



McNAIR RESEARCH JOURNAL
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University of Oregon McNair Scholars Program Research Journal

The Ronald E. McNair Post-Baccalaureate Achievement Program prepares low-income, first-generation college students and students from underrepresented groups to pursue graduate study that culminates in PhD degrees. At the encouragement of the McNair Foundation, Congress named the program to honor the legacy of Ronald McNair, an African American NASA astronaut and physicist who died aboard the space shuttle Challenger in 1986. Each year the UO supports approximately twenty-eight qualifying undergraduate McNair Scholars who show potential and commitment to complete doctoral-level work.

Susan Lesyk, Director, Teaching and Learning Center
Gail Unruh, Director, McNair Scholars Program



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helped make possible
the academic achievements
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**University of Oregon
McNair Scholars Program
Research Journal**

2015

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**Abstracts by McNair Scholars
at the University of Oregon**

**Thank you, Sweetie! Gratitude and Relationship
Satisfaction in Close Relationships**

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Psychology

Faculty Mentor: Christina Karns
Psychology

Positive psychology, which focuses on factors that enrich life, is a rising sub-field of psychology; within that subfield, gratitude is a topic receiving much attention. Previous research has shown that expressing genuine gratitude is an effective way of brightening interpersonal connections. With these discoveries in mind, this research explores how even brief expressions of gratitude can affect close relationships between an individual and a partner, family member, or friend. The Relationship Assessment Scale (RAS) and other assessment tools make it possible to measure relationship satisfaction both before and after a brief gratitude exercise. By completing a basic personality assessment, participants help to establish a baseline that may be used to compare results and determine correlations, if any, between personality, overall relationship satisfaction, and the gratitude intervention. We expect the results of this study to complement the mounting evidence of the effectiveness of even small exercises of gratitude.

The Role of CASK in Synaptogenesis

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The normal function of synapses requires the transport, recruitment, and stabilization of synapsin at developing presynaptic terminals. Late recruitment of synapsin to nascent synapses is regulated by cyclin-dependent kinase 5 (Cdk5), but the downstream effects of Cdk5 remain unknown. Calcium/calmodulin-dependent serine kinase a (CASKa)—a potential target of Cdk5 phosphorylation—was examined in the developing spinal cord of zebrafish embryos. Those embryos expressing a non-phosphorylatable analog of CASKa protein exhibited a significant reduction in touch sensitivity when compared to controls. Aberrant functioning of the CASKa analog in humans (CASK) has been linked to defects in synapses and other neurodevelopmental disorders, including microcephaly and X-linked intellectual disability. These results suggest that the CASK-kinase interaction may serve as a novel target for the remediation of CASK-associated disorders in humans.

More Than Just Words: EMOTAIX-Tropes Examines Linguistic Correlates of Mental Health

Jackie Cowell

Psychology

Faculty Mentor: Jennifer Ablow

Psychology

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Psychology

Given the fundamental role of language, the words people use reveal how they encode memories and interact with others. Because maternal depression and anxiety influence parenting behaviors and may lead to adverse child outcomes, examining the language use of at-risk, expectant mothers may help broaden our understanding of the relationship between how language is used to process emotions and reveal mental health outcomes. EMOTAIX-Tropes, a text-analysis software program for assessing the emotional lexicon, allowed us to examine the use of emotion language during the Adult Attachment Interview (AAI). Also, participants completed questionnaires to assess current mental health symptomatology. From the overall sample ($N = 105$), we used a subsample of 46 primiparous mothers. Analysis revealed a positive correlation between the use of words denoting aggression/hatred and the symptomatology of depression, anxiety, and trauma. Unexpectedly, there was a positive correlation between alexithymia and the use of both positive emotion words and total emotion words. These findings further our understanding of the link between emotion language and mental health and suggest how future analyses may more closely examine the specifics of these associations.

**Of Cost and Consequence:
Examining the Price of White Liberalism
in James Baldwin's *Another Country***

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Women's and Gender Studies

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Women's and Gender Studies

James Baldwin's 1962 novel, *Another Country*, intimately portrays the relationships of a racially mixed group of friends and lovers living in New York in the middle 1950s. Primarily concerned with the struggles and nuances of racial reconciliation, the novel's African-American protagonist, Rufus Scott, commits suicide less than one hundred pages into the novel, leaving the remaining characters to grapple with his sudden death and the forces that drove him to his demise. This paper explores the ways in which *Another Country*, written at the height of the Civil Rights Era, foretells the failings of post-racial America and investigates Baldwin's depiction of white liberalism as a force that counterintuitively stifles racial progress.

Gangs in America: Dispelling Detrimental Stigmas and Cultivating Alternatives

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Society's view of gangs and gang injunctions as elements of organized crime restricts the societal response to police action and limits positive actions from the community. This approach has not been effective as gangs continue to thrive in the face of death, incarceration, and high recidivism rates. This research examines an alternative idea that gangs might be productively viewed as organizations that emerge to meet the needs of a specific segment of individuals who live in deprived socio-economic communities. To be effective, a gang has to develop the leadership skills of individuals both to cope with and control the defiant individualistic characteristics of its members. To explore how gangs recruit and retain membership and how they promote leadership skills, this study employs a qualitative approach based on in-depth interviews of gang members in Oakland, California. The results of this study may improve our understanding of the relationship between a gang and its members, improve methods of studying gangs, and have implications for policies to create more effective alternatives to gang membership.

The State Effects of Subtle Physiological Arousal on Visual Working Memory Capacity: Sitting, Standing, and Cognition

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Mentor: Irida Mance
Psychology

Past research on the effects of acute physiological arousal on neuronal function has repeatedly shown that simple sensorimotor reaction times are significantly improved immediately following near maximal level exercise loads. Little work has been done, however to assess the effects of less strenuous, concurrent arousal on the more complex functions of working memory. Using cognitive tasks developed to estimate visual working memory capacity (VWMC) in both sitting and standing positions, the current study examines the effects on VWMC of subtle physiological arousal provided simply by standing versus sitting. Results indicate that there is no significant difference in VWMC for either condition. While not significant, the results of this study may still assist to constrain theory in this area of study by helping to establish the threshold of physiological arousal's effects on cognition. Results may also address recent revelations that chronic sedentary behaviors, and prolonged occupational sitting in particular, are strongly associated with deleterious health outcomes independent of leisure time physical activity or the overall level of fitness.

The Role of Pupil Dilation in the von Restorff Effect

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Faculty Mentor: Nash Unsworth

Psychology

Recent studies have shown that the role of pupil dilation is important for cognitive processes during learning and recall. The current researchers have revealed an interesting relationship between pupil dilation and attention levels, finding that larger pupil dilation is indicative of higher attention levels. This study investigates how novelty is reflected in pupil dilation and how attention levels can be shifted to other items on a word list by including an isolated item on a list of semantically related words. We hypothesize that this isolation, or von Restorff item, will increase pupil size during encoding and that this will lead to better recall. Preliminary behavioral results confirmed the von Restorff effect and showed that the distinct items were recalled more accurately than the non-distinct items on the control lists. Interestingly, the primacy item was still recalled first while the last item (i.e., the most recent) was recalled most accurately when made distinct. Further analyses will reveal if this heightened accuracy of the last item is also reflected in pupil dilation.

Screening the Neurotoxic Effects of Amyloid- β_{1-42} Peptides in *C. elegans* using a Micro-fluidic Electropharyngeogram Platform

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Alzheimer's disease (AD) is an irreversible and progressive neurodegenerative disease. Clinically, it strips memory and cognitive performance from patients while increasing deposits of toxic amyloid-beta ($A\beta_{1-42}$) peptides and neurofibrillary tangles of tau protein in the brain. Existing treatments for AD have limited effectiveness, making it vital to accelerate the search for new therapeutic compounds, possibly by examining the neurotoxicity of $A\beta_{1-42}$ oligomers. A preliminary study has suggested that feeding, *in vivo*, the neurotoxic $A\beta_{1-42}$ oligomers to *Caenorhabditis elegans* may inhibit the normal frequency of pharyngeal pumping. Using that earlier project as a starting point, this project tested the toxicity of $A\beta_{1-42}$ oligomers by examining the effect on the pharyngeal pumping frequency of *C. elegans*. Results showed that the $A\beta_{1-42}$ oligomers inhibited pharyngeal pumping in a dose-dependent manner after two hours of feeding. These results suggest that implementing a new microfluidic electropharyngeogram (EPG) platform may be a powerful tool for identifying the cellular and molecular mechanisms of the $A\beta_{1-42}$ oligomers and discovering drugs to treat Alzheimer's disease.

Facial Symmetry and Health in the Indigenous Amazonian Shuar of Ecuador

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Anthropology

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Anthropology

Faculty Mentor: Lawrence Sugiyama

Anthropology

Recently, several publications have suggested that facial symmetry and its attractiveness correlate with perceptions of health or “good genes.” Research also suggests that the relationship between symmetry and attractiveness may be used as a cue in making judgments about apparent health based solely on facial symmetry. Yet, actual evidence of facial symmetry and its connection to health or stress have been relatively unstudied. The minimal research that has been done has produced questionable results and still leaves room for much to be determined and tested. Various publications have attempted to link asymmetrical traits and their cause to an inability to resist the harmful effects of pathogens, mutations, and toxins experienced during development. Fluctuations in asymmetry have also been associated with a loss of fitness and with the assertion that, across many species, individual males experience a greater reproductive fitness when characterized by a highly symmetrical phenotype.

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Facile Synthesis of a Large Gallium Keggin Cluster

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Chemistry

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NEAT ORU, University of California, Davis

Group 13 metal clusters have been of interest in both materials chemistry and geochemistry because those substances occur naturally and make excellent precursors to thin films for various devices, including solar cells and laptops. Studying the synthesis of these clusters may provide a better understanding of the natural mechanism of synthesis and assist in finding more efficient ways to manufacture the clusters for use in devices. One way to synthesize the clusters is to use 2,6-naphthalene disulfonate in a supramolecular mechanism to promote cluster crystal formation, a method first developed by Tori Forbes in 2012. In the current research, the crystallized clusters were analyzed and verified by the Advanced Light Source at Lawrence Berkeley National Laboratory.

Research sponsored by the Center for Sustainable Materials Chemistry.

Alternative Splicing in the Cardiac Tissue of Myotonic Dystrophy Type 1 Patients

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Myotonic dystrophy type I (DM1) is an autosomal dominant neuromuscular disease caused by the expansion of CTG repeats in the 3' untranslated region of the DMPK gene. Transcription of the pathogenic DMPK gene subsequently produces toxic RNA molecules that form nuclear foci and sequester splicing factors, such as the MBNL family of proteins, causing many RNA transcripts to be spliced improperly. Current literature suggests that widespread missplicing drives many aspects of DM1, including insulin resistance and myotonia. Because cardiac abnormalities are the second leading cause of death for those with DM1 and because missplicing also occurs in cardiac muscles, further study is important. To analyze and characterize the missplicing events in cardiac muscles, this study used the cardiac tissue and derived RNA from nine DM1 patients and three healthy control individuals. Analysis revealed that numerous alternatively spliced exons are differentially included in DM1-affected heart tissue relative to controls. Several of these misspliced exons are within genes that previous research has implicated in the pathogenesis of dilated cardiomyopathy (DCM). Analysis identified genes that, when disrupted, are associated with both dilated cardiomyopathy and DM1. Although further inquiry will be required to understand the roles of particular exons in each disease, this research represents a step toward explaining the mechanisms of premature death in DM1 patients.

A Protocol to Purify and Determine the Protein Concentration of Malaria Vaccine Candidate Antigen Apical Membrane Antigen-1 (AMA1)

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Nearly half of the world's population may be at risk of malaria, with children in sub-Saharan Africa at highest risk for morbidity and mortality. Malaria caused by *Plasmodium falciparum* is the most severe and the major cause of malaria-related mortality. Apical membrane antigen-1 (AMA1) is a leading *P. falciparum* blood-stage vaccine antigen because anti-AMA1 antibodies inhibit erythrocyte invasion. In a recent vaccine trial, a monovalent AMA1-based vaccine showed high allele-specific efficacy against clinical malaria and was the first example of a blood-stage vaccine with measurable protection. However, limited information about the extreme antigenic diversity of AMA1 highlights the need for new methods to study AMA1 epitopes. An *E. coli* autotransporter, EspP, was engineered to display regions of AMA1 and their variants. The expressed proteins are printed onto high-throughput protein microarrays, but it is necessary to develop a method for determining the concentration of AMA1-autotransporter proteins. Ultimately, human sera of individuals obtained pre- and post-malaria season and pre- and post-receipt of AMA1 vaccine FMP2.1/AS02A will be reacted with the protein microarrays. Information on seroreactivity to AMA1 epitopes allows the identification of cross-protective

epitopes. Knowledge of immunologically relevant regions of AMA1 is key to developing a broadly protective AMA1-based malaria vaccine.

Research sponsored by the Howard Hughes Medical Institute Exceptional Research Opportunities Program (EXROP).

Selected Papers

More Than Just Words: EMOTAIX-Tropes Examines Linguistic Correlates of Mental Health

Jackie Cowell

Psychology

Faculty Mentor: Jennifer Ablow

Psychology

Faculty Mentor: Jeffrey Measelle

Psychology

Language gives humans the ability to label an otherwise undefined conglomeration of inner thoughts and feelings and then to process and communicate those feelings in an organized way. Because language is at the center of our daily interactions, it is one channel we use to gain insight into how people experience and make sense of the social world. Past research has revealed links between language and mental health (Mehl, 2006; Weintraub, 1981; Rude, Gortner, & Pennebaker, 2004; Wotschack & Klann-Delius, 2013) and this association has been studied with increased attention over the past decade because of its role in understanding how specific forms of psychopathology are experienced and expressed.

Attempts to quantify the association between language and mental health have taken many forms, including tests to reveal mental and emotional states through the words people use to describe Rorschach's ambiguous inkblots and systems of counting words in speeches or written work, and then linking the counts to an individual's thinking and behavior patterns (Weintraub, 1989). In a 2006 study exploring behavioral patterns among those with sub-clinical depression, Mehl found that depressive symptoms were correlated with an individual's use of words referencing positivity, sadness, self-focus, and causation. Pointedly, depressed people

tended to use more words related to sadness and fewer words related to positive emotions (Mehl, 2006). In studies exploring language use in individuals with high anxiety, Weintraub (1981, 1989) found that an anxious temperament correlates with a high rate of explaining words (e.g., because, since, and so that). As with depressed individuals, those with anxiety tend to show an increase in their use of negative words, although those with depressive symptoms showed a higher rate of words related to death and dying than those expressed by anxious individuals (Rude et al., 2004).

The prevalence of death-related words also occurs in the discourse of those who have experienced trauma and suggests a general sense of mental defeat, a term that refers to an individual's feelings of hopelessness, loss of autonomy and of giving up in response to having experienced an uncontrollable traumatic event (Ehlers, Clark, Dunmore, Jaycox, Meadows, & Foa, 1998). Additionally, experiencing a high level of trauma-related symptoms is correlated with difficulty integrating and organizing the traumatic event into one's current mental state. Because of these difficulties, people with histories of trauma are likely to have language features that reflect disorganization, incoherence, doubt, and self-blame when they speak about a traumatic memory (O'Kearney & Perrott, 2006). For example, a person experiencing distress related to trauma may abruptly shift from one topic to another.

Exploring the correlates of emotional language in persons with alexithymia is particularly relevant because individuals with significant levels of alexithymia have difficulty with both emotional expression and emotional processing (Bagby, Luminet, Rime, & Taylor, 2004). Studying the use of emotion language in this population is challenging because of the limited emotional vocabulary exhibited by individuals with alexithymia. Therefore, the rate and variation of emotion words prove difficult to mea-

sure among those with alexithymia. A more recent study by Wotschack and Klann-Delius (2013) used linguistic analysis to examine the differences in emotional expressiveness between participants with high and low alexithymia. Their results indicated that those who scored high on the alexithymic spectrum used significantly fewer different emotion words as well as significantly fewer total emotion words than those with low alexithymia.

Examining the emotional language use of mothers at high-risk for parenting problems is especially pertinent because risk factors such as maternal depression and anxiety, as well as unresolved histories of attachment with their own primary caregivers, are associated with adverse child outcomes including delayed emotional development, behavioral problems and lower IQ (Bergman, Sarkar, O'Connor, Modi, & Glover, 2007). Additionally, as a trait characterized by difficulties with emotion regulation, alexithymia may be linked with insecure attachment (Lenzi, Trentini, Pantano, Macaluso, Lenzi, & Ammaniti, 2013). The mechanisms that underlie this intergenerational transmission of psychopathology have yet to be identified.

Of particular interest is examining the role that emotion language plays in the transmission process. This is important because children learn about emotions through interactions with their primary caregivers. Secure attachment relationships support children's emotional understanding by promoting mother-child discourse about emotion. Studies have not yet looked at the interplay of psychopathology and emotion language expression that parents use when parenting, especially in caregiving contexts when the attachment system has been activated. More specifically, it is unknown whether the emotions expressed by a mother in reference to her own childhood attachment experiences relate to the way emotions are expressed with her child. Examining the emotion language correlates of mental health represents one step toward gaining a fuller understanding of

emotion language expression and its potential to have an intergenerational impact.

Text-Analysis Programs and EMOTAIX-Tropes

Much of the more recent findings on mental health correlates of language have come about with the development of advanced and efficient computerized text analysis programs. The Linguistic Inquiry and Word Count (LIWC) text analysis program, developed in 2001 by Pennebaker, Francis, and Booth, has gained increasing attention for its ability to identify psychological processes by counting and categorizing the words people use in daily communication. With newer technologies, more refined text analysis programs are being developed that will expand the capabilities of the LIWC system. For example, Piolat and Bannour (2009) created EMOTAIX-Tropes to explore French emotional discourse and writings. Now, however, EMOTAIX-Tropes has been translated for use by English speakers. By design, the EMOTAIX-Tropes program systematically analyzes the complete range of terms used to express emotion. The EMOTAIX dictionary component uses 2,014 emotion word references, comprising 4,921 words and both positive and negative affect terms. For example, words referencing sadness or anger fall within the overarching category of negative emotions, while words referencing joy or patience are considered positive emotions.

One benefit of the EMOTAIX-Tropes program is its ability to allow a detailed analysis of emotion words by providing the researcher with information regarding how each term is used. In addition to counting the emotional items within a given text, EMOTAIX-Tropes classifies the word items according to valence (positive or negative), context (literal or figurative) and nature (semantic category). Categories of emotion terms are thematically organized into three hierarchical levels with positive and

negative emotion words making up the highest and broadest level of the structure. The next level of emotion-related themes includes six categories (i.e., malevolence, ill being, anxiety, benevolence, well-being, and composure), each containing a relevant set of subcategories, in order to account for the entire emotional vocabulary.

Figure 1 presents the organization of the EMOTAIX dictionary according to valence and the specified emotion categories. The figure is arranged with negative emotions displayed on the left and positive emotions on the right. Within each of these two sections, there are three hierarchical levels with the broadest level on the outside. Benevolence, for example, falls in the broadest level of positive emotion words and includes the next level of terms which reference affection and kindness. The subcategory of affection is further broken down into more detailed categories and includes terms referencing love, desire, admiration, and attraction. The number accompanying each of the subcategories in the chart indicates the number of word references contained in each category. For example, there are 55 words in the EMOTAIX dictionary that express love. Further, there are 128 words referencing love, desire, and admiration that together make up the broader category of affection.

In addition to the six overarching themes within positive and negative emotions, three emotional categories—surprise, unspecified, and impassiveness—have valences that are ambiguous or must be assigned by the researcher based on the context of the term within the text. The neutral category of *surprise* allows the researcher to decide the positive or negative valence based on the verbal context of each term. The category of unspecified emotions includes terms such as emotion, feeling, and mood that, in themselves, lack a positive or negative charge. In instances where there is no additional contextual information, the term remains in the *unspecified* category. The final category of *impassiveness* includes terms that

Figure 1: EMOTAIX categories organized into three hierarchical levels on either side of a hedonic axis (positive and negative valence) (Piolat & Bannour, 2009).

<u>NEGATIVE EMOTIONS</u>			<u>POSITIVE EMOTIONS</u>		
MALEVOLENCE [365]	HATE [227]	<i>Resentment [50]</i>	<i>Love [55]</i>	AFFECTION [128]	BENEVOLENCE [183]
		<i>Disgust [51]</i>	<i>Desire [24]</i>		
		<i>Disdain [48]</i>	<i>Admiration [18]</i>		
		<i>Irritation [78]</i>	<i>Attraction [31]</i>		
	AGRESSIVENESS [138]	<i>Inhumanity [36]</i>	<i>Goodness [33]</i>	KINDNESS [55]	
		<i>Rage [41]</i>	<i>Gentleness [17]</i>		
<i>Anger [55]</i>		<i>Patience [2]</i>			
ILL-BEING [772]	SUFFERING [131]	<i>Pride [26]</i>	<i>Humility [3]</i>	HAPPINESS [51]	WELL-BEING [279]
		<i>Tragedy [12]</i>	<i>Bliss [7]</i>		
		<i>Pain [112]</i>	<i>Joy [21]</i>		
	MADNESS [76]	<i>Crying [7]</i>	<i>Laughter [23]</i>	LUCIDITY [17]	
		<i>Mental Illness [36]</i>	<i>Mental Health [10]</i>		
	DEPRESSION [295]	<i>Rambling [40]</i>	<i>Common Sense [7]</i>	SPIRIT [91]	
<i>Sadness [63]</i>		<i>Gaiety [20]</i>			
<i>Weariness [174]</i>		<i>Vivacity [62]</i>			
<i>Torpor [56]</i>		<i>Arousal [9]</i>			
DISORDER [142]		<i>Trouble [119]</i>	<i>Appeasement [37]</i>		RELIEF [59]
	<i>Remorse [23]</i>	<i>Release [22]</i>			
ANXIETY [114]	FRUSTRATION [130]	<i>Humiliation [57]</i>	<i>Esteem [10]</i>	SATASFACTION [63]	COMPOSURE [73]
		<i>Dissatisfaction [17]</i>	<i>Fulfillment [13]</i>		
		<i>Displeasure [40]</i>	<i>Pleasure [26]</i>		
	FEAR [61]	<i>Repression [16]</i>	<i>Catharsis [12]</i>	COURAGE [31]	
		<i>Terror [10]</i>	<i>Boldness [16]</i>		
		<i>Apprehension [37]</i>	<i>Self-Confidence [10]</i>		
TENSION [53]	<i>Shyness [14]</i>	<i>Ease [5]</i>	CALM [42]		
	<i>Panic [4]</i>	<i>Serenity [14]</i>			
	<i>Distress [18]</i>	<i>Tranquility [16]</i>			
	<i>Concern [31]</i>	<i>Relaxation [12]</i>			
SURPRISE [55]		UNSPECIFIED EMOTIONS [144]		IMPASSIVENESS [29]	

express an absence of emotion (Piolat & Bannour, 2009), such as fearless, apathetic, and detached. Because these terms refer to states lacking in affect, they remain in a valence-free category.

The EMOTAIX-Tropes program categorizes a person's emotion language according to the hierarchy of emotion themes and subcategories illustrated in the graph. It also provides numerical data such as the number of emotion words in each category that an individual uses. This numerical data gives the user a feel of the specific words the speaker uses most frequently as well as detailed insight into the speaker's emotional experience. The program's output enables the user to view each emotional term it identifies on the screen in its verbal context. This is an important feature, as many words naturally have double meanings. The term "blocked," for example, can be used in the expression, "I was feeling emotionally blocked," or the term can refer to distance as in, "I live just one block away." In the first example, the term is used to express an emotional experience or lack of emotions. The second example does not fit in the context of the emotional repertoire and would, therefore, be rejected by the user from the final emotion word count.

Current Study

Previous studies that focused on emotion words and content-laden words in general have failed to produce consistent results about how well those words reflect actual psychological states. Examining the association between mental health symptoms and emotion language has proven particularly challenging because less than 5% of the words people use in daily discourse can be labeled as emotional (Pennebaker, Mehl, & Miederhoffer 2003). This makes sense given that we live and interact in a fast-paced society with interactions often brief and emotional conversations not always welcome or even appropriate. Additionally, the available tools used to ac-

curately measure and examine emotion language fall short in their ability to reveal precise and detailed analyses of emotion words and take context into consideration. For example, the LIWC program ignores factors such as irony, sarcasm, and context (Tausczik & Pennebaker, 2010). Therefore, the LIWC classifies the word “crazy” as a term that fits into the category of madness. However, if a person were to say “I was crazy about him,” it would be inappropriate to categorize the word as reflecting madness because it is not being used in its literal context. Without taking context into consideration, the meaning of statements could be ascribed and categorized incorrectly. Ignoring context is problematic when trying to get an accurate picture of what individuals are saying.

The current study investigated the association between symptoms of depression, anxiety, trauma, and alexithymia and participants’ use of emotion words in a high-risk sample of primiparous women. In the present study, the Adult Attachment Interview (AAI; George, Kaplan & Main, 1984, 1985, 1996) was used to elicit women’s current state of mind with respect to their attachment history. Because the AAI asks respondents to reflect on emotionally significant interactions with their primary caregivers, it provides a rich context for exploring the associations between a person’s use of emotion words and their current mental health. To determine whether associations between women’s emotion language during the AAI and their mental health symptoms might be better explained by other factors, demographic variables were also assessed as possible moderators of an association between emotion language and symptomatology. Because this study sought to investigate an expectant women’s emotion language while her attachment system was activated (through the AAI), its results may add to a growing understanding of how emotional distress is transmitted from one generation to the next. Specifically, understanding how an expectant woman expresses herself emotionally when her attachment system is activated may provide insights into the experiences of her children.

We hypothesized that the emotion language of participants would be correlated with self-reported symptoms of depression, anxiety, and trauma, so that those with higher levels of symptomatology would use significantly higher rates of negative affect terms and significantly lower rates of positive affect terms than women reporting lower levels of symptomatology. Additionally, because alexithymia is marked by difficulties in both identifying and expressing emotions, we predicted that expectant women reporting higher levels of alexithymia symptoms would use fewer emotion words in their responses on the AAI. Based on previous studies that link low socioeconomic status with increased instances of psychopathology, we hypothesized that participant's socioeconomic status would moderate the association between women's mental health symptomatology and their emotional discourse.

Method

Participants

Participants were drawn from a larger project called *From Pregnancy to Parenting Your First Baby*, a longitudinal study that assessed 105 women at risk for parenting problems and their infants. The women in this study were a sample of low socioeconomic status, primiparous mothers from the Eugene-Springfield area of Oregon. All participants have histories of elevated depression symptomatology (as measured by the CES-D) and were recruited through hospitals and agencies within Lane County, Oregon. At enrollment, the women's mean age was 24 years ($SD = 4.5$); 80% of the women were English speaking European Americans with an average annual household income of \$9,634, placing the majority of the sample below the official US poverty level. The current study uses data from 46 of these women during their third trimester of pregnancy (see results section for demographic data specific to this subsample).

Procedure

The women visited the Developmental Sociobiology Laboratory during their third trimester of pregnancy as part of a larger assessment designed to explore the psychosocial processes related to the transition to parenthood. Prior to and during their visit to the lab, women completed different self-report questionnaires to assess their levels of depression symptomatology (CESD; Radloff, 1977), anxiety (BAI; Beck, Brown, Epstein, & Steer, 1998), trauma history (TSC; Elliot & Briere, 1992), and alexithymia (TAS; Bagby, Parker, & Taylor, 1994). During the lab visit, the women also participated in the Adult Attachment Interview, which includes questions about early childhood experiences with primary caregivers. The AAI was used because of the nature of the emotional responses the questions elicit from an individual. Each AAI was recorded using both audio and video formats and then transcribed verbatim by trained AAI transcribers. The interviewer's statements were marked in the texts, and the transcripts were formulated so that only the participant's words were analyzed in accordance with the requirements of the EMOTAIX-Tropes program. The emotion words that each woman used were counted and categorized within the nine overarching emotion categories of the EMOTAIX dictionary. Analyses were run to examine correlations between participants' self-reported measures of symptomatology and their emotion language patterns during the AAIs.

Measures

EMOTAIX-Tropes.

Participants' use of emotion words was analyzed using the EMOTAIX-Tropes (Piolat & Bannour, 2009) software. Each individual's emotion words were counted and categorized using the six emotion-related themes within the broader structure of either negative or positive emo-

tions. Words that did not fit the rubric of positive or negative emotions were organized using one of the three valence-free emotion word categories. Positive emotions were organized within the three subcategories of *benevolence*, *well-being*, and *coolness/calm*. Negative emotion words were organized into the three subcategories of *malevolence*, *ill being*, and *anxiety*. Each emotion word was viewed and its category verified or discounted by the researcher based on the context of the situation in which the word was spoken. Emotion words that did not fit within the spectrum of positive and negative were categorized under the headings of *surprise* (e.g., jumped, amazed, wondering) or *unspecified* if a reference was made to emotions without a specified valence (e.g., “I was very emotional”). Each word labeled as *unspecified* was individually assessed within the context of the situation it referenced. If the context provided sufficient information regarding the valence of the unspecified reference, the word was then categorized according to its appropriate categorical theme. In an effort to avoid misattributing valence or category to an unspecified term, most often the terms categorized as unspecified stayed within that category. After the emotion words were categorized according to valence and semantic category, emotion word tallies were computed for each individual transcript. The tallies were then correlated with each of our four mental health measures.

Depression.

Depressive symptoms were assessed using the Center for Epidemiological Studies-Depression Scale (CESD; Radloff, 1977). The CESD is a 20-item self-report scale used for measuring depression in the general population. It asks how often a person has experienced a symptom in the past week and provides a four point scale that ranges from 0 (Rarely/less than 1 day) to 3 (Most of the time/5-7 days). Examples of prompts include, “I felt lonely” and “I thought my life had been a failure.” Scores on the

scale range from 0 to 36; someone with a score of 16 or above is considered depressed.

Anxiety.

Anxiety was assessed using the BECK Anxiety Inventory (BAI; Beck, Brown, Epstein, & Steer, 1988). The BAI is a 21-item self-report inventory for measuring the severity of an individual's anxiety symptoms during the past week using a four point scale that ranges from 0 (Not at all) to 3 (Severe/I could barely stand it). The questionnaire covers a wide range of anxiety symptoms, such as fear of the worst happening, nervousness, shakiness, and an inability to relax. Total scores range from 0 to 63 with a score of 0 to 7 indicating minimal anxiety, a score of 8 to 15 indicating mild anxiety, a score of 16 to 25 indicating moderate anxiety, and a score over 26 indicating very high levels of anxiety.

Trauma History.

Trauma-related symptomatology was measured using the Trauma Symptom Checklist (TSC; Elliot & Briere, 1992). The TSC is a 40-item self-report questionnaire that examines current adult symptomatology related to having had childhood or adult traumatic experiences. Each symptom is rated according to how frequently it has been experienced over the past two months and uses a four point scale that ranges from 0 (Never) to 3 (Often). The TSC-40 consists of an overall score and scores on six subscales: Anxiety, Depression, Dissociation, Sexual Abuse Trauma Index (SATI), Sexual Problems, and Sleep Disturbance. For our analysis thus far, we have used only the overall score as a measure of total trauma symptomatology.

Alexithymia.

Participants completed a questionnaire using the Toronto Alexithymia

Scale (TAS; Bagby, Parker, & Taylor, 1994) to determine levels of alexithymia. The TAS is a 20-item self-report scale used to measure alexithymia, a term used to describe individuals who have difficulty identifying and describing emotion and who tend to minimize emotional experiences. The TAS has three subscales aimed at assessing difficulty in describing feelings, difficulty identifying feelings and externally-oriented thinking as well as a total score. We used the total score as the measure of alexithymia in our analysis.

Attachment state of mind.

The Adult Attachment Interview (AAI; George, Kaplan, & Main, 1984, 1985, 1996) is a formatted interview designed to reveal an individual's current state of mind about attachment experiences with primary caregivers. The interviewer asks questions about early interactions with caregivers as well as instances of loss and trauma. The questions also probe for information regarding the reactions and behavior of both the interviewee and the primary caregiver. The results of each AAI are traditionally coded and classified into three main categories: autonomous, preoccupied, and dismissing (Main & Goldwyn, 1998). For the purposes of this study, however, the AAI was not used in the traditional sense but rather as a tool to elicit emotional responses. The interviews were conducted by five graduate students and varied in length from 45 to 90 minutes. The AAIs were recorded and transcribed verbatim and then assessed for the use of emotion language.

Results

Preliminary Analysis

Before running the main analysis, descriptive demographics for the sample of 46 participants were evaluated. As displayed in Table 1, over

Table 1: Descriptive demographic information for sample

Variables	number	% of sample
Ethnicity		
Black or African American	1	2.2
White, not of Hispanic origin	38	82.6
Mexican American, Chicano, Mexicano	2	4.3
Other Hispanic	2	4.3
American Indian	2	4.3
Asian or Pacific Islander	1	2.2
Total	46	100.0
Education		
Less than High school	1	2.2
Some High School	3	6.7
High School Diploma or GED	19	42.2
Some College or 2-year degree	20	44.4
4-year degree College	1	2.2
Some school beyond College	1	2.2
Education level not reported	1	2.2
Total	46	100.0
Total Household Income		
Less than \$4,999	9	20
\$4,999 - \$9,999	3	6.7
\$10,000 - \$20,000	15	33.3
\$21,000 - \$40,000	14	31.1
\$41,000 - \$60,000	3	6.7
Don't know, live with mom	1	2.2
Income not reported	1	2.2
Total	46	100.0

80% were European-American. On average, the women had earned high school diplomas or had attended some college. The average household income was approximately \$10,000 annually.

To control for the above demographic data, associations between the women's demographic characteristics and both their emotion word and symptomatology scores were evaluated first. There was no significant association between a woman's educational level, household income, or ethnicity and her use of positive or negative emotion words ($p > .10$). Income and education also proved to be unrelated to women's symptomatology and their alexithymia score ($p > .10$). Although ethnicity was unrelated to alexithymia scores ($p > .10$), ethnicity was significantly related to their self-reported symptoms of depression, anxiety, and trauma, $F(5, 39) = 5.69, p < .001$. Specifically, women of Caucasian decent reported significantly lower levels of mental health symptomatology than did the non-Causasian women in the sample. Because of this finding, we controlled for women's ethnicity in our primary analyses.

Central Analyses

Table 2 provides a summary of the sample level statistics for the emotion word categories (both negative and positive) employed. Means and standard deviations are expressed in terms of the ratio of words used within the given category to the total amount of words (emotional and non-emotional) spoken by the participant during the entire interview. The ratios were calculated in this way to account for the length of the interview, as some individuals naturally speak more than others. Overall, women used significantly more negative than positive words during discourse on the AAI, $t(45) = -2.01, p = .05$.

Figure 2 presents an example of one individual's responses on the AAI within the category of negative emotions. This graphical representa-

Table 2: Descriptive Statistics for emotion word categories and subcategories

Variables	Mean	SD	Min.	Max.
Positive Emotions	0.83	0.43	0.37	2.29
Benevolence	0.38	0.16	0.14	0.96
Affection	0.35	0.15	0.12	0.95
Well Being	0.33	0.17	0.12	0.84
Happiness	0.1	0.1	0.0	0.51
Relief	0.16	0.1	0.03	0.5
Negative Emotions	0.98	0.31	0.4	1.65
Malevolence	0.13	0.09	0.0	0.44
Ill Being	0.69	0.25	0.26	1.34
Anxiety	0.15	0.08	0.02	0.37
Fear	0.09	0.07	0.0	0.26
Doubt	0.33	0.2	0.06	1.05
Total Emotion Words	2.17	0.69	0.02	3.5

tion of the woman’s emotion words displays the categories in the form of green or blue spheres with their size proportional to the number of words they contain. The distance between spheres (categories) correlates with the number of relations connecting them. Additionally, the graph is oriented so that the spheres (word categories) on the left are spoken before the central category, and the spheres (categories) on the right come after it. In this specific graph, for example, it appears that the individual made reference to crying both before and after referencing a negative emotion. For the purposes of the current study, the only information used from Figure 2 was the quantity of emotion words spoken in the transcript. The information displayed in this graph, however, speaks both to the ability of the EMOTAIX software to analyze the given data in many formats and its potential to inform future studies.

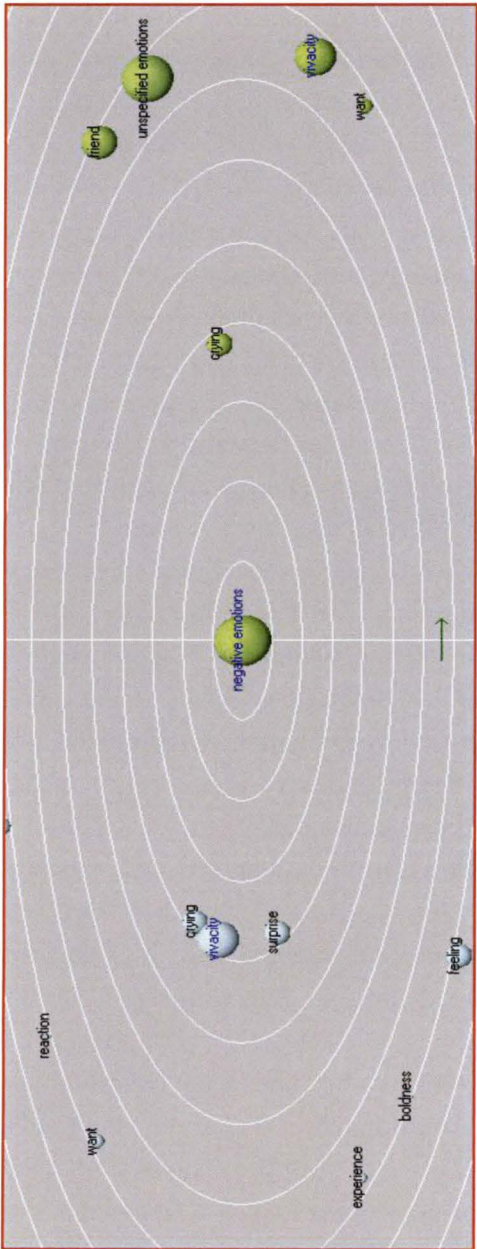


Figure 2: Graphical representation of an individual's emotion word use (Tropes, 8.4)

Table 3 displays descriptive statistics for each measure of mental health symptomatology. On average, women's depression scores ($M = 15.52$) were close to the clinical cutoff score of 16. Also, mean anxiety score for the sample indicates that the women reported, on average, moderate levels of anxiety during the time of assessment.

The Trauma Symptom Checklist (TSC-40), our measure of trauma symptomatology, was designed as a research tool and, therefore, has no clinical cutoff scores. The sample's average trauma score ($M = 24.7$) is suggestive of mild to moderate levels of trauma symptoms among the women. Compared to average TSC score ($M = 63.18$) from clinical pop-

ulation of 28 women with co-occurring PTSD and substance-dependence (Searcy, V. & Lipps, A, 2012), the women in our sample had substantially lower trauma scores.

Because of the high degree of inter-correlation among depression, anxiety, and trauma symptoms (r -values = 0.818 – 0.828, $p < .01$), and because a Principal Components Analysis (PCA) supported the utility of a single global measure of symptomatology, we calculated a total symptomatology score by summing women's scores on each of the symptom scales. This new measure, *psychopathology total*, includes depression, anxiety, and trauma and is displayed in Table 3. Because alexithymia was weakly correlated with women's reports of depression, anxiety, and trauma (r -values = 0.16, 0.25, 0.35), respectively, and because it did not load on the primary PCA factors, alexithymia was retained as its own score.

Table 3 also presents descriptive information regarding women's alexithymia scores. The average alexithymia score ($M = 46.4$, $SD = 10.57$) falls into the range of possible alexithymia, with the TAS scoring cutoffs as follows: scores less than or equal to 51 indicate non-alexithymia; scores greater than or equal to 61 indicate alexithymia; and scores between 52 and 60 indicate possible alexithymia (Bagby, Parker, & Taylor, 1994). A categorical measure of alexithymia was created with 73.3% of women ($n = 33$) falling into the subthreshold group (scores considered non-alexithymic) and 26.7% of women ($n = 12$) falling into the at-risk or above threshold range (scores indicating both possible and actual alexithymia). Relative to this categorical measure of alexithymia, we found no significant difference in women's depression scores, $F(1,43) = 1.05$, $p = .31$, or their anxiety scores, $F(1,43) = 2.45$, $p = .13$, as a function of alexithymia grouping. However, there was a significant difference in their reported trauma symptomatology, $F(1, 43) = 5.14$, $p = .03$, such that women in the high alexithymia group reported significantly higher trauma symptomatology.

Table 3: Descriptive Statistics for self-reported symptomatology

Measures	Min.	Max.	Mean	SD
CESD score (depression)	2	57	15.52	9.94
BAS score (anxiety)	0	55	13.67	10.29
TSC score (trauma)	2	82	24.7	15.65
Psychopathology Total (includes depression, anxiety and trauma symptoms)	5	194	53.89	33.74
TAS score (alexithymia)	29	80	46.4	10.57
Subthreshold (non-alexithymia)	$N = 33$	73.30%		
High-risk (possible alexithymia and alexithymia)	$N = 12$	26.70%		

Table 4 presents the correlations between symptomatology of depression, anxiety and trauma (Psychopathology Total) and the number of words produced on the AAI within each emotion word category. Analysis revealed that only one of the assessed emotion word categories proved to be significantly associated with women’s symptomatology. Consistent with our hypothesis, women’s total symptomatology score was significantly and positively correlated with use of words belonging to the malevolence category (i.e., words denoting hatred and aggression), so that as symptomatology related to depression, anxiety and trauma increased, women tended to use significantly more words during the AAI that connoted malevolence. Also, there was a moderately significant positive association between women’s total symptomatology score and the use of negative emotion words grouped in the subcategories of *Malevolence*, *Ill-Being*, and *Anxiety*.

Contrary to our hypothesis, women’s total symptomatology score

Table 4: Frequency of word use within each category

Psychopathology Total	r	p-value
Positive Emotions	0.054	.724
Benevolence	-0.034	.823
Affection	0.022	.885
Well Being	0.271	.069
Happiness	-0.035	.816
Relief	-0.085	.573
Negative Emotions	0.283	.057
Malevolence	0.582**	<.01
Ill Being	0.111	.463
Anxiety	0.087	.567
Fear	0.128	.396
Doubt	0.003	.985
Total Emotion Words	0.148	.325

**Correlation is significant at the 0.01 level

was not significantly correlated with the use of negative emotion words, nor was there a statistically significant association with any of the individual negative emotion subcategories of *Ill-Being*, *Anxiety*, and *Doubt*. Additionally, women's total symptomatology scores were not correlated with their use of total positive emotion words, specifically, words used in the subcategories of *Benevolence*, *Affection*, *Well-Being*, *Happiness*, and *Relief*. Finally, the total symptomatology scores were not correlated with their use of total emotion words.

Table 5 presents the correlations between our continuous measure of alexithymia symptomatology and the number of words used within each emotion category. Three emotion word categories proved to be significantly associated with women's symptoms of alexithymia. Despite our ex-

Table 5: Frequency of word use within each category

TAS (alexithymia)	r	p
Positive Emotions	-0.442**	< .01**
Benevolence	0.16	.3
Affection	0.18	.24
Well Being	0.4*	.01*
Happiness	0.16	.29
Relief	0.134	.38
Negative Emotions	0.26	.08
Malevolence	0.05	.75
Ill Being	0.27	.07
Anxiety	0.12	.43
Fear	0.1	.5
Doubt	0.11	.47
Total Emotion Words	0.49*	< .01**

*Correlation is significant at the 0.05 level.

**Correlation is significant at the 0.01 level.

pectation that alexithymia symptoms would be inversely associated with negative emotion words, alexithymia symptomatology was not significantly correlated with the total amount of negative emotion words used, nor with any of the negative subcategories. However, there was an unexpected significant positive correlation between alexithymia and use of positive emotion words. As alexithymia symptomatology increased, the use of positive emotion words also increased. In particular, alexithymia symptom scores were significantly and positively correlated with the women's use of words within the subcategory of *Well-Being*. Alexithymia was not significantly correlated, however, with any of the other four sub-

categories of positive emotions, namely, *Affection*, *Benevolence*, *Happiness* and *Relief*. Further, there was not a significant association between alexithymia symptomatology and the subcategories of *Ill-Being*, *Anxiety*, *Fear*, or *Doubt*.

Lastly, there was a significant positive association between alexithymia and the amount of total emotion words used, reflecting that higher levels of alexithymia symptomatology corresponded positively and significantly with emotion words in general. This finding is especially thought provoking, as previous research has noted a decrease in emotion words among individuals with alexithymia. This association, however, does not account for the variety of emotion words used, suggesting the possibility of an individual using the same emotion words repeatedly.

As a final test of alexithymia data, women's use of emotion words was examined in relation to their alexithymia grouping (i.e., subthreshold alexithymia, and clinically elevated alexithymia symptomatology). Means testing revealed that women in the clinically elevated alexithymia group used moderately more positive emotion words, $F(1, 43) = 3.33, p = .08$, significantly more negative emotion words, $F(1, 43) = 7.16, p = .01$, and significantly more total emotion words, $F(1, 43) = 8.26, p = .01$, than women in the subthreshold alexithymia group. These results indicate that women with clinically elevated alexithymia symptomatology generally used more emotion words, including both positive and negative words, than women reporting low levels of alexithymia symptomatology. Interestingly, the increase in emotion words by those with higher reported alexithymia symptoms suggests these women may have been overcompensating for their difficulty in identifying and describing emotions by producing emotion words that may not be reflective of their actual emotional experience. As women with high alexithymia scores also reported higher trauma symptomatology, we would expect them to use more negative than posi-

tive emotion words when describing early childhood experiences. Paired sample t-tests further revealed that women both at-risk for alexithymia and those with clinically elevated alexithymia scores generally used more negative than positive emotion words. In both cases, these differences did not reach statistically significant levels, $t(11) = -0.83$ and $t(11) = -1.68$, respectively, $p = .10$. These results are most likely due to the size of the subsample.

Discussion

This study sought to explain how psychopathology impacts how emotion is verbally expressed. The finding that, overall, the women in the study used significantly more negative than positive words was unsurprising. Because these women reported high levels of depressive, anxious, and trauma related symptomatology, it makes sense that their lexical choices would reveal thoughts related to negative emotional experiences.

The first hypothesis of maternal psychopathology as a predictor of both negative and positive affect word use was partially supported. While an increase in symptomatology (symptoms of depression, anxiety, and trauma) was not significantly related to the he number of negative emotion words used, it was significantly correlated with the use of words reflecting hatred and aggression (malevolence category). More specifically, the mothers who reported higher symptoms of depression, anxiety, and trauma also used more words reflecting hatred and aggression than their less symptomatic counterparts. This finding suggests that hateful and aggressive speech during the AAI is linked with psychopathology.

When looking at the data more descriptively, it appears that the use of words reflecting hostility and harsh parenting styles were the most prevalent terms used within the category of Malevolence (see Figure 3 for a breakdown of specific words used within this category). The terms used

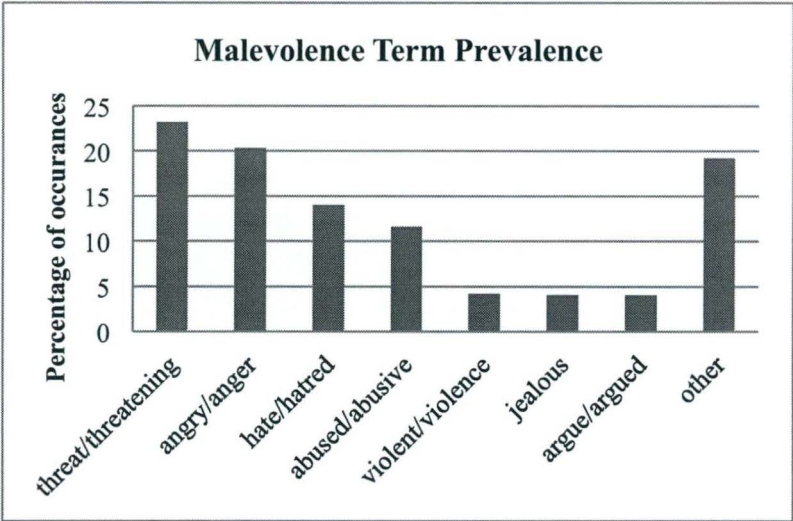


Figure 3: Prevalence of specific words used reflecting hatred and aggression. (“Other” refers to individual terms used less than 3% of the time).

most often by the women within the malevolence category were threatened/threatening (23.2%), angry/anger (20.3%), hate/hated/hatred (14%), and abuse/abusive (11.6%). These words suggest a substantial amount of either interpersonal or intrapersonal conflict around early attachment relationships among those who reported high levels of symptomatology.

Given that problems identifying and verbalizing emotions make up fundamental aspects of the alexithymia construct, we expected that women reporting elevations in alexithymia symptoms would show a marked decrease in their use of emotional language. This pattern did not unfold with the women in this sample. In fact, an opposite pattern emerged. As the women’s alexithymia scores increased, the amount of both positive emotion words and total emotion words used also increased. This increase in positive emotion word use may suggest a dismissive style of attachment among those with alexithymia. On the AAI, dismissing adults tend

to play down the effects of early distress related to attachment experiences and often describe caregivers in idealized terms (Borelli, David, Rifkin-Graboi, Sbarra, Mehl, & Mayes, 2012). It is possible that the women with high alexithymia scores increased their positive word use in an effort to downplay the impact of early trauma. This possibility aligns with previous findings that point to alexithymia being firmly linked with the avoidant-dismissing category of insecure attachment (Scheidt, Waller, Schnock, Becker-Stoll, Zimmermann, Lücking, & Wirsching, 1999; Taylor, 2000; Verhaeghe, 2004). Another theory behind the significant correlation between alexithymia and positive emotion words is the idea that positive emotion words are more socially acceptable. Negative emotions can often be more difficult to talk about, making the use of positive emotion words feel less vulnerable. Interestingly, the positive emotion words the women tended to use came from the *Well-Being* category and were more superficial by nature (e.g., “I’m fine” and “It was good”). These words generally do not elicit follow-up questions or emotional responses from the listener and consequently protect the speaker from being asked to further divulge about their emotional experience.

The increase in total emotion words (both negative and positive) corresponding to higher alexithymia scores suggests overcompensation as a possible behavioral strategy employed by participants to counteract their inability to recognize and communicate emotional experiences. Perhaps, in this case, the emotion words they used were an attempt to fill in the gaps with any emotion term they could think of regardless of whether the terms accurately represented their emotional experience.

When the women were broken into two groups according to their alexithymia score (a subthreshold group and a high-risk group), some marked differences emerged. For the women in the high-risk group, there was a significant increase in negative emotion language as alexithymia scores

increased. This was not the case for the women in the subthreshold group. Although the total emotion words increased for both groups, only those women classified as high-risk had a significant increase in negative emotion language. This pattern suggests that compensation may be occurring at all levels of the alexithymic spectrum, but that those with the highest alexithymia scores and, consequently, higher trauma symptomatology may have a more accurate expression of emotional experiences than those who report fewer trauma symptoms. In other words, trauma symptomatology at high levels may overshadow the impact that alexithymia has on how emotion language is expressed. Specifically, even if in the midst of compensatory behaviors, it appears that those with clinically elevated alexithymia scores have a tendency to overcompensate with negative affect terminology. Considering that the women in the high-risk alexithymia group also had significantly high trauma symptom scores, it makes sense that they would use more negative than positive words when referencing early childhood experiences.

Limitations and Future Directions

An area for future analysis involves the representation of symptomatology. Maternal distress was calculated based on total scores drawn from measures of depression (CESD; Radloff, 1977), anxiety (BAI; Beck, Brown, Epstein, & Steer, 1988), trauma (TSC; Elliot & Briere, 1992), and alexithymia (TAS; Bagby, Parker, & Taylor, 1994). However, both the TAS and TSC include subscales of specific symptoms that can be examined and scored separately within the total symptom score. While the total score of each measure provides an overview of associated symptomatology, the individual subscales were not taken into account. Future analyses should utilize these subscales in order to obtain a more precise understanding of women's specific forms of symptomatology because it may reveal

different lexical choices based on specific clusters of symptoms.

A second area for future study involves the use of the Adult Attachment Interview (AAI) as a tool for examining emotional discourse. Because the AAI prompts the speaker to give descriptions of both early childhood experiences and their emotional reactions to those experiences, it provides a rich framework for examining emotional processing related to an attachment state of mind. Within the AAI, there are some questions that specifically target emotionally distressing experiences, such as instances of loss or abuse. Future analyses using EMOTAIX-Tropes to examine emotion language patterns corresponding to individual questions on the AAI may reflect differences in patterns of emotional expression representative of traumatic experiences and those that correspond to a more general attachment state of mind.

Finally, because this study examined emotional discourse limited to the AAI, the results are not necessarily a reflection of emotional language expression in other contexts. Therefore, a number of questions remain unanswered. For example, does the language used on the AAI parallel emotional discourse during interactions with one's own child? If that is the case, how might the use of aggressive language in mother-child discourse impact the intergenerational transmission of attachment? Additional studies looking at the correlation between the use of emotional language on the AAI, and verbal emotional expression during parent-child interactions are needed to determine whether emotional discourse on the AAI more accurately reflects discourse in other social contexts.

Conclusion

Taken together, the findings of this study support the notion that maternal distress impacts an attachment state of mind and, consequently, emotional discourse related to early attachment experiences. A thorough

examination of the emotional lexicon reveals distinct patterns in the sub-categories of the emotional repertoire. Detailed analyses suggest a link between symptoms of depression, anxiety, and trauma and the use of aggressive and hateful emotional terminology. Additionally, patterns in emotional expression emerged specific to the construct of alexithymia. Not only did the use of emotion words increase with alexithymia scores, but also trauma symptomatology played a mediating role in how emotion words were expressed, showing that those with clinically elevated alexithymia and trauma scores used significantly more negative affect words.

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**Of Cost and Consequence:
Examining the Price of White Liberalism
in James Baldwin's *Another Country***

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America's the most wonderful country in the world, it is the most extraordinary collection of ill-assessed motives and undigested history, the most peculiar system of moral evasions and tremendous innocence. There's something very winning and very moving and very beautiful about those people who don't yet know that the world is big and complex and dark and that you have to grow up and become yourself big and complex and dark in order to deal with it. Americans still believe they can somehow get through life without ever being corrupted. It is an insane endeavor and, of course, this is where the Negro comes in. The Negro, by his presence, being on the bottom, affords society almost the only coherence that it has. (Mossman 57)

Introduction

As one of the most prolific African-American writers of the twentieth century, James Baldwin's work is characterized by his "radical humanism" (Kaplan and Schwarz 1) and deep insight into the nature of both the individual and the collective American psyche. At the time of the publication of his third novel, *Another Country* (1962), James Baldwin had already

asserted himself as an outspoken advocate for social justice. Following in the tradition of Richard Wright's *Native Son* (1940) and Ralph Ellison's *Invisible Man* (1952), Baldwin's *Another Country* quintessentially fits the genre of the African-American social protest novel. Although Wright and Ellison were Baldwin's contemporaries, and all three men were prominent African-American writers who boldly addressed the insidious presence of racism in America's urban North, the social and political landscape from the time Wright released *Native Son* to the time Baldwin published *Another Country* changed dramatically:

Events that transpired between the 1940s and 1960s (e.g., the urbanization of racial minorities, the gradual incorporation of minorities in the industrial sector, the protests by civil rights organizations as well as the over 200 race riots in the 1960s, and the contradiction between the democratic rhetoric of the U.S. government at the height of the Cold War and its treatment of the minorities at home) led to a change in the racial structure of the United States. (Bonilla-Silva, *White Supremacy* 138)

For this reason, although there are similarities between Baldwin's social protest novel and those of his contemporaries, *Another Country* must be analyzed as a product of its historic moment. More specifically, *Another Country* deserves to be recognized for its attempt to boldly disrupt the cultural narrative of the Civil Rights Era through its relentless examination of the role of white liberalism as a universal and uncomplicated approach to racial reconciliation.

Released at the height of the Civil Rights Era, *Another Country* intimately portrays the relationships of a racially mixed group of friends and lovers living in New York in the middle 1950s. Published on the heels of desegregation, the novel details the struggles and nuances of racial reconciliation at a critical time in American history when blacks and whites alike were tasked with imagining what integrated life might look like. Ad-

ditionally, its release coincided with the rise of Black Nationalism and only marginally preceded the Gay Liberation Movement. As a novel that showcased a queer, black man as its protagonist in that specific historical moment, the work was fiercely criticized as a racial abomination by Black Panther Party leader Eldridge Cleaver. Cleaver lambasted the novel's depiction of its protagonist, Rufus Scott, as "a pathetic wretch who indulged in the white man's pastime of committing suicide, who let a white homosexual fuck him in the ass, and who took a Southern Jezebel for his woman" (Cleaver 107). Hyper-masculine criticism from the black left was echoed by white social conservatives who were outraged by the novel's controversial exploration of interraciality, homosexual desire, promiscuity, and domestic violence.

In the decades since the novel's publication, much scholarship has been dedicated to deciphering Baldwin's motivation for creating—and then prematurely sacrificing—Rufus Scott, a character who uncannily resembles his creator. Interpretations of Rufus's suicide range from the belief that it signifies Baldwin's ambivalence toward his own racialized sexuality to William A. Cohen's assertion that "the critique Baldwin wanted to make about race he could only express fully in terms of sexuality" (15). Cohen's analysis suggests that Baldwin portrays sexual and racial politics as interdependent, an argument that Susan Feldman concedes in "Another Look at *Another Country*: Reconciling Baldwin's Racial and Sexual Politics," despite her critique of Cohen's conclusion that *Another Country* "appears more interested in the salvation of individual characters than radical social change" (89). While Baldwin carefully cultivates the interiority of his characters, *Another Country*—while being a work of character-driven fiction—also does significant theoretic work.

The novel presents an array of characters who occupy various social locations, and while many of those identities overlap, no two characters

mirror each other's experience holistically. For example, Baldwin only grants the reader access to the interiority of two African-American characters throughout the novel and, although Rufus and Ida are siblings, their genders and sexualities are foreign experiences to each other. It is clear that even their shared experience of being African-American cannot be simply universalized because American racial, gender and sexual hierarchies co-create one another. In her piece, "Mapping the Margins: Intersectionality, Identity Politics, and Violence Against Women of Color," Kimberle Crenshaw addresses the limitations of attempting to analyze intersecting identities independently:

Among the most troubling political consequences of the failure of antiracist and feminist discourses to address the intersections of race and gender is the fact that, to the extent that they can forward the interest of "people of color" and "women," respectively, one analysis often implicitly denies the validity of the other. The failure of feminism to interrogate race means that the resistance strategies of feminism will often replicate and reinforce the subordination of people of color, and the failure of antiracism to interrogate patriarchy means that antiracism will frequently reproduce the subordination of women. These mutual elisions present a particularly difficult political dilemma for women of color. (13)

The dilemma Crenshaw refers to is one commonly faced by those doing intersectional social work. Because identity categories are often treated as distinct entities that are frequently set against one another, the points at which multiple identities intersect and the complex epistemologies that those intersections produce are regularly erased, ignored, or problematically oversimplified in the political sphere. Alternately, fiction makes its most explicit claim for theoretical and political efficacy by intimately and accurately representing identities that are not easily classifiable within a text. In his book, *On Making Sense: Queer Race Narratives of Intelligi-*

bility, Ernesto Javier Martínez supports this stance by claiming that “for Baldwin, the novel has the opportunity to exceed the didactic limits of political pamphleteering as well as the presumed (detached) objectivity of the social sciences, and to tell a different story altogether” (3).

To best understand Baldwin’s efforts to “tell a different story” about American race relations, one should refrain from analyzing the identities of the characters in *Another Country* as fixed, for Baldwin deliberately presents them as “fluid, labile, and multiple” (Hsu 13). Additionally, readers should actively resist seeking to understand those identities as autonomous and instead focus on exploring the ways in which Baldwin allows his characters to examine and, in effect, create one another. Finally, rather than speculating about Baldwin’s motivation for disposing of his queer, black protagonist so early on in a novel primarily concerned with race and sexuality politics by fixating on Rufus’s identity alone, it is my goal to investigate the forces that drive Rufus to his demise by looking critically at the framework through which the characters in the novel understand and approach race.

Avoidance vs. Acknowledgment

Because *Another Country* situates itself in New York during the 1950s and boasts a cast of mostly white, progressively-minded, working-to-middle class artists, it should come as no surprise that the dominant ideology that the characters in the novel use to engage with race is through the framework of white liberalism. During the civil rights era, white liberalism “represented the [political] site for white people opposed to the racial ordering of the United States” (Aanerud 58). However, white liberalism, as Rebecca Aanerud describes it in “Now More Than Ever: James Baldwin and the Critique of White Liberalism,” is a contradictory “antiracist social category” (56) with a “complicated and uneven history” (58).

Although white liberalism can be—and often has been—used interchangeably in modern discourse with terms such as “abstract liberalism” and “colorblind racism,” the term white liberalism in the context of *Another Country* is used to signify the specific and prevailing liberal ideology that characterized the politics of many white advocates for racial justice in mid-century America. Additionally, Baldwin was a fierce critic of white liberalism and seemed never to refer to it by any other name.

According to Aanerud, this “social and political category of wide-ranging perspectives, beliefs, and agendas” (58) can be identified by a person’s application of at least one of the following defining ideological characteristics: racial paternalism, white guilt, or hyper-individualism. The characteristic of white liberalism that Baldwin appears most to despise is racial paternalism, or what Aanerud refers to as the “missionary complex” (61). Racial paternalism is rooted in colonialist discourse (61) and situates whiteness as both normative and superior, thus charging whites interested in racial equality with the responsibility of saving blacks from their naturalized inferiority. Conversely, white guilt situates white people who are sympathetic to racial justice as victims of the shame and anguish that accompany acknowledgment of a racialized history of domination in which people with similar phenotypes acted as oppressors. Aanerud contends that white guilt becomes manifest as a construction of “a paralyzed and impotent self” (65), a self-perceived victim, incapable of enacting social change, suspended helplessly in apology. Finally, hyper-individualism is the conception of oneself as purely individual, ultimately untethered to—and unconstrained by—greater social forces. While individualism is the undergirding principle of liberal theory, in the context of white liberalism, staunch adherence to individualism allows the positioning of oneself “outside of racism” by denying “the ways in which racism is embedded in the very structure of our society” (60). Ultimately, the objective of white

liberalism, above all else, is to distance whites (who wish to designate themselves as antiracist) from white supremacy (60).

In a 1965 interview with James Mossman and Colin MacInnes, Baldwin bluntly stated his opinion of white liberalism by saying "I can't stand White Liberals. Obviously, I can't stand White Liberals ... What I resent is the assumption I must be raised to their level. It seems to me that the only way we can deal with each other as human beings or as social units is to understand that we have something to give to each other" (Mossman 51). Given Baldwin's disapproval of the paternalistic way in which white liberalism demands that people of color "must be raised" to the "level" of whiteness, it is curious that *Another Country*—Baldwin's social novel—is dominated by characters whose thoughts and actions reflect white liberal ideology.

If Rufus's death is the central action of the novel, and white liberalism is the dominant ideological framework that the novel employs, it is worth investigating the ways in which these two things may be related. In many ways, Rufus's sudden disappearance is the cataclysmic event that forces the remaining characters to finally confront white supremacy. The demands of that confrontation are great, especially for those who, by adhering to a white liberal ideology, have managed to psychologically distance themselves from white supremacy. By allowing his cast of mostly self-proclaimed white liberals to grapple with the traumatic death of a beloved black friend, Baldwin exposes the paradoxical nature of white liberalism. In that way, *Another Country* explores how white liberalism is not the antithesis of racism, but rather a less explicit manifestation of it. White liberalism renders people of color dually marginalized by white supremacy. Whereas people of color are disproportionately affected by explicit racism as a systemic form of oppression, white liberalism, because of its distancing, avoidance, and denial of racism, offers "those who

have enjoyed little power in our society no mechanisms for understanding and challenging the systemic nature of their oppression” (Guinier, Torres 144). This is the position that Rufus finds himself in at the end of his life, a predicament characterized by desperate alienation, a propensity toward violence, and eventually, an acceptance of death as a more desirable alternative to living in such profound incoherence.

Rufus, however, is not the only character in *Another Country* to experience the irreconcilability of extreme incoherence. In *On Making Sense: Queer Race Narratives of Intelligibility*, Martínez contends that the novel is characterized by “states of profound confusion and unacknowledged incoherence” and adds that these states are “previously undocumented in the racial and sexual discourse of the American mid-twentieth century” (3). Martínez argues that the incoherence displayed by Baldwin’s characters results from their inability to grapple with the incommensurability of multiple and intersecting identities. Further, Martínez claims that the stakes of experiencing incoherence are not equal for all of the novel’s characters. Therefore, white liberalism is an ideological force that further stratifies the novel’s characters despite the antiracist efforts of those who employ it. Although all of the primary characters in *Another Country* are touched by the effects of white supremacy, those whose identities allow them to psychologically distance themselves from the effects of racial inequality employ the framework of white liberalism to do so, leaving those who cannot use that framework to bear the burden of structural oppression alone.

Distance vs. Closeness

The most consistent model of white liberalism in the novel is Rufus’s Irish/Italian best friend, Daniel “Vivaldo” Moore. Despite his closeness with Rufus and his relationship with Rufus’s sister Ida shortly following Rufus’s death, Vivaldo is the character that is most unaware of and disil-

lusioned by his complicity with racism. In a scene in which Vivaldo is travelling with Cass by cab, he recounts his experience visiting Ida's home immediately after Rufus's death:

"When I went up there, the day she called me to say that Rufus was dead—I don't know—I walked through that block and I walked in that house and it all seemed—I don't know—*familiar*." He turned his pale, troubled face toward her but she felt that he was staring at the high, hard wall, which stood between himself and his past. "I don't just mean that I used to spend a lot of time in Harlem," and he looked away nervously, "I was hardly ever there in the daytime anyway. I mean, there were the same kids on the block that used to be on my block—they were colored but they were the same, really the same—and, hell, the hallways have the same stink, and everybody's, well, trying to make it but know they haven't got much of a chance. The same old women, the same old men—maybe they're a little more *alive*—and I walked into that house and they were just sitting there, Ida and her mother and her father, and there were some other people there, relatives, maybe, and friends. I don't know, no one really spoke to me except Ida and she didn't say much. And they all looked at me as though—well, as though I had *done* it—and, oh, I wanted so bad to take that girl in my arms and kiss that look off her face and make her know that I didn't do it, I wouldn't do it, whoever was doing it was doing it to me, too." He was crying, silently, and he bent forward, hiding his face with one long hand. "I know I failed him, but I loved him, too, and nobody there wanted to know that. I kept thinking, They're colored and I'm white but the same things have happened, really, the *same* things, and how can I make them know that?" (113)

This passage is characteristic of white liberal ideology in that Vivaldo exhibits all three of the behaviors that Rebecca Aanerud outlines. First, he wills ignorance in his insistence upon not only familiarity, but sameness between himself and Ida and her family. Vivaldo's "willful not-seeing" is

what George Shulman identifies as a “disclaiming of responsibility, which fundamentally corrupts American life” (107). It is an ignorance that is not altogether innocent. Instead, Vivaldo’s compulsive inclination to identify with Ida is an unconscious attempt to situate himself on the side of the color line that protects him from having to confront the fact that Rufus’s suicide was motivated by the effects of racial domination. Second, his guilt is palpable. In his essay, “White Man’s Guilt,” James Baldwin explains that “no curtain under heaven is heavier than that curtain of guilt and lies behind which white Americans hide” (412). The weight of Vivaldo’s guilt is notable in the line, “And they all looked at me as though—well, as though I had done it.” He continues, “I didn’t do it, I wouldn’t do it, whoever was doing it was doing it to me too.” Vivaldo’s defensive declaration of innocence emphasizes his individualism, and thus minimizes the impact of systemic forces. He fails to acknowledge that “the great force of history comes from the fact that we carry it within us, unconsciously controlled by it in many ways, and history is literally *present* in all that we do” (“Guilt” 410). Even Vivaldo’s insistence on being viewed strictly as an individual exposes his complicity with white supremacy, making him, in effect, Ida’s least productive ally, despite his affirmation that the pair is tasked with facing similar realities. Additionally, he embodies the missionary complex in his desire to swoop in and “kiss that look off of [Ida’s] face.” Here, he distances himself further from Ida by privileging the restorative power of heterosexual masculinity over the anguish of racial trauma. Finally, Vivaldo romanticizes the condition of Ida’s family, stating that they are “the same old men, the same old women—maybe they’re a little more *alive*,” as if black poverty is somehow more romantic than the poverty he experientially knows. Lastly, the “high, hard wall” that Cass perceives as standing between Vivaldo and his past is a direct allusion to the distance Vivaldo maintains between himself and white supremacy.

When Vivaldo finishes his account, Cass bluntly counters it with “but they didn’t ... happen to you *because* you were white. They just happened” (113). Although this statement shows tremendous insight into the stratifying nature of white supremacy, Cass and Vivaldo are both suspended in the same ideological web. In an earlier scene in the novel, Cass and Vivaldo venture from Cass’s comfortable home in Greenwich Village to Harlem to attend Rufus’ funeral. When the two arrive at the church, Cass realizes that she has forgotten to bring a garment to cover her head during the service, and she races to a nearby shop to right her faux pas. The scene that unfolds exposes her discomfort with confronting blackness as an anonymous entity, despite her affection for Rufus and Ida individually. As Cass walks through the unfamiliar streets of Harlem alone, seeking an open clothing store at high noon on a Saturday, a paralyzing realization strikes her:

For a moment she thought to stop one of the women—one of the women whose faces she watched as though they contained something it was necessary for her to learn—to ask directions. Then she realized that she was mysteriously afraid: afraid of these people, these streets, the chapel to which she must return. She forced herself to walk more slowly. She saw a store and entered it. (117)

In this moment of pause and panic, Cass’s fear is clearly racialized. Although Harlem is periodically described throughout as the novel as “violent” and “oppressive,” those descriptions are usually paired with darkness and the dangers that lurk within it. This outing takes place during the middle of the day, and there is no evidence of anything that threatens Cass. She is notably afraid not only of the streets, but also of the people who are both unknown to her and of color. When she stumbles into the shop, she becomes increasingly more uncomfortable. At this point, Baldwin strategically shifts the third person omniscient narration and vocalizes

it through Cass as she describes the shop girl in a disconcerting way: "The girl, whose smile had clearly been taught her by *masters*, looked as though she sold at least one hat every Saturday morning, to a strange, breathless white woman" (emphasis added, 118). In that way, Cass unnecessarily emphasizes her whiteness ("strange, breathless white woman") while noting that the black service girl wore a smile "masters" must have taught her. The black girl's service to Cass paired with Cass's unusual use of the word "master" conjures up an uncomfortable image of black servitude. Furthermore, when Cass asks for a "black" scarf, she is surprised by "how the word seemed to roll through the shop!" (118). Cass's exaggerated discomfort throughout this scene is exemplary of the kind of *distance* the white characters in the novel consistently maintain from confronting evidence of white supremacy, despite their close relationships with black individuals.

Clarity vs. Obscurity

With the critical importance white liberalism places on the need to situate oneself outside of white supremacy, it seems reasonable to question the degree to which things defined by white supremacy become obscured. As distance affects the visibility of a thing, white liberalism leads white advocates to distance themselves from white supremacy and the realities of people of color in the United States who are defined by white supremacy. White liberalism, therefore, makes the lived experiences of people of color incomprehensible to white liberals. Essentially, if white liberals are unwilling to look directly at white supremacy, they render themselves incapable of seeing people of color clearly and holistically. Therefore, a refusal to acknowledge the forces that define the lives of people of color in this country renders them, to varying degrees, invisible to white liberals.

Ten years before the publication of *Another Country*, Ralph Ellison explored this phenomenon of invisibility in his novel *Invisible Man*. In the

prologue of his text, Ellison boldly suggests that, "it's when you feel like this [invisible] that, out of resentment, you begin to bump people back. And, let me confess, you feel that way most of the time. You ache with the need to convince yourself that you do exist in the real world, that you're a part of all the sound and anguish, and you strike out with your fists, you curse and you swear to make them recognize you" (4). Violence reoccurs throughout the novel. Notably, it is a motif that Baldwin allows his black characters to utilize as a response to being rendered invisible.

As the only two African-American characters among their white liberal peers, both Rufus and Ida use violence to assert agency. While Rufus's propensity toward physical violence in his relationship with Leona is widely recognized and critiqued by other characters in the novel, Ida also engages in a kind of psychological violence in her relationship with Vivaldo. In a 1984 conversation with Audre Lorde about brutality committed against the black female body and the disempowerment of black men, Baldwin plainly asserts, "if you drive a man mad, you'll turn him into a beast," to which Lorde counters, "if you drive a woman insane, she will react like a beast too. There is a larger structure, a society with which we are in total and absolute war. We live in the mouth of a dragon" ("Revolutionary" 130). The sentiment that Baldwin and Lorde share in this dialogue is not that either of them advocate violence, but rather recognize it as a reasonable psychological response to a system that threatens to extinguish one's humanity. What both Baldwin and Lorde are primarily concerned with is causality. Later in the conversation, Baldwin states:

Something happens to the man who beats up a lady. Something happens to the man who beats up his grandmother. Something happens to the junkie. I know that very well. I walked the streets of Harlem; I grew up there, right? Now you know it is not the Black cat's fault who sees me and tries to mug me. I got to know that. It's his *responsibility* but it's not his *fault*. That's a nuance. ("Revolutionary" 130)

Baldwin's distinction between fault and responsibility is imperative to understanding violence as a response to oppression. By contending that fault lies elsewhere, but that a "Black cat" is still responsible for his actions, Baldwin neither sanctions violence nor ignores the social and structural forces that make it a viable locus of agency.

While Rufus and Leona "[fight] each other with their hands and their voices and then with their bodies" (53), Ida's brand of violence involves infidelity and subverting the fragile masculinity that Vivaldo desperately clings to as a symbol of his heterosexual identity and a repression of his queer desire. The ways in which Rufus and Ida empower themselves by assaulting their partners are both gendered and sexualized. Physical violence for Rufus works to the end of affirming his masculinity while Ida manipulates Vivaldo with her sexuality, emphasizing the way in which race, gender and sexuality are historically bound together.

While Vivaldo's political identity as a white liberal allows his complicity with white supremacy to remain unseen and unchecked throughout the novel, Baldwin uses the perspectives of other white characters (particularly white men) to exaggerate the failings of Vivaldo's "progressive" ideology. When Ellis, a powerful white colleague of Richard's, combatively asserts to Vivaldo that "art doesn't exist in a vacuum; it isn't just for you and your handful of friends," he is condemning Vivaldo's naiveté as a writer, but Baldwin allows the line to be imbued with a bitter sense of irony in which the reader could easily replace the word "art" with "blackness" and the line would expose more about Vivaldo than either he or Ellis is aware. Ellis's tongue-in-cheek allusion to Vivaldo's racial tokenism almost immediately follows a telling exchange between Richard and Vivaldo in which Richard questions Vivaldo's motivations for courting Ida, the only African-American present at his book release party: "You've always had a thing about colored girls, haven't you," and Vivaldo replies

that he's never been in a relationship with an African-American woman before Ida. Richard stingingly counters, "No. But you used to do a lot of tomcatting up in Harlem. And it's so logical, somehow, that you should be trying to make it with a colored girl now—you certainly scraped the bottom of the white barrel" (156). In addition to revealing Vivaldo's inability to acknowledge that Ida's race is something that he cannot simply will other people not to see, these passages also expose the way in which Ida's gender is racialized—even among her white liberal peers—and hence, socially positions her in a status lower than "the bottom of the white barrel." This perspective is one that Ida is aware of and uses retributively to her advantage by engaging in an affair with Ellis in order to dominate Vivaldo and subvert his masculinity. After failing to communicate the way that racial inequality disproportionately affects her in their relationship, Ida learns to turn sex into a currency of power that, unlike race, Vivaldo is capable of understanding. She abuses the power of sex to disempower Vivaldo.

Ida's act of translating race into something that Vivaldo can comprehend extends beyond sex. Throughout the novel, Ida cryptically insists that all Vivaldo has to do is "pay [his] dues" (277). Her preoccupation with repayment is a way in which she linguistically converts her experience of racial domination into a vernacular of currency. Her demand for retribution is not monetary, however, but rather a plea to be seen by Vivaldo, who genuinely believes that his avoidance of racism will safeguard him against contributing to it. The use of transactional language as a metaphor for racial reconciliation is one that Baldwin uses in *The Fire Next Time* by stating that "a bill is coming in that I fear America is not prepared to pay" (378); however, Ida's forceful insistence that Vivaldo make reparations manifests itself as an act of verbal coercion. Although Ida's discourse of indebtedness springs from her desperation to communicate her experience

to her partner, Vivaldo internalizes her demands as an incomprehensible litany of unearned abuse. This is evident in an exchange he shares with Eric toward the end of the novel in which Vivaldo asks if Eric, in his relationship with Rufus, experienced the same kind of pressure for repayment that he regularly confronts with Ida. Vivaldo asks, “Didn’t he try to make you pay?” To which Eric casually responds, “Ah. He didn’t *try*. I paid” (340). In this moment, Eric conveys an understanding that for both Rufus and Ida payment is not atonement for a personal wrongdoing, but rather a metaphor for an acknowledgement of the unjust experience of African-Americans who live under the inescapability of white supremacy. However, this paradigm shift cannot occur in Vivaldo, so long as he is locked within the ideological structure of white liberalism; and thus, Ida’s motivation for both infidelity and her insistence upon repayment remain obscured to him by his experience of these things as victimization.

Risk vs. Responsibility

While Vivaldo is the quintessential embodiment of white liberalism, his character serves another purpose. In her essay, “Another Look At Another Country: Reconciling Baldwin’s Racial and Sexual Politics,” Susan Feldman argues that “in cultures based on patriarchal heterosexuality[,] the surplus repression of same-sex desire clearly serves—as Baldwin shows in *Another Country*—as a foundational support for class, racial, and sexual hierarchies” (96). Although Vivaldo publically presents himself in the novel as uncomplicatedly heterosexual, he serves, in addition to his adherence to white liberalism, as an example of repressed queer desire in the text.

Feldman’s statement about the interdependence of racial and sexual hierarchies is most evident in a scene that takes place toward the end of the novel between Vivaldo and Eric. Shortly after Eric, a white, bisexual,

American expatriate, returns to New York, he and Vivaldo become briefly, but intimately, involved with one another. This is the first time in the novel that Vivaldo's queer desire becomes physically actualized. Abruptly, just before the two men become intimate, Vivaldo brings Rufus up in conversation. As he recounts the details of the last moments he and Rufus spent alone together, he tells Eric that he "had the weirdest feeling that [Rufus] wanted me to take him into my arms" (342), but Vivaldo is unable to bridge the distance between them. Moments later, he expresses remorse for refusing to physically comfort Rufus on the night of his death: "But, oh, Lord, when he died, I thought that maybe I could have saved him if I'd just reached out that quarter of an inch between us on that bed, and held him" (343). Vivaldo's compulsion to confess his guilt over Rufus's death just before he and Eric become physically intimate brings the unconscious connection Vivaldo makes between race and sexuality to light. Furthermore, the reference that Vivaldo makes to the "quarter of an inch" that separated him from Rufus on the night of his death mirrors the description of his proximity to Eric in the present: "Here Vivaldo sat, on Eric's bed. Not a quarter of an inch divided them" (344). That "quarter of an inch" signifies both a physical and a psychological space, a terrifying void that requires Vivaldo to take a tremendous psychological risk in order to transcend. For Vivaldo, the replication of a quarter inch chasm between himself and a thing he refuses to face represents simultaneously both his doctrine of racial avoidance and his repressed queer desire. Ultimately, Vivaldo is only able to take that psychological risk with Eric.

In his essay, "Baldwin and the Problem of Being," George Kent asserts that "sex, for Baldwin, is obviously a metaphor for the act of breaking one's isolation and, properly experienced, responsibly entering into the complexity of another human being" (22). Contrary to Feldman's assertion that sexual desire and identity categories are historically linked,

Kent paints desire as less social and more individualistic. In this regard, Vivaldo's decision to indulge his repressed (and socially concealed) sexual desire with Eric rather than directly confront the effects of white supremacy with Rufus is a more ideal option because it poses less of a social risk. Because Vivaldo's rendezvous with Eric takes place exclusively in the private sphere, the prospect of being physically intimate with Eric and transcending the distance between them does not threaten the framework with which he orders the world as a white liberal.

In addition to the great psychological risk necessary to transcend the chasm between what is safe and what is desired, perhaps the greatest threat to one's identity arises from the personal responsibility necessary to take that risk. Choice makes responsibility unavoidable. In an intimate conversation towards the end of the novel between Eric and Vivaldo about each man's respective sexual fluidity, Eric claims his uncertainty and utilizes it as a critical point of self-reflection. Conversely, Vivaldo refuses to acknowledge his desire for men as an extension of his identity. Instead, he insists that he "can have sexual relations with men as a favor to them, as an acknowledgement of their need for him, but not with any sense of being changed by the encounter" (Martínez, "Dying to Know" 68). Eric resists Vivaldo's objective approach to consummating his desires and sharply replies, "but if you went to bed with a guy just because he wanted you to, *you* wouldn't have to take any responsibility for it" (*Another Country* 337). Eric's insistence that Vivaldo take responsibility for both his desires and his actions reveals what Martínez refers to as "an embedded epistemological thesis" within the text:

In order to know even complicated things like desire, one needs to make decisions that, in one form or another, amount to sustained personal and social commitments—sustained lines of inquiry—that have a stronger purchase on one's life than one intends. ("Dying to Know" 68)

Vivaldo's willingness to indulge his queer desire while refusing to claim it as an identity is a replication of his eagerness to create and sustain intimate relationships with both Rufus and Ida, despite his aversion to confronting the ways in which his complicity with white supremacy negatively impact their lives. While Vivaldo's white liberal ideology allows him to distance himself from white supremacy while entertaining relationships with people of color, it also allows him to have sexual relations with men without viewing himself as queer. This cognitive dissonance enables him to separate his individual actions from social structures of power and exposes the fact that what he "comprehend[s] as being good for [himself] may in fact be good for the perpetuation of oppression" (68). Although Vivaldo views himself as a benevolent, progressively minded advocate for social equality, his liberal ideology ensures his complicity with systemic oppression by allowing him to recognize himself solely as an individual whose actions have no social or political significance. Therefore, in the midst of profound incoherence, he is capable of taking solace in the safety of passivity. However, in his allegiance to safety, Vivaldo's inaction has irrevocable consequences, which include his strained relationship with Ida and, ultimately, Rufus's death.

Conclusion

Although *Another Country* was published more than fifty years ago, the novel's preoccupation with how best to approach racial reconciliation amidst the profound incoherence produced by the systemic stratification of identity categories produces is still a legitimate concern for many Americans. As the rhetoric of having achieved a post-racial society becomes increasingly more common—both in popular culture and in politics—Baldwin's work remains as relevant as ever. In our current historical moment, when the universalization of difference is characteristic of a lib-

eral approach to social equality, it has become polite to claim colorblindness. Consequently, many Americans refuse to critically examine the ways in which structures of systemic oppression continue to disproportionately affect people of color. In a 1961 interview with Studs Terkel, Baldwin warns of the dangers present in being complicit in this kind of casual racism: "In a way, the American Negro is *the* key figure in this country; and if you don't face him, you will never face anything" (16). Although the highest stake of Vivaldo's unwillingness to emerge from the safety of his white liberal ideology in order to intimately engage with the way white supremacy affects people of color is Rufus's death, the lasting significance of *Another Country* lies in Baldwin's keen ability to depict the problematic ideologies that keep us "locked together in a kind of misunderstanding of each other" (Mossman 51)—ideologies that will continue to persist and perpetuate social inequality until we are finally bold enough to face one another.

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The State Effects of Subtle Physiological Arousal on Visual Working Memory Capacity: Sitting, Standing, and Cognition

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Sitting, Standing, and Cognition

While many studies examining the effects of physiological arousal on cognitive performance have sought to add to or modify existing theory, most inquiries in this field still rely heavily on derivative versions of the longstanding Yerkes-Dodson Law for the formulation of research questions and hypotheses (Chang, Labban, Gapin, & Etnier, 2012; Tomporowski, 2003). Yerkes and Dodson (1908) postulated that reaction time and accuracy on cognitive tasks should improve as physical arousal increases, then decline after an optimal level of arousal is surpassed. A plot of the relationship resembles an inverted “U” pattern that should be more linear with simpler tasks and lower rates of arousal. Although originally formulated and tested in the context of sensorimotor reaction times or long-term learning at near maximal levels of acute exertion, these principles have lately been employed as researchers have sought to assess more subtle, concurrent arousal effects on short-term memory and the more complex cognitive functions of working memory.

Working memory is a short-term, limited capacity memory system that

involves higher aspects of executive cognitive control of selective attention for filtering, focusing on, manipulating, maintaining, and synthesizing a limited amount of sensory information. Although working memory is clearly important for recent recall, its role extends to the broader issues of reasoning, problem solving, and eventual long-term learning (Baddeley, 2010; Cowan, 1998; Drew & Vogel, 2009). Conceptually, working memory is further divided into two subsystems. One subsystem, verbal working memory, utilizes long-term memory to encode and maintain items that can be verbalized. The verbal working memory subsystem has a limited capacity that may be as few as seven items (Miller, 1956). The second subsystem, visual working memory, maintains items that cannot be easily verbalized and has been found to have a capacity of only three to four items (Luck & Vogel, 1997). Subjectively, visual working memory corresponds to the metaphorical mind's eye, while verbal working memory represents one's inner voice.

The current study examines the effects of the subtle physiological arousal evoked by standing, as opposed to sitting, on concurrent visual working memory cognitive tasks. By beginning to establish the arousal threshold, researchers can find out how little arousal is required to affect cognition, and constrain theory in the ongoing study of acute and concurrent neurophysiological state effects of arousal on cognition and brain function.

Some studies have indicated that attentional energy resources are shared between motor tasks used to promote arousal through physical activity and concurrent cognitive tasks resulting in a decrease in some measures of cognitive function. For example, exercise kinesiologists Ohlinger, Horn, Berg, and Cox (2011) used a treadmill workstation to test the effects of walking on concurrent measures of verbal working memory and motor skill. They observed no significant difference in performance for the work-

ing memory tasks, while measures of motor skill declined significantly during the walking condition. In another experiment, ergonomic researchers Schraefel, Jay, and Andersen (2012) administered a battery of tasks designed to assess six different domains of cognitive function: complex attention, executive function, cognitive flexibility, psychomotor speed, reaction time, and processing speed. Subjects carried out the tasks first while sitting and again while standing. They found a significant decrease in complex attention measures during the standing condition but no significant differences between conditions for any of the other five cognitive domains.

More results have suggested that physiological arousal activates the sympathetic autonomous nervous system, increasing heart rate and blood pressure to supply more oxygen and nutrients to the brain while stimulating neuroelectric and neurochemical mechanisms, which induces a state of increased attention and alertness that may increase cognitive performance. Exercise kinesiologists Chang and Etnier (2009) found that acute resistance exercise had a significant positive effect on automatic and executive function processes, while fellow kinesiologists Hillman, Snook, and Jerome (2003) observed that acute cardiovascular exercise stimulates neuroelectric processes resulting in corresponding significantly higher measures of verbal working memory. Developmental psychologists Schaefer, Lövdén, Wiekharst, and Lindenburger (2010) used N-back tasks and a treadmill to assess cognition while sitting or walking at fixed and subject preferred speeds. They found that cognition was significantly better only at speeds that the subjects chose. Social psychologists Esmaeili, Karimi, Tabatabaie, Moradi, and Farahini (2011) used movies to evoke positive emotional arousal and observed that subjects primed in that way performed better than the controls on a self-designed, analog short-term memory task.

While there is some conceptual and theoretical agreement in this field of study, most research examining the effects of physiological arousal on

cognition has produced mixed, inconclusive results. These differences may be a result of the many varied perspectives and disciplines represented by the studies and the corresponding vast differences in experimental design, methodology, participant samples, task types and timing, exercise types, intensity, and duration, as well as the differing research questions and hypotheses that the experiments tested. Even with these many various viewpoints, contexts, and seemingly ambiguous results, several recent meta-analytic reviews of relevant research have concluded that as little as twenty minutes of low to moderate intensity acute or concurrent physiological arousal produces a significant but small positive effect on verbal working memory measures of cognition regardless of the diversity of methods used (Chang et al., 2012; Frazier & Mitra, 2006; Lambourne & Tomporowski, 2010; Tomporowski, 2003).

The current research examines the effects of standing versus sitting on visual working memory capacity (VWMC). Rather than rely, as previous studies have done, on verbal working memory tasks, which depend heavily on long-term memory (Luck & Vogel, 2013), we use estimated VWMC as a measure of cognition. The active maintenance of neural representations on which VWMC relies creates a profound bottleneck in short-term memory and therefore provides a more sensitive estimate of contemporaneous capacity than measures of verbal working memory (Luck & Vogel, 2013). This capacity-limited visual memory system exhibits more bottom-up, automatic, and trait-like characteristics than its verbal counterpart. Also, the three to four item capacity of VWMC has a complex relationship with higher cognitive functions, such as executive attentional control, and strongly correlates with measures of fluid general intelligence (Fukuda, Vogel, Mayr, & Awh, 2010; Luck & Vogel, 2013; Mance & Vogel, 2013).

Additionally the current research uses a counter-balanced, within-subjects, repeated-measures experimental design in which posture and arousal

are manipulated by having the participants stand in the experimental condition and sit in the baseline control condition while concurrently administering two computer-generated tasks to estimate VWMC. The results of this study were expected to support the hypothesis that there is an effect on cognition of the subtle neurophysiological arousal provided by standing so that predicted VWMC scores would be significantly higher for the experimental standing condition than for the sitting control condition. While individual studies on this topic show mixed results, these expected results are consistent with meta-analytic reviews and align with the theory and models of both cognitive neuroscience and neurophysiological arousal represented in the existing literature.

Methods

Participants

Twenty-nine young adults were recruited from the University of Oregon Human Subjects Pool to take part in this experiment. The data for two individuals were excluded because of self-reported brain trauma, leaving 27 participants ranging in age from 18-24 years ($M = 19.90$, $SD = 2.88$).

Materials

Participants completed two computer generated tasks to assess VWMC. Both tasks have consistently exhibited good to excellent validity and reliability with strong correlations to each other. The first task is a change detection task developed by Luck and Vogel (1997). In this task, participants are briefly presented with arrays of one to eight colored squares in various locations. Following a short period for retention, a single colored square “probe” then appears in one of the formerly occupied locations. Participants use keystrokes to indicate whether the color of the probe square has changed or remained the same, with one-half of the trials

actually containing a change. The second task is a whole report task that is currently being developed and rigorously tested by researchers in Vogel's cognitive neuroscience lab at the University of Oregon. In this task, arrays of six colored squares in various locations are briefly presented to participants. Following a short retention period, each square is then replaced by a square of the same size divided into a grid of eight smaller colored squares that represents all of the possible color choices. Participants use a mouse to select one of the smaller squares to indicate the color of the square that formerly occupied that location. Participants also receive instructions to "left click" to indicate that they are confident of their responses and "right click" to indicate that they are guessing.

Procedure

When participants arrived at the lab for their appointments, they received standard consent forms assuring them of the confidentiality of the proceedings and their right to withdraw from the study without penalty. Lab personnel outlined the basic procedures and potential risks and benefits involved in participation. Participants were escorted to either a stand-up computer station for the experimental condition or a standard sitting computer station for the control condition. They received detailed instructions and demonstrations of both tasks outlined above. Half of the participants began in the standing position, and the other half began in the sitting position, with each set of tasks lasting approximately 45 minutes. When participants completed the first set of tasks, they were ushered into another room to complete the same set of tasks in the complementary postural condition. After participants completed the second set of tasks, lab personnel led debriefing sessions that explained the background, design, purpose, and rationale of the study. At that time, participants were encouraged to ask questions or provide comments, and they were thanked

for their participation. Participants also received a written debriefing form that outlined all the information they had just received and provided contact information for the lab, Human Subject Pool and Research Compliance Services staff.

Results

Reaction time and accuracy aggregates from each task are recorded and averaged into a single VWMC score for each task, condition, and individual. A repeated measures, two-tailed Student's t-tests indicated that there were no significant differences in VWMC scores between the sitting condition ($M = 2.37$, $SD = .1.23$) and the standing condition ($M = 2.29$, $SD = .83$) using the change detection task, $t(26) = .582$, $p = .566$. Also, there were no significant differences in estimated VWMC between sitting ($M = 2.80$, $SD = .347$) and standing ($M = 2.80$, $SD = .47$) when using the whole report task, $t(26) = .053$, $p = .958$.

Discussion

The results of this study do not support the hypothesis that there is a significant effect on cognition arising from the subtle physiological arousal provided by standing as opposed to sitting. While these results may seem to add even more mixed results to an already ambiguous field of study, the validity and reliability of the methods and tasks employed align with the principles and models of both cognitive psychology and neurophysiological arousal provided in the current literature. Given the diverse perspectives and disciplines ranging from kinesiology and ergonomics to developmental, social, and sports psychology that have thus far been involved this area of study, as well as the mixed results and differing conclusions, it may seem that little real, cohesive progress is being made in this area of research. Yet, all of these studies contribute to and extend the body of knowledge in this field, and most have begun to incorporate

methods, techniques, and theory from cognitive psychology, a tendency that suggests a promising way to have more consistent results in this line of research. Through the ongoing examination of the connections and interplay between physiological and neurological systems, cognitive psychology and neuroscience offer a theoretical framework to constrain and focus inquiry into mind and body interactions and effects. That theoretical framework may provide important conceptual advantages. First, it could provide much needed organization, structure, and context to guide future formulation of pertinent research questions and hypotheses. Second, cognitive psychology and neuroscience could potentially promote more consistent methods tied to guiding central theories. Third, greater theoretical unity could lead to increasingly consistent, definitive, and usable results from future experiments on this topic by placing them within the context of a well-developed paradigm specifically devised to quantify, analyze, and assess cognitive function.

Therefore, this research team concludes that standing simply does not supply enough physiological arousal to produce significant differences in VWMC, and that future experiments should focus on higher levels of arousal to establish a baseline threshold. While this experiment did not produce significant results, it does indicate that there is no significant difference in the higher cognitive processes of working memory performance between sitting and standing. Also, this experiment provides an impetus for change in the technology and knowledge industries where many recent studies have indicated that prolonged occupational sitting is associated with deleterious long-term health outcomes independent of leisure time, physical activity, or overall level of fitness (Chomistek et al., 2013; Katzmarzyk, Church, Craig, & Bouchard, 2008; Seguin et al., 2014). Therefore, although we have been unable to establish a baseline threshold of physiological arousal effects on cognition to show that sedentary work-

ers can literally think faster on their feet, we have provided evidence that standing while performing mental work does not detract from cognitive performance.

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Alternative Splicing in the Cardiac Tissue of Myotonic Dystrophy Type 1 Patients

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Introduction

Myotonic dystrophy type 1 (DM1) is the most common form of adult-onset muscular dystrophy, affecting roughly 1/8000 people worldwide.¹ The disorder is an autosomal dominant RNA repeat disease caused by an expanded CTG repeat in the 3' untranslated region (UTR) of the DMPK gene¹ (Figure 1). Transcription of the mutant DMPK forms a toxic RNA that is sequestered in the nucleus.¹ The toxic RNA, in turn, forms foci that accumulate in the nucleus and sequester different splicing regulators away from their normal targets, causing widespread splicing misregulation.¹ The MBNL proteins 1, 2, and 3 have been identified as splicing regulators especially prone to sequestration in DM1.¹ In addition to these sequestered proteins, another splicing regulator, CUGBP1, part of the CELF family, is hyperphosphorylated as a result of the expression of the toxic RNA repeats. The hyperphosphorylation results in the stabilization of CUGBP1 and its presence at relatively higher levels in the tissues of DM1 patients. Together, the changes in the MBNL proteins and changes in the activities of the CELF protein family are thought to be the primary cause of the splic-

ing misregulation observed in DM1.² The missplicing creates many alternate protein products that may be either nonfunctional or vary from their normal function.² These proteins include INSR, which has been shown to cause insulin sensitivity in DM1 patients, and CLCN1, which has been shown to cause myotonia.³ Other proteins including TNNT2 have been shown to cause cardiac defects in the disease.⁴

Previous researchers have not studied DM-related splicing changes on a global level in the hearts of human patients.⁵ Instead, only a few missplicing events in cardiac muscle have been previously investigated, and not with the breadth that RNA-Seq on a transcriptome level could provide.⁵ Studying the transcriptome, therefore, could provide much useful information on the missplicing events that occur in the cardiac muscle of DM1 patients. This is important because cardiac abnormalities account for the second highest cause of death in DM1 patients.⁶

In this study we compared the splicing patterns in cardiac muscle between DM1 patients and healthy controls. Numerous alternative exons were found to be differentially included in DM1 patients as compared to healthy controls. To investigate the potential affects these splicing changes may have on heart function, we examined the ontology of the parent genes. Previous research has suggested that a small list of these parent genes may have a causative effect in dilated cardiomyopathy (DCM).⁷ These genes include TNNT2, TPM1, CAM2KD, TTN, VCL, MEF2D, LDB3, NEXN, OBSCN, SYN1, and PDLIM3.^{8,9} These findings are important because prior research has already observed DCM in DM1 patients, and DCM is associated with a high mortality rate.^{10,11} The missplicing of these genes may perhaps lead to the DCM observed in DM1 patients. This research may verify whether these genes are related to DCM and suggest additional avenues for future research.

Methods

The biological samples used in this study were previously taken by Tom Cooper, a lab collaborator at the Baylor College of Medicine, and then sequenced by Eric Want at the Massachusetts Institute of Technology using RNA-Seq. Total RNA was depleted of ribosomal RNA following the manufacturer's protocol and then prepared according to the manufacturer's protocol.¹² The resulting paired-end RNA-sequencing libraries were sequenced on an Illumina HiSeq 2000 to yield roughly 100 million 2 X 60bp reads per library. The number of samples totaled 12, all taken from the cardiac muscle of recently deceased people. Nine of these people were previously identified with DM1, and three were identified as not having DM1. The data that was used came in the form of raw sequencing data with a list noting which tags belonged to which sample. Library quality was verified using FastQC.¹³ Next, the sequencing reads were compared to the human reference genome (version hg19) using GSNAP.¹⁴ Isoform abundances were estimated, and each of the nine DM1 samples was compared to each of the three control samples using MISO (version 0.4.9).¹⁵ A custom set of *hg19* alternative event annotations were generated from the Refseq, Ensembl, and UCSC gene models using custom scripts (available by request). For this analysis we focused only on the differential inclusion and exclusion of "cassette" exons between the DM1 and control samples.

The data were processed using multiple scripts in the graphic interface R Studio®, and the splicing events were organized based on whether the samples were from DM1 patients or from the controls. Following that step, one of the outputs from MISO, the percent spliced in (PSI), was averaged with a standard deviations of the grouped DM1 patients and the grouped controls. The averages of the PSI for the DM1 patients were subtracted from the controls for each splicing event. That result is referred to as the delta PSI and was the secondary factor for ranking the significance of each

event. The primary factor for ranking the significance of each event was another MISO output, the Bayes factor, which is a MISO measure of the confidence that the splicing events were actually observed in the samples. For example, a Bayes factor greater than five was considered to be significant. The comparison data was then filtered based on the criteria described below to identify misregulated splicing events.

Filtering criteria:

- At least $\frac{2}{3}$ of the controls and DM1 samples had their PSI values retained for that event.
- The absolute value of the mean delta PSI for each DM1 sample and each control is greater than 0.05 (i.e., $|\overline{\Delta\psi}| \geq 0.05$).
- At least $\frac{1}{4}$ of DM1 patients showed sufficient evidence of differential splicing compared to the controls (median Bayes factor ≥ 5).

The parent genes of the filter splicing events were then matched to the ontology terms with which they were associated and subdivided into new lists based on terms related to their function. These functional terms included contraction, heart, muscle, heart contraction, and muscle contraction. Next, we searched Pubmed for information about genes included in the “heart contraction” and “muscle contraction” lists to see if those genes were related to any known diseases of the heart. Finally, a search of the significant event list used a list of genes previously found to be related to DCM to see if any of the genes were found on both lists.

Results

Using MISO, we quantified a total of more than 35,878 unique splicing events from all of our samples. The PSI values for each event were averaged for each group of samples and ranked by the number of comparisons between DM and control individuals if the Bayes factor was five or greater. After applying our filtering criteria, we found that 583 cassette

exons showed evidence of differential inclusion in heart tissue derived from DM1 patients relative to healthy control tissues. Of the parent genes for these events, four were associated with the term “heart contraction,” 26 with the term “muscle contraction,” 31 with the term “heart,” 31 with the term “contraction,” and 125 with the term “muscle.” Three of the four genes associated with the term “heart contraction” were previously found to be associated with heart conditions (Figure 1). These genes included TNNT2, TPM1, and CAMK2D. Of the heart-related genes for which we searched on Pubmed, five genes of the 26 events related to the term “muscle contraction” were shown in previous research to be related to some kind of health condition of the heart. These genes included TNNT2, TPM1,¹⁶ CAMK2D,⁹ TTN,¹⁷ and VCL.⁷ By using the term “heart,” we found one additional gene—MEF2D^{18,19}—that previous research has seen as related to health conditions of the heart. We also found other genes in our list of 583 events that have been shown to be implicated in causing DCM.⁷ These genes included LDB3, NEXN, OBSCN, and SYN1. With further research we also found one additional gene, PDLIM3,²⁰ to be related to DCM. This gave a total of 10 genes from 26 events from the list of 583 significant alternative splicing events that have been shown to be causative factors for DCM. The roles that each gene contributes to DCM are shown in Figure 1. A diagram of the roles of TNNT2, TTN, TPM1, LDB3, NEXN, VCL and OBSCN in the sarcomere is shown in Figure 2.

Discussion

The results showed that the ratio of mRNA splice isoforms is different in DM1 patients than in unaffected, healthy individuals. Altogether we identified 583 cassette exon events that passed our stringent cutoff guidelines and warranted study. We need to perform qRT-PCR to confirm that the splicing events are indeed observed at the rate seen in our study. Of

GENE	Protein	Protein Contribution to DCM	Heart Related Illness
TNNT2	Troponin T type 2 ²⁷	Sarcomere ²⁷	Dilated Cardiomyopathy, other cardiomyopathies ²⁷
TPM1	Tropomyosin 1 ²⁷	Sarcomere ²⁷	Dilated Cardiomyopathy, other cardiomyopathies ²⁷
TTN	Titin ²⁷	Sarcomere ²⁷	Dilated Cardiomyopathy, other cardiomyopathies ²⁷
VCL	Vinculin ²⁷	Z-disk ²⁷	Dilated Cardiomyopathy, other cardiomyopathies ²⁷
MEF2D	Myocyte Enhancer Factor 2D ¹⁸	Transcription enhancer ¹⁸	Stress dependent remodeling of heart ¹⁸
LDB3	LIM domain binding 3 ²⁷	Z-disk ²⁷	Dilated Cardiomyopathy, other cardiomyopathies ²⁷
NEXN	Nexilin (F actin-binding protein) ²⁷	Z-disk ²⁷	Dilated Cardiomyopathy, other cardiomyopathies ²⁷
OBSCN	Obscurin, Cytoskeletal Calmodulin And Titin-Interacting RhoGE ⁷	Protein Kinase ⁷	Dilated Cardiomyopathy ⁷
SYN1	Synapsin 1 ⁷	Nuclear membrane ⁷	Dilated Cardiomyopathy ⁷
PDLIM3	PDZ and LIM domain 3 ²⁷	Cytoskeleton ²⁷	Dilated Cardiomyopathy ²⁷
CAM2KD	Calcium/Calmodulin-Dependent Protein Kinase Type II Delta Chain ⁹	Protein Kinase ⁹	Dilated Cardiomyopathy ⁹

Figure 1: Table of Genes Found in DCM and DM1.

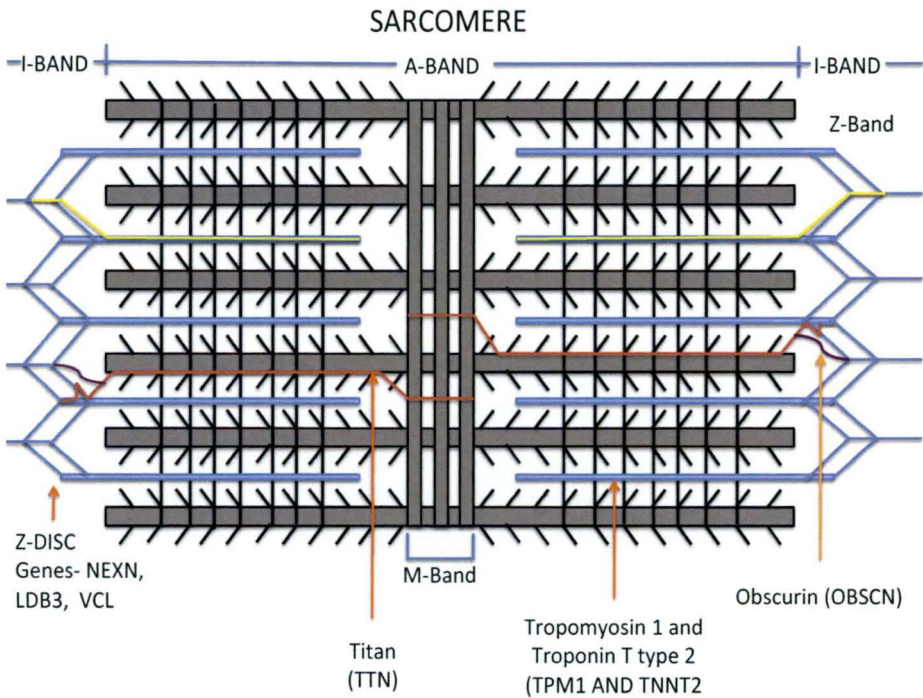


Figure 2: Genes and Role in Sarcomere. The genes NEXN, LDB3, and VCL make up proteins that are part of the Z-disc. Titan is a large protein that helps anchor the M-Band, A-Band, and I-Band together. Obscurin helps anchor Titan to the Z-band. Tropomyosin 1 is a coiled protein and helps regulate contraction. Troponin T type 2 helps regulate calcium.

these 583 alternate splicing events, we found that many were from genes related to vital functions of the heart with the most important and descriptive terms being “muscle contraction,” “heart,” and “heart contraction.” Of all the genes on both lists, we found six that previous researchers found to be related to significant health conditions of the heart. We also found an additional seven genes of the 583 significant splicing events that have been shown to have mutations that can cause DCM. This gives a total of

10 genes that have been shown to have a causative effect in DCM and, based on this study, show a significant likelihood of being misspliced. Because MBNL is important in development and regulates the transition from fetal to adult isoforms, the genes seen in this study could be reverting to their fetal isoforms. If this is occurring, the protein products of these isoforms may not be able to function properly, thereby leading to DCM. This potential is important because DCM commonly causes heart failure and sudden cardiac death.²¹ This finding is of even greater importance in DM1 because the second leading cause of death in DM1 patients relates to cardiac abnormalities.

Dilated cardiomyopathy has been observed in DM1 patients before.¹⁰ In one case study that examined the autopsies of 12 DM1 patients, 25% of patients had obvious signs of DCM.²⁴ Although the degree of prevalence of DCM in DM1 patients is not yet known, one of the largest cross sectional studies of heart-related illnesses in DM1 patients found that structural abnormalities were present in the form of left ventricular systolic dysfunction (20.6%) and reduced global longitudinal strain (21.7%).²⁵ Both abnormalities are signs of DCM,^{26,27} although DCM was not specifically examined in that cross sectional study. The missplicing of MEF2D, a transcription factor that has been shown to mediate stress dependent remodeling in the heart,¹⁸ could possibly add to the effect of DCM in DM1. If the missplicing of the MEF2D gene inhibits this protein's function, then it will be unable to mediate the stress caused by DCM, which could lead to more severe clinical effects of DCM.

Most of the genes found in relation to DCM and the genes found in this study have some function in the sarcomere of muscle⁷ (Figure 2). In past studies of the genes in DCM, researchers observed mutations that inhibited the proper functions related to muscle contraction.⁷ Given the large number of mutations that contribute to DCM, the pathophysiology is

complex and not completely understood.²⁶ Many mutations have been observed in genes that directly contribute to DCM through truncations of the protein product.²⁷ The most investigated genes include TTN, TNNT2, and TPM1.⁷ In both TTN and TNNT2, some of the mutations that contribute to DCM include mutations that cause missplicing.²⁸ Therefore, it would be possible for missplicing in at least two of these genes to lead to DCM. Whether the same missplicing events seen in DM1 can contribute to the same missplicing seen in these genes in some cases of DCM requires future study.

The results of this research suggest many possible areas of future research. For example, researchers could investigate the functional role of the 10 genes misspliced in DM1 that are also implicated in other heart conditions. To do so, it would be important to confirm these splicing events using qRT-PCR. It could also prove useful for future studies to see if any other kinds of splicing events could contribute to DCM as our study examined only one kind of missplicing event. It will also be important to study the functions of the aberrant isoforms expressed as a result of the missplicing in DM1 to understand the consequences of this misregulation. All of the genes under study were shown to have at least one of these events, and many had far more. If the function of these genes is inhibited in the same way as the mutations seen in these genes in DCM, the malfunction of those genes could perhaps cause DCM. We will have to test these genes to see if the observed alternative splicing events could mimic these mutations and if the rates of alternative splicing are significant enough to do so as well. By completing these tests, we may actually be able to see if any of these genes with the splicing seen in DM1 are responsible for DCM in DM1 patients and perhaps their premature death.

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