

# THE UNDERGRADUATE JOURNAL OF PSYCHOLOGY

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# Effects of Music Preferences on Young Adults

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**Abstract--***College-aged students (19-21) were surveyed using a depression inventory, a positive and negative affect questionnaire, a sensation-seeking questionnaire, and a music-listening preference scale to determine if music preferences are associated with depression and if everyday exposure to preferred music relates to ongoing moods. Participants were asked how many hours on average they listen to certain types of music and how many various types of music they listen to. Previous research suggests that moods can be induced and music is likely to influence persistent moods. Results supported the hypothesis that music has an effect on mood. Findings can be used to advise clinicians treating college aged students to look at their preferences in music when treating them for depression. Results can also be used to warn parents and make them aware of the effects that their children may have because of the type of music they listen to.*

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Music has long been thought to have an effect on mood, personality, and even actions of the listener. In 1989, specific genres of music such as heavy metal and rap were being examined under a microscope and came under heavy criticism. Around the same time, the Parents Music Resource Center (PMRC) was developed to warn parents about the dangers of music their children listen to. Members of the association asserted that the lyrical content of some music styles promoted a wide variety of undesirable behaviors including drug use, promiscuity, and even Satan worship (Arnett, 1991). The purpose of this study was to examine whether certain moods, such as depression, are linked to listening to certain genres of music within a college-level age group.

Burge and Lester (2001) conducted a study to examine music preferences and suicidal ideation in high school students. High school seniors completed a survey that included a hopelessness scale, a religiosity scale, a suicidal ideation scale, a manic-depressive tendencies scale, and a reasons for living scale. The only significant results occurred for current suicidal ideation by depressive tendencies. Symptoms of

manic-depression were not significant. Suicide was most closely related to heavy metal, classic rock, alternative, and punk rock music as opposed to light rock, folk, and gospel music. Music preference is related to mood changes, negative affect, and possibly suicidal ideation.

The relationship between music and high-risk behaviors has also been studied. For example, Arnett (1991) also studied the frequency of participation in reckless behavior among adolescents who listen to heavy metal music, using a large sample. Researchers used the Zuckerman Sensation Seeking Scale to measure the degree and variety of activities preferred by an individual. Male participants scored higher than female participants in sensation seeking at every age measured. Boys who listened to heavy metal music were higher in sensation seeking in only a few distinctive behaviors, such as driving while intoxicated, smoking marijuana, and using cocaine. However, boys who listened to heavy metal music scored higher on sensation seeking overall than the boys who did not listen to heavy metal music. Girls who listened to heavy metal music also scored higher on sensation seeking than girls who did not listen to heavy metal music. Both groups of participants who reported listening to heavy metal music also reported being more self-assured with regard to dating and sexual behaviors. This study suggests that listening to heavy metal rock music is related to high sensation seeking.

While music may affect suicidal ideation and other actions, it also appears to directly induce certain moods. Velten (1968) induced depressive moods by suggesting that participants try to feel the mood suggested by statements written on cards. He was successful in inducing the moods of both elation and depression by the statements. Mood was also altered in a study done by Bates, Thompson, and Flanagan (1999). Though the study was intended to measure the differences, if any, that exist between groups of more than two people, and individual induction of mood, both groups (individual and group) were found to be effective in bringing about increased levels of sadness, measured with the Beck Depression Inventory (BDI). Participants

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in this study were asked to read statements aloud, or to themselves, and then try to feel the mood suggested in the statement. The mood induction procedures used in this study were effective in inducing depressive moods and increased sadness. This study clearly shows that mood can in fact, be altered simply by reading statements.

Music has also been used as a tool to induce feelings (Ballard & Coates, 1995). These authors had male participants listen to heavy metal and rap songs under the guise of taking a memory for lyrics test. The BDI, an Adult Suicidal Ideation Questionnaire, and a State-Trait Anger Expression Inventory were then used to measure mood. Ballard and Coates found that rap elicited more feelings of anger and surprisingly, listeners of heavy metal showed a calmer release of emotion, suggesting that heavy metal has a cathartic emotional effect. These results may contradict the earlier studies because the music genre is becoming more popular and socially accepted.

Another example of a mood-related study is Field, et al.'s study (1998), who measured depression and stress. Participants listened to a selection of songs, received an EEG, and then took a BDI and a Depression Adjective Checklist. Participants in this study were chronically, but not clinically, depressed and listened to a selection of upbeat or inspirational songs. The data suggest that the effects of music moved in the direction of less depressive and less anxious moods post session. This study shows that mood can be altered either way, to make a person more depressed, as seen previously, or less depressed.

In addition to mood induction, the effect of music on persistent mood has also been studied. Persistent mood is defined as an ongoing state to the individual. Stratton and Zalanowski (1997) explored how everyday music-listening preferences and exposure were related to overall persisting moods by self-reported questionnaires. They studied three age groups and found that negative emotions were related to higher levels of listening to rock music in the college-aged participants than those who did not listen to rock music; no other genre was taken into consideration because rock was the dominant genre students reported listening to. Results were based on answers drawn from two questionnaires. Negative emotions were seen in classical music listeners for the college staff but no correlation was found between music type and emotions in non-college affiliated participants. Perhaps music is more powerful in inducing moods while participants are younger.

In summary, previous research suggests that positive and negative short-term moods can be induced by music. This study proposed to replicate part of Stratton and Zalanowski's (1997) study and projected to see the same in a college age population. Their strongest affiliations were shown with college-aged students. Based on several studies, findings were expected to project strong correlations between certain types of music (e.g. rock) and depression and long-term mood.

Taken together, the above studies indicate that music preference has an effect on mood and action. But this is specific to the type of music listened to. The first hypothesis was to replicate this finding in a college student population. In other words, it was predicted that specific music preferences on the harder rock side of the spectrum are associated with depression among college-aged students. This effect, previously found in high school students, and postulated to occur in college-aged students, is thought to remain the same because even though environment and social circles may change, attitudes toward music would not change dramatically. If any changes would occur in college-aged individuals, opinion of music would become stronger; therefore, individuals may be blinded that they are receiving negative effects. There was also a proposed focus in this study on depression rather than sensation seeking or destructive behaviors.

The results of this study are expected to substantiate previous findings that music listened to on a daily basis is related to persistent moods. This will be equally important, as college students are not often tested in mood and music studies. The results of this study are expected to show a clear relationship between genres of music and feelings of depression. This study is important because depression is prevalent in college students and if there is a link between depression and the music they listen to, this may be addressed and treated properly.

## METHOD

### *Participants*

Thirty-nine undergraduates at Queens University in Charlotte, NC were recruited for the study. There were 14 men and 25 women. They ranged from ages 18 to 22. Participants were mostly white, but minorities were also represented. Participants were representative of the college population.

### *Materials*

Participants were asked to estimate the number

of hours per week they listen to the various music genres. A pre-test group generated the list of genres and examples were given to ensure recognition of genres. A space for “other” was included to be sure that all music genres were represented. Mood was assessed using the Multiple Affect Adjective Checklist – Revised (c.f. Stratton & Zalanowski, 1997). This form measures five moods: anxiety, depression, hostility, positive affect, and sensation seeking. Participants rated 25 items on a 7-point Likert-type scale.

*Procedure*

Participants were recruited on a volunteer basis from around campus. All participants were given the questionnaires on two separate days. Both sessions were seated paper and pencil sessions and one was a formal classroom setting. They were given the surveys and asked to complete them in any order, to mix up the order and cut down on fatigue confounds that may have arisen across the group.

In order to collapse the 22 genres, several students were asked to place the genres into groups they felt fit together. These groupings were combined to form six groups of genres: light, classical, ethnic, hard, popular, and eclectic (which was reserved for any participant who was evenly distributed among the other genres). These groups were used in the final analysis.

*Results*

To test the hypotheses, several ANOVA’s were conducted to compare the music categories across several dependent variables: depression, positive and negative affect, and sensation seeking. There were no significant differences among genres for any of the dependent variables.

For sensation seeking, there was no significant difference among the music genre groups,  $F(3,34) = .31, p = .82$ .

The ANOVA for positive affect was  $F(3,33) = .42, p = .74$ . Negative affect was not significant among the music genres either,  $F(3,33) = .47, p = .71$ .

Depression showed no significant difference among the music genre groups,  $F(3,34) = 1.48, p = .24$ .

The means for each dependent variable compared to each music category can be seen in Table 1.

Interestingly, eclectic and hard music categories showed a significant difference in post hoc tests. However, since the overall ANOVA was not significant, this comparison can only provide guidance for future research.

**DISCUSSION**

Neither of the hypotheses were supported by the data. However, there are trends to show that some music preferences may be positively correlated with depressed moods.

The results neither support nor dispute previous research done on the topic. Literature on the subject sustains the fact that music preferences are correlated with depression in adolescents and older adults, and this study shows that the college aged students stand out in the fact that they are not equally as affected by music as adults are. Results for college aged students are closer to the previous studies that reflect relationships between depression and heavy metal music in adolescents. The literature also maintains that music preferences can have an extending effect on persistent mood, and this was not found in this study.

I feel that the college population may stand out on this subject because they are literally isolated in a

**Table 1**

*Means of Genres by Dependent Variables*

Dependent Variables	Light		Popular		Hard		Eclectic	
	<u>M</u>	<u>SD</u>	<u>M</u>	<u>SD</u>	<u>M</u>	<u>SD</u>	<u>M</u>	<u>SD</u>
Sensation Seeking	7.4	4	6.8	1.8	6.7	2.3	7.5	2.2
Positive Affect	37	7.1	33.9	4.5	34.7	4.6	34.9	4.7
Negative Affect	16	4.7	19.9	8.3	17.5	4.8	18	5.9
Depression	6.8	5.2	6.8	4.8	4.8	3.8	8.3	3.6

smaller communal version of the world. College is a place where high-level education takes place and because of that, students are naturally more intelligent and driven to think critically about media they consume than those who have not attended college. Because of this, students may be able to recognize and have more control over their feelings concerning and stemming from musical preferences than the general public.

The data may have been confounded because of the combining that had to be done to score the music preferences. Genres were combined into categories according to a pilot study done with some students who also attend Queens University of Charlotte. This was mentioned above and revealed six categories. A lot of error may have occurred when participants were placed in categories due to estimation, because of the amount of different genres they labeled.

I feel further research should better specify a conformed way to measure the amount of music participants listen to. Perhaps keeping a daily journal of the type of music, length of time, and the mood that they were feeling would yield more valid results. The way the participants were asked to report the amount of music they listen to could have taken too much strain because I asked for a weeks worth of music listening.

Since the second hypothesis on music affecting persistent mood was not supported, more research would be needed to support long-term effects on college students' moods. Censorship committees may take this into consideration when filtering material. It may be that only the younger listeners need to listen to filtered material based on previous research and this study shows that there would be no effect on older listeners.

In essence, the results imply that the college student age group mood is unaffected by music preferences. This finding could be used in an argument defending the rights of a music artist, especially when our society is prone to place blame on celebrity influence when individuals take destructive actions. However, it is recommended that further research with larger sample sizes be done to support the null for this age group, especially because previous literature does not support this finding.

Also, because of the trends observed that correlate depressive moods with listening to a large amount and many different kinds of music, this may be used as a tool to address feelings of sadness in college aged individuals in treatment. I would most recommend it as a gateway to conversation though, because it has not been supported.

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# The Negative Effects of Alzheimer's Disease on Caregivers and Their Remedies

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**Abstract**--*As the prevalence of Alzheimer's Disease continues to increase, the number of people being seriously affected by it is spreading to a group of individuals who have been largely overlooked. The caregivers of those suffering from this disease suffer themselves from psychological distress, physical illness, and economic strain and are not given the proper support needed in order to better their quality of life. In order to continue to enhance the daily lives of those who have Alzheimer's Disease, we must get to the root of their care and find more beneficial ways of assisting their caregivers. Through an analysis of the negative effects on Alzheimer's Disease caregivers and their remedies, the lives of everyone affected by this disease can be substantially improved.*

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Due to the severity of the ways Alzheimer's Disease manifests itself, including cognitive impairment, noncognitive features, and difficulties associated with activities of daily living, an extremely heavy demand is placed on the individuals who care for those with the disease. Alzheimer's caregivers are confronted with a large scope of problems as they venture into the caregiving role (Tarrier, Barrowclough, Ward, Donaldson, Burns, & Gregg, 2002). The majority of the problems they encounter fall primarily into three different categories: psychological distress, physical illness, and economic strain (Pillemer, 2002). Since these categories include a multitude of deep, impacting, and ongoing problems, it is not difficult to see why caregiving continues to be considered a main issue among gerontological researchers in the United States (Schulz & Williamson, 1991). However, in the midst of the array of negative effects on Alzheimer's caregivers, beneficial and noteworthy remedies still exist. Although Alzheimer's Disease essentially spirals downward as the individual's life progresses, the negative effects on Alzheimer's caregivers have the potential to be minimized.

Throughout research Alzheimer's caregivers are characterized as being highly susceptible to a variety of negative effects. The first group of effects to be discussed is psychological distress. The psychological distress that Alzheimer's caregivers experience can be not only long in duration, but also incredibly debilitating as well. The main forms of negative psychological distress that caregivers experience deserve much attention and will be focused upon for a portion of this paper, preceding the main elements of physical illness and the main causes of economic strain that caregivers are highly predisposed to as well.

To begin with, depression is a commonly recognized negative effect that Alzheimer's caregivers experience at a significantly higher rate of prevalence than the non-caregiving population at large (Kanel, Dimsdale, Patterson, & Grant, 2003a). It has actually been discovered in descriptive and intervention studies of dementia caregiving, that depression is one of the highest indicators of distress among caregivers (Schulz, Belle, Gitlin, Czaja, & Wisniewski, 2003). Research indicates many predictors of depression among Alzheimer's caregivers, including behavioral disturbances and especially aggressive behavior in persons with Alzheimer's Disease (Danahauer, Beckett, McCann, Gilley, Bienias, & Evans, 2004), a large number of patient problems, lack of social support (Schulz, 1991), and a strong relationship with the person with Alzheimer's Disease (Zanetti, Frisoni, Bianchetti, Tamanza, Cigoli, & Trabucchi, 1998). Behavioral disturbances in the persons with Alzheimer's Disease include a full range of difficult behaviors, such as changes in mood or expression, behaviors associated with cognitive decline, irritating behaviors, psychiatric behaviors, repetitive behaviors, and verbally and physically aggressive behaviors (Farran, Loukissa, Perraud, & Paun, 2003). Aggressive behavior actually "emerged as the strongest predictor of caregiver depression in a recent cross-sectional study" (Danahauer, 2004, p.199).

Research has also found that men are much more likely to have a higher increase in depression, once

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their role as a caregiver begins, than women (Schulz & Williamson, 1991). This may be due to their lack of experience as any type of caregiver, as females are more typically placed in this type of role with their children instead of males. This also may have to do with the fact that, overall, females tend to be much more nurturing by nature than males, which may account for males feeling awkward or uncomfortable when first transitioning into the role as primary caregiver. With this being said, the overall rate of depression almost always increases in Alzheimer's caregivers once the caregiving has begun, no matter what the individual's gender is. This is due to the enormous life-change that the caregiver will face as they continue to provide care to an Alzheimer's patient. Depression may exist in the caregiver before they begin providing care. Research suggests that there is a high positive correlation with simply providing care for an individual with Alzheimer's Disease and depression (Schulz & Williamson, 1991). A normally functioning individual before they take on the role as caregiver will most likely experience depression as his/her role progresses. Although the rates of depression are high in Alzheimer's caregivers, a study performed by Schulz & Williamson (1991) found these rates of depression to actually stabilize over time, due to the increasing ability of the caregivers to cope effectively with the demands over time.

An increase in the amount of stress that caregivers of those with dementia experience is well documented, making stress another main form of psychological distress (Tarrier, 2002). One reason caring for a person with Alzheimer's Disease is a chronic stressor is because the recipient of care generally lives about eight to ten years after initial diagnosis (Farran, 2003).

Pillemer's study (2002) attempted to prove that social support buffers against stressful conditions and chronic psychological distress, however the findings suggest that nearly any kind of social support alone is unable to reduce any long-term effects of stress. Another study found respite support services to contribute a great deal to decreasing the amounts of stress in the primary caregiver of an Alzheimer's Disease patient (Grant, McKibbin, Taylor, Mills, Dimsdale, Ziegler, & Patterson, 2003).

Other psychological distressors include dysfunctional thoughts, coping problems, loss and grief difficulties, fear, and acting out of character (Farran, 2003). These are often the resulting product of either depression or stress in the caregiver – most times even a combination of the two. These sorts of problems are often cyclical, making it difficult to determine what the

specific cause is and what the effects of that cause are. I believe that it is quite a task for professionals to fully help Alzheimer's Disease caregivers due to the ambiguity that lies within the cause/effect relationships of the experienced psychological distress – as it is with many other individuals suffering from psychological problems, not only Alzheimer's caregivers. With this said, take a moment to think about how difficult it must be for the actual caregiver to cope with the different types of psychological distress. In doing this, one is able to capture at least a tiny glimpse into the tormented psyche of an Alzheimer's caregiver. Another disturbing element of this is as the patient transitions into the terminal phase, the psychological distress becomes more intense for the caregiver, also described by family members as a "living funeral" (Cohen, 2003).

In addition to psychological distress, an array of physical illnesses occur among Alzheimer's Disease caregivers as well (Zanetti, 1998). This leads to the second category of main negative effects that Alzheimer's caregivers experience - physical illness (Pillemer, 2002). Physical illness in caregivers is due to numerous things, including lack of pleasant activities, no relaxation, the result of the psychological stressors taking a toll on the physical body, and the physical strength it takes to care for someone who has Alzheimer's Disease. Zanetti's study (1998) supports the claim that many Alzheimer's caregivers experience negative health effects.

A main form of physical distress that plagues caregivers and deserves some focus for a moment is the physical strength it takes to care for someone suffering from Alzheimer's Disease, due to the fact that as the disease progresses, the caregiver takes on more tasks to help the individual with activities of daily living. Such activities may include lifting the person out of chairs/their bed, helping them go to the bathroom, and bathing them, which requires the use of a lot of physical strength on the part of the caregiver. The majority of Alzheimer's Disease caregivers nationwide are females who are related to the patient – usually either the wives or daughters of the person with Alzheimer's Disease. This has been shown to be the case across countless studies, including one conducted by Farran (2003). In a study by Farran (2003), the participating caregivers were found to be seventy-nine years old on average. With this in mind, it is quite clear why physical illness plays an extremely large role in the overall negative effects on caregivers. With the caregiver's health ultimately declining anyway, due to increasing age, the additional amount of physical labor it takes to be the primary caregiver of a person with

this disease only causes the amount of physical illness to rise.

It is well-recognized that persons with Alzheimer's Disease suffer an overall declining ability to perform activities of daily living (ADL's), as aforementioned (Tarrier, 2002). Many of these activities include things that are necessary to be carried on despite the patient's inability to perform them. These activities require much effort if the person performing them is not the recipient of care. With females generally being shorter, less heavy, and weaker than males, it is obvious how being in charge of performing these tasks, for a male patient especially, would be physically draining.

The third category of main negative effects that Alzheimer's Disease caregivers experience is economic strain (Pillemer, 2002). This is such an enormous concern for caregivers, especially due to lack of support and the caregiving role taking place of, and actually becoming, a full-time job in itself. In fact, caregiver's personal resources have been found to be a powerful predictor of depressive symptoms – as a caregiver's financial resources decline, due to a decrease in the amount of money he/she makes or a decrease in the amount of financial assistance received elsewhere, his/her level of depression will most likely increase (Zanetti, 1998).

A gradual decrease in functioning for Alzheimer's Disease caregivers can be minimized as much as possible. To begin with, education has an enormous amount of power to help in almost any problem situation. Competence as a caregiver has been shown to decrease carer burden in each of the three main categories – psychological distress, physical illness, and economic strain (Zanetti, 1998). Being knowledgeable about the resources that are available to them is important for Alzheimer's caregivers. Competence about these resources decreases psychological distress because the caregiver has an outlet for professional assistance. It also decreases physical illness because the caregiver is more informed about tactics and proper methods that need to be used in physically caring for the individual with Alzheimer's, which decreases their own personal physical strain. Additionally, competence about resources has the potential to decrease economic strain through information the caregiver gains concerning different types of funding they are eligible to receive, which increases the caregiver's level of support so he/she does not feel like they have to go up against the financial strain all alone.

There are so many different programs that have a lot of support to offer Alzheimer's Disease caregivers. Caregiver support groups, sites on the internet, and self-help books all attest to the popular view that peer support improves caregiver well-being (Pillemer, 2002). However, research makes it abundantly clear that the type of support the caregiver receives is pivotal to its success and ability to produce long-term results. Although many support groups exist nationwide, in a variety of forms, a relatively new study conducted by Pillemer (2002) suggests that peer support, by itself, may not bring about long-term positive outcomes. Through the Peer Support Project within this particular study, the social support variable was isolated in order to determine whether or not it was effective on its own. The findings of this study suggest that social support alone does not improve the caregiving experience (Pillemer, 2002). This study makes a strong argument that caregivers should become a part of an in-depth and more substantial support program, than one that only provides social support. This type of support is actually one of the best ways to reduce caregiver burden and assist in coping skills for caregivers. In addition, another study performed shortly after it provides support (Farran, 2003).

Farran's study (2003) indicates the need for caregivers to familiarize themselves with more of a skill-building approach when searching for support, providing evidence that this type of approach is much more effective than both informative and support-based approaches. Some of the reasons why this approach is more effective than the others mentioned are because it involves direct application for caregivers by focusing on a broad array of skills – especially behavioral management and cognitive stimulation. It also addresses individual concerns expressed by family caregivers by identifying specific skills that caregivers need to possess. Another benefit is that it compares/contrasts what skilled versus non-skilled caregivers look like by describing what qualities and skills they both possess. Skill-building approaches help caregivers acquire skills that will help them deal with their own individual issues – such skills as: assertiveness training, cognitive skills in dealing with dysfunctional thoughts, coping skills, how to deal with loss and grief issues, how to increase pleasant activities, problem solving skills, relaxation training, how to properly use support services, and educational skills (which teach caregivers when behavioral/environmental interventions are no longer effective and when additional medical intervention such as medications and hospitalization is required) (Farren, 2003).

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When caregivers are educated about how to become more skilled, and are actively seeking and receiving proper support within a skill-building approach, the level of care they will provide to an Alzheimer's Disease patient will dramatically increase. The caregiver will be more informed about the disease they are helping the patient to learn to live with, they will be more aware of the reasons behind the changes that occur within the patient as their functioning declines, and, essentially, they will be able to take care of themselves better – psychologically, physically, and financially. I believe this approach provides an enormous benefit to the quality of support services that caregivers can become involved in. It will assist the caregiver, the Alzheimer's Disease patient, surrounding family and friends, and even doctors because the patient will be more suitably taken care of, requiring less abrupt assistance from medical professionals. I believe that the benefits of being involved in a skill-building approach need to be relayed to caregivers through whatever avenue is humanly possible – by medical professionals, educational affiliates, social networks, government and health care agencies, gerontological researchers, etc. Skill building support approaches involve much depth and have so much to offer Alzheimer's caregivers, that it would be a sheer waste for caregivers to be unaware of their existence.

Knowing that Alzheimer's Disease is "the most prevalent form of irreversible dementia," which affects close to four million patients in the United States (expected to triple in number within the next fifty years), and recognizing that many others are affected by this disease is important, whether or not you are the one providing care to an Alzheimer's patient (Kanel, 2003b). Providing care to an Alzheimer's patient has been associated with numerous and severe long-term stressors, (Schulz, 1991) including many psychological, physical, and economic challenges (Kanel, 2003b). Because of this, interventions that seek to decrease family caregiver distress have been increasingly focused upon within the past two decades (Farran, 2003).

As the awareness of this particular issue increases, more resources will be made available to Alzheimer's caregivers. Such resources will greatly assist in minimizing the negative effects on Alzheimer's caregivers. In doing this, not only will their overall quality of life be largely bettered, but their level of care for the Alzheimer's patient will improve as well. With so many individuals suffering from Alzheimer's Disease in the United States alone, intervention and assistance given to them and their caregivers will help the issue tremendously. As we become more educated about

the disease, and the ways in which caregivers can be better assisted, the level of care for many Alzheimer's patients will dramatically increase. Without such knowledge, many Alzheimer's patients will not receive the quality of care that they deserve. We must make those around us more aware of the impact that education has on the problem, with the recognition that education precedes knowledge and knowledge precedes change.

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# Overlap in the Neural Processing of Music and Language: A Review

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**Abstract--***The present review is a synthesis of music-language overlap findings in the brain, as evidenced by functional imaging and lesion studies. The literature suggests music and language are lateralized on a neural level according to auditory processing demands for both domains, rather than domain asymmetry, particularly in the temporal cortex. Left hemispheric dominance is observed for rhythm and rapidly changing sound patterns of speech. Pitch and language tasks of increasing difficulty exhibit right hemisphere dominance. In ascension from temporal lobes, presence of frontal activation is found in professional musicians, suggesting a relationship between musical proficiency and the pattern of cortical activation.*

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More than a century of literature documents and refines the neural substrates involved in the production and comprehension of language (Kolb & Wishaw, 2001). The scientific community's interest in musical processing, however, is relatively recent. While nonhuman species communicate through sound, the complexity of human music and language is not found in other species. Given the heavy reliance of both language and musical processing domains on temporal structure of acoustic information, one might expect neural processing convergence across these domains. Koelsch et al. (2002) found that the classical language cortical network was activated in response to structured musical stimuli in their functional magnetic resonance imaging (fMRI) study of nonmusicians. In-key chords played on piano served as a base against which modulations (consonant, harmonically inappropriate chords), clusters (neither consonant nor harmonically correct chords), and deviant instruments (consonant, harmonically appropriate chords of differing timbre) activations were compared. Bilateral activity in a cortical network of lateral frontal and temporal cortex including, but not limited to, both areas of Broca and

Wernicke, anterior insula, superior temporal gyri and sulci, planum polare, planum temporale, and Heschl's gyri (which house primary auditory cortices, PAC). Most of these areas have been found to be involved in the processing of auditory speech. This superior temporal and frontal network appears to be specific to structured acoustics, as nonmusical oddballs do not activate higher cortical perceptual tissue to the extent of music. The authors' argued for a parallel between harmonic intervals of chords and phonemic intervals of words in justifying frontal-temporal correspondence between music and language.

The present review refines domain overlap to common auditory feature attributes through lesion and empirical support. Activity in the cerebella appear necessary for auditory integration, asymmetry between characteristics of both musical and language auditory stimuli are found in temporal cortex, routing to inferior parietal lobes is inefficient to quickly and accurately judge one's sound environment, and patterns of frontal cortical activation provide insight to musical proficiency and neural response to sound.

## *Cerebellar Auditory Integration*

Although most of the evidence for musical and language pathway convergence is found on a frontal-temporal level, the cerebellum may have a temporally integrative function. The non-motor contribution of cerebellum is most fascinating, as this region is evolutionarily primal to higher cortical tissue. Prior language studies have found cerebellum involvement during silent recirculation of verbal material, planning of speech output, auditory coding of verbal information, and rhythmic memory (as cited in Gaab et al., 2002).

A lesion review suggests that normal cerebella function is necessary for analyzing pitch changes of speech and music. Nicholson and colleagues' (2003) reported on KB, a 72-year old amateur musician of 14 years who exhibits melodic and speech aprosody subsequent to a unilateral right frontal parietal infarct including cerebellum and lenticular nucleus. Marked

difficulties were observed in individual identification of auditory stimuli and discrimination between stimuli pairs when pitch and timing cues are considered. The deficit was specific to prosodic sound (speech with pitch changes and melodic analogues derived from such speech); environmental and segmental speech discrimination (speech not reliant on structure or pitch changes) remained selectively intact.

Levitin et al. (2003) performed the first fMRI study of persons with Williams' syndrome (WS) and found that the cerebellum contributes to musical processing. WS is a neurogenetic disorder resulting in hyperacusis (decreased auditory threshold during sound detection), preserved musical abilities despite higher cognitive disabilities, a higher emotional response to music, and an inability to distinguish music and noise (Francke, 1999). Functional imaging results demonstrated that WS persons' activations to music and noise are reserved to right cerebellum and amygdala, while controls' consistently recruit superior and middle temporal gyri bilaterally.

Pitch changes are pivotal to emotional contour of music. WS persons' stronger emotional response to sound and pitch processing dysfunctions characteristic to KB may arise from cerebellum overactivity and lesion, respectively. Considering these anomalies, this review suggests cerebella are needed for initial integration in prosodic processing.

Gaab et al. (2002) studied tonal processing and found positive correlations between cerebella activation and discrimination between tones. Participants were presented with a sequence of tones and asked to differentiate identical from different pitches in this sequence. Latent bilateral activation of dorsolateral cerebella areas positively correlated with tonal discrimination. Insights from the tonal study should be made cautiously, as participants were nonmusical and stimuli were not within a musical context.

To sum, cerebellum provides important integrative function to timing and frequency features of music and language processing. Integrative information from the cerebellum ascends to numerous cortical loops for higher processing. Therefore, inferences on the nature of cerebellum contribution to music and language perception demand further empirical testing.

### *Auditory Feature Asymmetry Within Temporal Lobes*

Rather than left dominance for language and right dominance for music, pitch and temporal auditory features of both language and music are lateralized in the right and left temporal lobes. Zatorre and colleagues'

review (2002) of the primary auditory cortices (PAC) reveal left pyramidal layer II cells of PAC within Heschl's gyrus are larger with deeper and widely dispersed connections relative to right hemisphere homologues, enabling fast temporal analysis requisite for speech. Decreased size of pyramidal cells within the PAC vicinity of the right hemisphere form a complementary system to process spectral, slowly evolving sound, like that of structured pitch sequences.

Proximal to PAC, and of similar cytoarchitecture, are the planum temporale (PT, posterior STG). As in the PAC, the white matter density within the left PT exceeds the right PT, enabling superior processing of temporal changes (Zatorre, 2002). Further, Meyer et al. (2000) fMRI study found increased activations of the entire left perisylvian cortex when subjects passively judge auditory sentences as 'grammatical' or 'ungrammatical'. In this same fMRI study, right frontal retrieval was found when subjects are assigned an additional syntactic 'repair' task, corresponding to pitch complexity. This review details this theoretical relationship in the frontal activation section.

Zatorre et al. (2002) suggested such asymmetry, left temporal auditory and right frequency auditory specializations, might have risen to enable simultaneous processing of both features. Specifically, timing and frequency information undergo quality trade-offs at high-resolution levels (Joos, 1948). Lateral systems therefore bypass acoustic constraints and permit comprehensive evaluation of the entire auditory scene.

Lesion studies support temporal hemispheric asymmetry of auditory features. Contrary to prosodic sound, segmental speech and environmental sound perception remains intact following right inferior parietal frontal lesion, excluding temporal lobes (Nicholson et al., 2003). WS persons do not exhibit consistent activations of temporal cortex (Levitin et al., 2003), perhaps contributing to undifferentiated perception of music and noise in the latter and intact processing of segmental speech of the former.

Di Pietro et al. (2003) reported a 48-year old former professional musician of 14 years, DL, with left temporal lobe lesions and subsequent difficulty processing auditory rhythms. Despite rhythm and speech perception and production impairments, melodic perception remains intact. DL was able to produce and discriminate melodic features of sound without difficulty. Intact meter judgment, a global rhythmic aspect, was evidenced by perfect march vs. waltz discrimination. The dissociation between melodic and

rhythmic abilities supports the notion that the processing of different acoustic features is lateralized, rather than strict hemispheric dominance of music and language systems.

Acoustic processing efficiency derived from temporal and spectral asymmetry is demonstrated in the superior temporal lobe. Functional MRI results (Koelsch et al., 2002) localize harmonic integration of sounds to upper banks of the right superior temporal sulcus, located in posterior regions of the temporal lobe, beneath inferior parietal cortex. This area is also activated by vocal sound (as cited in Koelsch et al., 2002) and necessary for phoneme identification and prelexical access (Meyer et al., 2000). Harmonic integration of musical stimuli within right superior temporal sulcus may therefore complement interval analysis of left perisylvian cortex.

While most informative aspects of language are found in syntax, pitch variations add meaning to grammar. Pitch sequence is crucial to musical identification. Tempo builds 'mood' to this sequence. The temporal lobes demonstrate asymmetry between specific acoustic features of both musical and linguistic cognitive domains, as opposed to hemispheric specialization for each domain.

#### *Inferior Parietal Lobes as Auditory Distractions*

The integrative function of inferior parietal lobes for short-term storage of visual-auditory information (Platel et al., 1997) does not carry over well to auditory processing. Gaab et al. (2003) fMRI tonal processing found decreased parietal and increased temporal cortical utilization positively correlate with superior auditory judgment. A weakness of this study was that stimuli were nonmusical.

This review proposes that the temporal and frontal cortices are superior to the inferior parietal lobe in auditory processing. Parietal regions represent elevated levels of integration, a process that may prove detrimental to fast and accurate processing of auditory time and frequency variations. Successful analysis may proceed hierarchically from temporal auditory processing to frontal lobes for meaning. Routing to parietal lobes is therefore distractive and inefficient to quickly and effectively evaluate one's sound environment.

#### *Frontal Processing Patterns Differentiate Musical Proficiency*

Activation, or lack thereof, within frontal cortices may differentiate professional musicians from novices and nonmusicians. In an event-related potential

(ERP) investigation of auditory spatial processing amongst conductors, musicians, and nonmusical controls, Nager and colleagues (2003) found frontal source activation of conductors positively correlates to enhanced acoustic processing. Behaviorally, response from musicians is faster and more accurate than that of nonmusicians. Nd (Negative displacement) attention effect and frequency MMN (mismatched negativity) index ERP performance across experimental groups and indicate selective attention to central auditory space in all subject groups. However, for peripheral space, only conductors exhibit an Nd gradient, indicating musical experience enhances attention to largely ignored parts of an auditory scene.

Neural population differences between conductors, musicians, and non-musicians are not suggested as with similar experimental designs with blind subjects and sighted controls (Roder et al., 1999). Rather, it appears conductors' enhanced selectivity is due to superior neural routing mechanisms. Although the frontal central ERP source measured in these subjects was not lateralized, one might expect professional musicians increased exposure to and production of music cause musical processing and production to mimic that of verbal language, whose core features tend to have left preponderance.

When subjects are instructed to 'repair' ungrammatical sentences, increased activation of right Broca's homologue is found (Meyer et al., 2000). Absence of right Broca's homologue activation when subjects are instructed to passively judge sentences as grammatical or ungrammatical suggests cortical function at elevating levels of language difficulty. Frontal activation by modulations amongst a nonmusical cohort in the Koelsch et al. fMRI study (2002) was limited to the right Broca's homologue. Modulated chords had correct interval structure and a differing tonal key relative to an in-key base. Correct interval structure therefore explains nonactivation of Broca's area; a source specialized for syntactic phonemic analysis (Meyer et al., 2000).

This review postulates that previously discussed larger pyramidal cells of left temporal lobes, which allow for enhanced analysis of temporal auditory cues, carry such information onto left frontal substrates for perceptual processing. An empirical study of modulation detection in musicians, analogous to the design of the Koelsch fMRI study (2002), may find increased activation of frontal networks during musical processing. Left hemispheric dominance during processing of musical stimuli, corresponding to professional musicians' paralleled music and language processing, is expected.

## CONCLUSIONS

To sum, convergence of musical and language networks is stronger than previously thought. Low-level processing of auditory features for both domains necessitates activation of the cerebella. Activity in temporal lobes required in both domains reveals stark asymmetry between timing and frequency auditory features. In temporal cortices, left hemispheric dominance of timing information and right hemispheric dominance of pitch processing are found. Routing to inferior parietal lobes appears inefficient to quickly and effectively assess one's sound environment. Activation patterns within frontal lobes may indicate musical proficiency.

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# Locus of Control and Voting Participation in U.S. Presidential Elections

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**Abstract**--According to Rotter (1966), those with an internal locus of control engage in active behaviors to facilitate reinforcement, while individuals with an external locus of control disengage from similar behaviors. Locus of control theory provides a potentially important predictor of the likelihood of voting, with voters predicted to exhibit an internal locus of control. Locus of control and participation in the last presidential election were correlated ( $N = 40$ ), with voters tending towards an internal locus and nonvoters towards an external locus. This correlation remained even with political-related items removed from locus of control scores. Results suggest locus of control is predictive of people's decision to vote or abstain.

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“Don’t blame me! I voted for <the last presidential election’s losing candidate>!” With each new United States presidential term comes another bumper sticker pointing the finger of the implicitly poor state of the nation at a stranger in traffic, assuming he or she voted for the new Commander-In-Chief. However, chances are a not much greater than 50% that the person reading the bumper sticker actually voted. In 2000, 60% of eligible voters actually did so. In 1996, that number was slightly less at 58% (United States Census Bureau, 2004). This leaves approximately 40% of U.S. citizens who have the right to vote, and participate in the country’s future, with little more to say than, “It’s not my fault. I didn’t vote for any of them.”

Perhaps, from a non-voter perspective, plausible deniability is the purpose behind refusing to exercise one of America’s most fundamental rights as a citizen. If the country appears to be in disarray in the hands of elected officials, a non-voter has potential blamelessness on which to fall back. After all, it does seem the average U.S. citizen has little control over what happens in the

upper reaches of our government. If scandal, corruption and deceit are inherent in the position of “the most powerful person in the world,” it is understandable why people eligible to vote might chose to avoid indirect support of such unsavory behavior.

How much control do we, as voters, really have over our government? If we feel we do have control, and that our actions as a whole dictate what will inevitably happen to us, it is reasonable to expect such an attitude would increase participant activity in political processes. Conversely, if we assume much of what happens is out of our control, and our lives are directed by authorities we can not influence or powers we can only fathom, why put forth any more effort than is necessary to exist within a fatalistic framework? With the importance of voter participation in our democratic system, understanding predictive variables influencing the process enhances our ability to provide solutions for the apathy surrounding this basic civil right.

Julian Rotter considered our view of government when he put forth the idea of locus of control (1966). He theorized individuals with an internal locus of control are more likely to perceive reinforcements (rewards) as earned through their own actions, so they actively pursue those reinforcements. On the other hand, those with an external locus of control are more inclined to perceive reinforcements as having origins in people or powers outside their control, so are more likely to behave passively because they are less inclined to attribute their own action with a forthcoming reward.

Rotter’s Locus of Control Scale (1966) was designed to assess a person’s degree of internal or external control (I-E). Since then, researchers have used locus of control scales in order to explore correlations with depression (Burger, 1984), personality disorders (Watson, 2000), stress response (Pruessner, et al., 1997), and a variety of other behavioral and physiological associations. Applications of locus of

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control may extend even to politics. As detailed in the proceeding literature review, there is evidence to suggest a correlation between locus of control for the political items on Rotter's scale and several social-political dimensions, as well as studies suggesting no significant association with I-E scale items except those designed to assess political attitudes.

Deutchman (1985) surveyed high school seniors and liberal denomination (Protestant) church members. Rotter's scale and an additional political involvement scale were used to rank participation from easy to hard on formal (government related activities) and non-formal (seeking power outside a governmental sphere) political dimensions. Deutchman established a relationship between the locus of control and formal political involvement, which includes activities such as voting, donating campaign funds and working for a candidate. Individuals with high levels of political involvement tended to have an internal locus of control. Due to the age differences in the sample, apparently a result of half of the sample consisting of high school students, items related to the formal political activity of voting were removed from the developed survey and administered separately. This aspect of the study highlights the correlation between an internal locus of control and formal political activity in the tendency to vote.

Leming (1974) attempted to measure political activism in adolescents as well, but steered clear of the voting variable that could be problematic for participants of this age. High school students were selected from pools of subjects in an accredited community-based problem solving class, those who had been suspended for protesting the Vietnam War on school grounds, and those with neither activist nor non-activist leanings. Using a participant's affiliation with any of the three groups, in addition to faculty assessment and participant self-assessment, students were rated high or low for activism. Multiple instruments were used, including the I-E Control Scale and Sense of Political Efficacy Scale (Campbell, 1954) to assess locus of control. However, this study failed to find a significant correlation between locus of control and political activism.

Peterson and Maiden (1993) examined the other end of the age spectrum, choosing a random sample of Allegany County, NY residents over 60 years old to study how personality factors such as neuroticism, extraversion, openness and self-concept were associated with political behavior. They defined political

participation as the extent of community work related to problem solving, working for or donating money to a candidate, and communicating with a government agency regarding a given issue. Rotter's I-E Control Scale assessed self-concept, while the NEO Personality Inventory was used to assess neuroticism, extraversion and openness. There were high correlations between I-E, and extraversion and openness, and a less significant correlation between I-E and neuroticism. There was also a significant positive correlation between political participation and internal locus of control.

Two studies suggest the association between the I-E control scale and political participation stem primarily from the political items included in Rotter's scale. Abramowitz (1973) used factor analysis to identify two locus of control domains based on non-political and political items in the I-E scale proposed by Mirels (1970). Level of political involvement was assessed using the Kerpelman Political Activity Scale (Kerpelman, 1972), a 24 item Likert-type scale measuring both current and desired involvement in political activity, and locus of control was assessed using Mirels' (1970) scale, Rotter's (1966) scale and Abramowitz's own I-E scale (White, 1969). It is worth noting that Abramowitz's I-E scale did not include political locus of control items. As expected, locus of control scores based on Mirels' Factor II (political items) were correlated significantly with political activism, with a more internal locus associated with greater political involvement. However, scores based on Mirel's Factor I (non-political items), Rotter's I-E, and Abramowitz's scale did not show such a correlation.

The fact that Mirel's Factor II scores correlated with political activism, and Mirel's Factor I & Abramowitz's scores did not, suggests the lack of a correlation between Rotter's I-E and political activism scores is due to the predominantly non-political items in Rotter's I-E scale. With only a fraction of political locus of control items on the I-E scale, overall scores on this scale may appear inconsistently related to political behavior variables.

Scaturro and Smalley (1980) agreed with Abramowitz's findings, but disagreed with the study's suggestion that Rotter's I-E scale was, in its entirety, not predictive of political activity. They implemented a four-factor scoring modification of Rotter's I-E construct proposed by Collins (1974) that measured locus of control on factors of Difficulty (I), Justice (II), Predictability (III), and Political Responsiveness (IV).

Overall locus of control scores on Rotter's I-E scale correlated with political activism in this study, but with the Political Responsiveness subscore removed, this correlation disappeared. This result again suggests that only a domain specific political locus of control variable correlates with political behavior.

Considering the variability of studies with regard to assessment, subject demographics, and flexible definitions of political participation and/or activism, it may be beneficial to reexamine the association between the internal locus of control and voting behavior. Voting participation may differ from general political activism, inasmuch that political activism does not guarantee the desired outcome of actually voting. In addition, voting rates have declined since many of the reviewed studies were completed. Perhaps the relationship between locus of control and political behaviors has changed. These concerns elicited further investigation of locus of control and its ability to predict voting participation.

In particular, this study examines the association between locus of control and voting participation in a non-college sample of adults, allowing for an expansion of external validity beyond the university environment. The passage of time and non-availability of instruments used in previous studies allows for a fresh perspective. I suggest voters will have an internal locus of control relative to non-voters, who will have a more external locus of control. This study will also address the political/world affair items in Rotter's I-E scale to examine what part, if any, they play in the prediction of political activity.

## METHOD

### *Participants*

40 adults, 21 years or older, were conveniently sampled in diverse settings (restaurants, homes, etc.) in Charlotte, North Carolina. 20 were voters and the remaining 20 were non-voters. Gender and ethnicity of participants were not controlled in this study. However, a dozen of the participants were contacted and sent surveys via electronic mail, expanding participant location beyond North Carolina.

### *Design*

The study uses a correlational design with voting participation and scores on Rotter's (1966) locus of control scale as variables of interest.

### *Materials*

Rotter's Locus of Control Scale was used, consisting of 29 items, including six filler items to help reduce confounding biases in self-assessment. Half of the items were negatively keyed and distributed throughout the survey. Each item has a choice between two possible responses, from which a participant selects one in accordance with their agreement. For example, one item of a political nature allows a subject to select from "the average citizen can have an influence in government decisions" or "this world is run by a few people in power, and there is not much the little guy can do about it." The selection of the latter statement, indicative of an external locus of control, would score one point, while choosing the former, indicative of an internal locus of control, would not result in no points. A total score is compiled from all survey items, excluding fillers, upon completion. The highest possible score is 23, suggesting the most external locus of control, and 0 is the lowest score, indicating the most internal locus of control.

### *Procedure*

Surveys were distributed to participants, either in person or by electronic mail, and were collected upon completion. Half of the surveys were administered to participants who considered themselves non-voters (had not voted in 2000 and did not plan to vote in 2004). The other half were distributed to voter participants (voted in 2000 and planned to vote in 2004). Voting behavior was determined by asking the participant if they had voted in the U.S. presidential election in 2000 and intended to vote in 2004. A "yes" response indicated a voting participant, while a "no" response indicated a non-voter. All participants were of eligible voting age and citizenship in 2000. If a participant did not vote in 2000 due to circumstances beyond their control, but gave an indication they had definitely intended to vote in 2000 and 2004, the subject was rated as a voter. Informed consent was included in the survey, and participants were debriefed only at their request.

Social desirability bias, while a consideration, did not appear to be a factor of major concern. All participants were usually forthcoming about their voting behavior when asked, and measured using the same survey. All but six "voting" subjects who had not voted in the 2000 election indicated a history of voting behavior, or were too young to have voted in the 1996 election. "Non-voters" were decidedly so, indicating they either

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never voted or would only vote if it were necessary or convenient.

### RESULTS

For the first analysis, results from the locus of control surveys were calculated after removing the six filler items, leaving 23 items for statistical consideration. Reliability of the locus of control survey was calculated at an alpha of .74. The mean total locus of control score was 12.3 ( $SD = 6.03$ ). This indicates the average participant had a locus of control near the midpoint between the lower (internal locus) and the higher (external) ends of the scale of possible scores. For voters, the mean locus of control score was 8.4 ( $SD = 4.76$ ), while non-voters scored on average 16.1 ( $SD = 4.56$ ), suggesting voters were more likely to score on the internal end of the scale while non-voters scored on average on the external end. There was a significant positive correlation,  $r(38) = .65, p < .05$ .

The second analysis was completed with the six political and international affairs questions (items 3, 6, 12, 17, 22 and 29) removed from all calculations. The mean non-political locus of control score was 9.7 ( $SD = 4.26$ ), suggesting a slight change in the direction of I-E towards the internal locus with those items removed. Voters had a non-political locus of control score of 7.9 ( $SD = 4.32$ ), and non-voters had a mean of 11.55 ( $SD = 3.41$ ). Of particular interest, the correlation between internal/external locus and voting behavior, while somewhat reduced, remained significant,  $r(38) = .43, p < .05$ , even when the political locus of control items were removed.

### DISCUSSION

The present study found a correlation between voting participation in recent presidential elections and locus of control scores. Results indicate a tendency for voters to have lower (more internal locus of control) than non-voters (more external locus of control). Furthermore, the correlation is somewhat reduced but remains significant even when political locus of control items are removed. Results suggest voting status is predictable by a general locus of control construct, as opposed to a domain-specific political locus of control construct. While other studies have examined political activism along a relatively broad spectrum, the present study considered only the independent variable of voting,

as well as how the political items within Rotter's scale affected any existing correlation.

There are several possibilities to consider. Perhaps the general construct of locus of control is related more to voting participation than to broad political involvement. Other aspects of political involvement are partaken to the extent participant's feel they can influence the political debate. As such, those aspects have closer ties to an individual's political locus of control in that they can influence the debate by varying their political behavior through actions such as shouting, waving signs, or clever debate. Therefore, a possible relationship exists between participation and the perception that these specific aspects of control might be successful, and thus associated with a narrow sense of locus of control.

Perhaps voting depends more on whether people feel they can influence the outcome. Here, one has to have general faith their one and only one vote can influence change. There is also a chance this study's findings differ from those reviewed earlier because the relationship between locus of control and political behavior is changing over time. The difference between the results of this study and others presented here may have less to do with a single political behavior (voting) versus multiple political participation behaviors, and more to do with inevitable changes in our culture.

Results appear to support Deutchman's findings, especially on the voting dimension. That study, finding the most notable association between I-E and voting, was nonetheless comprised of a substantial number of high school students, half of the participant pool to be exact. Consequently, voting was a variable not applicable across 22 subjects. Our study was applicable across all participants, and investigated only voting behavior rather than multiple dimensions of political activity.

Peterson and Maiden (1993) considered adults over 60 when contemplating the association between I-E, basic personality traits and political participation. The significant correlation between an individual's I-E and degree of political activity was similar to results found in our assessment of I-E and voting, despite the age differences of participants.

In reference to Abramowitz's findings, our results were contrary. Aside from the age difference between participants (college students compared to adults), our measurement tools were fewer and unmodified from the originals, and the independent

variable less broad in scope. It was interesting to note how removing the political items from the I-E scale for our second analysis suggested a slight shift towards an average internality in comparison to an average externality with the political items included in the analysis. Perhaps a larger sample would negate the shift, but it appears the political items added more weight to an external locus. However, a statistical analysis for this particular finding was not completed and is open for further investigation should larger samples indicate similar findings.

Our results were also contrary to Scaturo and Smalley findings, although similar in disagreement to Abramowitz's findings that suggest the I-E scale in its entirety was not predictive of political activity. They also used multiple assessments and a quadruple factor analysis of which political items were a quarter, in comparison to Abramowitz's use of Mirel's dual factor analysis with half of the factors politically related. Additionally, Scaturo and Smalley's sample, while larger, again consisted of younger university students in comparison to our study's adult pool.

However, our study was intentionally limited in scope in comparison to the studies of Abramowitz, and Scaturo and Smalley's. We examined I-E against voting behavior, one of the easiest political activities in which to engage with minimal expense of personal resources such as time and money. While I-E may not predict overall political activity as suggested in the latter studies mentioned above, it may predict less complex and time-invested political behaviors like voting.

Still, the present finding of a correlation between locus of control and voting behavior provides an important predictor of a political behavior (i.e., voting) that is of great importance to our society. With only slightly more than half of eligible voters actually doing so, approximately 40% chose not to participate in selecting a president, who in turn guides the path of the country and, indirectly, the lives of those living in it. Should a candidate or advocacy group find a method for tapping into the internal locus of those with a tendency towards the external, perhaps a larger turnout of voters during elections would facilitate a more inclusive representation of American's desires in relation to the future of the United States.

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# The Relationship Between Anemia and Sleep

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**Abstract**—*This article explores the relationship between anemia and sleep loss. The literature reviewed discloses the various mechanisms through which sleep is disturbed and/or lost in patients with different types of anemia. It is evident from the work reviewed that co-morbidity and other complications associated with anemia act synergistically against restful sleep. The author concludes with a recommendation that patients complaining of sleep disturbance be routinely checked for anemia.*

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A reported 3.4 million Americans are affected by anemia (Turkoski, 2003). There are many types of anemia, the most common being iron deficiency anemia (IDA; Turkoski, 2003). Blood loss, insufficient intake of iron, and impaired absorption of iron are three ways to develop IDA (Turkoski, 2003). According to Turkoski (2003), “the clinical evidence of IDA is usually slow to develop and increases in severity when untreated, e.g., increasing fatigue, and eventually all the systemic effects of hypoxia”. Insomnia, disturbed sleep, altered cognitive functions, and impairment of the quality of life are some common complaints that patients with IDA have (Tarasiuk, Ali, Moser, Friedman, Tal & Kapelushnik, 2003).

Two other types of anemia are sickle cell anemia (SCA) and Thalassemia (Tarasiuk et al., 200d). Sickle cell anemia is caused by abnormalities in red blood cell (erythrocytes) hemoglobin (HbS) results in formation of long rigid rods that stretch the cell into a characteristic elongated crescent shape that compromises the ability to perform oxygen exchange. Thalassemia is an anemia that affects the globin proteins that are instrumental in carrying oxygen to different parts of the body (Turkoski, 2003).

Anemia can affect sleep in a number of ways. Severe damage and scarring to the spleen resulting in an immense decrease in its size is a condition called autosplenectomy that usually occurs in patients with

sickle cell anemia (Sickle cell anemia, n.d.). It is believed that if this condition occurs in a patient before age 5, their body will try to compensate by enlarging other lymphoid organs like the tonsils and adenoids (Wittig, 1988). Enlarged tonsils and adenoids are one of the biggest contributing factors in Obstructive Sleep Apnea (OSA) the others being obesity and genetic predisposition (Beebe & Gozal, 2002). This is just one example of how anemia can influence a person’s sleep quality and quantity.

Chronic pain can also affect sleep. Sickle cell anemia can be very painful. Because the sickled cells do not have the flexibility of the normal shaped cells, they get caught in the blood vessels and subsequently block the flow of oxygenated blood. These occurrences are called vasoocclusions and are extremely painful. There are also some long term consequences of vasoocclusions that are similar to the effects of OSA, some of which include cerebral stroke (Palomaki & Partinen, 2000), delayed growth (American Thoracic Society, 1999), pulmonary infarct (Walsleben, 1997), and congestive heart failure (Walsleben, 1997).

In their study dealing with the psychosocial functioning of patients with different illnesses, Barrett et al. (1988) found that the patients with sickle cell anemia and chronic pain scored their problems with sleep higher than patients dealing with obesity or respiratory disease. They also found that pain was scored the second most severe problem that patients with sickle cell anemia reported.

Restless Leg Syndrome (RLS) and Periodic Limb Movement Disorder (PLMD) are also associated with anemia. Even though they are two distinct disorders, there is a 30% to 80% comorbidity (30% of patients with PLMD have RLS and about 80% of patients with RLS have PLMD; Simon, 2003). It has been found that even a slight deficiency in iron, mild enough to not be considered IDA, can contribute to

RLS (Simon, 2003). Tarasiuk et al. (2003) discovered that children suffering from two different types of chronic anemia displayed PLMD which contributed to sleep impairment and an increased arousal index.

Sleep onset is accompanied by disordered breathing and a decrease in lung volume (Walsleben, 1997). This may not be a cause for concern in healthy patients, but for patients who have insufficient levels of oxygen in their blood to begin with, this may cause problems like the ones mentioned above. One study observed that there is a 2% decrease in oxygen saturation during sleep in both anemic and healthy patients (Castele, Strohl, Chester, Brittenham, & Harris, 1986). In addition, they found an indirectly proportional relationship between oxygen saturation and the “tidal excursions of rib cage and abdominal motion”, indicating that the more an individual’s body tries to compensate for the decrease in oxygen saturation the less oxygen will be available to them because of the cost of breathing (Castele et al., 1986).

Along with being more likely to suffer from OSA, RLS, and PLMD, those who suffer from anemia may not be as responsive to hypercapnia (too much carbon dioxide in the blood) and a combination of hypoxia (too little oxygen in the blood) and hypercapnia, as other people. Moss and Harding (2000) found that lambs that were exposed to anemia prenatally were not as responsive to hypercapnia and a hypoxia-hypercapnia combination as the control lambs. When the body recognizes a state of hypoxia or hypercapnia, a signal is sent to the breathing control center to modify breathing. Reduced sensitivity to these signals in anemic organisms prevents the body from making the necessary adjustments to get the appropriate amount of oxygen that it needs to optimally function through the night. Also, a study done with sheep revealed that, along with inhibited breathing, moderate and severe anemia inhibits rapid eye movements (Koos, Sameshima & Power, 1987).

The quality and quantity of sleep can also affect anemia. Sidman and Fry believe that conditions like OSA that further decrease anemic patients’ oxygen saturation will intensify and make more frequent the vasoocclusive crises (1988). This may be because hypoxia intensifies the sickling of red blood cells (D’Aloia, 1993). Along the same lines, studies done with rats treated with anticoagulants have shown that

sleep deprived rats developed severe anemia and that the severity of the anemia was directly related to the amount of sleep deprivation (Drucker-Colin & Winocur, 1971).

Several lines of research indicate that women have more sleep complaints than men (Buboltz, 2001). Considering the information found about anemia’s relationship to sleep, this makes sense. Women are more susceptible to anemia because of iron loss through their menstrual cycles and the increased need for iron during pregnancy (Turkoski, 2003).

The present review suggests that the existence of certain blood disorders is just as important of a factor as inflamed tissue is for Obstructive sleep apnea (OSA) or obesity is for Central sleep apnea (CSA). These disorders can cause and/or exacerbate the elements that cause the two types of sleep apnea. Therefore we can expect to see the same behavioral and cognitive problems with anemia as we do with OSA and CSA. We should then give more consideration to the role of anemia when trying to assess a patient’s sleep problems. Because the most common form of anemia can be treated with a dietary supplement, the solution to a better quality and quantity of sleep, and therefore better quality of life, is a simple one.

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