doesn't allow students enough time to be out in the streets doing bad things. I believe we are graduating more students and sending them straight to a four year university". The author then asked, "But what about the other students that are not enrolled at these schools? Did the district simply give up in trying to educate everyone fairly? Aren't these other students left with a sense of academic helplessness and social isolation because they know they are not good enough? Oh no, I truly think that our district hires the best instructors that meet all the qualifications. I think they are still getting a good quality education. It is just a matter of ones own self-determination. If this world was a perfect place we would educate everyone at a fundamental. What do you think of the teasing and harassment from fundamental kids upon traditional school students within our own neighborhood? Doesn't this affect their academic performance while at the same time it segregates people in the community? I really have not heard anything like that happen in our city. I would think everyone still gets along even. What she does not know is that the surveys conducted show the opposite.

The next school the author visited was Saddleback High (a non-fundamental school) According to the 10th grade guidance counselor; fundamental schools are public schools that admit students across Santa Ana that meet certain criteria. Fundamental schools only accept student applicants who meet a GPA and test score requirements. This high school counselor informant describes these schools as housing "the best of the best students." In John Ogbu's article he states one of the factors associated with minority school underperformance is the "situation of lowered expectation of teachers and administrators" (1987 pg 9). The differences in thinking between Godinez and Saddleback are shown in their mission statement. As stated on the principal's message on the Godinez Fundamental High School website, these schools are created to provide an "outstanding college preparatory educational program, accompanied by a wide array of co-curricular and extra-curricular activities" (www.sausd.us). Although these schools will greatly benefit and prepare its students for college, it also segregates those students not accepted to the fundamental schools. The difference in service to the students in the non-fundamental schools is evident by the distinct mission statement of Saddleback High School to the principal's message at Godinez Fundamental High School. The mission statement states that the school's "programs stimulate learning and implement the state curriculum standards" (www.sausd.us). It goes on to say that "students will develop appropriate social skills, problem-solving techniques, decision-making strategies, and career preparation skills, as well as basic skills and technological expertise to promote life-long learning" (www.sausd.us). No where in the mission statement or in the principal's message does it state any kind of preparation for college or extra-curricular activities as the Godinez Fundamental High School explicitly states. This discrepancy suggests that the students enrolled in non-fundamental high schools do not receive the same education or opportunities as those students attending fundamental school. Therefore, the children of this community are being segregated from each other on the basis of intelligence.

This counselor at Saddleback High School (where most of the adolescents of this community are designated to attend) states that the segregation of students takes a great toll on non-fundamental schools. This counselor reported that prior to the creation of fundamental schools, Saddleback was the best

high school in Santa Ana in regards to academics and student involvement. However, with the creation of fundamental schools, Saddleback now houses "the worst of the worst students." The counselor states that the school needs the academically high achievers that are now attending near by Godinez Fundamental High School. These students "pull up school spirit," increase student involvement, and create more student lead events. Without these students, the rest of the student body suffers. As stated by the counselor, there is little motivation and involvement by the students of Saddleback. Many students feel upset for not being accepted into a fundamental school. They feel that they have to settle for Saddleback and they begin to feel inadequate as students. The counselor describes this feeling of inadequacy as a disease, for it begins with a few students and spreads to the rest of the student body. Students begin to view education as less important and aren't motivated to become involved in school activities. This type of disease is also known in psychological terms as the self-fulfilling prophecy. Our expectation of that student being an underachiever has led that person to behave in ways that fulfill that expectation.

This spreading of negative attitude towards education is becoming normalized for the students of Saddleback as a reaction to institutionalized restraints due to the creation of fundamental schools. In chapter 3, Ghetto-Related Behavior and the Structure of Opportunity, of Wilson's book, When Work Disappears, new normalized behaviors and attitudes in regards to the lack of employment opportunities are also a reaction to restraints for those living in impoverished areas of Chicago. The dynamics of these Chicago communities are similar to what appears to be occurring at Saddleback. In sections of Chicago that are made up of high poverty rates and low employment opportunities, a phenomenon known as transmission by precept occurs among the residents living in these communities. Transmission by precept is defined as "whereby a person's exposure to certain attitudes and actions is so frequent that they become part of his or her own outlook" (71). This is true in these communities in regards to the only visible male role models being pimps and drug dealers, consequently many youth model themselves after them because of their constant exposure (56). This idea of transmission by precept can also be applied to the students of Saddleback. If there is a consistent exposure to such feelings of academic inadequacy and lack of peer role models, then students will begin to feel academically inadequate and unmotivated to become involved. This corresponds to the counselor's statement of students' negative feelings spreading like a disease. Lack of self-efficacy is also present in the low income communities of Chicago. Self-efficacy is defined as an individual's "beliefs in one's own ability to take the steps necessary to achieve goals" (75). Low self-efficacy can be created from the experiences of low income and lack of employment opportunities, but is also reinforced by "similar feelings and views of others who share the [same] conditions and culture" (78). This leads to lower collective efficacy in which the community as a whole shares the same beliefs of inability to reach goals (78). Collective efficacy may also be occurring among the students of the Saddleback. Many may individually feel unable to reach goals due to experiencing rejection from the fundamental schools and the lack of academic and extra-curricular opportunities that aren't offered as strongly in non-fundamental schools. This individual low self-efficacy, like that of those residents of impoverished Chicago communities, then leads to a lower collective efficacy through transmission by precept.

TEACHER EXPECTATIONS

Interviews were also conducted to six teachers at the two types of public schools. For the traditional high schools: 1 out of 3 teachers said they have high academic expectations for their students and 1 out of 3 expect their students to attend a Cal State or other 4 yr. university. For the fundamental high schools: 2 out of 3 have high academic expectations for their students and 3 out of 3 expect their students to attend a Cal State or other 4 yr. university.

SUPPLEMENTAL QUESTIONER

The supplemental questions were written by the researcher to better understand the feelings and attitudes that surround pupils in Santa Ana. These questions were included in the three survey packet. The results show that:

- 12 out of 20 traditional students said they get teased in their neighborhoods by fundamental students.

- 16 out of 20 traditional students said fundamental students have a better chance (than them) of going to college.
- 15 out of 20 fundamental students said traditional high school students do not have the desire to go to college.
- 19 out of 20 fundamental students want to go to go college.
- 8 out of 20 traditional students want to go to college.

ONE WAY ANOVA ON SELF-ESTEEM, SELF-EFFICACY SURVEYS

While the interviews of the guidance counselors, teachers, and student supplemental questions shed a light to the problem it is the quantitative section of the research that awakens the dilemma. A One-Way ANOVA was used to run the results of the student surveys (questions are on appendix a and b). With a confidence interval of 95% the analysis of variance concluded that the fundamental students are significantly different than the traditional students in their self-esteem and self-efficacy (Mean-fund=22.65, Mean-trad.=16.25; F=24.852, p=.000 Mean-fund=31.45, Mean-trad=27.10; F=5.494, p=.024). (Table 1) Also, self-efficacy was correlated with self-esteem at r=.326, p=.040 which means the greater your self esteem, the greater your self efficacy. (Table 2)

DISCUSSION

The results from the interviews and surveys suggest that there is a phenomenon occurring at one of the most homogeneous cities in America. Santa Ana Unified School District has unconsciously started a trend in which high school students from the same ethnicity and socio-economic status see themselves in a different light due to different expectations. Past research has proven that school and teacher expectations do have an effect on a students' behavior. The different mission statements (when comparing a fundamental versus a traditional) are largely responsible for this bifurcation in education. The fundamental schools are also recruiting not just the best students but faculty as well. This leads to faculty who stay at the traditional high schools to have lower academic expectations for their students. The teacher and counselor interviews conducted in this research have proven that there are lower expectations among faculty who work at a traditional high school. These lower expectations have a detrimental effect on the students when they are out of school. Kids are being teased for not being good enough which in return makes the traditional students not care about school. If this trend continues we can be assured that more and more kids who have the potential and determination to do good in school will become victims of the system and will "fall off the tracks of success". These future scholars who once had ambition to go to a university will end up being technical expertise's at the local auto repair shop.

FURTHER DIRECTIONS

The educational system in Santa Ana can be improved by implementing training programs for teachers' to raise their awareness of their thinking and behavior with regard to expectations and of the potential negative effects of differential treatment. The District can also remove the "fundamental" part in these public schools and have a single mission statement for all schools. Instead of investing in fundamental schools, traditional schools should receive more funding to current successful programs like AVID, Upward Bound, Talent Search that have proven to be a positive thing in the lives of these adolescents.

LIMITATIONS

There needs to be noted that this research has very important limitations. First, the sample size of the teacher and counselor interviews is very small due to the sake of time. Second, the validity of my supplemental questions could be in question. These questions were written by the researcher and were specific to Santa Ana's community. Third, parental involvement was not considered a variable in this project. Research has shown that authoritative parenting can lead to higher probabilities

of a student succeeding in academics. None of the questions included parental involvement.

WORKS CITED

Caprara, G.V, Barbaranelli, C, Pastorelli, C, Bandura, A, & Zimbardo, P (2000). Prosocial Foundations of Children's Academic Achievement. Psychological Science. 11, 302-306

Caprara, G,V, Barbaranelli, C, Pastorelli, C, Bandura, A, & Zimbardo, P (2001). Self-Efficacy Beliefs as Shapers of Children's Aspirations and Career Trajectories. Child Development. 72, 187-201

Marshall, H.H., and Weinstein, R.S. A Comparison of Classrooms Expected to ENHANCE OR Undermining student's . Washington, DC: National Institute of Education; Bethesda, MD: National Institute of Mental Health; Chicago, IL: Spencer Foundation, 1985. (ED 259 027).

McKown, C, & Weinstein, R.S. (2007). Teacher Expectations, Classroom Context, and the Achievement Gap. Journal of School Psychology. 46, 235-261.

Niemic, C.P., Lynch, M.F., Vansteenkiste, M., Berstein, J., Deci, E., & Ryan, R. (2006). The Antecedents and Consequences of Autonomous Self Regulation for College. A Self-Determination Theory Perspective on Socialization. 29, 761-775.

Steele, C. M. (1997). A threat in the air: How stereotypes shape intellectual identity and performance. *American Psychologist* 52 (6): 613-629

Steele, C. M., Spencer, S. J., & Aronson, J. (2002). Contending with group image: The psychology of stereotype and social identity threat. Advances in Experimental Social Psychology Volume 34. Advances in Experimental Psychology 34. p. 379

www.census.gov

www.materdei.org

www.sausd.us

TABLE 1

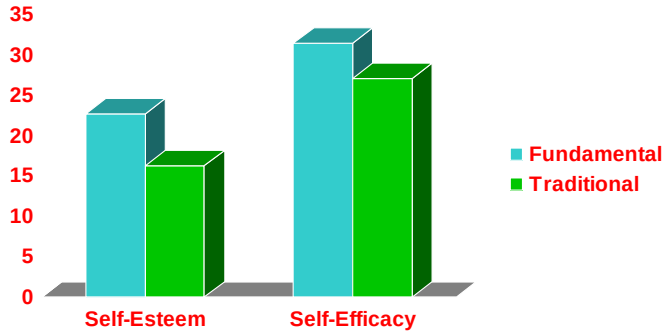

TABLE 2

		Self-Esteem	Self-Efficacy
S.Esteem	Correlation	1	.326
	Significance		.040
	Size	40	40
S.Efficacy			
	Correlation	.326	1
	Significance	.040	
	Size	40	40

APPENDIX A

JERUZALEM/SCHWARTZ SELF EFFICACY BELIEF

1. I can always manage to solve difficult problems if I try hard enough.
2. If someone opposes me, I can find the means and ways to get what I want.
3. It is easy for me to stick to my aims and accomplish my goals.
4. I am confident that I could deal efficiently with unexpected events.
5. Thanks to my resourcefulness, I know how to handle unforeseen situations.
6. I can solve most problems if I invest the necessary effort.
7. I can remain calm when facing difficulties because I can rely on my coping abilities.
8. When I am confronted with a problem, I can usually find several solutions.
9. If I am in trouble, I can usually think of a solution.
10. I can usually handle whatever comes my way.

APPENDIX B

ROSENBURG'S SELF ESTEEM SCALE

1. I feel that I am a person of worth, at least on an equal plane with others.
2. I feel that I have a number of good qualities.
3. All in all, I am inclined to feel that I am a failure.
4. I am able to do things as well as most other people.
5. I feel I do not have much to be proud of.
6. I take a positive attitude toward myself.
7. On the whole, I am satisfied with myself.
8. I wish I could have more respect for myself.
9. I certainly feel useless at times.
10. At times I think I am no good at all.

APPENDIX C

LIFE ORIENTATION TEST

Circle the response that best reflects your feelings about each statement .

1. In uncertain times, I usually expect the best.

strongly disagree disagree neutral agree strongly agree

2. It's easy for me to relax.

strongly disagree disagree neutral agree strongly agree

3. If something can go wrong for me, it will.

strongly disagree disagree neutral agree strongly agree

4. I always look on the bright side of things.

strongly disagree disagree neutral agree strongly agree

5. I'm always optimistic about the future.

strongly disagree disagree neutral agree strongly agree

6. I enjoy my friends a lot.

strongly disagree disagree neutral agree strongly agree

7. It's important to me to keep busy.

strongly disagree disagree neutral agree strongly agree

8. I hardly ever expect things to go my way.

strongly disagree disagree neutral agree strongly agree

9. Things never work out the way I want them to.

strongly disagree disagree neutral agree strongly agree

10. I don't get upset too easily.

strongly disagree disagree neutral agree strongly agree

11. I'm a believer in the idea that "every cloud has a silver lining."

strongly disagree disagree neutral agree strongly agree

12. I rarely count on good things happening to me.

APPENDIX D

SUPPLEMENTAL QUESTIONERS

Questions to students at both types of schools

1. How much do you agree with the following statement about your current school and teachers? (yes or no)

a) Discipline is fair. b) Most teachers discipline others who are not their favorite.

2. How often do you think it is OK to: a) cut a couple of classes; b) skip school for a whole day.

3. How often do you think it is OK to: a) cheat on tests; b) copy some-one else's homework? (on a scale of 1-10 with 10 being you greatly think)

4. Do you think that other students see you as a good student?

5. Do you think that other students see you as a troublemaker?

6. How often do you try as hard as you can in math, English, history, & science? (scale 1-10 with 10 trying very hard)

7. Do you want to go to college?

These next set of questions will be asked only at the two fundamental high schools.

1. Do you think you get a better education here than at your past school?

2. Do you think students at non fundamental schools are less educated than you?

3. Do you feel that students at a non-fundamental do not have the desire to go to college?

These next set of questions will asked only at two traditional high schools:

1. Do you think students at a Fundamental get a better education than you?

2. Do Fundamental students that live in your neighborhood ever

tease you for being at non-fundamental?

3. Do you have the desire to go to college?

APPENDIX E

INFORMED CONSENT FORM

You are invited to participate in a comparison study involving two types of high school students: a traditional student (i.e. Saddleback) and a fundamental high school student (i.e. Segerstrom). Specifically, this project will look at students' ambitions to go to a 4 year university. You were selected as a possible participant in this study because you are a member of a traditional or fundamental high school in Santa Ana Ca. If you decide to participate, you will be asked to fill out (3) forms and complementary questions totaling no more than 15 minutes to complete. The purpose of these questioners is to get a general idea of your population in regards to academic ambition. None of the questioners will ask you to disclose any personal information as your confidentiality is critical to the research. Your decision whether or not to participate will not prejudice your future relation with the University of Southern California or your current high school. If you decide to participate, you are free to discontinue participation at any time without prejudice.

If you have any questions, please do not hesitate to contact us. If you have any additional questions later, please contact Jose Rios at (714) 943-8976 or joserios@usc.edu who will be happy to answer them. You will be offered a copy of this form to keep.

You are making a decision whether or not to participate. Your signature indicates that you have read the information provided above and have decided to participate. You may withdraw at any time without penalty or loss of benefits to which you may be entitled after signing this form should you choose to discontinue participation in this study.

Student Signature/Date

_____

Signature of Parent/Legal Guardian/Date

_____

Signature of Researcher/Date

_____

IS T.O.D…D.O.A? A DEMORAPHIC ANALYSIS EXAMINING 2000-2008 LOS ANGELES TRANSIT ORIENTED DEVELOPMENT (TOD)

DANIEL WU

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The triple threat of California's housing crisis, global climate change, and urban poverty has spurred hundreds of millions of dollars of investments into Transit Oriented Developments (TOD) in Los Angeles. As an application of Smart Growth planning, TOD is considered an alternative form of urban development that may counteract this triple threat. Despite these large investments, however, current TOD literature has provided limited attention both on disaggregated demographic patterns and on the issue of equity, particularly how the impacts of TOD have affected some populations more than others. This limited attention is reflected in the lack of discussion not only about race and class, but also about inner-city TODs, such as the Red and Blue line. This limited attention is especially significant because of Los Angeles' racist history of sprawl, particularly with sprawl's relationship to urban poverty. If equity is not considered, TOD may mirror historical patterns of development that simply recreate racialized poverty within Los Angeles. By realizing the significance of equity, this study seeks a holistically disaggregated approach to demographic analysis around TOD stations. By individually analyzing a half mile "sphere of influence" around 35 rail transit stations along the Red and Blue Lines, this study surveys disaggregated demographic patterns from 2000 to 2008 around specific population characteristics—specifically race, income, and occupation. The analysis involves a comparison among the Red and Blue lines and Los Angeles City by analyzing median percentages and percent changes and identifying significant outliers. The analysis finds demographic patterns that exhibit warning signs, specifically around significant decreases in minority populations and low-income communities, which may be of relevance to policy-makers and local communities. Based on the results of this study, future directions include in-depth case studies of selected outliers, policy discourse, process analysis, and methodological improvements. This study will thus be important for community-based organizations, neighborhoods, local government, developers, educators and transit agencies perhaps to create more balanced, equitable TOD.

INTRODUCTION

The triple threat of California's housing crisis, global climate change, and urban poverty has spurred hundreds of millions of dollars of investments into Transit Oriented Developments (TOD) in Los Angeles. As an application of Smart Growth planning, TOD is considered an alternative form of urban development that may counteract this triple threat. Despite these large investments, however, current TOD literature has provided limited attention both on disaggregated demographic patterns and on the issue of equity, particularly to how the impacts of TOD have affected some populations more than others. This limited attention is reflected in a lack of discussion not only around race and class, but also about inner-city TODs, such the Red and Blue line. This limited attention is especially significant because of Los Angeles' racist history of sprawl, particularly with sprawl's relationship with urban poverty. If equity is not considered, TOD may mirror historical patterns of development that simply recreate racialized poverty within Los Angeles.

Realizing the significance of equity then, this study seeks a holistically disaggregated approach to demographic analysis around TOD stations. By individually analyzing a half mile "sphere of influence" around 35 rail transit stations along the Red and Blue Lines, this study surveys disaggregated demographic patterns from 2000 to 2008 around specific population characteristics—specifically race, income, and occupation. The analysis involves a comparison among the Red and Blue lines and Los Angeles City by analyzing median percentages and percent changes and identifying significant outliers. Before delving deeper into the TOD literature, however, a richer background must be provided about the context of LA's development and the theoretical planning considerations behind TOD.

WHY TOD? A BRIEF REVIEW OF SPRAWL, POVERTY, AND SMART GROWTH

Suburban sprawl, "a dispersed, low-density pattern of single-use development that makes driving the only convenient mode of travel," (Raya and Rubin 2006) is of particular importance to Los Angeles and TOD. This pattern of development has existed as a predominant form of urban development in LA's history. Sprawl not only has large environmental impacts significant for climate change (the personal automobile, for example, is known to account for 40% of California's CO2 emissions), but also sediments historically-rooted racist and classist institutions (Pulido 2000), which have harmful socio-economic effects for communities of color. For example, discriminatory redlining policies by the Federal Housing Administration restricted loans for communities of color and, at the same time, encouraged middle-class white households to the suburbs (Blackwell and Fox 2003). Transit policies historically also played a large part. The highway system was a crucial multi-billion dollar investment that originally catered to the white suburban community, and was one example of public policy that significantly shaped the city, "facilitat[ing] the decentralization of the economy and the concentration of urban poverty (Katz and Bradley 1999). Though market forces and consumer preferences have played critical roles in sprawl, public policies like the above shaped the "rules of the development game" (Katz 2002) and ultimately had devastating impacts on tax bases, resources, and economic vitality for the inner cities.

Despite this legacy, current policies continue to cement sprawl and racial and economic segregation. Exclusionary land use and zoning policies (such as requiring expensive multi-car garages and large lots) are important economic barriers for lower-income families from moving into the suburbs and newer developments. In questioning the motivations for such exclusionary policies, scholars such as George Lipsitz in The Possessive Investment in Whiteness have detailed the structural economic benefits maintaining white privilege has for white American communities, in a process that "provides [white Americans] with resources, power, and opportunity" (Lipsitz 2006). As the history and the current reinvestment of sprawl manifests, inequitable public policies and developments may reflect another facet of white privilege and thus deals intricately with structural racism in American society. The process of sprawl and ensuing residential racial and class-based segregation

perhaps explains much of contemporary urban poverty (Charles 2003).

Residential segregation linked to suburban sprawl is the dominant socio-economic barrier for communities of color. Segregation has been described as "a key missing link in explaining racial disparity" (Cutler et al. 1999). People of color who live residentially segregated "experience residential circumstances that are…detrimental to their future social mobility because "any process that concentrates poverty within racially isolated neighborhoods will simultaneously increase the odds of socioeconomic failure within the segregated group" (Charles 2003). Especially in Los Angeles (LA), where sprawl and residential segregation of Blacks, Latinos, and Asians goes hand in hand with concentrated poverty (Berube and Frey 2002), high rates of long-term joblessness, out-of-wedlock births, school drop-outs, crime and social disorder, and lower average wages for those who work (Charles 2003) have all been documented. Indeed, suburban sprawl and residential segregation is one, if not the most, critical social problems in Los Angeles and, perhaps, all major cities nation-wide.

In this context, smart growth has been raised as an alternative-planning paradigm to address the problems discussed above. By addressing "the rules of the development game" mentioned previously, the paradigm seeks to "slow decentralization, promote urban reinvestment and promote a new form of development that is mixed use, transit-oriented and pedestrian friendly" (Katz 2002). States, Katz in his article "The Future of the American Metropolis?" argues, is an important nexus to implement the smart growth framework, acknowledging the power states have over impacting growth trends due to their control over issues such as land use, governance, transportation, and local taxation (Katz 2002). Other urban and economic scholars have built upon the paradigm of smart growth. Regional equity is an alternative paradigm that this study takes up, which not only seeks to promote smart growth, but also holds issues of racism, classism, and environmental and social justice as integral to its paradigm. Regional equity seeks to integrate regions, cities, and suburbs as well as the voices of communities and the underprivileged.

Encouraging housing and transit, through transit-oriented development (TOD), may be a promising way to promote equitable development. Though it is rare to frame TOD in terms of regional equity, to successfully promote equitable development, TOD at its heart must address the structural racism and classism ingrained within historical and current urban development and suburban sprawl. Typically, as seen in the literature, TOD is often simply seen as an application of smart growth planning theory. Specifically, TOD refers to "mixed-use, walkable, location-efficient development that balances the need for sufficient density to support convenient transit service with the scale of the adjacent community" (Belzer and Autler 2002). Importantly, TOD can "connect people to jobs, services and education opportunities…especially important for households without access to a car. Investments in clean transit can also reduce traffic congestion and air pollution as well as improve public health at the community level" (Danielsen et al. 1999). Indeed, building off the principles of regional equity, TOD has the potential to holistically address many important urban problems, equitably improving urban life (from socio-economic to environmental and health), especially for segregated communities of color.

A LITERATURE REVIEW OF THE MAJOR EFFECTS OF TRANSIT ORIENTED DEVELOPMENT (TOD)

Due to the focus of this research project on exploring land use and residential patterns of TOD, a review of the broader impacts of TOD will be useful in order to set a context for this research. Both the positive and negative impacts of TOD have an extensive literature, which range from land-use impacts to economic development.

Land and land Use impacts. Cervero in Transit-Oriented Development in the United States: Experiences, Challenges, and Prospects highlights an important land impact: that of higher land and building values near transit stations. Cervero describes that properties and businesses have experienced rising land

prices and rent. Better circulation and architectural integration facilitated by TOD have resulted in higher premiums and prices. However, he notes that it is "a pecuniary impact of relative gains", with relative losses for properties and business that lie away from stations (Cervero 2004). Importantly, not all transit is the same. Cervero and Landis in "Twenty years of the Bay Area Rapid Transit" system notes that the quality of the transit service plays a major role in shaping prices for property and land in residential areas (Cervero and Landis 1997). Other literature points to a similar conclusion. An analysis of Los Angeles' Metro Rail revealed that commercial space within half a mile of the rail corridor had "an additional $31 increase in mean sale price per square feet over the mean sales price of a comparable control group outside of the rail corridor, between 1980 and 1990" (Fejarang 1994).

Research analyzing the shifts in land use impacts have been mixed. Cervero and Landis (1997) investigated the San Francisco's Bay Area Rapid Transit (BART) system, using digitized property tax records (square footage, lot area, year of construction) for privately owned parcels and tracking the accumulation of total square footage of residential and non-residential development within a quarter-mile and half-mile ring around transit stations. By compiling trend lines and historical comparisons, Cervero finds that much of the "land-use changes associated with BART have been largely localized, limited to downtown San Francisco and Oakland and a handful of suburban stations. Elsewhere, few land-use changes have occurred, either because of neighborhood opposition or a lackluster local real estate market" (Cervero and Landis1997).

By using match-pair comparisons around access points by transit stations and freeways, Cervero and Landis (1997) also found that increases in floor space near freeway corridors have been greater than those near BART stations. An important exception has been multi-family housing. In the instances that floor space near BART stations have increased, vacant and developable land has been an important predictor of whether or not land use changes had occurred. Cervero concludes that although BART, by itself, could not facilitate large land-use changes, with the proper public policy initiatives under a larger regional vision (as demonstrated by the local government's role in encouraging multi-family housing), a more complete type of transit oriented development could develop into fruition.

Economic Development. Closely tied to land prices and land use is economic development. TOD has much potential to attract investments and business in economically declining neighborhoods. The project for Public Spaces in The Role of Transit in Creating Livable Metropolitan Communities noted the role of Union Station in Washington DC, which helped spark an "urban renaissance. Retail sales have increased at an annual rate of 5%, and, according to one analysis, between 1,200 and 1,500 new jobs have been created at the station itself" (Project for Public Spaces 1997). A study of Fruitvale transit village in Oakland yielded similar results in Statewide Transit-Oriented Development Study: Factors for Success in California. Previously, businesses were 40% vacant, but after the TOD program, less than 1% of those businesses are now vacant. In addition, several new jobs have been created through the project. However, in line with Cervero's analysis with multifamily projects, this project did not occur without institutional support. The transit village drew heavy subsidies with over several million dollars in grants (Parker et al 2002).

Gentrification. An important consideration within economic development is gentrification. It is defined as the "process of neighborhood change that results in the replacement of lower income residents with higher income ones" (Kennedy and Leonard 2001). Kennedy and Leonard in "Dealing with Neighborhood change: A Primer on Gentrification and Policy Choices" note that access to transit systems and relative housing prices are tied to gentrification, both of which are facilitated by TOD. Gentrification is tied to equity because of the possibilities of forced displacement of lower income residents and economic development through increasing tax bases and poverty decentralization.

The literature on gentrification due to transit is mixed, however. In "Gentrification Trends in New Transit-Oriented Communities," Kahn uses home price and demographic data at the census tract level to investigate trends in major urban areas in the US. GIS and linear probability models are used to analyze TOD treatment on Central Business Districts. He generally finds that gentrification increases in "Park and Walk" facilities

and has no effect or decreases in "Park and Ride" facilities, which rely on automobile transportation. In Los Angeles, for example, Kahn finds an interesting result: an absence of gentrification as well as an increase in residential poverty for "Park and Ride" facilities (Kahn 2007).

An important limitation of the study, however, was an aggregation of the data of all rail lines in the Los Angeles MTA. Important differences and socioeconomic contexts between rail lines were missed in Kahn's statistical regressions. Despite the possibilities of gentrification and increased home prices, Cervero notes promising developments to fuse TOD with affordable housing. "Location efficiencies" TODs provide by reducing automobile expenses as well as reduced parking in some developments help mitigate the effects of the affordable housing crisis faced in major cities such as San Francisco and Los Angeles (Cervero 2004). He also notes that only one in four households can afford the median-priced home (Cervero 2004).

Renne in his dissertation "Transit-Oriented Development: Measuring Benefits, Analyzing Trends, and Evaluating Policy" posits similar conclusions. Analyzing the socioeconomic composition of Metropolitan Service Areas in 2000 for San Francisco and Los Angeles, he notes that the data for nonwhite and foreign born around rail stations over the past thirty years "indicate no patterns of displacement" (Renne 2005). He further notes that

"poverty rates have increased more in TODs than their respective regions, but eventually notes that…"it does not mean that it is not possible in the future…If fuel prices continue to increase and traffic congestion worsens in metropolitan areas, the housing demand in TODs is bound to increase. Unless the supply of housing in TODs increases correspondingly, prices may soar to the point that would then price out the poor and lead to gentrification" (Renne 2005).

Lin in "Gentrification and Transit in Northwest Chicago", on the other hand, finds evidence of gentrification, though in a different area. Mainly analyzing property value change versus properties located farther from transit, Lin concludes that transit access appears to be a spur to gentrification (Lin 2002). He also finds that gentrification happens in waves, emanating from the central district.

Travel Behavior. Travel behavior is another important effect to be reviewed. To be effective, TOD must reduce automobile use and support other modes of travel, such as bicycling, walking, and public transportation. A major ridership study carried out by Cervero in Ridership Impacts of Transit-Focused Development in California revealed that, in many cases, TOD has been effective. Residents living near transit stations were five times more likely to commute by rail transit compared to the average worker (Cervero 1993) and, in Santa Clara, similar results were found: residents living near light rail corridors were also five times more likely to use transit than the residents of the county as a whole.

In the 2004 study "Travel Characteristics of Transit-Oriented Development in California" by Lund et al. (Lund et al. 2004), updating Cervero's 1993 study, travel-diary surveys, 2000 census tract data, and GIS tools were used to conduct an aggregate analysis of proximity to transit, land-use, and modal splits for the SF bay area. Using GIS, census data was interpolated for 1-mile rings around rail stations, finding transit accounting for 12.6% , compared to 9.7% of trips regionally. Furthermore, the density, diversity (referring to land-use mix such as retail and service areas, measured by job quantity), and design of the built environment were studied, each of which displayed a strong positive relationship for ridership. For example, ridership increased from 24.3% to 66.6% from 10 to 30 units per gross acre in SF. Design, which measures the average number of city blocks per acre 1-mile from a transit station, was found to be the strongest predictor of transit modal shares, with an R-squared statistic of 0.817. Shrinking the average block size from six to three acres, for example, increased the probability of taking transit from 11.2% to 48.2%. The study also utilized multivariate analysis to prevent study bias created by only investigating single factors at a time. Notably, despite controlling for other factors such as the effects of the built environment, every 10 additional units per gross acre (density) were still associated with a 3.7% increase in transit share. Lund and Cervero's (2004) model accounted for over 90% of transit share in the SF bay area.

An important factor to consider, however, is resident self-selection. In "Residential Self Selection and Rail Commuting", Cervero and Duncan find that residential self-selection for

preferring public transit use accounted for 40% of the decision to commute via public transit (Cervero and Duncan 2002). Not all TOD, however, is created the same. Residents who live with free parking, forced to take multiple trips on transit to reach a destination, and have better free way accessibility will most likely not use transit (Lund et al. 2004). Furthermore, Cervero notes in his conclusion that self-selection does not "diminish the importance of planning for and building transit-oriented residences" (Cervero 2002) because the marketplace are often far from perfect. Factors such as Not-In-My-Backyard resistance and exclusionary zoning are factors that obstruct a perfectly functioning market. Identifying such barriers actually affords the opportunity to introduce market-responsive actions, such as specific kinds of zoning and parking standards, to increase resident self-selection for TODs and thus increasing ridership.

Furthermore, it must be made clear that the not all TOD is made equally. Policies, such as free parking, negatively affect the proportion of residents TODs can switch over from automobile usage. In Transit-Oriented Development in the United States: Experiences, Challenges, and Prospects, Cervero points out that "42% of station-area residents who paid for parking commuted by rail compared with just 4.5% who received free parking" (Cervero 2004).

A LITERATURE REVIEW OF EQUITY AND TRANSIT

Another crucial in this research is equity, particularly as it relates to transit. Inequities in job accessibility exist because of an automobile dependent urban structure, as "Job Accessibility as an Indicator of Auto-oriented Urban Structure Individuals" points out. Groups who "are unable to use cars are significantly disadvantaged in accessing economic opportunities…auto commuters enjoyed much more extensive areas of high accessibility" (Kawabata and Shen 2005). By using job and worker data from the 1990 Census Transportation Planning Package and origin to destination average travel times through a spatial distribution and competition formula, Kawabata and Shen illustrate the gravity of this point through a global comparison. For thirty minute commutes, mean job-accessibility was 1.08 in Tokyo, greatly exceeding that of Boston (.17) and Los Angeles (.10) (Kawabata and Shen 2005).

Scholars have also pointed to the way inequities of job accessibility are structured by race and class. Deka in The Geography of Urban Transportation describes the phenomenon of spatial mismatch, the "decentralization of employers to suburban areas lead[ing] to unemployment among African Americans living in the inner cities." As minorities face limited residential choices in the suburbs—whether due to exclusionary zoning policies, high costs of living, or even housing and market discrimination—a labor surplus of minority workers, especially African Americans and Latinos, occurs. Ihlanfeldt and Sjoquist (1998) in "The Spatial Mismatch Hypothesis" posit that such labor surpluses result in unemployment, lower wages, and longer commutes for these workers. Furthermore, poor information about distant jobs, discrimination in the labor market, and low-quality transit services has barred inner city minority groups from finding suitable employment (Ihlanfeldt and Sjoquist 1998).

However, disparities in the literature of job access exist. The main disparity deals with the issue of spatial mismatch. In "Transportation, Telecommunications, and the Changing Geography of Opportunity", Shen (1999) argues that suburban residents, compared to inner city residents, do not necessarily have a comparative advantage in terms of job openings. The Central Business District (CBD) is often one of the most opportunity rich areas. Although inner city neighborhoods and poverty enclaves are the most opportunity poor areas, their proximity to the CBD offsets poor opportunity. Shen ultimately argues, however, that regardless of location, residents without automobile access, especially in poor public transit areas, are disadvantaged. Spatial barriers contribute to this disadvantage for inner city residents, especially because "very few residential areas have enough location advantage to make up for their mobility disadvantage" (Shen 1999). In fact, he points out that residents without cars living in a suburban area may have significantly reduced job accessibility. Shen attributes the difference in the spatial distribution of job opportunities within the literature to different methodologies, particularly between those that measure employment changes (for example, growth and decline)

and those that measure employment levels; the latter of which Shen uses. Shen then points out that neither approach is solely appropriate: both employment levels, to account for work opportunities due to turnover, and employment changes, to account for opportunities due to growth, must be used. He finds that ignoring turnover overlooks nearly 95% of job opportunities in a metropolitan area.

Disparities in transit subsidies have been well documented. Duran notes the unequal benefits given to rail riders, who receive 28 dollars of subsidy compared to the 1.17 dollars for bus riders. Bus Riders are found to be "80 percent people of color and 80 percent poor, while almost the opposite is true of rail users in general and more specifically in Los Angeles" (Duran 1995). Iseki and Taylor in "The Demographics of Public Transit Subsidies: A Case Study
of Los Angeles" also note this trend by using service consumption and travel survey data from the Los Angeles County MTA and a set of multi-factor cost allocation models. They improve upon previous models by precisely measuring individual subsidized transit trips. They discover that "benefits of transit subsidies disproportionately accrue to those least in need of public assistance" (Iseki and Taylor 2001).

The impact of transit subsidy choices has affected inner-city communities disproportionately. This is seen through the investment of freeways. Deka (2004) argues that suburban land owners and suburban, generally wealthier and white, individuals primarily benefited from freeways. Minority and low-income individuals are often situated in the inner-city, and, with traditionally lower automobile ownership rates and with jobs historically located in the city, many did not use the freeway for transit purposes. With this context, Deka paints the "vicious circle of activity decentralization and degradation of cities" (Deka 2004). Freeways were often built through low-income and minority areas, which often had lower land values, disrupting communities and increasing crime. Freeways, by increasing accessibility to the suburbs, further facilitated the decentralization of not only affluent and middle-class households, but also employment opportunities. Freeways, as federal transit choices, were thus important factors in facilitating suburban sprawl and urban disinvestment (Deka 2004).

In addition to subsidies, inequities related to transit costs also exist. In Moving to Equity: Addressing Inequitable Effects of Transportation Policies on Minorities, Sanchez et al. describes that the lowest economic quintile in 1998 spent 36% of their income on transportation, while the highest quintile spent only 16 percent. With housing, transit is found to be one of the most financially intensive costs for families (Sanchez et al. 2003). Deka (2004) also outlines the relative expenditures on transit by both income and race. Data from the Bureau of Labor Statistics, shows a regressive pattern in the rate of change, with income groups from $4,999 to $14,999 reaching nearly 52.9% increases in transit expenditure, while $70,000 and above experience 16.8% increases. Race matters too. Blacks experienced a 62.5% increase from 1992-2000 while Whites and experienced 43.9% increase. Deka explains these differing rates of expenditure to minority automobile dependence (Deka 2004). Other scholars have pointed to automobile dependence as a behavior facilitated by increasing suburban sprawl, road dominance in urban planning, and highway subsidies (Deka 2004; Policylink 2004).

Disparities in mobility also exist. By comparing income and racial data in the 2001 National Household Travel Survey, Pucher et al (1998) note that the "poor, racial and ethnic minorities, and the elderly have much lower mobility rates than the general population" (Pucher et al. 1998). They also find that differences within racial and ethnic minorities depend on income class. In general, they find that African Americans and Hispanics are more likely to use alternative forms of transit than the automobile, including the school bus, the taxicab, and even walking. Important to note about these studies is the effect of aggregation. Larger national studies mask differences not only in economic indicators regarding race but also between major cities or even, for the purposes of this study, between rail lines and different TODs. Important insights may be drawn through disaggregated data and more specific case narratives (Valenzuela 2000).

Duecker and Bianco's warning in the Effects of Light Rail Transit in Portland about TOD holds great relevance here. In their analysis of TOD developments in Portland, they warn about inequalities created by an insular focus. An insular focus can favor the interests of one group over another. In particular

they point out that "most TOD planning efforts target areas of new growth, thereby continuing to neglect the serious and complex problems of the inner city…the emphasis becomes misplaced, chasing the elusive choice rider while underserving the captive rider" (Duecker and Bianco 1998). This warning may very well hold relevance to the Los Angeles TODs.

Although the literature on the effects of TOD and transit equity is extremely large, the following pieces were selected due to their relevance and the strength of their scholarship for this research topic. These pieces provided insight about the possible effects TOD may have on communities, particularly land values, economic development, and travel behavior. They also provided insight about the current landscape of transit equity, particularly as it relates to race and class. Importantly, the pieces both set an important context for this research and provided direction to fill gaps in the literature.

RESEARCH QUESTIONS

The preceding literature review demonstrates the vitality of the research committed thus far. This research project in particular, however, fills important gaps in this literature. Several distinctions are worth mentioning. A crucial methodological difference exists. The study employs a disaggregated approach across the 35 stations, using a unique data set provided by the Claritas demographic dataset. This disaggregated approach provides a balancing act: using local data surveyed by Claritas—in a "bottom up" approach—while providing space to observe this data on a larger 35 station landscape--in a "top down" view. Furthermore, this study seeks to integrate TOD/planning literature with analyses found in urban and American studies. A disaggregative demographic method is crucial to this study on two main aspects: within variable for race (for example, not simply "white and non-white" and "native versus foreign-born"), income, occupation, and travel to work data as well as within LA rail as a whole (for example, disaggregating red and blue lines). Furthermore, the contributes to the literature on gentrification and transit, which has previously only utilized changes in household price (Lin 2004). The quantity of studies that assume the socio-economic homogeneity of all spaces the LA MTA rail lines traverse is surprising.

In addition, also missing from much quantitative work in the topic is analysis explicitly concerned with equity, which will be further explored in this section. The final distinction lies within this study's distinctive scope. Not only does this study investigate a unique data set of estimated 2008 Census data, it also focuses on TODs that traverse inner-city, Los Angeles neighborhoods. Indeed, as Hess 2004 points out, a focus on the latter is largely unaddressed in the TOD/planning literature.

This survey technique was utilized to answer three vital questions about Los Angeles TOD:

1. What are the demographic characteristics of the red and blue lines according to several indicators, particularly around population and household density, transit to work, race, income, and occupation?
2. What are the differences between these demographic characteristics for the red and blue lines according to these indicators?
3. How well does TOD meet its claim for denser development and reduced automobile use?
4. How equitable have the demographic changes been, according to the indicators named above?

These questions will shed light into the intersections between equity and demographic patterns that have ample room to be strengthened in the literature.

METHODS

POPULATION AND SAMPLING PROCEDURE

The study investigates the Metropolitan Transit Authority's (MTA) rail lines within Los Angeles' urban region. Currently, there are five major rail lines: the Red, Purple, Blue, Green, and Gold Lines. However, this investigation will use all transit stations north of the Harbor Freeway Transit station. This is not sampling per se but is rather an exploratory study of the population. This focus is done to focus on residential patterns and land use patterns closer to the urban core of Los Angeles.

However, brief descriptions about each of the rail lines

Figure 1: The Red Line (Source: LA Metropolitan Transit Authority (MTA))

The Blue Line (Figure 2) has twenty-two transit stations. However, as mentioned in the sampling procedure, only the transit stations north of the Harbor Freeway will be examined. This amounts to 11 transit stations, including the 7th street/ metro center. Table 3 similarly outlines key facts about the transit station.

Figure 2. The Blue Line (Source: Los Angeles Metropolitan Transit Authority).

PROCEDURE

This study systematically investigates 35 transit stations in the Red and Blue Lines. The investigation involves data collection of demographic patterns, drawn from a unique Claritas database, of a slew of variables, including population growth, household growth, race, household income, occupation, educational attainment, travel to work, and housing values. Most of these variables are broken down into several categories (See Figure 3).

Variables	Race	Income	Occupation	Education	Housing	Travel to work
	White, Non-Hispanic/Latino, Black, Asian, American Indian/Alaska Native, Pacific Islander, Other, Multiracial	Less than $15,000; $15,000-$49,999; $50,000-$99,999; over $100,000	Unemployed, Not in Labor Force, Blue Collar, Service/Farm, White Collar	Less than High school, High school/GED, Less than 4-years college, 4 years college, More than 4 Years College	Up to $99,999; $100,000 to $399,999; $400,000 to $749,999; $750,000 to over $1,000,000	Motor (automobile, Carpool, Motorcycle); Public Transportation, Non-Motor (Bicycling, walking), Other (work from home)

Figure 3

Data collection for demographic patterns first requires mapping a half-mile radius diamond around a transit station. As Loukaitou-Sideris and Banerjee note, this half-mile represents the "sphere of influence" residents are willing to travel in order to use transit (Loukaitou-Sideris and Banerjee 2000). Census data for the variables named in the previous paragraph from 2000 to 2008 will then be obtained through the Claritas database for each of the transit stations for the Red and Blue lines.

Demographic analysis is crucial to this research. Demographic analysis will revolve around two main comparisons: comparison between the Red and Blue lines and Los Angeles city-wide. Differences in race, income, occupation, and travel-to-work data, for example, will be compared between the Red and Blue rail lines as well as Los Angeles city as a whole. New variables will be created for "Difference between 2008 and 2000" and "Percent Change" across the specified variables through the statistical packaging software SPSS. Percent Change is calculated to allow for comparisons across time between the Red and Blue Lines and Los Angeles City-wide.

Quantitative methods utilizing SPSS will be necessary for this demographic analysis. Three main statistical analyses will occur. The first will be to establish whether the changes across the Red and Blue Lines are unique and significant, compared to Los Angeles as a whole. Uniqueness will be established through one-sample t-tests across the previously named variables, using LA's values as test statistics.

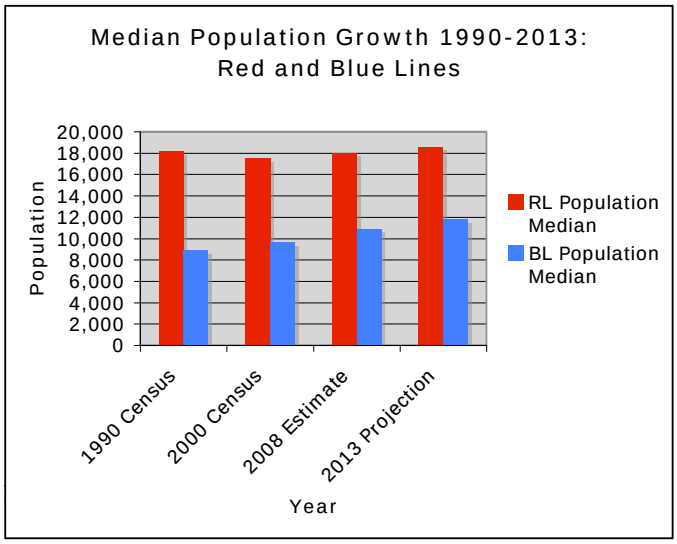
Secondly, patterns within the lines will also be examined. These patterns may be helpful in pointing out inequitable outcomes for certain demographic groups in light of Transit Oriented Development. An omnibus bivariate correlation, which is a large correlation table with all the named variables, may help

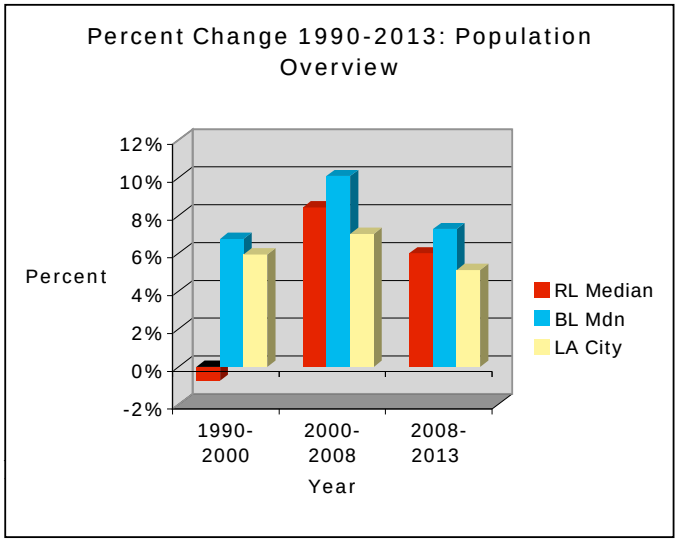
specify significant variable pairs. Afterwards, stepwise multiple regressions can create models that test how significant variables (independent variables) affect outcomes, specifically for a dependent variable, such as percent change in race. The multiple regression provides a coefficient of determination (R-square) that names the proportion of variability in a data set that is accounted for by the statistical model created by the independent variables. In other words, if, for example, a multiple regression for percent change in race used a model of independent variables that included housing values and income, and if a .70 R-square was calculated, then this result refers to 70% of the variance in the percent change in race accounted for by housing values and income.

Finally, potential sites for case study, particularly around the extremes, will be chosen and discussed in the discussions section. More rigorous criteria for defining TOD's exist, such as Belzer and Autler's (2002), including location efficiency, value recapture, livability, financial return, choice, and efficient regional land use patterns. These criteria may be measured for these case studies in future research. Additionally, case narrative describing the history, context, and policy landscape will be explored for these sites.

FINDINGS

The following section provides the findings established through the methodology described above. Each variable used will be given consideration in terms of significant difference compared to LA. Furthermore, those variables found significantly different will be used as dependent variables in stepwise multiple regressions. The findings for these regressions will be provided under the related variable heading and will be useful in finding patterns within lines.





Charting population trends around the half-mile sphere of influence for the Red and Blue line transit stations helps answer the question of population density around these areas. Figure A graphs population trends from 1990-2013. Keep in mind that 2013 data is projected through the Claritas database (see Appendix D for detailed Claritas methodology). The Red line displays higher overall median population density during the 23-year span, with a median of 18,093 individuals per .25 square mile (due to the half mile radius), while the blue line displays lower population density with a median of 10,279 per .25 square mile.

Percent change from 1990-2013 shows a slightly more nuanced picture. The Red Line experienced median negative growth from 1990-2000, median positive growth upwards of 8% (10% average growth) from 2000-2008, and 6% median and

average growth from 2008-2013. The Blue Line and Los Angeles City (LAC) experience a similar upside-down "V" trend, but at much higher growth levels throughout. For example, both the Blue Line and LAC do not experience a negative decrease from 1990-2000 as seen in the Red Line. From 1990-2013, the Blue Line experiences a 7% median growth rate, while the Red Line and LAC from 1990-2013 experience similar median growth rates at 6% and 5.94% respectively.

A one sample t-test is calculated from 2000 to 2008 for both the Red and Blue Lines (Figure A3). A statistically significant result is found for population growth at .030.

One-Sample Test

	Test Value = .0703					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
poppercentgrowth	2.261	34	.030	.0605708576	.0061251516	.1150165636

Figure A3

HOUSEHOLD GROWTH

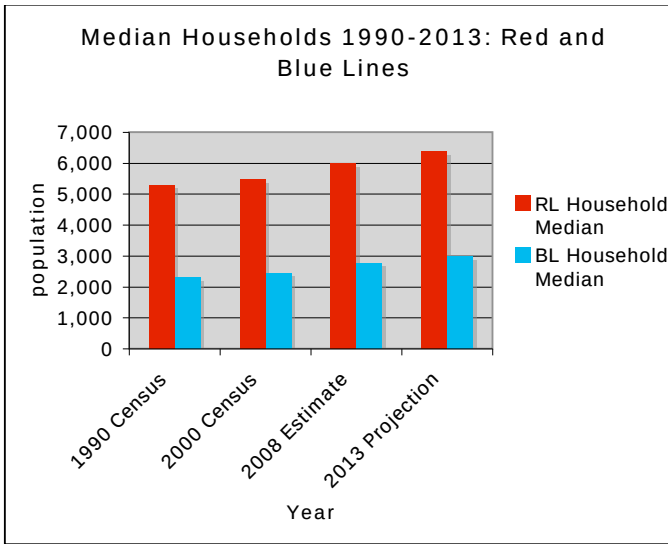


Figure B1

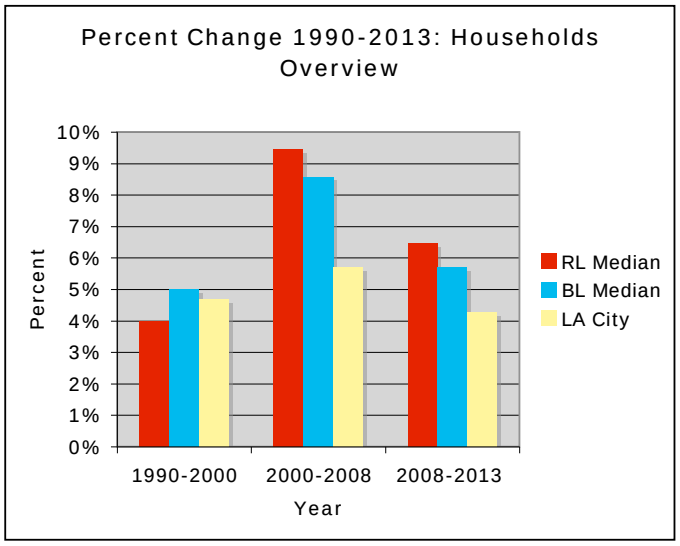


Figure B2

Charting household trends also helps answer the question of density around Red and Blue transit stations. Figure C details Median Household from 1990-2013. Red Line has higher household density than the Blue Line throughout the years, with a median of 5,747 households, climbing up to over 6,000 households per .25 miles by 2013. In contrast, the Blue Line, with a median of 2,622 households from 1990-2013, reaches upwards of 3,000 households per .25 miles by 2013.

Percent Change shows a similar upside down "V" trend seen in population growth. The median percent change from 1990-2013 is 6% for both the Red and Blue Lines, while LAC experiences a median of 4.70%. All three sets peak from 2000-2008: Red with a median of 9.46% and an average of 18.22%, Blue with 8.59% and an average of 13.60%, and LAC with 5.71%.

A one-sample t-test is also calculated for household growth from 2000 to 2008. The test reveals a significant value of .015 compared to Los Angeles citywide.

One-Sample Test

	Test Value = .057					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
hhpercentgrowth	2.551	34	.015	.099997174279	.020342167718	.179652180841

TRAVEL TO WORK

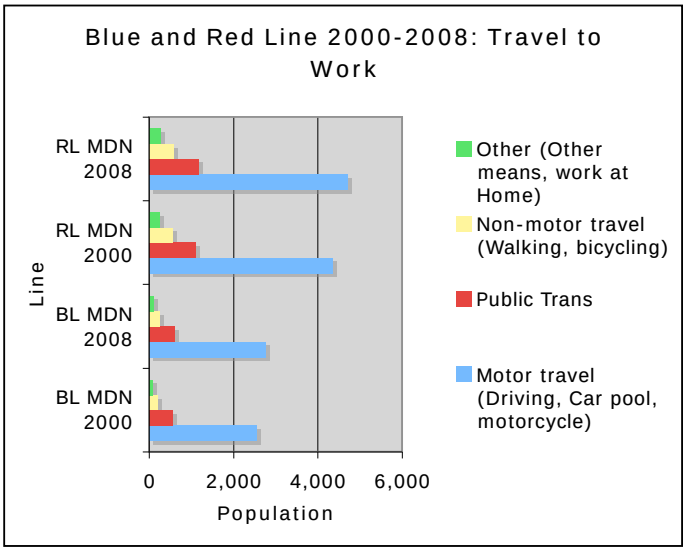


Figure C1

Travel to work data helps answer the travel characteristics of the populations around the Red and Blue lines. The Red Line's median motor travel to work increases from 2000, from 4,339 to 4,696 in 2008. Figure C1 shows that public Transportation increases from 1,086 to 1,158, though a fourth the usage of motor travel. Median Non-motor travel remains 9% of the population. Though the Blue line experiences less motor travel, it also has a smaller population base. Similar slight increases in public transportation (at 17.30% of the population in 2008) and non-motor travel (at 8.50% of the population in 2008) is seen in the Red Line.

Percent change from 2000-2008 provides another perspective through time. Figure C2 shows that the Blue Line experiences the highest median increase for motor (14.16%), public transportation (11.60%), and non-motor travel (11.05%). The Red and LAC experience less significant median increases, though the Red Line displays higher public transportation increases than LAC as a whole. However, percent of total population around the transit stations shows less motor travel and more public transportation and non-motor travel than LAC.

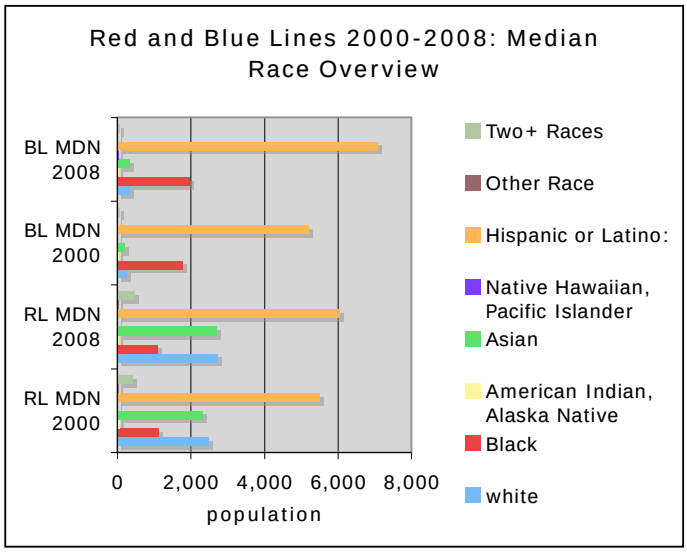
One Sample t-tests for motor travel were calculated for the Red and Blue Lines aggregated and the Red and Blue Lines disaggregated. Using the LA test statistic of .075, although the aggregated t-test (degrees of freedom or df = 34) showed a significance level at p = .027, t =2.306, and Mean Difference (MD) = .06827 percent change, the disaggregated tests provided different results. Motor Travel to work one-sample t-test (df = 13) for the Red Line was insignificant at p = .360 and t = .949. The Blue Line's (df = 20) percent increase, however, was significant at p = .047, t = 2.114, and MD = .09388 percent change. Thus the 9.39% more residents of the Blue Line, on average, used motor travel than residents of LA as a whole.

One Sample t-tests for public transportation revealed insignificance for both aggregated and disaggregated analyses. Using a test statistic of .104 for LA, aggregated analyses revealed (df = 34) t = .786, p = .438; therefore the percent changes for public transportation on the two lines were therefore insignificant. Disaggregated one-sample t-test for the Red Line (df = 13) is -.005, p = .996; for the Blue Line (df = 20) = .846, p = .408.

Insignificance was also found for nonmotor travel. Using the LA test statistic of .086, aggregated one-sample t test (d=34) is t = 1.034 and p = .308. Disaggregated one-sample t tests for the Red Line (df = 13) = .239, p = .815 and the Blue Line (df = 20) = 1.012, p = .323.

Finally, One sample t-tests for "other" were found to be significant for both the Red and Blue Lines. Aggregated one-sample t test (df = 33) using the LA test statistic of .059 found t = 3.884 and p = .000, which is highly significant. Disaggregated analysis found that the Red Line (df = 13) = 2.237 and p = .043; the Blue Line (df = 19) = 3.291 and p = .004. Both are significant.

RACE



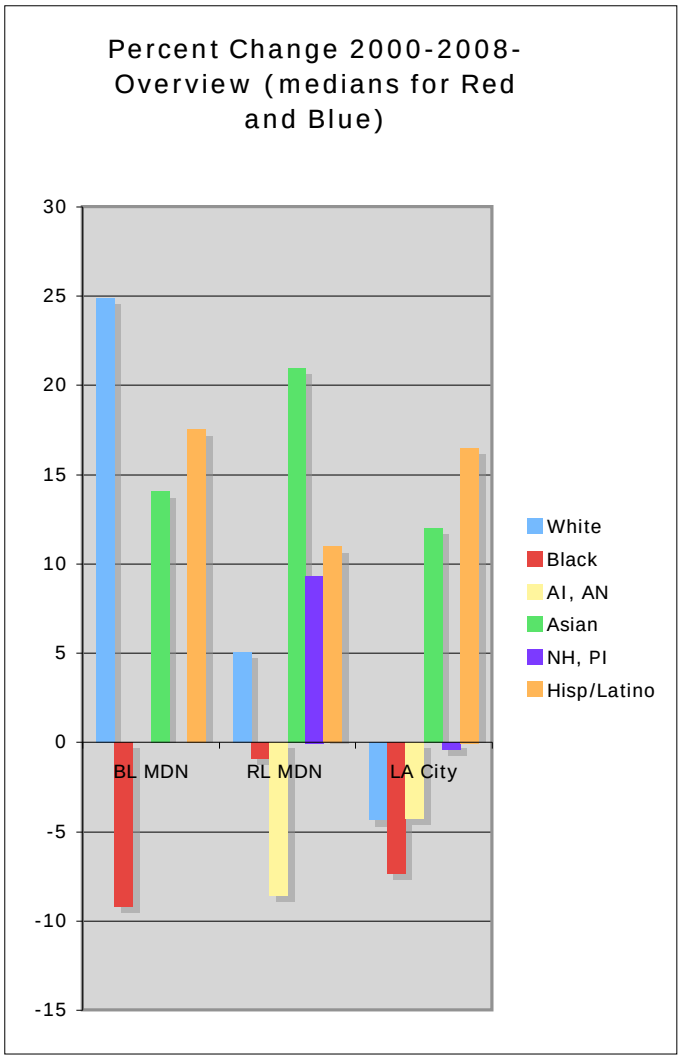


Figure D2

The following three sections present disaggregated data for race, income, and occupation for the Red and Blue Lines and LAC. This data helps analyze how specific demographic groups around transit oriented development sites are being affected. Figure D1 shows that, for both the Red and Blue Lines, Hispanic/Latinos are the population majority: 46.04% and 72.21% in 2008 respectively. Furthermore, the Black median population is higher around the Blue line (19.96%) than the Red Line. Both Asians and Latinos congregate in higher proportions around the Red Line (20.59% and 20.75% respectively). Figure D3 provides more specific percentages of the median population.

	RL MDN 2000	BLMDN 2000	LAC 2000
White	20.78%	3.14%	29.75%
Black	9.47%	23.37%	10.88%
Am Indian, Alaska Native	0.40%	0.28%	0.24%
Asian	19.49%	2.63%	9.87%
Native Hawaiian, Pa. Island	0.10%	0.20%	0.12%
Hispanic or Latino:	46.03%	69.39%	46.53%
Other Race	0.34%	0.13%	0.25%
Two+ Races	3.39%	0.85%	2.36%
	100.00%	100.00%	100.00%
	RL MDN 2008	BLMDN 2008	LAC 2008
White	20.75%	3.25%	26.60%
Black	8.36%	19.96%	9.42%
Am Indian, Alaska Native	0.32%	0.31%	0.22%
Asian	20.59%	3.24%	10.33%
Native Hawaiian, Pa. Island	0.11%	0.27%	0.11%
Hispanic or Latino:	46.04%	72.21%	50.63%
Other Race	0.27%	0.08%	0.23%
Two+ Races	3.56%	0.69%	2.45%

Figure D3

Figure D2 displays race demographic changes from 2000-2008 for the Red and Blue Lines and LAC. The Blue line experienced large white median population growth upwards of 24.9%, in contrast to the Red Line with 5.03% and LAC with -4.3%. Hispanics increased the most around the Blue Line (17.5%), but below citywide increases (16.4%) around the Red Line (10.9%). Asians increased consistently through all three sites, the highest on the Red Line with 20.9% increases. Blacks faced decreases in median population in all three sites, the highest on the Blue Line with a -9.18% decrease. Finally, Native Americans decreased the most significantly around the Red Line (-8.6%), while Native Hawaiians/Pacific Islanders increased the most around the same line (9.3%).

Aggregated one-sample t-test for Hispanic/Latino populations (df=34) revealed t = .279 and p = .782. On the aggregate level, percent change is thus insignificantly different than that of LA as a whole. Disaggregated one-sample t-tests for Hispanic/Latino populations, however, revealed a different picture. Using the LA test statistic of .165, the Red Line (df = 13) experienced t = -2.780, p =.016, and MD = -.08713, pointing to less than 8.71% change Hispanic/Latinos on the Red Line as compared to LA city as a whole. The Blue Line one-sample t-test (df = 20) found t = 1.472 and a p =.157, so the percent change for Hispanic/Latinos was insignificant.

Aggregated one-sample t-tests for percent change in Whites found t = 3.646, p = .001, and MD = .16095, resulting in a significant change. More specifically, disaggregated one-sample t-tests for White populations revealed different significance levels for the Red and Blue Lines. Using the LA test statistic of

-.043, the Red Line one-sample t-test (df=13) = 3.429, p = .004, and a MD = .09950. The Blue line one-sample t-test (df=20) = 2.871, p = .009, and MD = .20192. Both of these results point towards increases in percent change of the white population around the Red and Blue Lines compared LA as a whole.

Though percent change of Blacks was found to be significant in an aggregated t-test (df = 34, t= 2.430, p = .021, MD = .10444), two disaggregated one-sample t-tests for Black populations revealed mixed significance. With the LA test statistic -.073, the Red Line one-sample t-test (df = 13) = 2.411, p = .031, and MD = .12093. The Blue Line one-sample t-test (df = 20) = 20 and p = .161, so the percent change of Blacks were insignificant compared to LA citywide.

Aggregated one-sample t-test for American Indians/Alaska Natives approached significance, with df = 32, t = 1.999, and p = .054. However, disaggregated one-sample t-tests for American Indians/Alaska Natives also revealed mixed significance. Utilizing the LA test statistic of -.042, the Red line one-sample t-test (df = 13) found t = -.852 and p = .410. The percent change was therefore insignificantly different compared to LA. The Blue Line one-sample t-test (df=20), however, found significance with t = 3.230, p = .005, and MD = .18308. The American Indian population therefore significantly increased in percent change compared to LA as a whole.

Aggregated one-sample t-tests for Asians also approached significance, with df = 34, t = 1.996, and p = .054. However, disaggregated percent changes for Asians in both the Red and Blue Lines were found to be insignificant. Utilizing the LA test statistic of .120, the Red Line one-sample t-test (df = 13) = 1.842 and p =.088. The Blue Line one-sample t-test (df = 20) = 1.334 and p = .197.

Finally, percent change for Native Hawaiians/Pacific Islanders in an aggregated one-sample t-test was insignificant: df = 33, t = 1.683, p = .102. Disaggregated tests confirmed the aggregate result, finding insignificance in both the Red and Blue Lines. Using the LA test statistic of -.003, he Red Line one-sample t-test (df = 13) = 1.533 and p = .149. The Blue Line one-sample t-test (df = 20) = .855 and p =.403.

MULTIPLE REGRESSIONS

Stepwise Linear Multiple Regression Analysis (LMRA) was conducted in order to piece out relationships between variables that have been found to be significantly different than LA around the Red and Blue Lines. The percent change of white collar and service workers were highly significant predictors of the Hispanic/Latino population (β=1.384 and β=.442, p= .005, p =.045 respectively). The adjusted R-square, which describes the percentage of the variance the independent variables (percent change of white collar and service workers) account for the variance of the dependent variable (percent change of Hispanic/Latino population), was 95.1%.

LMRA was also conducted on Whites on both the Red and Blue Lines. A slew of variables including percent change of educational attainment less than four years of college (β=1.740, p= .000), black (β=-.383, p= .001), housing values up to $749,000 (β=-.248, p= .003), incomes less than $15,000 (β=-.985, p= .001), and Asian (β=.291, p= .023) were significant predictors of the percent change of White populations. The adjusted R-square for this model is found to be 94.8%.

The percent change of Blacks on the Red Line were significantly predicted by the percent change of incomes less than $15,000 (β=1.477, p= .005) and motor travel (β=-.519, p= .037), with this model accounting for 99.8% of the variance of the dependent variable.

Finally, the percent change of Native American/Alaska Natives on the Blue Line were significantly predicted by the percent change of Whites (β=.816, p= .001), with the model accounting for 63.3% adjusted R-square.

INCOME

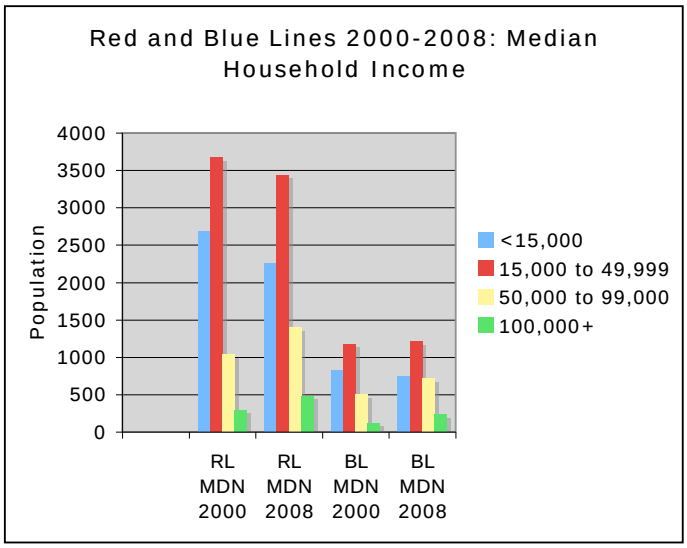


Figure E1

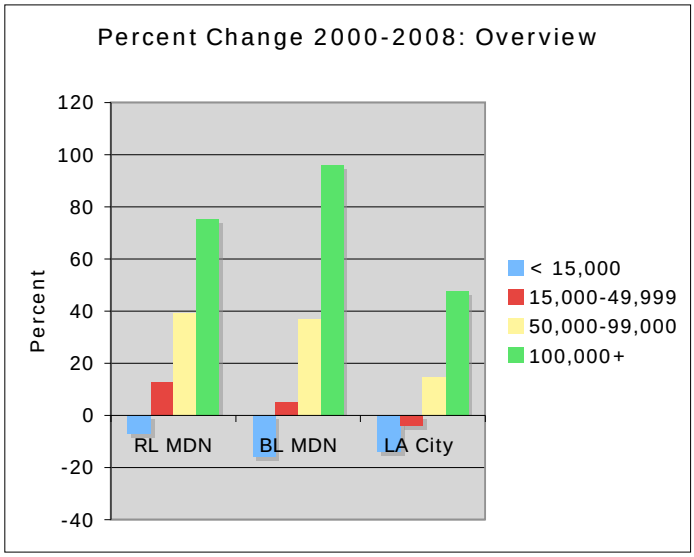


Figure E2

Median Income is also another useful variable to consider in demographic change. Figure E1 displays Median Household income between the Red and Blue Lines. Though the Red Line has a higher overall population both with incomes below 15,000 and 15,000 to 49,999, one must also account for its higher population density. Median incomes below 15,000 consist of 26.73% of the Red Line transit station population, while incomes from 15,000 to 49,999 consist of 36.64%. In comparison, the Blue line has higher percentages for both categories of median income: 33.90% and 47.87% respectively for the two populations. The same trend exists for median incomes from 50,000 to 100,000+: though the Red Line has more of this kind of demographic, the blue line has a higher percentage. Further percentages are seen in Figure E3.

Household Income	RL MDN 2000	BL MDN 2000	LA City 2000
<15,000	26.73%	33.90%	20.83%
15,000 to 49,999	36.64%	47.87%	41.63%
50,000 to 99,000	10.37%	20.42%	23.92%
100,000+	2.95%	4.91%	13.63%
Household Income	**RL MDN 2008**	**BL MDN 2008**	**LA City 2008**
<15,000	22.02%	27.11%	17.03%
15,000 to 49,999	33.46%	43.52%	37.91%
50,000 to 99,000	13.63%	25.82%	26.01%
100,000+	4.67%	8.51%	19.04%

Figure E3

Figure E2 displays the median percent change from 2000-2008 for the Red and Blue Lines and LAC. All three sites show decreases in median incomes below 15,000, highest in the Blue Line with a -15.9% change. Furthermore, increases in the next three median income categories (from 15,000 to 100,000+) for the Red and Blue Lines are all comparatively larger to those of the LAC. Incomes of 100,000+, for example, show increases of 75.06% for the Red Line and 95.9% for the Blue Line, compared to the 47.6% increase citywide.

One-sample t-tests were again calculated for all the variables groups. Utilizing a -.136 LA test statistic, the percent change of income groups less than 15,000 found significance in an aggregated test statistic ($df = 34$, $t = 2.378$, $p = .023$). However, disaggregated analyses found a more complex picture between the Red and Blue Lines. The Red Line one-sample t-test ($df = 13$) = 2.431, $p = .030$, and $MD = .08417$, with thus a higher mean percent change compared to LA as a whole. The Blue Line ($df = 20$) = 1.144 and $p = .266$. The Blue Line's percent change was thus insignificant in contrast with the Red Line's.

The aggregated one-sample t test for the percent change of income groups ranging from 15,000 to 49,999 were found to be significantly different ($df = 34$, $t = 4.424$, $p = .000$) than that of LA. Disaggregated t-tests confirmed this result for both the Red and Blue Lines. With a -.038 LA test statistic, the Red Line one-sample t-test ($df = 13$) = 2.779, $p = .016$, and $MD = .15842$. The Blue Line one-sample t-test ($df = 20$) = 3.445, $p = .003$, and $MD = .11956$. Both the Red and Blue Line had a higher mean percent change for this income group compared to LA as a whole.

The aggregated one-sample t-test for percent change of income groups from 50,000 to 99,999 was found to be insignificantly different compared to LA, with a df = 34, t = 1.437, p = .160. Disaggregated analysis found a subtler picture with percent change significantly different for the Blue Line, but not the Red Line. With a .149 LA test statistic, the Red Line one-sample t-test (df = 13) = 1.182 and p = .258. The Blue Line (df = 20) = 3.736, p = .001, and MD = .21111, thus pointing to a higher mean percent change compared to LA as a whole.

Finally, percent change of income levels over 100,000 was found to be insignificantly different in an aggregated one-sample t-test (df = 34, t = .546, p = .588). Disaggregated analysis confirmed this result for both the Red and Blue Lines. Using a .476 LA test statistic, the Red Line one-sample t-test (df = 13) = -1.219 and p = .245. The Blue Line one-sample t-test (df = 20) = 1.433 and p = .167.

MULTIPLE REGRESSIONS

An omnibus bivariate correlation table and a stepwise linear multiple regression analysis (LMRA) was also used to reveal relationships between the variable sets. Based on the significant percent changes in income, multiple regression analysis was used for income levels below $15,000 on the Red Line, $15,000 to $49,000 for both the Red and Blue Lines, and $50,000 to $99,999 on the Blue Line.

For the first demographic group, percent change of Blacks were found to be a highly significant predictor of the percent change of income groups below $15,000 (β=.985, p = .002), accounting for 96.1% (adjusted R-square) of the variable's change. Furthermore, adding percent change of motor travel increases the predictability of the model (β=.670 and β=.357, p = .005 and .017 for percent change of Blacks and motor travel respectively), finding 99.8% (adjusted R-square) of the variance accounted for.

When disaggregating the data between Red and Blue Lines, the LMRA finds no significant predictors for the Red line, but isolates percent change of education over four years as a highly significant predictor of income groups from $15,000 to $49,000 (β=.956, p = .000), with an R-square of 90.6%. Aggregating the data between the two lines, the LMRA finds percent change of education less than four years as a highly significant predictor of the same income group (β=.852, p = .000), with an R-square of 70.7%.

Finally, the LMRA for income groups $50,000 to $99,999 finds significant predictors in the variables: percent change of education over four years, income below $15,000, and incomes from $15,000 to $49,999 (β= 1.683, -1.819, and .888 and p = .001, .000, and .000 consecutively). The three predictor variables accounts for 95.0% variance (R-square).

OCCUPATION

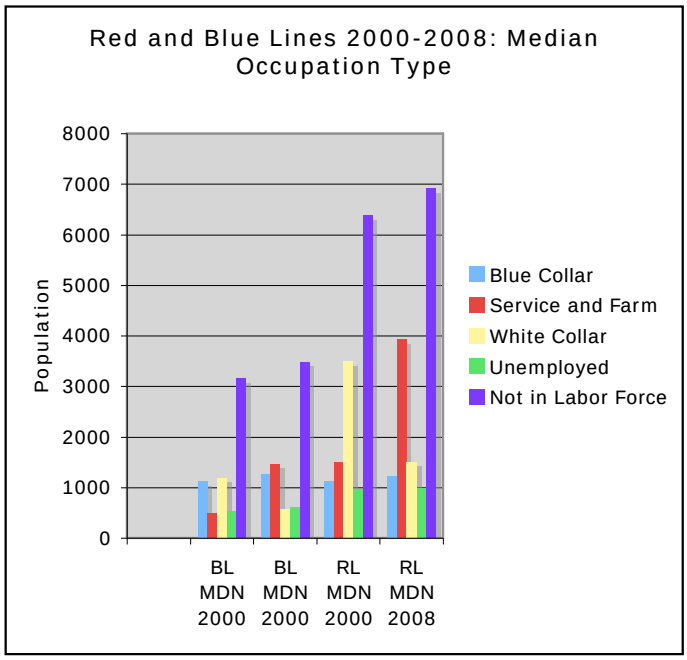


Figure F1

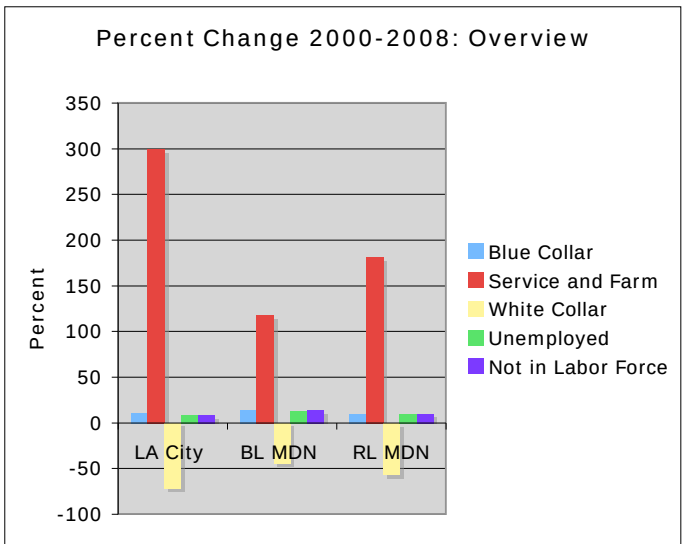


Figure F2

The third variable used to scrutinize the demographics of change around the Red and Blue lines is occupation type. Figure F1 shows that though the Red Line appears at first glance to have a higher population around all occupation types, the picture is more complicated when accounting for population size. The Red Line exhibits higher percentages of median service and farm (26.98% versus 19.84% in 2008) and white collar (10.31% versus 7.75% in 2008), while the Blue Line displays a higher percentage of blue collar (17.14% versus 8.40% in 2008) and unemployed (8.23% versus 6.79%). In 2008, LAC has higher percentages in service and farm and blue collar (compared to the Red Line) and white collar (compared to the Blue Line). Further percentages are detailed in figure F3.

Age 16+, Occ. Class	RL MDN 2000	BL MDN 2000	LA City 2000
Blue Collar	8.31%	17.24%	12.46%
Service and Farm	11.14%	7.62%	8.85%
White Collar	25.98%	18.28%	33.25%
Unemployed	7.14%	8.16%	5.58%
Not in Labor Force	47.43%	48.70%	39.87%
Age 16+, Occ. Class	RL MDN 2008	BL MDN 2008	LA City 2008
Blue Collar	8.40%	17.14%	12.74%
Service and Farm	26.98%	19.84%	32.70%
White Collar	10.31%	7.75%	8.92%
Unemployed	6.79%	8.23%	5.61%
Not in Labor Force	47.51%	47.03%	40.03%

Figure F3

Figure F2 shows the percent change from 2000-2008 around LAC and the Blue and Red Lines. The largest changes are in service and farm and white collar. While LAC experienced service and farm changes upwards of 300% increases, the Blue and Red Line experienced 117.7% and 181% increases consecutively. In contrast, white collar employment decreased downwards of -71% in LAC, while the Blue line experienced -43.9% decreases and the Red Line -56.2% decreases. The changes for blue collar, unemployed, and not in labor force were not as large, but experienced the greatest positive changes on the Blue Line.

Utilizing an LA test statistic of .088 for percent change of unemployment, significance was found for the Red and Blue Line aggregated (df = 34, t = 2.181, p = .036, MD = .05609 and thus a higher unemployment level). Disaggregated one-sample t-tests found mixed significance for the Red and Blue Lines. The percent change of the Red Line was not significantly different from that of LA, with a df =13, t = -.095, and p = .926. The Blue Line one-sample t-test (df=20), however, found a t=2.423, p=.025, and MD = .09470, with thus a higher percent change of unemployment than LA as a whole.

With an LA test statistic of .086, the percent change of Not in Labor Force (NILF) was insignificant on the Red and Blue Lines aggregated, with a df = 34, t = 1.960, p = .058). Disaggregated one-sample t-tests simply confirmed insignificant differences on both the Red and Blue Lines compared to LA. The Red Line one-sample t-test (df = 13) = .490 and p = .632. The Blue Line one-sample t-test (df = 20) = 1.934 and p = .067.

The percent change of Blue Collar workers revealed similar results. Both the percent changes of Red and Blue Lines were no significantly different than LA. Using the LA test statistic of .106, the aggregated one-sample t-test (df = 34) = 1.239 and p = .224. The disaggregated method also confirmed a lack of significant difference. The Red Line one-sample t-test (df = 13) = .356 and p = .727. The Blue Line one-sample t-test (df = 20) = 1.219 and a p = .237.

With the LA test statistic of 2.999, the aggregated one-sample t-test for the percent change of Service workers finds significance with a df = 34, t = -2.849, p = .007, and a MD = -.98368. The disaggregated one-sample t-tests find, however, finds significant difference around the Blue Line, but not the Red Line. The Red Line one-sample t-test (df = 13) = -.786 and p = .446. In contrast, the Blue Line one-sample t-test (df = 20)

= -3.860, p = .001, and MD = -1.26615. The Blue Line thus has less percent change of service workers compared to LA city as a whole.

The percent change of White Collar workers finds highly significant differences in an aggregated one-sample t-test (df = 34) = 6.530, p = .000, and MD = .25749. The disaggregated one-sample t-tests also confirms this significant difference around both the Red and Blue Lines compared to LA citywide. Utilizing the LA city test-statistic of -.710, the Red Line one-sample t-test (df = 13) = 2.855, p = .014, and MD = .22879. The Blue Line one-sample t-test (df = 20) = 6.964, p = .000, and MD = .27662. Therefore, both the Red and Blue Line experienced less percent decreases of White Collar workers compared to LA citywide.

MULTIPLE REGRESSION

LMRA was also utilized for the three statistically significant findings above. Percent change of Hispanic/Latinos highly predicted the percent change of Blue Line unemployment (β=.973, p= .000), accounting for 94.1% of the variance. When percent change of incomes over $100,000 is added into the model, the adjusted R-square increases to 97.3%, with β=.911 and β=.188 , p= .000, and p=.006 for percent change Hispanic/Latino and percent change incomes over $100,000 respectively.

Secondly, percent change of housing values up to $749,000 and over $1,000,000, white collar workers, nonmotor travel, and incomes over $100,000 highly predicted the percent change of Blue Line service workers. The betas were found to be -.131, .485, -.383, .407, and -1.96, with significances of .000, .020, .000, .001, and .004 respectively. The resulting model had an adjusted R-square of 98.5%.

Lastly, percent change of service workers and motor travel residents highly predicted the percent change of White Collar services workers on an aggregated level for the two lines (β= -1.099 and .839, p = .000 and p= .000 respectively). The resulting model found through LMRA had an adjusted R-square of 70.8%.

EDUCATIONAL ATTAINMENT

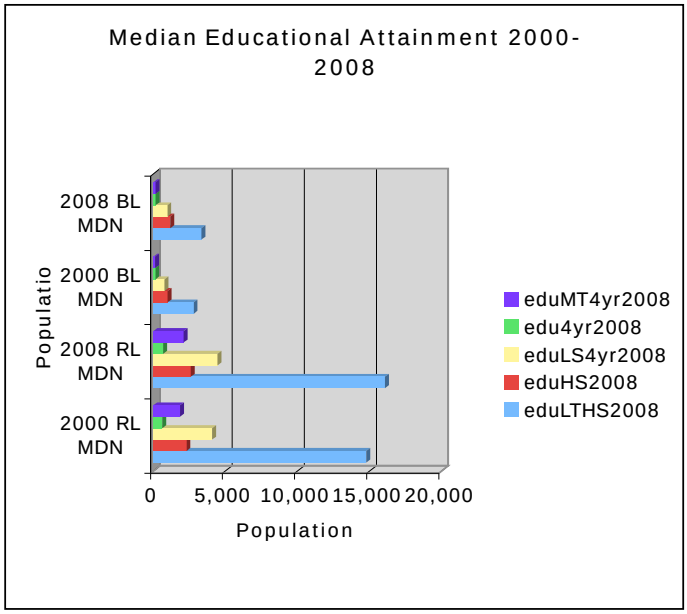


Figure G1

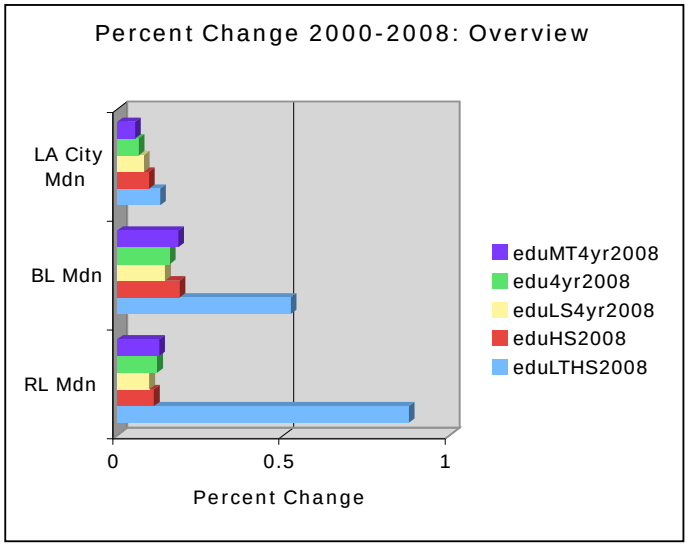


Figure G2

The fourth demographic characteristic analyzed is Educational Attainment, which play handily into discussions of race and class. Figure G1 provides a general population picture for the Blue Line and the Red Line in 2000 and 2008. A distinguishing characteristic between the Red Line and Blue line is the proportion of "More Than 4 year" (masters, professional, graduate degrees) and "Less than 4 year" (associate and some college) groups. In the Red Line Less than Four years exceeds High school attainment in contrast to the Blue Line.

Figure G2 provides the percent change for educational attainment from 2000 to 2008. On nearly most accounts, Less

Than High School groups have exceeded the LA city median, with the largest increases seen in the Red Line. More Than 4 year college attainment has seen the largest increase along the Blue Line.

One sample t-tests were also carried out across the five educational attainment categories to measure if these percent changes across the Red and Blue Lines are significantly different than LA city's percent changes. Using the LA test statistic of .130, the Less than High School category saw significant difference on both aggregated and disaggregated levels across the Red and Blue Lines. The aggregated one-sample t-test (df = 34) = 6.922, p = .000, and MD = .55427. The disaggregated tests also revealed significant difference. The Red Line one-sample t-test (df = 13) = 5.618, p = .000, and MD = .74159. The Blue Line one-sample t-test (df = 20) = 4.612, p = .000, and MD = .42938. This means that both of the Red and Blue Lines experienced percent changes of Less than High School greater than that of LA as a whole.

Aggregated one-sample t-test found significance (df = 34) = 2.945, p = .006, and MD = .06764. Disaggregated one-sample t-tests for High School attainment, however, found mixed results, with insignificant difference for the Red Line and significant difference for the Blue Line. Using .096 LA test statistic, the Red Line one-sample t-test (df = 13) = 1.644 and p = .124. The Blue Line one-sample t-test (df = 20) = 2.503, p = .021, and MD = .0871, resulting in higher percent changes in high school attainment populations than LA city as a whole.

Aggregated one-sample t-test also found significance (df = 34) = 3.496, p = .001, MD = .05536, but the disaggregated one-sample t-tests for Less than Four Year college attainment found mixed results, mirroring that of High school attainment: significance for the Blue Line, but not the Red Line. Utilizing the LA test statistic of .080, the Red Line one-sample t-test (df = 13) = 1.968 and p = .071. The Blue Line one-sample t-test (df = 20) = 2.929, p = .008, and MD = .06846, resulting in higher percent changes in Less Than Four Year college attainment populations than LA citywide.

Disaggregated one-sample t-tests for Four Year college attainment found significant differences for both aggregated and disaggregated one-sample t-tests for the Red and Blue Lines. The aggregated t-test (df = 34) = 4.030, p = .000, and MD = .11693. With a LA test statistic of .065, the Red Line one-sample t-test (df = 13) = 2.253, p = .042, and MD = .09083. The Blue Line one-sample t-test (df =20) = 3.315, p = .003, and MD = .13433. Thus, both the Red and Blue Line experienced higher percent changes than LA citywide.

Finally, More than Four Year College attainment also had significant differences compared to LA city for both aggregated and disaggregated one-sample t-tests across the Red and Blue Lines. The aggregated one-sample t-test (df = 34) = 3.770, p = .001, and MD = .15982. Similarly, the Red Line one-sample t-test (df = 13) = 2.703, p = .018, and MD = .11365. The Blue Line one-sample t-test (df = 20) = 2.938, p = .008, and MD = .19061, finding that both the Red and Blue Line experienced percent increases greater than the LA city average.

DISCUSSION

This study sought to investigate 35 potential and realized Transit Oriented Developments (TODs) across the Red (14 stations) and Blue Lines (21 stations) in Los Angeles. Census-based demographic changes from 1990 to 2003, for population and household growth, and from 2000 to 2008, for travel to work, race, income, occupation, and education were surveyed in a half-mile radius "sphere of influence" across these 35 TOD sites.

The previous section provided data that helped answer the two "what" research questions posed above. This section, in contrast, will help answer the two "how" questions: how well TOD has met its claims for denser development and reduced automobile use and how equitable demographic changes from 2000-2008 have been. Particularly after the Travel to Work sub-sections and beyond, specific TOD stations will be highlighted as extremes for future research.

POPULATION AND HOUSEHOLD GROWTH

Although the study does not account for land-use patterns around TOD stations, due to the difficulty of accessing such data, the demographic patterns for population and household growth can be suggested through 2000-2008 census data. This

data is central to answering whether TOD has met its claim for denser development because demographic changes may serve as reliable proxies for development patterns.

Considering the above, both population and household growth in a .25 square mile radius appear to have increased more significantly (p=.030 and p=.015 consecutively) than Los Angeles citywide when observing change data for the Red and Blue Lines and Los Angeles City. The Blue Line, for example, has a median of 7% population increase and 6% household increase, compared to 5.94% and 4.70% for LAC respectively.

The picture for the Red Line is slightly more complicated due to the timing of its operation, which began in several segments. The first segment, which spanned from Union Station to MacArthur Park, opened in 1993; the second, which traveled from Wilshire/Vermont to Hollywood/Vine opened in 1999; and the third, to North Hollywood, opened in 2000 (MTA). Taking into consideration that the Red Line, then, became fully operational as an integrated whole in 2000, the median percent change for population from 2000-2013 is 7%, similar to the Blue Line, and 7.97% for household growth.

Acknowledging the history of the Red Line and the Blue Line, another limitation must be highlighted for the rest of the variables, which cover 2000-2008. The absence of 1990 baseline data—again due to difficulties in access—may provide difficulties for a point of comparison "pre-TOD." For the purposes of this paper, LA City medians are used as a point of comparison instead.

Finally, the claim that TOD uniquely affects density is not made. That the Blue Line has less density than the Red Line provides the basis for this limitation. Other factors also affect density. Furthermore, density differences may exist due to the fact the two lines span two very different spatial areas—with the Red Line located within the city, while the Blue Line travels for 22 miles south towards Long Beach.

TRAVEL TO WORK

Utilizing travel to work data helps answer the question of reduced automobile use. Although motor travel, public transit, non-motor travel, and other travel means have all ostensibly increased in percent change and population numbers, these increases may simply be due to overall increases in population. Indeed, the results of the one-sample t-tests shows a picture in which TOD does not reduce automobile use and increase public transportation use.

Motor travel actually increased significantly (p = .047) for the Blue Line, though not the Red Line. Percent changes in public transit usage and nonmotor travel additionally were found to be insignificant. Many reasons exist in the literature about why motor travel may increase and public transit usage and nonmotor travel to not significantly increase. These include the possibility of policies around TODs such as free parking that may hinder and public transportation usage and facilitate motor vehicle usage, as discussed by Cervero (2004), and the significantly decreased work opportunities created by a lack of automobile access especially by those living in the outlying areas of the Central Business District (such as those areas around the Blue Line), as discussed by Shen (1999).

An unexpected finding, however, was that the percent change of Other travel means, which included working from home, was found to be significantly different for both the Red and Blue Lines (p = .043 and .004 respectively) compared to LA citywide. The reasons for this percent change is not clearly established in the literature in Transit Oriented Development, but the "working from home" demographic provides some clues about demographic changes in the Red and Blue Line. Drucker and Khattak's study in "Propensity to Work from Home" used logit models, which found that "educational attainment and the presence of small children in the household encourage frequent working from home" (Drucker and Khattack 2000). Generalizations, however, cannot be made about this demographic because the nature of "other" travel means include both "other" and "working from home".

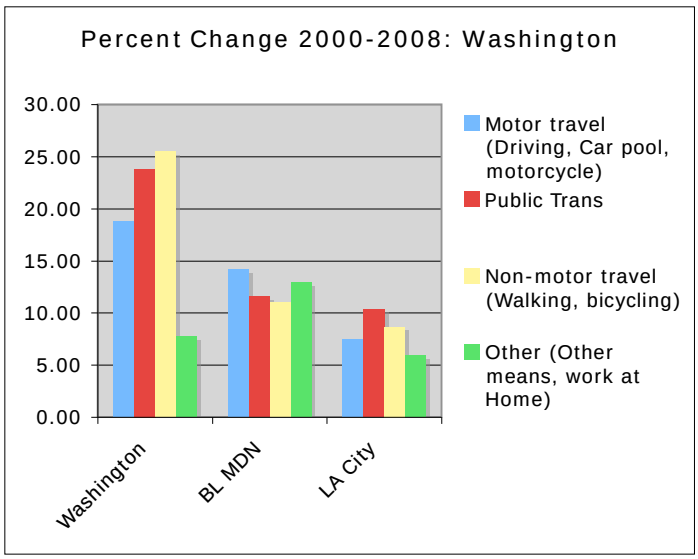


Figure 2A

This disaggregated approach urges closer observation. Washington Station in the Blue Line may be one such possibility for case study. Figure 2A shows that the station experienced favorable percent increases for public transit of 23.84%, compared to the Blue Line Median of 11.60% and LAC median of 10.36%. Non-motor transit increased 25.54%, compared to 11.05% and 8.65% for the Blue Line and LAC median respectively. Lastly, public transit users consisted of 23% of the population and non-motor users 12%, compared to 10.46% and 4.22% LA citywide.

RACE

The issue of equity across demographic groups such as race is the last research question that urges, at least in this paper, a preliminary discussion that will hopefully spur further research that connects TOD with equity. The question is particularly important because it has crucial urban public policy consequences.

The first step towards answering this research question is defining equity. Though many definitions of equity exist depending on the context of its usage, this study submits one used by Norman Krumholz, the influential Planning Director for the City of Cleveland, in the context of equity planning: "an effort to provide more choices to those residents who have few, if any choices" (Krumholz 1982, cited Garrett and Taylor 1999). Garrett and Taylor note that Krumholz used this definition to counter "the inherent unfairness and exploitative nature of the urban development process, a process that excluded the poor from the suburbs and concentrated them in declining inner-city areas" (Garrett and Taylor 1999). This paper seeks to supplement this definition in a demographic framework, observing how equally demographic changes are being applied across all cross-sections of society, particularly across race, income, and occupation.

Four notable statistically significant demographic changes should be considered. The first is the smaller percent change of Hispanic/Latinos ($p = .016$) on the Red Line, compared to LA as a whole. There is at least an 8.71% change difference, which is large, considering the proportion of Hispanic/Latinos in LA in general. The result thus points out the possibility that groups such as Hispanic/Latinos, who also may come from more humble backgrounds, are not equally served by TODs on the Red Line. Furthermore, especially because the Central Business District, or Downtown Area, that the Red Line traverses is, as Shen (1999) points out, an important site of job opportunity, unequal levels of access to the residences in the area may have consequences on employment access.

Statistically significant influx of whites into both the Red and Blue Line ($p = .004$ and $p = .009$ respectively), statistically smaller decreases of Blacks from the Red Line, and statistically significant increases of the American Indian/Alaska Native populations into the Blue Line ($p=.005$) are also three other interesting trends that counteract LA's percent changes.

Because the limited attention race dynamics have received in TOD-specific demography in the literature, a point of comparison for these results becomes difficult. These results, however, complicate the large quantitative study cited in this literature

review, specifically by Kahn 2007, who posits the absence of gentrification and displacement in Los Angeles. Granted, the reasons for these racial trends are not made clear in this particular study (though preliminary data show strong housing price increases for Red and Blue TOD), this data provides evidence of inequitably distributed racial outcomes around TOD stations, particularly for Hispanic/Latinos and Whites. Interestingly, Whites, compared to other racial groups around the Blue Line, make up the largest percent change around TODs. This finding must be pieced out further to find the demographics of these white populations, why they have greater access compared to other minority groups, and what is drawing them to these areas. This differences might be due to the disaggregated approach of this study, by both using disaggregated measures for both race and rail Lines. Secondly, these results further demonstrate the complexity of racial diversity, sampled by TOD areas.

The stepwise linear multiple regressions provide further complexity to this picture describing the dynamics around race. The relationship between the percent change of white collar (β=1.384) and service workers (β=.442) with the percent change of Hispanics is a telling example. This example immediately shows the way race interacts with class in a complex way. How might Hispanic/Latinos be associated with the service occupation, which is often associated with lower-paying jobs, as well as white-collar occupation, which is often associated with higher-paying jobs? Although this complexity must be further explored through case study, scholar such as Saskia Sassen (1991) in The Global City point to the "dual" nature of employment global cities such as Los Angeles exhibit. In this case, this dual relationship is seen between service and white-collar workers in LA. The LMRA findings on Whites also deserve attention. Complexity again is observed. Interestingly, the percent change of Whites is negatively associated with the percent change of Blacks (β=-.383) and incomes less than $15,000 (β=-.985). These findings thus point to the possibility of inequality in the relationship between these two demographic groups around the dynamics of change around the Red and Blue Lines, with the possibility of displacement (as signaled by the negative beta sign). But the picture is not so simple. The percent change of whites are also negatively associated with the percent change of housing values up to $749,999 (β=-.248) and positively associated with the percent change of Asian (β=.291) groups. Both of these findings point to the need to piece out further information on the impact of housing values on displacement and interracial dynamics around TODs. One can easily ask, why might the percent change of Whites be negatively associated with Blacks, but positively associated with Asians? Even the picture of the Asian demographic must be further pieced out, with ethnicities such as the Vietnamese who have different characteristics than more established ethnicities such as the Japanese. However, an important limitation must be acknowledged: the study is not disaggregated enough. It still treated all transit stations around the Red and Blue Lines as "equal" TODs when TODs may have different contexts and typologies: for example, TODs that are stagnant, market-driven, and/or public policy driven. The fact that this additional layer is not addressed aggregates all the Rail Lines, finding results whose contexts are not addressed.

FUTURE CASE STUDIES

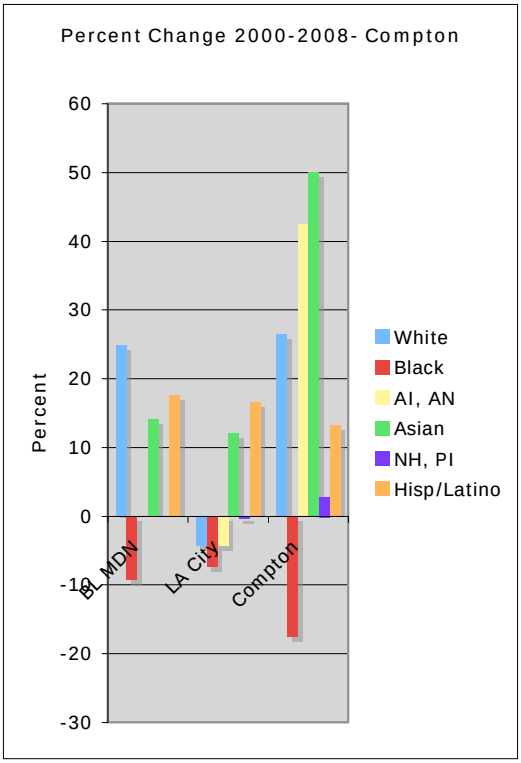


Figure 2B

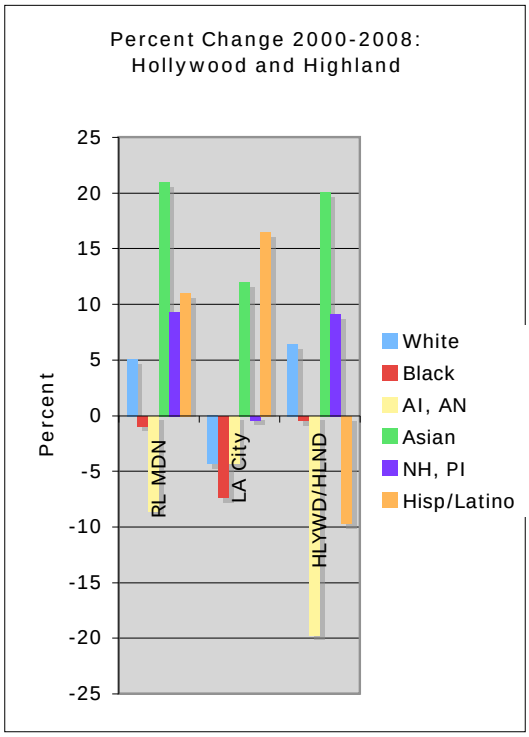


Figure 3B

Identifying potential sites for case study is a useful tool to identify extremes and outliers that may have unique contexts for future observation. This identification may also serve as potential warning signs for larger, future, and potentially inequitable demographic changes in the area. Figure 2B displays Compton's racial demographic changes, while Figure 3B shows Hollywood and Highland's. Both of these sites were chosen because they exhibited large, abnormal percent changes in certain racial categories. In Compton, the large percent decrease of -17.51% in the Black population is especially significant since Blacks consisted of 29.43% of the site in 2000, exceeding both the Blue Line Median and LA City median of -9.18% and -7.29% decrease consecutively. Although it may be tempting for some to simply point to the increase of the white population as a cause of this decrease, Whites only increased by 27 individuals. However, that claim is only based on this data, which may exclude a larger trend in white emigration to Compton as this data only sampled in a .5-mile radius around the TOD. Though Compton has been cited in the Los Angeles Times as a major site for redevelopment, with corporate-led investments of tens of millions of dollars to the area (Esquivel 2008), the picture still remains unclear: how has Hispanic/Latino growth still climbed 13%?

Figure 3B at Hollywood/Highland is another site of large demographic changes. Notably, both the American Indian/Alaska Native and Hispanic/Latino categories decreased significantly, with -19.64% and -9.63% decreases respectively. Though the American Indian population's percent change is large due to its small base population, the decrease in the Hispanic/Latino population is significant as it originally consisted of 26.75% of the non-hispanic population. Interestingly, similar decreases have been seen from 2000-2008 in Hollywood/Western and Hollywood/Vine.

Figure 4B, in contrast, displays an interesting site in which all racial categories have increased significantly, much above both the Blue Line and LA City medians. Although the population is still predominantly Hispanic (38.41%), White (31.22%), Asian (21.04%), and Black (4.65%) groups still have exhibit significant percentages, particularly for a Blue Line stop. With the factors described above and with the data shown in these case studies, it may be posited that demographic changes have not affected racial groups equally around TODs. At the very least, warning signs of possible inequitable forces have come to light.

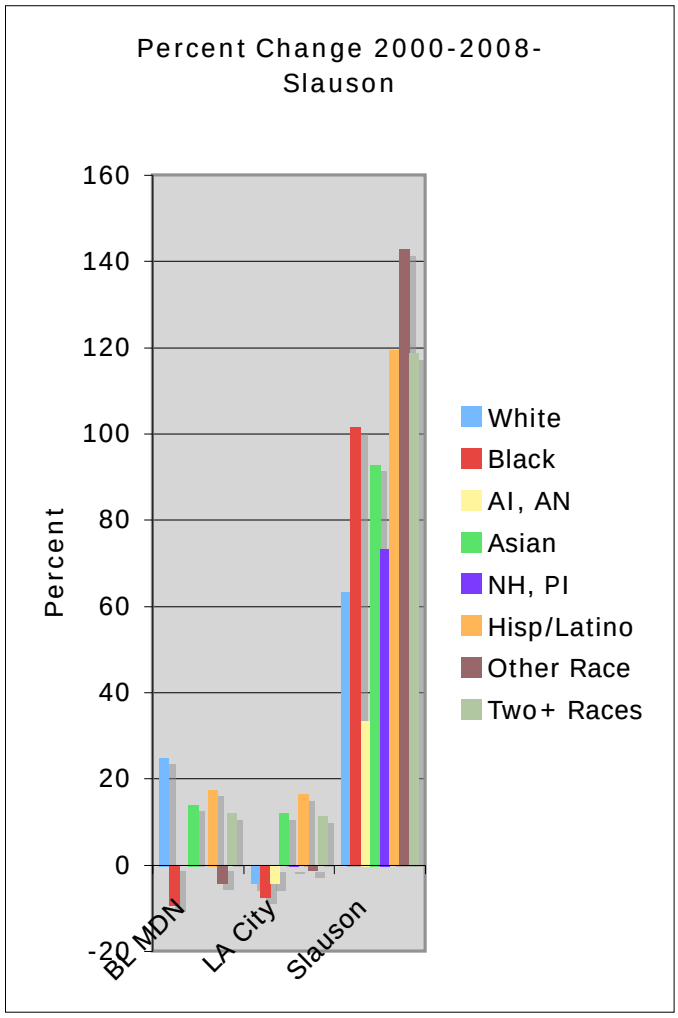


Figure 4B

INCOME

Income level is another important demographic level when considering the issue of equity. The picture of income change, like race change, is complicated. Four findings are worth noting: Less decrease of less than $15,000 around the Red Line (p=.030), increase of $15,000-49,000 around the Red and Blue Lines (p=.016 and p=.003 respectively), higher increase of $50,000-99,999 around the Blue Line (p= .001), and no significant difference of change for incomes over $100,000. These findings seem to challenge the idea that lower-income groups are being uniquely displaced compared to LA as a whole, but support the idea that mid and upper-middle income ranged groups have increased access to these areas. As supported by increased population and household density, these trends may be a sign of increased residential areas that do not necessarily result in trade-offs between the demographic groups from 2000-2008. However, because this study only captures the broader quantitative picture from 2000-2008, it cannot account for longer-term dynamics such as increased property values that may be to come (Lin 2004). Either way, these findings complicate the previous literature described by Renne in 2005 and Kahn in 2007. Both assert that certain demographic groups, such as whites and higher income groups, experience no significant changes compared to communities of color and lower income groups. These are thus claims that this study complicates.

Furthermore, linear multiple regression analysis (LMRA) complicates this picture further by finding the relationships between the variable groups. For income groups below $15,000, for example, the percent change of Blacks were found to account for 96.1% of change for this income group. Although regressions do not mean causation, the relationship points toward an inequitable trend in which, perhaps, TODs along the Red Line heavily affect low-income blacks. Indeed, in this instance, race and class interact in an important way that has affects on which racial groups have increased access to the Central Business District or even a place to live. This finding thus resonates with previous literature such as Pulido 2004, which discusses the inequitable ways LA has historically evolved in relationship to lower-income, communities of color.

FUTURE CASE STUDIES

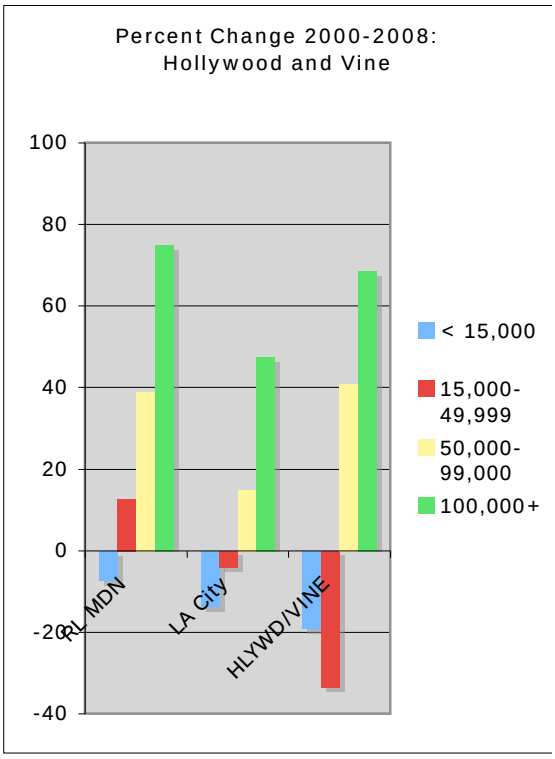


Figure 5B

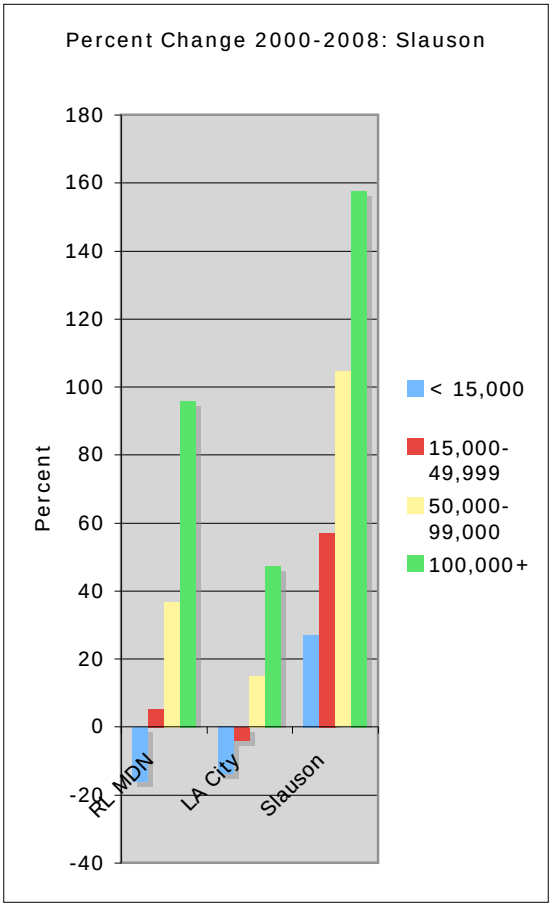


Figure 6B

Figure 5B (Hollywood and Vine) yields a potentially important site for further case study. Mirroring the other two Hollywoods (Hollywood and Highland, Hollywood and Western), Hollywood and Vine experienced a large decrease in both below $15,000 and $15,000-49,999 populations, of -18.9% and -33.22% respectively. Both of these decreases largely exceeded both the Red Line median (-7.02% and 12.57%) and the Los Angeles (-13.62% and -3.81%) demographic trends. Especially in an area sampled of at least 10,000 and the demographic below $15,000 taking 30.08% of the population in 2000 and $15,000-49,999 46.43% of the population in 2000, this is a significant decrease in lower income individuals.

Figure 6B (Slauson), shows another potentially interesting site, not because of its large decreases, but because of its large increases in all sub-variables. Slauson appears to defy and exceed most of the trends seen in the rest of the Blue Line. Interestingly, the TOD saw a large increase in below $15,000 individuals (27.14%), compared to Los Angeles City's -13.62% and the Blue Line's -15.92%. Despite the increases, the TOD still displays warning signs. With below $15,000 once consisting of 16.41% of the population and $15,000-49,999 32.34% of the population, both sets have decreased in proportion, nearly 5% each. Both $50,000-99,000 and $100,000+ have increased by nearly 3% and 7% in proportion to the total population.

OCCUPATION

Occupation type is another important variable because the type of occupation (white collar versus service for example) often corresponds to issues of class. Three statistically significant findings that contrasted with broader LA percent changes were: increased unemployment on the Blue Line, less increases of service workers on the Blue Line, and less decreases of white collar workers on Red and Blue Lines. Much like the trends observed in income, the trends in occupation are also complicated, but ultimately point to different levels of access and desirability around these stations, when compared to LA-wide trends. This inequality is seen in the lower access provided to service workers on the Blue Line and higher access to white-collar workers on both the Red and Blue Lines compared to LA in general. The increase of unemployed workers and the lack of

data that points to an overall uniform decrease or increase of service or white-collar workers, however, complicate the issue.

The findings from the LMRA also point to trends that urge further investigation. With 94.1% of the variance for changes in unemployment rates accounted for by the change in Hispanic/Latino populations, the finding points again to the interaction between race and class. In light of this interaction, complications are found in terms of the spatial complexity around TODs that limit access to certain population groups, such as Hispanic/Latinos and increase access to others, such as Whites. Though at first glance it appears the increase of unemployment rates that are associated with increases of the Hispanic/Latino population would seem to complicate these trends, correlation is not causation—further qualitative investigation is needed to piece out the story behind this complexity.

This discussion also applies to the percent change of Blue Line service workers. Segments of the model, such as percent change of housing values up to $749,000, white collar workers, and incomes over $100,000, seem to fit into discussions of trade-offs between demographic groups surrounding development (Lin 2004). Indeed, housing values up to $749,000, white-collar workers, and groups with incomes over $100,000 had an inverse relationship with service worker populations. But the picture, again, is more complicated. That housing values over $1,000,000 are positively associated with service workers challenges the seeming coherence of the model, and again point to the stark complexity of space within even a .5 mile radius. The inverse relationship between service and white-collar workers is further found with a beta of -1.099 in the LMRA of white-collar workers. These analyses also point to the transit patterns of different occupation groups. White-collar workers are significantly and highly related to motor travel (β=.839), while service workers are significantly related to nonmotor travel (β=.407). This discussion thus complicates the previous literature, which negate any claims that inequitable patterns across demographic groups exist. These trends, such as unemployment levels associated with the Hispanic/Latino population and housing values and income groups over $100,000 inversely associated with service workers, point to the need for safeguards in access to development areas.

FUTURE CASE STUDIES

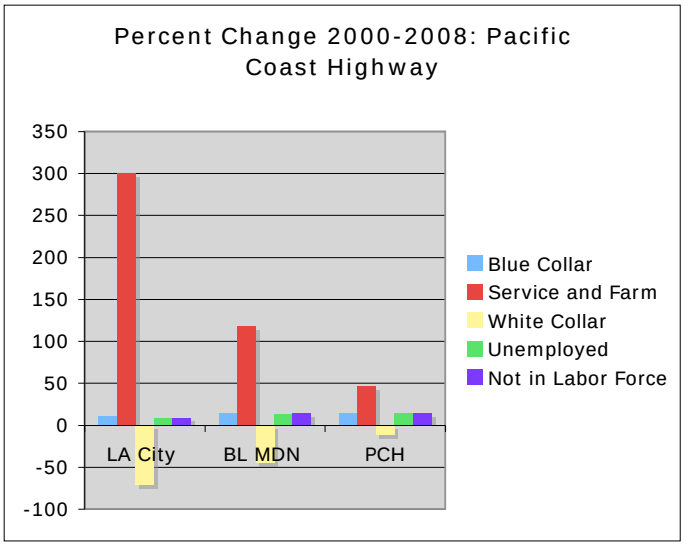


Figure 7B

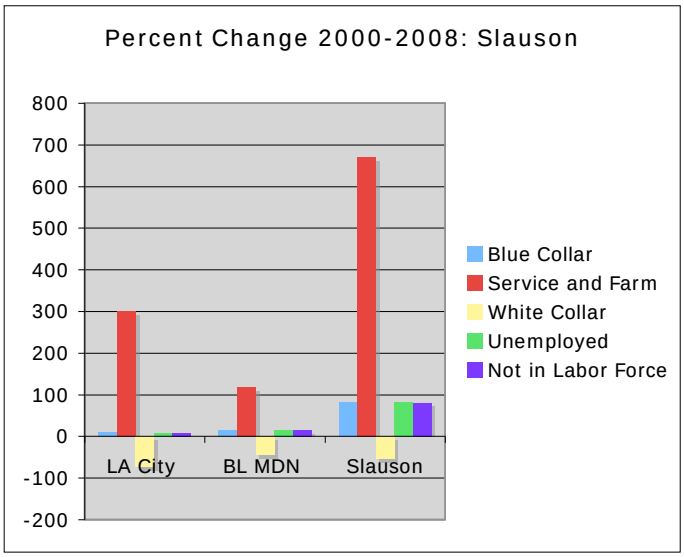


Figure 8B

`Figure 7B (Pacific Coast Highway) shows an interesting TOD site. It deviates from both the LA City and Blue Line Median trends on both the decreases of the white-collar industry and the increase of the service and farm industry (see Table 9B). Instead, the area has a high presence of blue collar and white-collar workers. These characteristics, however, may just be endemic to the area, but further exploration is needed to account for its abnormality.

	Blue Collar	Service and Farm	White Collar
LA City	10.60758039	299.9138538	-70.96998062
BL MDN	13.86138614	117.7777778	-43.87605963
Pacific Co. Hy	13.86138614	46.51474531	-10.71055381

Lastly, Figure 8B (Slauson) again appears as an abnormal TOD site that has potentially important consequences with further case study. First, the area has increased in service and farm by 669%, compared to the Blue Line's median of 117.7% and LA City's 300%. Blue Collar and Not in Labor Force increases have also increased much above the Blue Line and LA City demographics (See Table 10B). What stands out in Slauson is its exceptionally low unemployment rate. While median unemployment is 8.20% on the Blue Line from 2000-2008 and LAC's 5.59%, Slauson's stands out as 1.74% unemployment from 2000-2008. Further case study is needed.

	Blue Collar	Service and Farm	White Collar	Unemployed	Not in Labor Force
LA City	10.60758039	299.9138538	-70.96998062	8.800086858	8.645367366
BL MDN	13.86138614	117.7777778	-43.87605963	13.58695652	13.7671417
Slauson	81.48148148	669.7761194	-52.06692913	82.60869565	80.19271949

EDUCATIONAL ATTAINMENT

The one-sample t-tests found significant increases for demographics whose educational attainment was less than high school, four year college and over four-year college around the Red and Blue Lines as well as significant increases for high school attainment and less than four year college around the Blue Line. Much like the trends seen in previous variables, the trends seen in educational attainment also complicate the picture of change around TODs from 2000 to 2008. Less educated groups, such as less than high school, still appear to increase around both rail lines, while highly educated groups, such as more than four years of college, also appear to increase around these rail lines. On the issue of educational status alone, these findings thus slightly complicate the issue put forth by Kahn in 2007 that also analyzed educational attainment.

FUTURE CASE STUDIES

Figure 11B points to the TOD site that is continually showing deviations from both the Blue Line Median and LA city's percent changes across the chosen variables: Slauson station. What is unique about Slauson station is that it has significant percent changes across all the disaggregated levels of educational attainment. The highest percent change is seen in education more than four years of college with a 128.23%. The lowest percent change is seen in education less than four years of college at 50.28%. A precursory search shows the evidence of a community economic development corporation that has played a large part in the development of this area. Further research is needed to investigate the story and process behind this community.

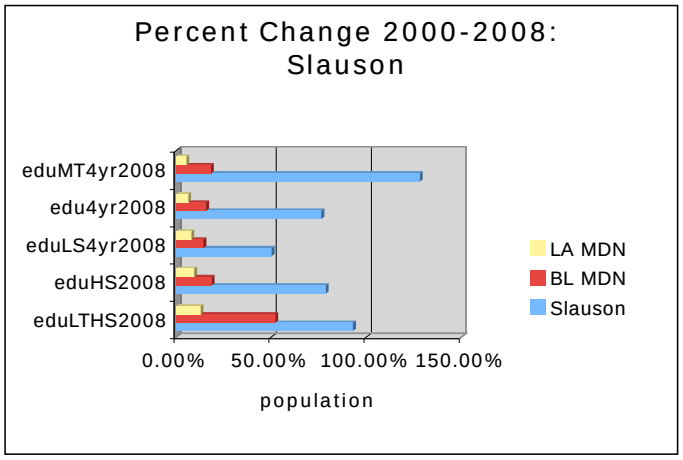


Figure 11B

CONCLUSION

With rail developments totaling $613 million alone in 2005 (Railway Age 2005), with $4 billion for TOD projects in 2004 (Coleman 2004) and a multi-billion dollar proposition for high-sped rail (Proposition 1) in November, with passenger vehicle emissions alone totaling 40% of greenhouse gas emissions in California (Decicco and Larsen 2004), and with a housing crisis of national proportions (Dreier 2007), the implications of TOD are more important than ever. Working families spend 58% of their total income on housing and transit combined (Lipman 2006). Yet amidst this large capital spending in Los Angeles TOD, Duecker and Bianco's crucial warning must be heeded. The issue of equity must not be forgotten in the quantity of growth by forsaking the quality of development. TOD must also serve those who live in the inner city—those who are more likely to be communities of color, and those who, amidst growing wage inequalities (Dreier 2007) and economic segregation (Charles 2003), are struggling to make ends meet.

In summary, realizing the importance of equity, this study sought a holistically disaggregated approach to demographic analysis around TOD stations. By individually analyzing a half mile "sphere of influence" around 35 rail transit stations along the Red and Blue Lines, this study surveys disaggregated demographic patterns from 2000 to 2008 around specific population characteristics—specifically race, income, and occupation. The analysis involves a comparison among the Red and Blue lines and Los Angeles City by analyzing median percentages and percent changes and identifying significant outliers.

Four limitations are worth mentioning. The first concerns the study's focus. Los Angeles has a unique context that may separate it from other major cities. Los Angeles has a unique set of immigration patterns in its intensity, demographic patterns in its diversity, and a sprawling urban form often described as "fragmented" (Fogelson 1993). These unique contexts limit the possibilities of generalizing the results found here towards other TODs nationally and globally. However, general principles may be gleaned through the Los Angeles experience. Secondly, time constraints played a large part in conducting all research aspects of TOD originally intended. Third, the lack of 1980, 1990, and land use data also shorten the integrative analysis of this study. Though LA percent changes was used as an alternative to the 1980 and 1990 data, the use of such data will be crucial for a more comprehensive study. Lastly, this quantitative analysis, though it employed much disaggregation compared to previous studies, still did not disaggregate enough. The issue is about treating all transit stations as equal levels of TOD. The contexts around various TODs must be elaborated and more indices must be explored, such as policy and institutional factors, which can be illuminated through case study and qualitative work.

Several strengths are also worth mentioning. The disaggregated approach of Los Angeles is useful because of the potential insights that may be gained from a detailed comparative analysis within the LA MTA rail system. Much of the previous literature tends to aggregate statistical data, assuming that large metropolitan areas like Los Angeles are homogeneous. It is the contrary: much of Los Angeles is heterogeneous and highly complex in its spatial, socioeconomic, and physical ordering. A detailed comparison between rail lines, which traverse areas that may differ greatly in income levels, for example, during the same time period is missing from the literature. Furthermore, this study emphasizes disaggregation across racial, income, and occupation for demographic studies around TOD, which has received limited attention in previous studies. Previous studies, for example, have aggregated race by creating binaries, such as white versus non-white populations and native versus foreign-born populations. Especially because Los Angeles has such diversity, and because different racial groups have such unique experiences, aggregating race to such an extent may miss many important interactions and demographic patterns. The results found from the provide warning signs on demographic patterns, which may help guide policy making for Los Angeles' future. In the midst of significant capital spending, the potential is great for a future that is both equitable and economically strong.

Several areas are worth pursuing in next phases of research. An important area that flows out of the analysis is further case study of selected sites to weave a detailed background story around demographic analysis. Further integrating qualitative and quantitative methods would greatly strengthen research around TOD's impacts, especially because of unique situations around various transit stations. These case studies could account for specific design measures, neighborhood characteristics, and application of different TOD typologies.

Because TOD deals intricately with policy, analyzing the discourses used when policymakers discuss TOD and general transit policy would greatly elaborate the context of how such policymakers predict and discuss the consequences of TOD, particularly around issues of race, class, the economic market, and inequality. Furthermore, the policy process would also enlighten the context of implementation and idea creation around TOD. In particular, the analysis may measure how equitable and inclusive the process is towards relevant stakeholders and interest groups. For example, what might be some of the larger barriers that prevent community-based groups from playing a larger role in the development process, compared to the currently small role such groups play compared to private developers in the discourse of "private-public collaboration."

In addition, methodological improvements may be made. These improvements include increased sampling sizes, comparing

changes across .5 mile, 1 mile, and 5 miles for example. Increasing baseline data for 1990 demographics and integrating land use data through geographical analysis would also help provide a better spatial picture, particularly in the ways land use and specific development patterns interact with demographic patterns.

Ultimately, this study is especially relevant due to the upcoming November 1st election. Proposition 1 supports a multi-billion dollar bond measure to invest in hundreds of miles of high speed rail, under the discourse of improving the environment and promoting economic development. Especially due to the warning signs seen in this study in particular, then, such propositions may be cast into sharper detail. We must ask: How equitable are transit infrastructure investments? How do these investments affect other individuals more than others? The study will thus be important for community-based organizations, neighborhoods, local government, developers, educators and transit agencies perhaps to create more balanced, equitable TOD.

APPENDIX

Civic Center/Tom Bradley101 S. Hill St., Los Angeles 90013
6 Bike Rack Spaces/6 Locker Spaces

Hollywood/Highland
Hollywood Bl. & Highland Av., Hollywood 90028

Hollywood/Vine
6250 Hollywood Bl., Los Angeles 90038
60 Park/Ride Lot Spaces (Parking Fee), 18 Bike Rack Spaces

Hollywood/Western
5450 Hollywood Bl., Los Angeles 90028
10 Bike Rack Spaces/2 Locker Spaces

North Hollywood
Lankershim Bl. & Chandler Bl., North Hollywood 91601
1,101 Park/Ride Lot Spaces, 68 Bike Rack Spaces/8 Locker Spaces, Kiss & Ride Drop-Off

Pershing Square
500 S. Hill St., Los Angeles 90017
2 Bike Rack Spaces/2

Locker Spaces
7th St./Metro Center/Julian Dixon
660 S. Figueroa St., Los Angeles 90017
Transfer Point to Metro Blue Line

Vermont/Beverly
301 N. Vermont Av., Los Angeles 90004
14 Bike Rack Spaces

Vermont/Santa Monica/LA City College
1015 N. Vermont Av., Los Angeles 90029
18 Bike Rack Spaces/2 Locker Spaces

Vermont/Sunset
1500 N. Vermont Av., Los Angeles 90027
10 Bike Rack Spaces/4 Locker Spaces

Westlake/MacArthur Park
660 S. Alvarado St., Los Angeles 90057
14 Bike Rack Spaces Kiss & Ride Drop-Off

Wilshire/Vermont
3191 Wilshire Bl., Los Angeles 90005
16 Bike Rack Spaces/8 Locker Spaces

Union Station/Gateway Transit Center
801 Vignes St., Los Angeles 90012 3,000 Park/Ride Lot Spaces (Parking Fee), Union Station - 8 Bike Rack Spaces/4 Locker Spaces, Gateway - 16 Bike Rack Spaces/16 Locker Spaces

Universal City
Lankershim Bl. & Universal Terrace Pky., North Hollywood 91608

390 Park/Ride Lot Spaces, 16 Bike Rack Spaces/14 Locker Spaces, Kiss & Ride Drop-Off

Table 1: Address and Miscellaneous Details for the Red Line (Source: LA MTA)

Civic Center/Tom Bradley101 S. Hill St., Los Angeles 90013
6 Bike Rack Spaces/6 Locker Spaces

Pershing Square
500 S. Hill St., Los Angeles 90017 2 Bike Rack Spaces/2 Locker Spaces

Table 2: Address and Miscellaneous Details for the Purple Line. Redundant Transit Stations removed. (Source: LA MTA)

Pico
1236 S. Flower St., Los Angeles 90015
LA Convention Center

Grand
331-1⁄2 W. Washington Bl., Los Angeles 90015 Bike Rack/Locker Available

San Pedro
767 E. Washington Bl., Los Angeles 90021

Washington
1945 Long Beach Av., Los Angeles 90021

Vernon
4421 Long Beach Av., Los Angeles 90021

Slauson
5585 Randolph St., Los Angeles 90032
6 Bike Rack Spaces/2 Locker Spaces

Florence7225 Graham Av., Los Angeles 90002
100 Park/Ride Lot Spaces, 12 Bike Rack Spaces/4 Locker Spaces

Firestone
8615 Graham Av., Los Angeles 90002
6 Bike Rack Spaces

103rd street
10100 Grandee Av., Los Angeles 90002

Imperial/Wilmington/Rosa Parks
11611 Willowbrook Av., Los Angeles 90059 Transfer Point to Metro Green Line, 975 Park/Ride Lot Spaces, 30 Bike Rack Spaces/4 Locker Spaces

Table 3: Address and Miscellaneous Details for the Blue Line. Redundant Transit Stations removed. (Source: LA MTA)

Allen Station
395 N. Allen Av. Pasadena 91106

Chinatown Station
901 N. Spring St. Los Angeles 90012-1862
Parking coming in 2008

Del Mar Station
230 S. Raymond Av. Pasadena 91105
600 Park/Ride Lot spaces

Fillmore Station
95 Fillmore St. Pasadena
131 Park/Ride Lot spaces (priority parking fee)

Heritage Square/Arroyo Station
3545 Pasadena Av., Los Angeles 90031
145 Park/Ride Lot spaces

Highland Park Station
151 N. Avenue 57, Los Angeles 90042-4115

Lake Station
340 N. Lake Av., Pasadena 91101-1806
100 Park/Ride Lot spaces (parking fee)

Lincoln Heights/Cypress Park Station
370 W. Avenue 26, Los Angeles 90031-1864
91 Park/Ride Lot spaces

Memorial Park Station
125 E. Holly St., Pasadena 91103

Mission Station
905 Meridian Av., South Pasadena 91030-3135
122 Park/Ride Lot spaces (parking fee)

Sierra Madre Villa Station
149 N. Halstead, Pasadena 91107-3127
950 Park/Ride Lot spaces (priority parking fee)

Southwest Museum Station
4600 Marmion Way, Los Angeles 90065-5026

Table 4: Address and Miscellaneous Details for the Gold Line. Redundant Transit Stations removed. (Source: LA MTA)

WORKS CITED PAGE

Loukaitou-Sideris, A. and Banerjee, T. (2002) "The Blue Line Blues: Why the Vision of Transit

Village May Not Materialize Despite Impressive Growth in Transit Ridership." Journal of Urban Design 5.2, 101-125.

Belzer, D. and Autler, G. (2002). "Transit Oriented Developent: Moving From Rhetoric to Reality." The Brookings Institution Center on Urban and Metropolitan Policy And The Great American Station Foundation.

Berube, A. and Frey WH. (2002). A Decade of Mixed Blessings: Urban and Suburban Poverty in Census 2000. Washington, DC: The Brookings Institution.

Blackwell, AG. And Fox, RK. (2004). "Regional Equity and Smart Growth: Opportunities for Advancing Social and Economic Justice in America." Funder's network For Smart Growth and Livable Communities.

Cervero, R. (1993). Ridership Impacts of Transit-Focused Development in California. Monograph 45. Berkeley: Institute of Urban and Regional Development, University of California.

Cervero, R. and Landis, J. (1997, January). "Twenty years of the Bay Area Rapid Transit system: Land Use and Development Impacts." Transportation Research Part A: Policy and Practice 31.4, 309-333.

Cervero, R. and Duncan, M. (2002). "Residential Self Selection and Rail Commuting: A Nested Logit Analysis." Berkeley: University of California Transportation Center.

Cervero, R. (2004). Report 102: Transit-Oriented Development in the United States: Experiences, Challenges, and Prospects. Washington, DC: Transit Cooperative Research Program (TCRP) and the Federal Transit Administration.
Charles, CZ. (2003). "The Dynamics of Racial Residential Segregation." Annual Review of Sociology 29, 167–207

Coleman, L. (2004). "Transit-Oriented Development Takes Hold in Los Angeles." Urban Land Institute. October 4.
http://www.uli.org/AM/Template.cfm?Section=Home&CONTENTID=10834&TEMPLATE=/CM/ContentDisplay.cfm

Cutler DM, Glaeser EL, Vigdor JL. (1999). "The rise and decline of the American ghetto." Journal of Political Economy 107.3, 455–506

Danielsen, KA., Lang, RE., Fulton, W. (1999). "Retracting Suburbia: Smart Growth and the Future of Housing." Housing Policy Debate 10.3, 513-541.

DeCicco, J. and Larsen, K. (2004). "Automaker Carbon Burdens in California." Environmental Defense and Energy and

Transportation Technologies, LLC.

Deka, D. (2004). Social and Environmental Justice Issues in Urban Transportation, in. The Geography of Urban Transportation, Third Edition, Susan Hanson and Genevieve Giuliano, Editors. New York: The Guilford Press. 332-355

Dreier, P. "LA's Housing Crisis." (2007) Los Angeles Times Online Edition. April 9. http://www.latimes.com/news/opinion/la-op-dustup9apr09,0,6276621.story?page=1&coll=la-opinion-center

Duecker, K. and Bianco, M. (1998). Effects of Light Rail Transit in Portland: Implications for Transit-Oriented Development Design Concepts. Portland, OR: Center for Urban Studies, Portland State University.

Drucker, J. and Khattak, AJ. (2000). "Propensity to Work from Home: Modeling Results from the 1995 Nationwide Personal Transportation Survey." Transportation Research Record: Journal of the Transportation Research Board 1706, 108-117

Duran, Lisa. (1995). "Bus Riders Union in L.A." Race, Poverty and the Environment. 6.1, 8-10. **Ewing, Reid, Tom Schmid, Richard Killingsworth, Amy Zlot, and Stephen Raudenbush. (2003). Relationship between urban sprawl and physical activity, obesity, and morbidity. American Journal of Health Promotion 18:47-57

**Feagin, JR and O'Brien, E. (2003). "White Men on Race." Beacon Press: Boston, MA.

Fejarang, RA. (1994). "Impact on Property Values: A Study of the Los Angeles Metro Rail." Presented at the Transportation Research Board, 73rd Annual Meeting, Washington, D. C.

Fogelson, R. (1993). The Fragmented Metropolis: Los Angeles, 1850-1930. Berkeley and Los Angeles: University of California Press.

Garrett, M and Taylor, M. (1999). "Reconsidering Social Equity in Public Transit,"Berkeley Planning Journal, 13: 6-27.

Jaccard, J and Beccer, MA. (2002). Statistics for the Behavioral Sciences. Belmont: Wadsworth/Thomson Learning.

Hess, DB and Lombardi, PA. (2004). "Policy Support for and Barriers to Transit-Oriented Development in the Inner City Literature Review." Transportation Research Record: Journal of the Transportation Research Board, No. 1887, TRB, National Research Council, Washington, D.C., 26–33.

Ihlanfeldt, K. and Sjoquist, D. (1998). "The Spatial Mismatch Hypothesis: A Review of Recent Studies and Their Implications for Welfare Reform," Housing Policy Debate 9: 849-892.

Iseki, H. and Taylor, BD. (2001). "The Demographics of Public Transit Subsidies: A Case Study of Los Angeles. " Presented at the 81st Annual Meeting of the Transportation Research Board.
Kahn, ME. (2007). "Gentrification Trends in New Transit-Oriented Communities: Evidence
from 14 Cities That Expanded and Built Rail Transit Systems." Real Estate Economics 35.2, 155-182.

Katz, B. (2002). "Smart Growth: The Future of the American Metropolis?" Centre for Analysis of Social Exclusion. CASE paper 58.

Katz, B. and Bradley, J (1999), "Divided We Sprawl," Atlantic Monthly.

Kawabata, M. and Shen, Q. (2005, March). "Job Accessibility as an Indicator of Auto-oriented Urban Structure: A Comparison of Boston and Los Angeles with Tokyo." Environment and Planning B: Planning and Design.

Kennedy, M. and Leonard, P. (2001). "Dealing with Neighborhood change: A Primer on Gentrification and policy choices." The Brookings Institution Center on Urban and

Metropolitan Policy and Policylink.

**Leyden, K. (2003). "Social Capital and the Built Environment: The Importance of Walkable Neighborhoods." American Journal of Public Health 93.9, 1546-1551

Lin, J. (2002). "Gentrification and Transit in Northwest Chicago." Journal of Transportation Research Forum, Published in Transportation Quarterly 56.4, 175-191.

Lipman, B. (2006). "A Heavy Load: The Combined Housing and Transportation Burdens of Working Families." Center for Housing Policy

**Lipsitz, G. (1998). The Possessive Investment in Whiteness: How White People Benefit from Identity Politics. Temple University Press: Philadelphia.

**Loukaitou-Sideris, A. and Banerjee,T. (1998). Urban Design Downtown: Poetics and Politics of Form. Berkeley, CA: University of California Press.

**Loukaitou-Sideris, A. and Banerjee, T. (2002). "The Blue Line Blues: Why the Vision of Transit Village May Not Materialize Despite Impressive Growth in Transit Ridership." Journal of Urban Design 5.2, 101-125.

Lund, HM., Cervero, R., Wilson, RW. (2004). "Travel Characteristics of Transit-Oriented Development in California." Presented at the American Planning Association Presentation for "Statewide Planning Studies."

Parker, T., Arrington, G., McKeever, M., Smith-Heimer, J. (2002). Statewide Transit-Oriented Development Study: Factors for Success in California. Sacramento: California Department of Transportation.

Porter, D. (1997). Synthesis of Transit Practice: Transit-Focused Development. Washington, DC: Transit Cooperative Research Program (TCRP) and the Federal Transit Administration.

Project for Public Spaces. (1997). Report 22: The Role of Transit in Creating Livable Metropolitan Communities. Washington, DC: Transit Cooperative Research Program (TCRP) and the Federal Transit Administration.

Pucher, John, Tim Evans, and Jeff Wenger. (1998). "Socioeconomics of Urban Travel: Evidence from the 1995 NPTS." Transportation Quarterly, 52.3

Pulido, L (2004). "Rethinking Environmental Racism: White Privilege and Urban Development
in Southern California." Annals of the Association of American Geographers 90.1, 12–40

Railway Age. (2005, July) "Los Angeles MTA approves $2.86 billion budget." Simmons-Boardman Publishing Corporation. http://findarticles.com/p/articles/mi_m1215/is_7_206/ai_n14923523

Raya, R. and Rubin, V. (2006, Fall). "Safety, Growth, and Equity: Transportation." Policylink.

Renne, JL. (2005). "Transit Oriented Development: Measuring Benefits, Analyzing Trends, and Evaluating Policy." Dissertation for Graduate Program in Urban Planning and Policy Development, Rutgers, The State University of New Jersey.

Sanchez, TW, Stolz, R., Ma, JS. (2003). Moving to Equity: Addressing Inequitable Effects of Transportation Policies on Minorities. A joint report of The Civil Rights Project and the Center for Community Change.

Shen, Q. 1999. "Transportation, Telecommunications, and the Changing Geography of Opportunity." Urban Geography 20.4: 334-355.

Valenzuela, A. "Race, Inequality and Travel Patterns Among People of Color." Edited by Bettel. Travel Patterns of People of Color. Washington, DC: Federal Highway Administration.

THE JERK 'MOVEMENT': AESTHETICS AND IDENTITY IN AN EMERGENT YOUTH DANCE FORM

SHAMELL BELL

American Studies & Ethnicity
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McNair Scholars Program
University of Southern California

This project explores, Jerkin', a street dance form that has grown from modest beginnings by inner-city Black youth in Los Angeles, California, to an international cultural phenomenon. I argue that inner-city youth use Jerkin' as a tool to not only perfect their craft, but as a way to contest and mobilize against the negative forces in their community such as gangs and the dominating perceptions of Hip-Hop style and Black masculinity. The theoretical framework of this study borrows from George Lipsitz's theorization of the Gramscian concept of organic intellectuals and exemplifies a term I refer to as corporeal education. Jerks use new media platforms such as You Tube to connect youth in their community and across the world, transforming "blighted" urban spaces, into dance arenas and podiums for social commentary. Through a yearlong ethnographic fieldwork study composed of direct immersion in the Jerkin' community, this research provides critical insight into a phenomenon that may otherwise be overlooked. This study poses the following questions: How do Jerks use style and fashion to differentiate themselves from other forms of dance such as Break Dancing? In what ways do Jerks articulate their organic intellectual analysis? What lessons can be drawn from their formation of Jerk crews and the Battle Circle? Findings from this research reveal how Black youth look for outlets in order to express their artistic talents, display rich cultural traditions, form bonds with peers, release frustrations and combat other stressors, and establish small communities of support. Study results make it clear that beyond representing one of the latest dance forms among today's youth that is hip and appealing, the Jerk 'Movement,' when studied analytically provides important contributions to existing scholarship related to Black youth and Culture and Ethnic Studies.

INTRODUCTION

I sit mesmerized while watching a YouTube video depicting adolescent Black boys adorned in tight, brightly colored jeans, beanies, and multi-colored flannel shirts or brilliantly colored t-shirts emblazoned with cartoon characters. Youth engaged in acrobatic and gymnastic moves: they are using walls as catapults, they do back flips off of playground equipment and the rooftops of houses and schools. They take leaps of faith, plummeting to their knees. Movements with elasticity akin to circus performers. Performing coordinated movements reminiscent of simulated baseball plays in which each dancer pretends to throw an imaginary ball while freestyle dancing and then pitch to the next dancer to hit the ball and prompt their freestyle. They dance wildly in the middle of street intersections as cars attempt to drive by. Street corners, parking lots, alleys--any and everywhere else—you name it, it's their stage. Noticeably artistic, bold, and radiating confidence as they dance around with friendly dispositions and welcome the presence of others. These kids are in direct opposition to the stereotypical images of inner-city youth as downtrodden because of the destructive conditions of their neighborhoods. Instead, they are symbols of what Gloria Anzaldua calls the 'in-between world,' those which demonstrate the performative and stylistic self-making of subjects who have been represented as pre-determined beings by both American society, as well as the Black community. It is only after viewing the entire You Tube video that I discover who they are. They call themselves Jerks.

This study explores, Jerkin', a street dance form that has grown from modest beginnings in Los Angeles, California and includes inner city Black youth, to an international cultural phenomenon. I argue that inner-city youth use Jerkin' as a tool to not only perfect their craft, but also as a way to contest and mobilize against the negative forces in their community and the dominating paradigms that shape them including, but not limited to, gangs, Hip-Hop style and their respective conceptualizations of Black masculinity. The theoretical framework of this project borrows from George Lipsitz's theorization of the Gramscian concept of organic intellectuals and exemplifies a term I refer to as corporeal education . Jerks use new media platforms such as YouTube to connect youth in their community and across the world, transforming "blighted" urban spaces with few options for recreation, into dance arenas and podiums for social commentary. I explore the ways in which they are using new media platforms such as YouTube, Facebook, Twitter, MySpace, and text communication to define and articulate their identity, empower themselves, execute their authority, and mobilize against the detrimental social forces plaguing the inner-city community.

Through a yearlong ethnographic fieldwork study composed of direct immersion in the Jerkin' community, this paper provides a critical discussion of a phenomenon that may be otherwise overlooked. My project poses these questions: In what ways do Jerks articulate their organic intellectual analysis? How do the various aesthetic and performative choices of Jerks allow them to negotiate the conditions of urban Black experience? How does their aesthetic difference allow them to reappropriate the Battle Circle important to Hip-Hop culture in other dance forms, such as Break Dancing or Krumping, for their own specific ends? What lessons can be drawn from their formation of Jerk crews and the Battle Circle ? Furthermore, this study demonstrates how Black youth respond to their environment in culturally specific ways and, therefore, provides an important contribution to existing scholarship on Black and Cultural Studies.

METHODOLOGY

My methods included a yearlong ethnographic fieldwork study composed of direct immersion in the Jerkin' community, personal interviews, and observing Jerkin' functions and battles. My collection of survey responses varied from discussion questions by email, to "mobile blogs" in which the Jerks would send texts, emails, and pictures to my cell phone. Jerks also updated their Facebook, MySpace, and Twitter social networking accounts. In addition, I collected original poems as well as audio journals of their experiences.

The age group of the participants ranged from middle school students to young adults. The main participants in this

study, the leading Jerk crew, the Ranger$, were recruited by contact through YouTube. I also visited local high schools and malls to recruit additional participants, since these contexts constitute the primary sites for Jerkin'. During this immersion, I was asked to choreograph for the Ranger$. In my dual role as choreographer and researcher, I observed the different public spaces that Black youth reclaimed as their "space".

During recorded interviews with Jerks, I asked them to delineate: the who, what, where, why and how of Jerkin'. I conducted over a dozen interviews and at least biweekly encounters with the Ranger$ and Go Go Girl$ from June 2009-February 2010. I culminated ethnographic fieldwork with the introduction of a newly formed Jerk crew, the Street Fighterz, from February 2010-June 2010. Additionally, I observed Jerks in the New Haven, CT area from June 2010-August 2010. The qualitative interviews in this study illuminate Black youths' motivation for Jerkin' and their understanding of Jerkin' as a movement. I continue to conduct interviews and ethnographic observations.

BACKGROUND

THE LOS ANGELES LANDSCAPE

To place Jerkin' in its geographical context is to be cognizant of the societal forces it was bread out of; the birthplace of Jerkin' was South Central Los Angeles. Drastic shifts in the labor market beginning in the 1970s greatly affected inner city communities. Many Blacks held manufacturing jobs and a decline in this industry along with the mechanization of agriculture grossly affected their income (Delaney 104). The US Census Bureau's report on "Income, Poverty, and Health Insurance Coverage in the United States in 2004" quantifies 24.3% of Blacks as living under the poverty line (US Census Bureau). The absence of positive male figures is also noted as a risk factor of gang involvement (Cureton 28). Additionally, 26.5% of female-headed households were listed below the poverty line. Even if the accuracy of these numbers is questioned, low socio-economic level is evidence of a major factor of the deterioration of opportunities for Blacks. Neighborhood influences heavily affect the opportunities for youth and their outcomes. Professor and Sociologist Tim Delaney outlines four elements of social disorganization in neighborhoods. Delaney cites family environment, lack of resources in education, need for acceptance, and low economic status as reasons why inner city youth find comfort in subcultures, be it gangs or as presented in this study, Jerkin'. In addition, the increase of female-headed, single-parent households is a chief reason attributed to the reason why Black youth seek gangs (Delaney 107). Further research proposes economic and cultural constructions due to the conditions of the neighborhood leading to gang involvement (Cureton 22). Delaney writes, "social disorganization stimulates the creation of subcultures that are in opposition to the dominant cultural values and norms. Delinquent and criminal subcultures tend to flourish in poor areas that, over time, lead to a subculture of deviance that has values in contrast to conventional ones" (Delaney 77). This social disorganization is what Jerks fight against, in addition to the lure of gang culture. Nearly every conversation with a male Jerk alluded to their choice of Jerkin' as a positive alternative to gangs. Most significantly, Jerks spoke of its lifesaving abilities of rejecting gang culture and choosing the Jerk lifestyle.

The exact origin of Jerkin' is obscured much like a popular urban legend. The movement began spreading across Southern California in 2008 and became a full-fledged internet phenomenon in the summer of 2009 . Ironically, this self-identified dance 'movement,' which emerged from a "gangster's groove ", intended to highlight its mobilizing qualities that aimed to provide an alternative to gangs and spread positivity among inner-city youth. The highly recognized staple moves, the reject and Jerk stomp, are reminiscent of the "Crip Walk" and "Hoover Stomp". Jerkin' tightly clinches the space between gang culture, Hip-Hop culture, and rock/skater culture. This dance continues to change, evolving from various dance forms such as break dancing, Krump, juke dancing, and hyphy. Jerks do not claim to have created an original dance, but its dissemination through new media gives is certainly original.

To the uninitiated, the classic Jerkin' movement looks like a distant relative of a stylized "funky chicken". The dancer bends their knees slightly and constantly move them in and out while flapping both arms and rocking back and forth. Various

arm movements can be added, but the essence of the dance is in the motion of the lower body. The "reject" consists of forward-backward steps that in practice are running backward in place while hopping rhythmically and looks very similar to a mix of the once-popular dances "The Running Man" and/or "Roger Rabbit". As it relates to Jerkin', the pin drop is a specialized move that is used to break up the repetition of the normal Jerkin' motion. To execute a pin drop, the dancer puts one foot behind the opposite knee and a drop to the ground, and then rises while doing a full spin.

There is a clear entrepreneurial side to Jerkin'. Jerkin' entrepreneurs have emerged producing their own music as well as Jerk inspired clothing lines. The desire to fit into the business world instead of the informal economy of gang culture is another positive aspect of the Jerkin' movement. An LA Times article suggests, "students at middle and high schools across the country are ditching baggy pants and XXL T- shirts for skinny jeans and neon colors and —Jerkin' proponents claim — maybe along the way throwing out worship of gangster culture in favor of entrepreneurship and business smarts" (Los Angeles Times, April 11, 2010).

The soundtrack of the Jerkin' community started with San Francisco bay area "hyphy " Hip-Hop music, but Jerks quickly began to make their own sound. Record companies have tried to thrust Jerkin' into the mainstream with the rap-duo New Boyz and the popular song, "You're a Jerk " originally recorded at group member Ben J's house and produced by member, Legacy. The song spread like wildfire across Southern California through YouTube and was picked up by a local radio DJ. The New Boyz subsequently signed to the record label Asylum. Following suit, record companies such as Interscope and Warner Brothers/ Asylum rapidly signed Jerk-influenced acts: Audio Push, Cold Flamez, the Bangz, and the Rej3ctz (New York Times November 20, 2009). Following the mainstream success of his single "Toot It and Boot It," YG, ex-gang member and currently signed to Def Jam records says, "you didn't need to fight when you could make YouTube videos. Kids that wore baggy pants with a rag hanging out began wearing skinny jeans and Jerkin' and having fun. It's saved lives" (LA Weekly Aug 6 2009).

In the first section, the reader is introduced to thinking of Jerks as organic intellectuals and corporeal educators. The ways in which Jerks articulate their organic intellectual analysis is also examined. In addition, along the lines of Cathy Cohen and Robin DG Kelley, I explore how Jerks exhibit the possibility of identifying political agency in 'everyday decisions and actions'. I finish the section by looking at the politics of Hip-Hop and keeping in mind that Jerks may not be overtly political, but have social, political, and economic implications to their actions.

I. In what ways do Jerks articulate their organic intellectual analysis?

Jerkin' illustrates the possibility of dance as a legitimized place for Black identity formation, political deliberation, social awareness, and liberation. Vehicles for social change exist in many forms, ranging from literature to the arts. This intervention explores Jerkin' as a potential intersection of performance with social consciousness. I examine performance as accurately presenting a visual and oral history that challenges the dominant representation of an existing order within these performances, while simultaneously presenting a historical genealogy with the ability to evoke and provoke emotion in its audience. Jerkin' can be used as a physical interpretation of marginalized voices produced in a racialized context, in which dance offers a vignette into the intersection of activism, performance, and social consciousness. Traditionally, the word 'activist' requires a certain type and level of work. This paper positions Jerkin' as a physical manifestation of action within social, political, and economic forces. Although their strategies and tactics toward liberation may vary, the larger implication lies in the mobilization of masses of youth by evoking emotions within them that leads to direct-action or art in hopes of challenging those in power. Jerks exhibit traits of organic intellectualism as Black youth 'reject' normative standards of society and the Black community. This study borrows from George Lipsitz and Barbara Ransby's take on organic intellectuals, a term originally coined by Italian Marxist intellectual Antonio Gramsci. Lipsitz (1988) explains, "organic intellectuals use their knowledge and imagination in the way that intellectuals do, although they lack formal recognition from society that they are engaged in intellectual activity through social contestation and social action" (10). Ransby (2005) adds

that this type of intellectual is "one who learned lessons from the street more than from the academy and who sought to understand the world in order to change it" (Ransby 6). The key to understanding Jerks as organic intellectuals lies in the shared impulse towards collective action and mass mobilization among the Black youth. Performance can likewise be an authentic source of commentary, politically and otherwise. Cohen writes, "and while these choices are not necessarily made with explicitly political motives in mind, they do demonstrate that people will challenge established norms and rules and face negative consequences in pursuit of goals important to them, often basic human goals such as pleasure, desire, recognition, and respect" (Cohen 30). The ability to create and mobilize a movement that uplifts youth marks, in my estimation, Jerks as "organic intellectuals." It is important to note that these youth do not see themselves as organic intellectuals. However, just because they do not ascribe to this title does not mean that the characteristic of an organic intellectual does not apply to them.

Following cultural historian Robin Kelley's (1994) analytical model, this study attempts to fully understand Jerkin' and its activist impulses by observing the daily activities of individuals. Typically, activists, by definition, display intentionality in their effort to bring about transformative change and are usually identified by their direct action. However, a movement does not have to be organized according to traditional standards. Similarly, activists engaged in movements do not have to pass out pamphlets or chant their goal; rather, activists such as Jerks can achieve a common goal vis-à-vis dance and performance. Activism can also be found in individuals' every day activities, including dance forms that oppose social forces in a positive manner such as Jerkin'. Kelley (1994) declares, "we must not only redefine what is political but question a lot of common ideas about what are 'authentic' movements and strategies of resistance" (3). He suggests that we reject common notions of authentic political organizations and reveal non-traditional forms of political agency that exist beyond formal political institutions. Jerks widely identify Jerkin' as a 'movement'. Tammy Maxwell, mother of Julian Goins and manager of the Ranger$, explains, "Jerking is a movement, almost like in the '80s when rap started. There's a style to it, and a music and a lifestyle and all the kids have really jumped on it" (New York Times, November 20, 2009, web).

This symbiotic relationship between performance and activism has been integral to Black culture and counter mainstream dance forms. Jerks connect the importance of those deemed "deviant" to political resistance. "With careful investigation we might begin to understand why the same people who daily "reject" formal and informal incentives for conformity, choosing instead alternative oppositional live-styles, are most often not engaged in the kind of mass mobilization that organizers and academics contend would significantly improve their lived condition" (Cohen 33). An article by a Washington reporter, Dayo Olopade, expressed the hipster/blister culture's 'tendency to turn social difference into total liberation' with a point of 'not having any rules'. Along the lines of Cathy Cohen and Robin DG Kelley, Jerks exhibit the possibility to identify political agency in 'everyday decisions and actions' (Cohen 31). One might argue what Cohen points out that Dorian Warren warns "cumulative acts of individual agency are not the same as collective agency" (Cohen 38). Jerks do not explicitly ascribe to a political agenda; however, the distinct impact of a large number of adolescents with a common purpose of rejecting the negative conditions of their environment gives hope for a new assessment of collective agency. Jerkin' provides a space for seemingly 'unconnected behavior' to be viewed as conscious acts of resistance to improve their lives. Ean "Smash" Washington, 15, of the Street Fighterz explains,

"Not many other dances inspire you to do things to change your ways of your lifestyle. It can change you a lot in different ways as in how you dress, a different kind of way to express your feelings it just shows that you are you and that dancing can change your state of mind and change your way of viewing the world" (Washington, Ean).

Moreover, this ethnographic study offers an original intervention of Jerks as instructors of a 'corporeal education '. Although the term corporeal education has been used in Helvétius' writing, it carries a different meaning in this study. I joined the terms corporeal (bodily) and education after my ethnographic fieldwork uncovered different levels of lessons being taught through Jerkin'. Not only is technique learned through

the body, but so too are life concepts and social mobilization. Jerks use their body to teach dance moves and life skills such as diligence, dedication, and coping mechanisms. This qualitative research supports the fact that most Jerks understand and clearly articulate the relationship between societal pressures, injustice, and the various coping mechanisms used before Jerkin', with the psychological significance Jerkin' currently plays in their lives. In fact, most of the participants convey similar stories concerning Jerkin' as a means of coping with the pressures in their immediate lives.

One way in which Jerks articulate their organic intellectual analysis is through teaching each other through battles. For this, You Tube often serves as both their lecture hall and their stage. Jerks use the Internet to spread positivity, teach moves, and demonstrate their skills to youth across the globe. Many Jerks come from urban areas and low socio-economic backgrounds and they are aware of institutional practices and policies set to criminalize and disadvantage Black youth in inner-city communities. In addition, Jerks are aware of and respond to gang culture in their neighborhoods. In particular, the Jerks' awareness of the societal ills endured by the Black community prompts their response in the form of performance through a physical embodiment of their social consciousness.

Another way in which Jerks' organic intellectualism is articulated is through a performance some refer to as reclaiming space. For example, performance may reflect social consciousness when a Jerk dances in response to a lack of safe recreational activities in his/her community. Dashawn Blanks, aka Day Day of the Ranger$, the most popular Jerkin' crew in the world, describes their choice of locations for Jerkin' as a means of 'reclaiming space'. Reclaiming space is seen as Jerks perform in the middle of a street in response to the lack of safe and recreational programs at local parks or in response to the privatization of public spaces. Through this performance, Jerks not only reclaim this space as their own, but also make public their arenas and podiums for social commentary. Reclaiming space presents a visual account and history that may challenge the dominant representation of existing order within society. While reclaiming space, Jerks then become instructors and historians documenting their experience, often for the entire world on You Tube. They also present a historical genealogy of a Black youth-inspired movement and performative art that has the ability to evoke and provoke emotion in its audience. To the driver and untrained onlooker simply trying to navigate traffic and evade Jerks on the street their activities may provoke irritation. However, I argue that this act is a liberatory one that evokes a sense of empowerment for Jerks.

The Jerkin' movement is expressed publicly, which means that for Jerks social capital turns into political capital. These influential Black youth have the ability to upload a video on YouTube and in a matter of minutes have dozens of comments on their pages and hundreds of views. This dance form has presented itself as a catalyst for race consciousness and racial uplift for Black youth and a form of solidarity among all races of youth. Jerkin' is a dance form that forces us to recognize political activity that might be overlooked because it takes the form of silence and/or silencing outside the realms of formal political exchange and deliberation (Iton 148). Melina Abdullah asserts, "Hip-Hop is the central core of political expression for an otherwise voiceless generation of marginalized people and holds tremendous potential as a movement for urban youth" (Abdullah 1). Jerkin' bears a close resemblance to Hip-Hop in this context. Hip-Hop and Jerkin' are both forms of artistic and political expression that stem from exclusion. Jerkin' is the most recent physical interpretation of Hip-Hop and symbolizes the current conditions of the Black community. It has the capacity to rouse collective action that brings forth transformative change. Jerkin' demonstrates a transition from the downtrodden mentality as a result of inner-city tribulations toward a proclaimed aversion to gangs and the prison industrial complex. Jerkin' has emerged as a youth movement, successfully emphasizing the development of grassroots leaders in community mobilization.

Mark Anthony Neal suggests Hip-Hop as a "conduit for political discourse" (Neal 140). Tricia Rose writes in her book, Black Noise, "the Los Angeles uprising, police brutality, censorship efforts, and community-based education... It [hip-hop] is the central cultural vehicle for open social reflection on poverty, fear of adulthood, the desire for absent fathers, frustrations about Black male sexism, female sexual desires, daily rituals of life as an unemployed teen hustler, safe sex, raw

anger, violence, and childhood memories" (Rose 18). All of these issues have been recurring themes in the interviews with Jerks. The style and syntax of Rose's writing is just as remarkable as her content. Similar to Rose's description of Hip-Hop, Jerks use dance, attitude, and style to reinvent the inner city experience and "symbolically appropriates urban space" (Rose 22). Black youth have found opportunities to break social norms and impose on public spaces claiming these spaces as their own. School hallways, top of buildings, malls, parks, and most significantly the middle of the street are well-known Jerkin' spaces. Akin to my thoughts of Jerkin' in relation to politics, Neal suggests, "any serious interrogation of the symbolic efficacy of Black youth cultural practices must understand their social, economic, and political milieu" (Neal 560). Jerkin' can be interrogated as Black cultural expression, identity, and a symbol of rebellion. It is important to note the political agency of Jerks may not be overtly political. However, many Jerks may have very political consequences to their actions. For example, Ranger$ member Day Day's MySpace status read "Skinny Jeans or Die", a rejection of gang culture and a campaign similar to the political slogan "vote or die".

In the next section, I introduce the Jerk identity in relation to the various ways in which aesthetic and performative choices Jerks make to negotiate the conditions of urban Black experience such as positive Black identity. Also discussed is how Jerks have fashioned an identity, both as individual Jerks, and as members of a collective, vis-a-vis specific dance moves, clothing, ways of walking, talking, and being in the world. The section concludes with an exploration of one specific space in which this identity is performed, displayed, and reinforced: the Battle Circle.

II. How do the various aesthetic and performative choices of Jerks allow them to negotiate the conditions of urban Black experience?

As members, often referred to as "reps" derived from the word representatives, of three different Jerk crews walk through the Lakewood Mall in Lakewood, CA it is impossible to miss the imprint Jerkin' style has made on not only urban youth, but also the entire generation. The style of Jerks shows the interaction of different identities among youth and their influence on each other. Different identities may include "rockers," adolescents who listen to rock music or "skaters," those that skateboard, and hipsters/blipsters, those with interests in non-mainstream fashion and culture, particularly indie rock. Some identities are misunderstood and others morphed or simplified. For example, adolescents who might dress like Jerks, but do not Jerk. Jerk culture has heavily influenced the style of dress for youth across all nationalities and the age-range for clothing style has a much wider range of acceptance than performing Jerk-inspired moves. At the Lakewood Mall people varying in age from 3-25years old were wearing a variation of skinny jeans. At first glance, I almost made the mistake of thinking a "rocker" was a Jerk because he was wearing a flannel shirt and skinny jeans. However, his status as a "rocker" was distinguishable because of his rock inspired accessories (earring, bracelets, and band decals on his backpack). Dayo Olopade's article on "The Rise of the Black Hipster" quotes Kumar of the band Das Racist: "a lot of this all [comes] from a resurgence of '80s culture into the boring modern day; across races—tight jeans and bright clothing aren't distinctly un-hip hop so to speak" (The Root). Jerk style is the in-between world of rock and Hip-Hop. This is seen in Ryan "Savior" Sheldon's clearly Jerk style; however, it was not until Darrien "Prodigy' Washington, 16, confronted Savior's T-shirt choice by saying "You don't even know who 'Pierce the Veil' is!" (Pierce the Viel is a band that labels themselves as emo, hardcore punks). "Savior" responded, "I don't. But I like the shirt." "Prodigy" explained, "in Texas, I was the total opposite before Jerkin'. I used to be a rocker, a skater. When I heard of Jerkin' and looked it up on YouTube, I found out who I was. I did a [180]. I converted. I moved to California and found myself when I started Jerkin'. If I didn't know about Jerkin' I would ask, what are you? Because Hip Hop is baggy jeans and rock is darker! Who are you Jerks?" (Washington, Darrien)

Skin-tight jeans on a Black teenaged boy? Could there be more to the Jerks' attention-grabbing style and movements? For starters, their style is distinct from what we are familiar with in Hip-Hop culture. Fashion has changed drastically and Jerks are at the forefront of popularizing new influential styles. Boys are no longer wearing baggy jeans, what Jerks call "baggy daddies"; they now wear tighter, skinny jeans as a way of distinguishing

themselves. Dick Hebdige (1979) writes, "the communication of a significant difference, then (and the parallel communication of a group identity), is the 'point' behind the style of all spectacular subcultures" (102). I refer to the "Jerk Identity" as the manner in which Jerks greet each other, talk, walk, move, and dance, which creates a collective identity-- and also acts as a form of individual expression. The Jerk Identity is constructed though identity markers, which include: language, clothing style, and dance moves. Hip-Hop historian Nicole Hodges (2009) identifies key "performative codes" associated with Black identity in Hip-Hop that are also relevant to styles of dress observed among Jerks. These codes are broken up into three groups: language which includes vernacular; styles of self adornment which includes clothing and hairstyles and embodied gestures that includes dance moves, walks, and attitudes (Hodges vii).

Jerkin' as an Alternate Site for Positive Identity Formation

Jerkin' also provides symbolic and psychological qualities important in positive identity formation. Pioneering psychologist Dr. Erik Erikson wrote, "a positive sense of identity depends on the support which the young individuals receive from the collective sense of identity characterizing the social groups significant to him: his class, his nation, his culture" (89). Jerkin' creates a positive and collective sense of identity that is also characterized by anti-gang and anti-prison empowerment, whereas "negative group identities" are sought after in the formation of "cliques" of criminal gangs (Erikson 196). Further, Dr. Joseph L White describes the characteristic of a positive Black identity:

"positive self concept, sense of self worth, positive Black identity and connection with the Black community and Black culture, accurate perception of the social environment and of racism, ways of coping with stress and conflicting Black and White cultural expectations, emotional intimacy with others, and ability to work productively and to develop and overall level of competency and effectiveness" (White 192).

Jerkin' provides each of these characteristics for a positive Black identity. Among the other symbolic and psychological qualities, the kinship bond created in the Jerkin' community provides many Jerks with a sense of purpose, involvement, and familial qualities that many describe they lack in their home environment. The psychological coping mechanisms embedded in Jerkin' offers key positive effects on identity formation. In addition, psychologist and professor of psychology Joseph L. White found that family and friends help form positive Black identity despite "dominant cultural stereotypes" (White 191). Jerkin' provides urban Black youth with a positive Black identity in the midst of socioeconomic calamity and negative stereotypes ascribed by the dominant culture.

Jerks do not ascribe to negative stereotypes; in fact, Jerkin', instead, forms dynamic and resistant constructions of Black identity. The Jerkin' identity develops in response to power, more specifically, resistance toward blocked access to power. Jerks operate in terms of crime vs. freedom. Dr. Erik Erikson suggested, "group identity cultivates its own sense of freedom" (Erikson 89). They reject and oppose what they feel to be "true criminal acts" such as robbery. Jerks use dance as an alternative to criminal acts and dance to achieve freedom from societal forces, such as poverty. Analyses of their actions uncover the Jerks' to be rebels in the sense of going against authority and control. However, in light of their personal stories, which include a number of social and psychological forces ranging from poverty to the loss of loved ones, their actions are much deeper than nuisance behavior. Instead, Jerks embody the physical nuances of coping with social forces. One key act of identity discussed is the reclaiming of space. Reclaimed space is where the difference between crime and freedom is articulated and examined. Jerkin' in certain spaces may be read by mainstream society as "trespassing," but this is a perfect example of Jerk's reinterpreting societal rules. According to Jerks, robbing someone is a true criminal act; however, trespassing on school grounds or Jerkin' in the middle of a street intersection while cars are passing is a form of liberation. In addition to the libratory aspects of Jerkin' and among the types of positive Black identity formation in adolescents, cultural exchange, specifically dance, has recently been a popular alternative site of identity formation. A common survey response from Jerks was an "expression" of this identity through their style and reinforced in the Battle Circle.

Jerkin' invokes another familiar aspect of Black dance forms: the Battle Circle. The Battle Circle is the central location

of movement in Black youth dance forms. One can observe the circle in Break Dancing or "breaking", a dance form that emerged in the 1970s in South Bronx of New York among Black and Latino youth. Breaking uses a cypher, or circle, where b-boys and b-girls take turns flaunting their best moves (Schloss 86). Jerkin' borrows from the "breaking" tradition. Dance theorist Sally Banes writes, "breaking is more than the sum of its movements; it is also the way movements are combined, as well as the costumes, music, setting, audience, and the interaction between dancers and spectators" (Banes 150). Jerkin' is intricately linked to its subculture which provides a "contextual" explanation of where Jerkin' comes from "aesthetically and/or historically" (Banes 25). This new subculture follows closely behind previous street dance forms. Similar to Breaking, Jerkin' is a method by which ones body is used to "inscribe your identity on streets and trains, in parks and high school gyms" (Bane 122). The Jerkin' movement provides Black youth with a model in using physical art to build an identity otherwise thwarted by the criminalization of Black male youth and the perception of urban Black males as gang members. The Battle Circle is the physical art space in which Jerks seek acceptance. The level of skill the dancer shows through her/his freestyle abilities garners this acceptance; the greater level of skill displayed, the more likely the dancer is to be accepted and her/his dancing skill authenticated as supreme. Break dancing and Jerkin' are said to be left behind around late teenage years. However, the younger adolescents took the dance form and "innovated" it. Bane discusses the phenomena in Breaking as she recounts an interview with a break-dancer, "some people claim that Breaking is played out. The younger kids keep developing it, doing more wild things and more new stuff. We never used to spin or do acrobatics. The people who started it just laid down the foundations" (Bane 122). Jerkin' was heavily inspired by the "Battle Circle," the acrobatic dance moves of break dancing, and "the aim is to burn off the opposition by suddenly performing an Unnamed Move (a move, that hasn't been seen before and so can't be matched straightaway") (Neal 226).

We also see the Battle Circle in two recent dance forms, Clowning and Krumping, which emerged in Los Angeles in the late 1990's and early 2000's among Black youth. The transitions from Clowning to Krumping to Jerkin' in Black popular dance of the late twentieth century all rely on the "Battle Circle" as a site in which to not only show their skills, but also release the stress of urban life. Currently, there are few studies on Jerkin'. Consequently, this study draws from research on Hip Hop, as well as work on the Krump dance movement of the early 2000s. Tommy J. Curry, a PhD candidate from Southern Illinois University, Carbondale began a discussion on the social relevance of Krump and argues Krump as a positive social transformation. The birthplace of Krump, the Los Angeles neighborhoods that witnessed the urban rebellions of 1965 and 1992, is significant. It was fitting that David LaChapelle opened his 2002 film, RIZE, which documented Krump dancing, with the correlation between social unrest and Krump. LaChapelle does this by inserting images from the Watts Rebellion of 1965 and Los Angeles Rebellion of 1992, and then visually segues into Krumping. Based on this montage, it can be inferred that David LaChapelle understood Krump to be political. Rachel N. Hastings, PhD candidate, proposed that RIZE provided a "historical preservation of an embodied ritual of resistance" and "engages in the process of performative decolonization".

The Krump dancers in RIZE found that dance provided them with an important sense of fellowship that was missing in their homes and schools. As one Krumper, Tight Eyez, explained in the film, there were no after-school activities to join outside of basketball or football. Similarly, Krumper/Choreographer Lil' C noted, "and where they're from, you're either in a gang or in a dance group" (CBS News, June 30, 2005). Like Jerkin', Krump was a grassroots group and announced the emergence of a self-proclaimed social movement. Krump provided these youth with a voice. CBS News reporters similarly described Krump and its practitioners accordingly: "They call it a movement. Dancers of all ages and colors square off and face down competitors in so-called 'Battle zones.' `I practice every day and it keeps me off the streets" (CBS News, June 30 2005). A dancer named Dragon also explained in the CBS interview, "I see liberation of a people. And not just African American people. I see liberation of all people who have been oppressed, no matter where they are. I see that as the culmination of the rise of a people who have been held back for so long. The people who just want to be free for real. I see that as a liberating sign for freedom, kind of

like the culmination of Martin Luther King's 'I Have a Dream'" (CBS News, June 30 2005). Another dancer, Lil C, added, "this is a visual synopsis of what we're going through. What we incur on a day-to-day basis. It's free. It's freedom. It's being free." I have also heard similar sentiments from my research participants who Jerk. Krumpers and Jerks alike can use dance to liberate and mobilize, giving them a unique role as organic intellectuals.

While Jerkin' is in a body of dances that are agents of mobilization, such as Krumping, what makes it particular is the identity it negotiates through its style. Cohen writes, "these so-called deviants have chosen and acted differently, situating their lives in direct contrast to dominant normalized understandings of family, desire, and sex" (Cohen 30). Jerks contradict dominant norms in society, but also counter the prevailing Hip Hop culture in the Black community. They use style to contest existing paradigms in Hip Hop, whereas Krump was centrally located in the Hip Hop paradigm. Jerkin' is a hybridization of identities. Jerks are symbols of the 'in-between world' demonstrating the performative and stylistic self-making of subjects who have been represented as pre-determined beings by both American society and the Black community. The most compelling and often reproduced aspect of Anzaldúa's work is the metaphor of this so-called "Borderlands". The border is a social construction that has a definitive absolute location but is simultaneously a relative location in which it is in relation to something else. At this point of junction, the border, unapologetically intertwines and overlaps two different spaces creating a unique new culture. In an interview with Ann E. Reuman, Anzaldúa likens the border to an in between zone with overlapping space in which identity is relational to an "other" (2000). Jerks are a hybrid, marginal identity outside the norms of American society and African American society.

Jerkin' style, identity, and expression are interrelated. This is seen through "Smash's" description of style as "a dedication and freedom of expression through fashion and, for Jerks, expression is the free will to show feelings in a natural way" (Washington, Ean). A desire for a collective identity using his style is observed as Ryan "Savior" Sheldon explains, "I think it's good that if you dress like a Jerk that you have someone else like you" (Sheldon, Ryan). A common theme in the interviews and surveys was that Jerkin' served as a form of expression, creative outlet, and means for expressing a shared and unique identity. This identity gives Jerks recognition and an elevated status that they would be lacking without identifying as a Jerk. Lauren "Lo Lo" Butler explains,

"People know me that I have never even met before because they see me Jerk on YouTube. If I did not Jerk, I do not think I would have as many friends as I have because I just moved to LA from Las Vegas [Summer 2009]. It's easy to make friends, if you see a Jerk you already know you have something in common with them. Plus, you don't make friends with just one person you often make friends with an entire crew" (Butler, Lauren).

The style of Jerkin' always invites an audience. Darrien "Prodigy" Washington explains, "My teachers tell me, 'I can't wait to see what you are wearing each day. It is so cool'" (Washington, Darren). The Jerkin' attitude is about being noticed by an audience. Audience members watch and observe and also become participants. Dance theorist Randy Martin writes in this regard, "the audience, when taken as an object of representation, is best understood as a means of participation. The audience is not only part of the event's reason for being but also its means of becoming" (Martin 38). The Jerkin' audience is different from that of a dance form performed on stage such as Modern Dance. The audience in the Battle Circle becomes intrinsically involved with the performer at times even providing the rhythm for the dancer with handclaps or rapping "Go Lo Lo…Lo Lo Goes." The Battle Circle is the premier site for identity formation and Jerk authentication.

In addition, Thomas F. DeFrantz echoes Fanon in "Black Bodies Dancing Black Culture: Black Atlantic Transformations," as he suggests we "consider dancing Black bodies as: the agents of social change, as case studies of identities in formation, and as avatars of ethnically-inflected artistic expression" (De Frantz 2). The Battle Circle is a focal point in which these Black youth unify, purify, and transition into social actors. Moreover, the Battle Circle creates a cohesive and collective identity that is characterized by anti-gang and anti-prison empowerment. Lauren "Lo Lo" Butler describes the Battle Circle as a place for the "competition of creativity and dance style because most

Jerkin' moves are the same, so the winner of the battle was the most creative one" (Butler, Lauren). Ean "Smash" Washington suggests the Battle Circle is taken seriously by Jerks and also seen as a way to meet new friends. Lo Lo agrees and says, "some Jerk because they were unaccepted and Jerkin' was a way for them to make friends" (Butler, Lauren). The Battle Circle is a site for acceptance, solidarity, and collectivity. Hip-Hop theorist Angela Ards writes, "on city streets and in parks, hip hop crews—the peaceful alternative to gangs--sought to settle disputes through lyrical battles and break dancing competitions rather than violence" (Neal 312). Jerkin' empowers youth away from gangs and prison, insofar as its very aesthetics (e.g., "skinny jeans" vs. baggy jeans) distinguish them from gang culture and other styles of dress.

Jerkin' provides Black youth with a model to use physical art to build an identity otherwise thwarted by the criminalization of Black male youth and the perception of urban Black males as gang members. Cultural Historian Dexter Gordon (2003) discusses the Black community's ability to "construct, reconstruct, and contend for Black identity" (Gordon 10). Black youth use dance, specifically Jerkin', as a mechanism to accomplish these ends by changing the perception of urban youth through Jerkin'. The Battle circle is the physical art space in which Jerk's seek acceptance. Furthermore, skill and identity are examined during a battle. A novice can reign over a battle and emerge a Jerk. Jacorey "Corey" Williams, 18, formerly of the Ranger$ explains, "I saw my homeboy Spank on YouTube in a video with the Go Go Power Rangers (former name of the Ranger$), so I practiced for two days until I had the chance to battle to become a part of the crew. I battled Spank and won, so I was made a member of the Ranger$" (Williams, Jacorey). Technique and endurance is important as well as the study of the craft and creation of your own style and moves.

The Jerk identity directly speaks to authenticity as Jerks use the Battle Circle and identity to answer the questions: What is a real Jerk and how do they locate a real Jerk? A real Jerk is someone who is validated within the Battle Circle and supports Jerkin' as a positive movement. Real Jerks are located by their unique style and dance moves. Ean "Smash" Washington, 15, of the Street Fighterz explains, "a real Jerk is someone that expresses themselves through style and creativity and has the determination they need to succeed" (Washington, Ean).

The next section will discuss the lessons that can be drawn from the formation of Jerk crews and the Battle Circle; particularly, I explore the activities and mobilization that occurred in response to acquiring and simultaneously rejecting gang culture. Also discussed are the social forces that prompt Back youth to Jerk and the similarities and distinctions with Los Angeles gang culture.

III. What lessons can be drawn from the formation of Jerk crews and the Battle Circle?

Jerkin' as a Gang Survival Tactic

What began as a normal stop at the mall turned into a lesson on Jerk survival against gangs. I was unaware this lesson would be the beginning of a rapport with another crew in the Jerkin' community. I parked in the lot closest to the food court at the newly renovated Fox Hills Mall. As I got out of my car I counted, One. Two. Three…Seven Black men sheathed almost solely in red with the exclusion of their baggy blue jeans. The men richly draped in nuanced shades or red signaling ALARM, proceeded with caution. I fumbled about my purse for my keys to set my car alarm with hopes to move quickly into the mall. In my periphery I counted three Jerks adorned in bleached skinny jeans, one teenaged boy in a bright blue transformers shirt, another in a vivid green shirt with the character Oscar from Sesame Street on the front. I noticed the bleached streaks in their hair. The youngest Jerk had a shocking red and orange Mohawk, a rock inspired hair style characterized by the sides of their head shaved, and the hair left in the middle spiked up. Two of the boys were Jerkin' while the other two were standing with one knee perched against the wall. I heard the gang members laughing and mockingly singing the lyrics to the popular song that launched Jerkin' into mainstream culture, "You're a Jerk! You're a Jerk!" The Jerks straightened up their posture. I nervously waited near my car to avoid the interaction between the gang members and the Jerks. I anticipated a negative incident. The Jerks and I were shocked and relieved that instead of harassing the Jerks, as I would later find out another group of gang members had briefly done earlier, these particular gang members did not threaten them. The gang

members simply walked past them and into the mall. This was a perfect lesson on the anti-gang qualities of Jerkin'. Jerkin' is a form of anti-gang survival because their clothes quickly identify them as non-gang members. Jerks demonstrate how Black youth respond to their environment in culturally specific ways.

Gang and Jerkin' Parallels

There has been much debate and uncertainty on the definition of gangs. To date there is no standard definition of the term "gang" (Cooper 5). However, the common link in all attempts at a definition includes a group consisting of "primarily young adult males from homogenous low income inner-city neighborhoods" with at least five members engaging in "criminal activity" (Cooper 14). Although it is important to note that "criminal activity" has not always been included in the definition of gangs, current discussions on gangs refer to those involved in drug trafficking and criminal, violent activity. In 2004, there were approximately 760, 000 gang members in 24,000 gangs (Cooper 1). The typical age of gang members ranges from ages 12-24 years of age. The composition of Jerkin' crews has a similar age-range, with the average Jerk around 15-17 years of age. There are many parallels between gang members and Jerks, it is no wonder that when "Jerkin started originally it was called the Hoover Dance which started in the halls (juvenile hall). It started off as a gang dance people would throw up their sets as in their gangs signs and from there on, it when on as a dance" (Trendz LA). Although "stolen" from the Hoover Crip gang, it is apparent that a negative was turned into a positive. In addition to the rejection of negative activities, Jerks spread a positive, good mood and are eager to bring people together. Shaquiel Harris, 16, explains, "no one died, you don't get shot from being in a Jerkin' gang?" Jerkin' is positive, fun, and builds confidence. Also, Jerks become mentors and influence others. "People used to think being a gangbanger was cool and fun," says Marquese " Nifty" Scott, "but it was negative, everyone got in trouble. Jerkin' turned it around. It's about using the same energy to do something positive" (LA weekly Aug 6 2009).

Why do youth choose gangs or Jerkin'?

Youth choose gang affiliation for varied reasons including, identity or recognition, protection, fellowship and brotherhood, intimidation, and criminal activity (LAPD website). The desire for recognition as a source of power is an important coping mechanism for the marginalized. Mike Davis argues, "gangs, in the most straightforward sense, mint power for the otherwise powerless from their control of small urban spaces: street corners, slums, playgrounds, parks, schools, prison dormitories, even garbage dumps" (Hagerdorn xi). Jerks also seek recognition in the Jerkin' community, otherwise they would be rendered powerless in their community. Youth in inner city communities may choose gang affiliation in order to receive protection from rival gangs in surrounding neighborhoods. On the contrary, youth may choose Jerkin' in order to receive protection against gangs. Protection can be sought in forming Jerkin' crews because it sets youth apart from gang culture. The most significant parallel between gangs and Jerkin' is fellowship and brotherhood. The LAPD writes, "to the majority of gang members, the gang functions as an extension of the family and may provide companionship lacking in the gang member's home environment" (LAPD website). This lack of companionship in the home environment is also seen in the survey responses of Jerks. As Jerks, brotherhood is key, and youth acquire an entire community of "broos". Especially in the beginning of Jerkin' it was very common for a Jerk to walk up to another Jerk and ask, "What's your name broo?" This act acknowledges kinship and builds an immediate rapport due to their common hobby, Jerkin' (Hagerdon xxviii). Personal advancement such as selling drugs and making money is another reason why youth may choose to become affiliated with gangs. Jerkin' provides youth with the allure of personal advancement in the form of status and potential music or clothing deals.

Most Jerks interviewed in this study recounted experiences of being surrounded by gangs in schools and in their neighborhoods. For example, JaCorey Williams of the Ranger$ recounts, "going to school, growing up around gangs, you see it every day. To stay away from all that I took Jerkin' as a way to handle it through dance. It doesn't even have to be dance, you can write, draw, something. Use your talents as expression and ventilation. Don't gang bang." (Williams, JaCorey). Jerkin' disrupts gang ideology and deconstructs the negative aspects of

gang culture. The most popular survey response to "Why do you jerk?" is "dance instead of getting in trouble or gangbanging". This dance form provides an escape route from gang culture by rejecting illicit activities and moving towards dance. Jerkin' helps in surviving the streets of Los Angeles because as one Jerk explains, "Jerkin' helps gangs think we are not a threat. He's not from a hood. It doesn't help you get by all the time if a gang banger just wants to mess with someone." JaCorey explains, "Jerkin' keeps the youth from doing "mischievous things, coming up single-parent families, get kids to come to Jerk and socialize, work together, get together in a crew and get them into a movement. Get to know other individuals and maybe get to know people just like them. Get out there dance, make videos, do it for the better instead of slanging and making fast moves. They can do something productive with themselves." (Williams, JaCorey)

Protection from other gangs is another reason why youth would choose to be involved in gangs. However, the Jerkin' community seeks protection against gangs by getting involved in Jerkin' crews to deflect attention from potential mistaken gang affiliation. In addition, Legacy from the New Boyz attributes youth moving away from gangs to Jerkin'. Legacy explains, "people used to go to parties to go to parties and get shot up and now they go to parties to Jerk" (ABC News).

CONCLUSION

"The circle of the dance is a permissive circle: it protects and permits…(Dance) may be deciphered, as an open book, the huge effort of a community to exorcise itself, to liberate itself, to explain itself. There are no limits—inside the circle" (Fanon 57). The circle is a focal point in which these Black youth unify, purify, and transition into social actors. The dance circles create a cohesive and collective identity as a form of empowerment, anti-gang, and anti-prison. The way the Jerks greet each other, talk, walk, move, and dance forms their collective identity. Whether it is the desire for acceptance, recognition, or commercial success Jerkin' provides youth with the ability to mobilize. Whether Jerks were garnering commercial success, booking appearances, shows, or just having fun, they secured a site for a positive identity formation, an alternative to gangs, and even offered youth and adults alike a corporeal education. The organic intellectualism of the youth is apparent by the number of lives being saved, identities being found and authenticated, and, the ability of these youth to positively change their immediate environment in the midst of socioeconomic calamity. Even if unintentional, the pressurized societal ills have paved the way for these recent dance forms to emerge and Black youth continue to reinvent new dance forms in the midst of political, economic, and social calamity. Through this discussion of the Jerkin' movement, I look forward to providing a sounding board in order for the community to make their voices heard enlisting Jerks not as "participants" or "subjects" but as a social beings teaching us something.

On my final day of drafting for this paper I take a break to clear my head. Walking down the sidewalk of York Street, I stop at an intersection and am amazed that I see Black teenaged boys adorned in skinny jeans, New Haven Jerks. One Jerk exclaims, "practice your pin drops!" They were Jerkin' and collecting money to buy printed t-shirts of their new crew. I walk over to the obvious ringleader of the crew and asked "how long have you been Jerkin'?" The Rated X Jerkin Crew had only formed four months ago and they were already out on the street engaging in a Battle circle and perfecting their moves. Without identifying that I was conducting research on Jerkin' I asked: "why do you jerk?" The Jerk answered, "it's fun and it keeps me out of trouble." This is significant because Jerks across the nation including New Haven, CT could clearly articulate the positivity of Jerkin' that has grown from its modest beginnings by inner city Black youth in Los Angeles, California. I was overwhelmed with joy because it was a reminder that this research is significant.

WORKS CITED

ABC 7 News. Skinny Jeans & Movement on the Rise! http://worldstarhiphop.com/videos/video.php?v=wshh0CiB44D0g9cfkWHT

Abdullah, Melina. "Hip-Hop as Political Expression:

Potentialities for the Power of Voice in Urban American." The Black Urban Community: From Dusk Till Dawn. Ed. Lewis Randolph. United Kingdom: Palgrave MacMillan, 2006.

Anzaldua, Gloria. Borderlands/La Frontera: The New Mestiza. San Francisco: Aunt Lute, 1987.

Austin, Chad. North Carolina State University Newsroom: Rap Music Linked to Sexism in New Study by NC State Researchers http://news.ncsu.edu/releases/rap-music-linked-to-sexism-in-new-study-bync-state-researchers/

Banes, Sally. Writing Dancing in the Age of Postmodernism. Wesleyan University Press: Hanover, 1994. Print.

Baumgarten, Mark. City Arts Magazine: Keep it Pushin'. September 29, 2009 http://www.cityartsmagazine.com/issues/tacoma/2009/10/keep-itpushin%E2%80%99

Bedinghaus, Treva. "What is Modern Dance?" Web. 20 November 2009. Web. <http://dance.about.com/od/solodancestyles/p/Modern_Dance.htm>

Burlew, A Kathleen Hoard et al. African American Psychology: Theory, Research, and Practice. SAGE Publications Inc: California, 1992. Print.

Cooper, John C. Youth Gangs: Causes, Violence, and Interventions. New York: Nova Science Publishers ,Inc., 2009. Print

Cureton, Steven R. Hoover Crips: When Cripin' Becomes a Way of Life. New York: University Press of America, Inc., 2008. Print.

DeFrantz, Thomas. "Alvin Ailey's Embodiment of African American Culture." New York: Oxford University Press, 2004.

DeNavas-Walt Carmen. US Census Bureau: Income, Poverty, and Health Insurance Coverage in the United States: 2004. August 2005, pdf.

Ducker, Eric. Jerky boys and girls: New Boyz, Rej3ctz and more lead a new youth movement Los Angeles Times Music Blog. http://latimesblogs.latimes.com/music_blog/2009/06/jerky-boys-and-girls.html

Erikson, Erik. Identity Youth and Crisis. W.W. Norton & Company Inc: New York, 1968. Fanon, Frantz. "The Wretched of the Earth." New York: Grove Press, 1963.

Gilroy, Paul. "The Black Atlantic: Modernity and Double Consciousness." Cambridge: Harvard University Press, 1993.

Gordon, Dexter B. "Black Identity: Rhetoric, Ideology, and Nineteenth-Century Black Nationalism." Carbondale and Edwardsville: Southern Illinois University Press, 2003.

Gramsci, Antonio. "Selections from the Prison Notebooks." New York: International Publishing, 1971.

Hagedorn, John M. A World of Gangs: Armed Young Men and Gangsta Culture. University of Minnesota Press: Minneapolis, 2008. Print.

Hodges, Nicole. "Sampling Blackness: Performing African Americanness in Hip Hop Theater and Performance." Michigan: ProQuest, 2009.

Horton, Charles H. "Social Consciousness", Proceedings of the American Sociological Society, 1 (1907): 97-109. Web, 29 November 2009. http://www.brocku.ca/MeadProject/Cooley/Cooley_1907.html

Iton, Richard. "In Search of the Black Fantastic: Politics and Popular Culture in the Post-Civil Rights Era." New York: Oxford University Press, 2008.

Kelley, Robin D.G. "Race Rebels: Culture, Politics, and the Black

Working Class." New York: The Free Press, 1994.
LAPD. Why Young People Choose Gangs. The Official Website of the Los Angeles Police Department. http://www.lapdonline.org/top_ten_most_wanted_gang_members/content_basic_vi ew/23473

Lipsitz, George. "A Life in the Struggle: Ivory Perry and the Culture of Opposition." Philadelphia: Temple University Press. (1988).

Martin, Randy. Critical Moves: Dance Studies in Theory and Politics. Duke University Press: Durham & London, 1998. Print.

Mccarthy, John D. and Mayer N. Zald. "Resource Mobilization and Social Movements: A Partial Theory." The American Journal of Sociology 82 (1977): 1212-1241.

Mish. Hearty Magazine Online. April 12, 2010. http://heartymagazine.com/features/pink-dollaz-interview-jerkin-la-music-scene

Neal, Mark Anthony. "What the Music Said: Black Popular Music and Black Public Culture." London: Routledge, 1998.

Ransby, Barbara. "Ella Baker and the Black Freedom Movement: A Radical Democratic Vision." North Carolina: University of North Carolina Press, 2005.

Rose, Tricia. "Black Noise: Rap Music and Black Culture in Contemporary America." Indiana: Wesleyan, 1994.

Rose, Tricia. "The Hip Hop Wars: What We Talk About When We Talk About Hip Hop—and Why It Matters." Philadelphia: BasicCivitas, 2008.

Schloss, Joseph G. "Foundation: B-boys, B-girls and Hip-Hop Culture in New York." New York: Oxford University Press, 2009.
TownBiz. SoPrupradio.com. Jerkin' Stolen from the Hoovers? (The Hoover Stomp) http://www.soprupradio.com/?p=4510

Trebay, Guy. "Hip Hop's New Steps" New York: New York Times Online. 20 November 2009. <http://www.nytimes.com/2009/11/22/fashion/22jerking.html?_r=2>
< http://owl.english.purdue.edu/owl/resource/747/12/>
Trendz LA. New Dance Craze Keeping Youths Out of Trouble. http://trendsla.wordpress.com/2009/11/19/new-dance-craze-keeping-youths-outof-trouble/

Wallace, Maurice D. Constructing the Black Masculine Identity and Identity in African American Men's Literature and Culture, 1775-1995. Print.

White, Joseph L. Black Man Emerging: Facing the Past and Seizing a Future in America. W.H. Freeman and CO: New York, 1999. Print.

Williams, Drid. Anthropology and the Dance: Ten Lectures. University of Illinois Press: Urbana and Chicago, 2004. Print.

Womack, Ytasha L. Post Black: How A New Generation Is Redefining African American Identity. Lawrence Hill Books: Chicago, 2010. Print.