This Song Takes Me Back:
An Evaluation of the Efficacy of Music Therapy on Patients Suffering from Alzheimer's Disease

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May, 2nd 2014
PSY 80/MUS 59, Spring 2014
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In 2014, we still have no cure for Alzheimer's and merely have side-effect riddled countermeasures, but it is absolutely imperative that science continues to find measures to mitigate and eventually cure the affliction. Alzheimer's Disease affects over five million Americans, accounting for almost 500,000 deaths each year as the 6th leading cause of death in the nation.[i] The physical, mental, and emotional traumas caused by Alzheimer's are ravaging and heartbreaking, and the disease is too frequently pushed to the wayside due to its prevalence in the elderly, despite the presence of roughly 200,000 individuals under the age of 65 afflicted with early onset Alzheimer's.[ii] Since heightened research began on the matter in the late 1980's, it has been proven that music therapy can have very notable clinical benefits in patients suffering from Alzheimer's Disease. It has been a difficult task for researchers to pinpoint the exact neurological mechanisms through which music therapy assists patients because the neurological dystrophy makes it very challenging for patients to engage in customary research measurements. In addition, there is limited knowledge of the neural networks through which music can affect the brain, making it very difficult to pinpoint the underlying mechanisms of how music therapy can assist patients. Despite this, progress is continually being made and it has become clear that music seems to resonate with portions of the brain that are otherwise lost to Alzheimer's. While music may not be the ultimate cure for the disease, we must continue gathering data on its effects

and the mechanisms through which it assists patients. The study of music therapy and its effects on patients with Alzheimer's can unequivocally shed some light into how we might one day find a cure, and at the very least it can be used as a supplemental treatment and a tool that can help ease the horrors of the disease and assist with communication, mood enhancement and regulation, and potentially even memory.

Alzheimer's Disease is the most common form of neurodegenerative dementia in which the neurons in the brain fall into increasingly intense states of disrepair as the patient ages with the disease. It is characterized by the accumulation of neurofibrillary tangles and neuritic plaques caused by increased levels of the beta-amyloid protein outside neurons and the tau protein inside neurons.[iii] The increased presence of these two proteins overtakes the neurons and causes them to disconnect from one another and ultimately die, resulting in the widespread loss of neural mass as well as the accumulation of dead cell matter.[iv] A particularly frustrating facet of Alzheimer's Disease is that it is generally difficult to diagnose as well as treat due to the irregular manner in which it can affect patients in addition to the long period of time over which Alzheimer's takes hold. While the most general sign of Alzheimer's is the presence of intense memory loss and the inability to learn new things, many other functional parts of the brain can experience deterioration such as the centers responsible for language, spatial conception, judgement, and mood regulation.[v] To make diagnosis and treatment even more difficult, these traits are also common among a great deal of other forms of dementia including, but not limited to, stroke induced dementia, dementia with Lewy bodies, Parkinson's Disease, and Creutzfeldt-Jakob Disease.[vi]

Despite modern evidence of its efficacy, music therapy as a clinical practice is still constantly facing the difficult task of differentiating itself from other, less professionally

demanding forms of therapy such as pet therapy. In the early phases of experimentation with music therapy, the rationalization of its implementation was anything but scientific, relying heavily on anecdotal and observational evidence. As research evolved and gained legitimacy, the earlier forays into the field were most concerned with facilitating communication and socialization, which is a primary concern in Alzheimer's patients since they frequently experience increased agitation in addition to a severely diminished ability to both articulate and comprehend verbal interactions depending on the stage of their disease. In a 1995 study, 19 Alzheimer's patients were observed to gauge the reactions of patients in different stages of cognitive deterioration to twice weekly, 60 minute music sessions over the course of six weeks (Sambandham & Schirm, 1995). The findings of the study suggested a very wide range in responses to the music therapy sessions and ultimately it failed in elucidating very much of a pattern in the patients' animation, verbalization, and behavior, resulting in a conclusion that the memory inhibitions of the patients nullified the long term effects of the music therapy. That said, the patients did tend to appear notably more relaxed during the sessions and more social with the other patients in the 20 minute observation periods following the therapy sessions, including the exhibition of more societally appropriate interactions. Also of note was that the memory and "reminiscent" capabilities of the most severely afflicted patients improved immediately following the sessions, though there was some doubt as to the sufficiency of memory measurement as well as the question of interference of rare and somewhat inexplicable occurrences of "periods of lucidity." While ultimately the clinical ramifications remained a mystery in this early study, the resounding conclusion of the paper was that the "findings add to the knowledge that music can be a positive intervention, capable of reaching the inner core of the individual to reaffirm humanness and self-worth" (Sambandham & Schirm, 1995).

As life expectancy and geriatric population continued to rise as time passed, the Alzheimer's crisis gained public exposure and the search for cures and therapies gained speed. Sambandham & Schirm's conclusion that music can be a way to, at the very least, "minimize the tragedy of the disease" (Sambandham & Schirm, 1995) garnered more widespread interest as research pressed on. In a 1998 meta analysis of research conducted since 1985, an attempt was made to minimize and overcome the limitations of the "qualitative nature…and methodological variability" of the burgeoning field and try to better understand the ideal conditions to maximize effectiveness of treatment (Koger et al., 1998). The synthesis of information corroborated those found in Sabandham & Schirm's study, making note that overall there seemed to be a significant improvement of patient mood and agitation, as well as a positive effect on their communicative abilities regarding group socialization and cognizant vocalization. Despite these trends, ubiquitous and specific factors which promote amelioration of Alzheimer's effects remained unidentifiable, the study citing the fact that efficacy was highly dependent on the receptiveness of individual patients to specific types of music exposure. Additionally, while it was not able to define a relationship between treatment length and its longterm effectiveness, this was attributed to the limitations of the studies involved in their meta analysis due to the fact that observation periods usually immediately followed the therapy sessions. The study concluded with a description of future proposals to improve research validity such as the inclusion of "blind" data collectors, the direct juxtaposition of multiple kinds of music exposure, the further exploration into the neurology of the underlying mechanisms through which music therapy affects patients, a more careful classification of the stage and type of dementia in subjects, and the long term observation and analysis of potential effects.

The following year saw the inclusion of some of the advice suggested by Koger et al. (1998) in a 1999 study done on the different effects of "individualized versus classical 'relaxation' music" on agitation caused by Alzheimer's related dementia (Gerdner, 1999). The goal of the study was to find a healthy and federally acceptable method of coping with the agitation as opposed to the restraint and chemical based solutions previously used, and to mitigate the restrictions of the limited number of caretakers available in the workforce. Combining the knowledge that Alzheimer's seems to leave music processing systems intact despite the deterioration of language processing, and the fact that distant memories remain vivid despite the inability of patients to retain recent information, the study implemented an 18 week program in which two groups of patients were exposed to both individualized music geared toward activating their earliest and strongest memories as well as generic classical music with a two week washout period between the exposures. Both quantitative and qualitative measurements were conducted, and both suggested that individualized music (usually suggested by family members of the patients) drastically decreased the rate of agitated behavior, significantly more so than did the classical music. Despite quantitative corroboration of music therapy's efficacy, the truly astounding results come from specific cases and instances. Individualized treatment was so potent that it was able to make one patient go from begging for death and lashing out at her roommate to smiling, and it was even able to evoke specific memories of people and occurrences from early life in other patients. While the study's findings were limited to the homogenous caucasian sample, it again exhibits just how beneficial music therapy (individualized music therapy in particular) can be in the lives of patients, families, and caretakers. The wonder of music therapy is that, while the benefits are by no means unanimous, there is almost no risk in at least attempting implementation. If for whatever reason (such as the

instigation of bad memories or very rare cases of music induced epilepsy (Fukui, Arai, & Toyoshima, 2012)) the patient reacts negatively, the music can simply be stopped and not reimplemented. However, if a patient responds with a smile, or a reminiscence, or even the retraction of a death wish, music therapy can be easily included in the daily lives of these patients.

While observational studies and case studies have continued through the 21st century, an increased presence of neurological studies has arisen in the new millennium. For example, in a 2008 paper a theory that music affects the steroid hormone levels in the brain resulting in increased neurogenesis and neural plasticity was extensively explored (Fukui & Toyoshima, 2008). The presence of increased levels of cortisol, testosterone, and estrogen have been proven to help facilitate communicative strength in a plethora of different animal species, and in humans it is known that cognition and memory are both affected by the presence of these steroids, and they are directly involved in stress management, neurogenesis, and the protection of neural networks. In a followup study in 2012, this theory was taken to the field and saliva samples were collected in order to measure hormone secretions of patients before and after music therapy sessions (Fukui, Arai, & Toyoshima, 2012). The results corroborated much of the prior theorizing and found that music therapy incited increased levels of testosterone and 17ß-estradiol, both of which have been reported to mitigate neuronal degeneration. The study also provided insight into the most effective ways to administer treatment. While music alone promoted hormonal health, music combined with the presence of a music therapy professional resulted in far more potent effects. The results of this study are crucial, as the use of hormone supplements to ease the effects of the disease has met with success, but the side effects make the option less than ideal, resulting in tragedies such as breast cancer and stroke. Music on the other

hand is inexpensive, widely available, and very rarely detrimental to a patient's health and wellbeing. Due to the immense power of these steroids and music's ability to regulate their secretion, it seems as though music may not only be a means of alleviating the horrors of severe Alzheimer's, but it may also be instrumental in delaying the onset of the disease.

In addition to the analysis and synthesis of research done on neurological hormone levels and music's effect on them, advancement in brain imaging technology has helped to facilitate a more purely scientific examination of the effects of music on Alzheimer's affected brains. In a 2011 study, differences between Alzheimer's patients and analogous control subjects were examined, and the different responses to familiar and non-familiar music were explored using fMRI (Jacova et al., 2011). The results suggested that Alzheimer's patients have "differential neural recruitment with respect to preserved music recognition" and the new knowledge of how different familiarities of music affect regions such as the lingual gyrus, the left inferior parietal, the left superior, and striatum could be invaluable in further refining how music is used as a clinical tool. As technology continues to improve, studies that use brain imaging techniques may be vital in understanding how Alzheimer's riddled brains differ from normal brain in how they process music. Understanding the mysterious mechanisms through which music resonates with Alzheimer's patients may be a key step in finding methods to delay or even halt the onset of the disease, and perhaps it may even lend a clue as to how it may be cured.

With the field now populated by both observational and scientifically analytical evidence supporting music therapy as a very viable and effective treatment, research has begun to move away from purely behavioral effects and change its focus to a deeper look into one of the most troubling and elusive aspects of Alzheimer's: the widespread loss of memory capabilities. Utilizing novel melodies as well as nonsense words, a 2009 study sought to test the strength of

musical and verbal short term and long term memory in an Alzheimer's population versus in a control population (Ménard & Belleville, 2009). The findings suggested that Alzheimer's patients experience a decline in their musical and verbal memory, both in the short and long term, and that perhaps music and verbal short term memory share some neural networks, though this was not corroborated or supported by any findings regarding long term memory. While these findings seem to suggest that music may not be as efficacious as we might hope, they also do not account for the utilization of music from an individual's past. To a small degree this study dissociates itself from being applied to music therapy as a whole due to the use of novel melodies rather than an individualized repertoire. As Gerdner (1999) suggested, individualized music has been empirically shown to have a greater effect on behavioral traits of Alzheimer's patients, so this may also translate to their internal neurology as well. In addition, there is some potential promise to the suggestion that musical and verbal memory share a number of neural networks. This overlap could be a blessing or a curse, the implications either being that since verbal memory is known to be in a deficit, so too must be musical memory, or that music may provide us with a key to accessing the shared paths in order to bolster both forms of memory, though more studies are needed to corroborate either of these potentialities.

In the following year, a 2010 study embarked on a similar mission to determine whether verbal cues could be better encoded in Alzheimer's patients when the words were associated with music, utilizing the knowledge that verbal and musical memory seem to share common neural networks (Simmons-Stern et al., 2010). Patients and control subjects were presented with a spoken and sung version of numerous multi line lyrics from children's songs, with which they were reportedly unfamiliar prior to experimentation. While Alzheimer's patients expectedly performed far poorer than did the control subjects when asked to recall the presented lyrics, the

results of the combinative effects of verbal and musical encoding resulted in a significant increase in Alzheimer's patients' ability to recall the lyrics as opposed to when they were merely presented with spoken words. Their accuracy increased from 28% to 40%, no small feat for individuals who are forced to struggle with the limiting effects of Alzheimer's on a daily basis. What really makes this impressive is that similar results were not found in the control group who actually experienced a minor decrease in recall ability (from 77% to 74%, which was considered statistically insignificant), suggesting that something very unique is occurring in the patients' brains. Speculation exists that the bolstering effect of music on Alzheimer's patients' memory is due to the slower decay of brain regions commonly associated with music processing (such as the basal ganglia, nucleus accumbens, hypothalamus, and others (Simmons-Stern et al., 2010)) as compared with the regions associated with general memory. Another theory is that music helps to direct the attention of Alzhiemer's patients, which would facilitate better encoding of information, and that the music may contribute to general arousal which could generally enhance the neurological processes associated with verbal encoding. While the true mechanism through which this enhancement occurs is not known, the findings of Simmons-Stern et al. without a doubt provide very compelling evidence suggesting the efficacy of music and music therapy as tools for assisting patients in ways that surpass temporary behavioral effects and in fact permeate deep neurological networks that are otherwise lost to the disease.

Clearly music therapy is still a developing field in which much more research is necessary, but over the course of the last three decades, leaps and bounds have been made in the study of behavioral and neurological effects of music and music therapy on patients suffering from Alzheimer's Disease. Despite medicine's immense expansion and progression, we are still far from finding a cure to this destructive disease, so it is absolutely imperative that we continue

to explore the mechanisms through which Alzheimer's affects the brain, and music has much promise as a potential lost link in solving the riddles of the disease. The horrors of Alzheimer's affect not only the patients, but also their families, caretakers, and other residents of care facilities. So long as the cure continues to elude us, we must at the very least make efforts to ease the horrors of the disease. Music therapy has been proven time and time again to mitigate patients' intense agitation, improve communicative abilities, and even promote fond reminiscence. Evidence has also been collected suggesting the promotion of vital neurological hormones that may be key in protecting and maybe even regenerating portions of the brain's neural networks that are continually damaged by Alzheimer's. Modern research is even suggesting that music therapy may be key in helping patients learn and recall new information. While music therapy in its current stages is still far from providing us with a cure, it is clear that it is an invaluable tool in improving the quality of life of patients and those close to them, and as research continues it may even provide us with a vital stepping stone in the creation of a cure for this horrible disease.

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ENDNOTES

[i] "Latest Facts & Figures Report," *Alz.org,* Alzheimer's Association, 02 May 2014, https://www.alz.org/alzheimers_disease_facts_and_figures.asp#prevalence.
[ii] Ibid.
[iii] "2012 Alzheimer's Disease Facts and Figures," *Alzheimer's & Dementia, Volume 8, Issue 2,* Alzheimer's Association, pg 10.
[iv] Ibid.
[v] Ibid., pg 7.
[vi] Ibid., pg 6.