"How does art neurologically affect the brain and therefore impact individuals and different audiences within society through art therapy?"

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Part I: Introduction

The paintbrush strokes the canvas, the pencil meets the page, and the potter's hands grasp the clay. In this moment, the artists are enveloped in momentary sensations of movement and touch. They may be lost in the flow of artwork with nothing else on their mind but the simple, calming task at hand. That does not, however, mean that nothing is happening in their minds. In each of these scenarios, the creation of art activates numerous regions in the brain much like little neurological fireworks. Art is a powerful mechanism for creativity, expression, and personal growth for people of all backgrounds. Art therapy is a means of utilizing art, as it is a psychotherapy involving free emotional expression through multiple art forms such as painting, modeling, and drawing. However, art therapy is not the most common form of therapy and is usually overshadowed by traditional therapy due to the difficulty of quantifying its effects. Despite this, art has been shown to have a plethora of positive neurological effects, even without the support of therapy. Although traditional therapy remains beneficial, diverse groups within society who struggle with mental, physical, and emotional illnesses with a communication barrier would neurologically benefit from making art and participating in art therapy because of the many unique ways that art impacts the brain.

Part II: Historical Context

Art has been used to convey information, emotions, symbolism, and spirituality in all cultures across the globe for the last 40,000 years or more ("The History of Art Therapy"). In its long and diverse evolution from cave drawings to 20th century expressionism to the street art of Banksy, art has developed increasing influence in society as a means of self-expression, creativity, and personal growth. The use of art in a therapy setting has a much shorter timeline.

Introduced in the 1940s by Adrian Hill and Edward Adamson, art therapy quickly developed as a form of therapy and spread to multiple hospitals and personal practices. In the United States, art therapy was pioneered by Margaret Naumburg and Edith Kramer, both of whom encouraged the growth of art therapy through University education and increased amounts of hospital programs ("The History of Art Therapy"). By the mid 20th century, art therapy was widely practiced. Since then, art therapy has become a modern blend of therapeutic art practices that support self expression and aid in diagnosis.

The biggest change in the field of art therapy, and in any field really, has been the technological and scientific advances of the 21st century. The neurological effects of art have only recently been discovered, as neuroimaging was developed in the late 20th century. The invention of brain scans and FMRIs allowed for neuroimaging of the human brain, which has significantly advanced art therapy. Such a large influx of knowledge from scientific advancements, however, resulted in more value being placed on quantitative data (numbers and evidence) than qualitative data (observed or perceived changes). Without strong quantitative data and evidence due to the lack of enough significant research, art therapy is utilized less than traditional therapies. However, the more discoveries that are made, the more the field of art therapy and our understanding of art and the human mind will progress.

Another reason for growth in the field of art therapy is a higher demand. The need for art therapy has increased alongside the growth of social issues and physical or mental deficiencies. Significant social issues such as increasing amounts of at-risk youth, veterans with PTSD, and levels of depression and trauma-caused disorders and illnesses have resulted in all sorts of treatments. Prescription medications and traditional therapy have come to the aid of these rising issues, as well as to physical and mental illnesses such as dementia, cancer, and HIV/AIDs. The increased demand for treatment combined with the rise of advanced technology has spurred the expansion of art therapy and continues to encourage its growth.

Part III: Research and Analysis

In the search to understand the impacts of art on the human psyche and society, research can be broken down into two categories. The first is what effects art production has on the brain. It explores how the brain works as it processes the information that we receive, process, and turn into memories. It also triggers specific areas within the brain that are of significant importance in how we function. The second category is the effects of art production on different audiences in society such as dementia patients, trauma patients, and people with physical diseases such as cancer. Seeing what happens on a neurological level in the brain helps us to better understand the impact that art has on people and why it has such an influence.

Art on the Brain

Processing Art

Sensory information includes visual, haptic, and sensorimotor information. Haptic sense includes the use of touch and feeling and sensorimotor information relates to and uses both sensory or motor functions. Another similar type of information is psychomotor information, which relates to both physical and mental activity. Sensory information is how we perceive not only the world, but also what we experience when making art. The art-making process is, essentially, all sensory information. This can include the creation of visual art, the use of clay, and the simple action of moving a paintbrush or pencil.

Sensory information, after it is received, can be processed. Processing within the brain is broken down into two types: top-down processing and bottom-up processing. As explained by Tripp, “top-down processing...is initiated by the cortex and involves cognition, planning and thought...bottom-up processing...is initiated at the more fundamental sensorimotor and emotional level, and is connected with overall body processing”(177). These two types of processing are opposite in the way they work, as top-down starts with someone’s initial conscious thought and works its way down to their actions while bottom-up starts with the action and/or sensation and makes its way up to their conscious or unconscious mind. Sensory information moves through our body and into our brains through bottom-up processing, as the information is noticed and then comes into consciousness. The process of art, then, uses bottom-up processing.

After it is processed, sensory information then moves into the stage of memory. Memory is stored through the use of bottom-up processing, or at least some forms of it are. As Tripp further explains, there are two main ways that memory is stored, which is through “...explicit memory, which is episodic, factual, and autobiographical, requiring focal attention; and through implicit memory, a predominately emotional, sensory, and unconscious memory often described as related to the body” (177). Much like the two types of processing, implicit and explicit memory function somewhat opposite of one another. Explicit memory is recallable, consciously retrievable information, such as recalling the answers to a test, and implicit memory is not conscious but is stored rather in the body, such as knowing how to ride a bike. Implicit memory is recalled through sensory information. When sensory information is perceived, it is processed using bottom-up processing and then can be stored mostly in implicit memory. Things that we store in our implicit memory may be things that we are not even aware of. This is why certain smells bring back strong memories and drawing out a picture can evoke past sensations and emotions.

The pathway that sensory information takes is useful to us because it is primarily how trauma is stored. Most, if not all, trauma is perceived as sensory information that is processed from the bottom-up, and then becomes part of the implicit memory, held within the body and subsequently affecting it negatively. This pathway can explain why people experience and re-experience trauma in their bodies, as their bodies are responding to recollective sensory information from that trauma. However, this pathway shows us that what is stored using sensory information can also be retrieved using sensory information. When sensory stimulation is used to create a traumatic memory, then sensory stimulation through art can be used to access it as well. The sensory stimulation involved in the creation of art can trigger the sensations, memories, and emotions experienced in a traumatic event. Most of the time, triggering traumatic memories would not be a good thing. However, most people are unaware that these changes are even taking place. Art helps in the body's releasing of trauma, simply because it shares the pathways through which it was created. These shared pathway of processing and forming memories between creative expression and trauma is how art can positively impact us. This is one of the reasons why art works so well as a therapeutic modality. It can be used to access information in an indirect manner where the patient can process the trauma in a safe environment.

Affected Regions of the Brain

The areas within the brain that are stimulated by creative action are specific to emotion and memory. Touch and haptic sensory information, such as the feeling of molding clay, is processed in the somatosensory primary cortex. As explained by Lusebrink, "Touch and haptic perceptions involve movement and also activate emotions because the amygdala receives information from the somatosensory primary cortex" (127). What we touch and physically feel has a direct connection to the amygdala, which is the part of the brain responsible for emotions. The sensory information that is collected in the amygdala then travels to the orbitofrontal cortex and the prefrontal cortex, the first of which is described as, "...likely involved in emotional regulation, whereas the different areas of the PFC (prefrontal cortex) have been conceptualized as dealing with affective working memory anticipating the consequences of positive and negative emotions" (Lusebrink 128). The orbitofrontal cortex is effective in regulating emotions while the prefrontal cortex is significantly involved with memory. In fact, the prefrontal cortex is primarily responsible for "the functions of working memory, attention, and inhibition" (Lusebrink 128). The stimulation of the amygdala, prefrontal cortex, and orbitofrontal cortex caused from somatosensory information (involving both the brain and the body), significantly impacts our emotions, how we deal with them, and memories.

Connectivity

While sensory information may stimulate the brain, however, the real key lies in bilateral stimulation and interconnectivity. Bilateral stimulation is the activation of both the left and right hemispheres of the brain. The right side of the brain is where the creative and emotional processing takes place and the left side is associated with more analytical and linear thought processes. Most sensory information that is perceived when creating art is processed in the right hemisphere of the brain, but as the information increases the activation spreads to the left hemisphere as well (Lusebrink 127). This form of bilateral stimulation, using both sides of the brain, is key to resolving trauma, as "...the bilateral integration of information processing between right and left hemispheres… has been proposed to be a core component of the resolution of unresolved trauma.” (Monti et. al 365). The involvement of both hemispheres of the brain while conducting an activity is effective in processing and resolving trauma. This is most likely because traumatic memories are stored in the right hemisphere of the brain (Monti et. al 364). Utilizing neural pathways in both hemispheres may “activate the right hemisphere storage and integration of traumatic events, resulting in a decrease in PTSD symptoms.” As discussed in the previous section, accessing trauma allows it to be released from our bodies and decrease its symptoms by using the same avenues through which it was stored and integrated into our bodies. However, the real resolution of trauma comes when the information gathered by the right hemisphere of the brain is associated to meaning. Describing and verbalizing what an image or art piece represents results in left hemisphere activity (Monti et. al 365). Consciously associating our art to meaning and verbalizing it results in bilateral stimulation. When we recognize and verbalize our feelings, the unconscious information that was processed by the right hemisphere becomes consciously associated with emotions and memories in the left hemisphere. Therefore not only the creation of art, but also the conceptualizing, reflection, and verbalization of it is beneficial to our psyche.

The other key factor involved in the positive effects of art is the interconnectivity of the regions of the brain. Researchers conducted a study on the effects of visual art production. It tested two groups, one that participated in a visual art production class and one that only viewed and evaluated art. The latter group served as a control group that would test factors such as group interaction that might otherwise change the connectivity being measured. They tested connectivity in the Default Motor Network (DMN), which is a highly correlated network within the brain associated with "cognitive processes such as introspection, self-monitoring, prospection, episodic and autobiographical memory, and comprehension of the emotional states and intentions of others" (Bolwerk et. al 1). The fMRI scans from the art production group showed that there was a significantly increased amount of bilateral connectivity in the DMN between several different regions including the premotor cortex, prefrontal cortex (mentioned earlier), and superior and inferior parietal lobules among many others (Bolwerk et. al 3). These regions of the brain, particularly the premotor cortex and parietal lobe, are associated with sensory information processing while the prefrontal cortex regulates emotions. There was no such connection between the right and left hemisphere in the art evaluation group. Connectivity was also measured in the visual cortex as a control test. In both groups it showed no increased or significant connectivity (Bolwerk et. al 4). This shows us that the production of art indeed creates increased bilateral stimulation and interregional connectivity in the DMN.

The sensorimotor cortex, where sensory and motor information is processed, was also tested for a change in connectivity. However, unlike the other results this area tested as having increased *intra*regional connections but less *inter*regional connectivity. There was an increased connectivity within each region, but less between the different regions. This is, however, a positive outcome as it shows increased differentiation of sensory input. This is especially important in the case of ageing minds, as "the loss of specialization in certain regions of the brain, with reduced distinctiveness or differentiation at the neural level, is generally thought to represent a compensation strategy of the ageing brain" (Bolwerk et. al 7). Thus, the increased specificity of the brain in the sensorimotor cortex is extremely beneficial.

Interconnectivity, however, also has another benefit aside from bilateral stimulation, and that is psychological resilience. The two groups from the study were also tested on psychological resilience, or stress resistance, before and after creating or viewing art. Bolwerk describes it as, "...a protective personality characteristic that allows individuals to control negative effects of stress and thus enables a successful and healthy functioning even in stressful life conditions" (2). An increased psychological resilience means that we are better able to handle stress and mentally bounce back from negative situations. In the study completed, the art evaluation group did not experience any change in psychological resilience, but the art production group had a significantly improved resilience (Bolwerk et. al 3). This change in resilience is most likely due to increased connectivity. There was a statistically significant correlation between functional connectivity in the DMN and greater resilience, as well as with the frontal cortices (Bolwerk et al 5). This illustrates that interconnectivity results in higher psychological resilience and helps us deal with stress.

Art on People

Dementia Patients

Practicing art has implications larger than just those found in the brain. If we zoom out from studying how the brain is affected by art, we see a diverse audience who can specifically benefit from art production.

Senior citizens and older people, specifically with dementia and alzheimer's disease, are a target audience for art practices, as their minds are in different stages of damage or degeneration. However, according to Andrew Duxbury, a specialist in geriatric medicine, "the impulse to create is always with us…in a brain that is developing dementia, the artistic impulse usually is not damaged and remains intact" (qtd. in Stallings 136). Despite the state of the mind in the stages of dementia, the innate impulse to create and express is still there.

Patients with dementia are affected in certain areas of their brain, such as "... the temporal and parietal lobes of the brain… These are the regions of the brain that govern many higher-level intellectual activities such as language" (Stewart 3). Furthermore, "Alzheimer's disease is associated with damage to the visuo-constructive skills" (Lusebrink 130). This shows that the very parts of the brain that dementia and Alzheimer's disease affect are the very parts of the brain that creating art helps to reconstruct. As mentioned before, the parietal lobe is significantly influenced when producing art. Visuo-constructive skills are skills that utilize spatial information to create designs or patterns. This is why using three dimensional media, like clay, for haptic stimulation with Alzheimer's patients is a very common practice (Lusebrink 130). Haptic feedback helps the patient recognize form and spatial relationships, directly counteracting the damage to visuo-constructive skills as well as activating the parietal lobe that may be degenerated.

In this way, the damage or degeneration within ageing brains can be somewhat counteracted. This also applies to people with brain damage or impaired pathways in general, as "...kinesthetic action can serve as a reconstitutive agent in that it can stimulate motor memories including those sequences of motor action relegated to the basal ganglia. Haptic sensory stimulation can bypass impaired brain areas and help to reconstitute memories" (Lusebrink 129). This means that touch and movement are able to stimulate memory of lost mental or physical facilities. Basal ganglia, another neuron structure in the brain, is one of the two bridges between the motor association cortex (where planning and control of movement occurs) and the somatosensory cortex, making it vital to the processing of motor information. Art involving haptic stimulation (such as touch and motor movement) is a way of stimulating basal ganglia and therefore helping to reconstruct the damaged pathway between the motor and somatosensory cortices that is so common in Alzheimer's patients (Lusebrink 128).

In the case of dementia patients, the use of collage has been found as helpful due to its link to memories, reminiscence, and symbolism. Collage is a medium that is particularly helpful because it is "...an effective vehicle for the process of reminiscence. Collage making… is possibly one of the best media for life review because it addresses the need for stimulus in creating art while still allowing choice" (Stallings 137). The process of reminiscence and life review are forms of thinking and talking about one's life, and have been effective in patients with short-term-memory loss and even terminal patients (Stallings 137). The use of collage, as stated, allows for patients to feel as if they have the power of choice in what images they use. This, also, is an important aspect of therapeutic collage.

Cancer Patients

People who are diagnosed with cancer undergo a significant amount of stress. The illness itself is a distressing situation, while along the way they are presented with numerous challenges they must deal with as well. Negative self perception, poor coping strategies, and weak social supports are just some of the leading causes for stress in cancer patients. An estimated 20-40% of cancer patients have extremely high levels of stress (Monti et. al 363). Stress in turn negatively impacts overall health and may even increase the symptoms of their illness. However, art interventions have been proven to reduce stress in cancer patients and have a positive effect.

This most likely comes from a combination of sensory stimulations, as "...the kinesthetic activity in art making may facilitate a release of tension and serve to enhance a relaxation response while aiding in the toleration of stressors" (Tripp 176). The stimulation from movement and kinesthetic activity provides patients with relaxation and the ability to handle things that may cause them stress. Furthermore, reduced stress may be due to the role that neural pathways play in the brain. As Monti explains, "...art therapy tasks could be designed in a way that may integrate brain pathways related to distressing experiences, providing a mechanism for stress reduction" (364). The brain pathways mentioned here are the same ones studied earlier in the section, "Processing Art". Pain and art stimulation share a neural pathway in processing and the formation of memories. Therefore art can play a role in the accessing of these pathways as a healthy way to release tension and reduce stress.

Furthermore, art stimulation does not just share neural pathways with pain, but also several parts of the brain. As learned before in the section, "Areas in the Brain", art stimulates the amygdala, which is the center for emotion, and the somatosensory cortex. Pain is experienced in these structures as well, as "...the signal is carried… to the somatosensory cortices, it also engages the limbic amygdala, and anterior cingulate cortex (ACC), and the insular lobe" (Hass-Cohen 177). The anterior cingulate cortex, although not mentioned before, is associated with conflict resolution (Hass-Cohen 177). It is apart of the DMN discussed in the "Connectivity" section of this paper. We can, from here, make connections and understand that both pain and art, as forms of sensory information, are processed similarly and experienced in many of the same areas of the mind.

The concept of reducing stressors also relates to psychological resilience, discussed in the earlier section, “Connectivity”. Art production, as we know, increases psychological resilience, which is one’s ability to handle stress and negative emotions. In terms of cancer patients and people with physical illnesses, this can serve to reduce their symptoms of distress.

A study was conducted on a group of breast-cancer patients that measured their psychological distress and stress related complaints (using the Symptoms Checklist Revised, a way of measuring distress) before and after a Mindfulness-Based Art Therapy (MBAT) intervention. During this intervention, women participated in mindfulness practices and instructed art activities and production. The results of the study showed “statistically significantly greater decreases in symptoms of distress as compared to subjects in the...control” (Monti et. al 369). The MBAT was an effective means to reduce distress in cancer patients. Art production is capable of reducing stress in cancer patients who struggle with having extremely high levels of stress. Considering that art is reductive on all forms of stress and not just in stress relating to cancer, art is most likely also beneficial to patients with other stress-inducing illnesses.

Trauma

Although it was discussed before in the “Processing Art” section of this paper, the role and influence that trauma has in our lives cannot be overstated. When most people think of trauma, they might think of PTSD, or Post Traumatic Stress Disorder, caused by dramatic and life-threatening incidences. Although this is one form of trauma, trauma also can be experienced as small and seemingly ordinary incidences such as a time when someone felt humiliated in front of the class, etc. Trauma, then, is any past or ongoing experiences that negatively affect our psyche.

One of the most interesting and pivotal aspects of trauma is how difficult it is to verbalize. This is not just a common theme that most people find to be true, but a neurological effect that trauma has on the brain. As stated by Tripp, "...brain scans... show that the left frontal area of the cortex, in particular the Broca's area (the center of speech) appears to shut down when trauma is recalled" (177). Trauma quite literally shuts down the part of our brain responsible for speech, leaving us speechless in our efforts to talk about a traumatic event. This shows the need for a therapeutic modality that can lead to the expression of memories and emotions that cannot be expressed verbally.

As mentioned before in the "Processing Art" section, trauma is brought into the body through bottom-up processing, the same type used when producing art, and then becomes integrated in our bodies through implicit memory. This being said, involving oneself in sensory stimulating activities such as art is a natural way for the effects of trauma to be reversed. Trauma is also significantly helped by connectivity in the brain. As stated before in the "connectivity" section, bilateral stimulation is key to the resolution of trauma. Whether it be extreme trauma resulting in PTSD or smaller cases of trauma, art production significantly helps to resolve it not only due to the neurological or psychological aspects, but also because it is a form of expression when verbalizing is near impossible.

Part IV: Conclusion

Art is a profound influence in our lives. Whether it be a famous painting hanging in the Louvre or the scribbles drawn by a four-year old, art impacts the minds of all artists alike. Art as a lone activity is significantly beneficial to our psyche. The shared neurological pathways encourage the release of trauma and show the natural connection between creative processes and our biological functions. It also impacts our brains through activating areas associated with emotions and memories. The most key influence that art has is its ability to create bilateral connectivity within the brain and increase interconnectivity within regions that promote specialization, which results in the resolution of trauma and a heightened ability to handle negative situations. All of this goes to show that art is therapeutic in itself. There does not have to be a therapist setting in order for it to be effective. This alone proves the power of art to transform us.

However, that does not mean art therapy is no longer necessary. On the contrary, art therapy is the perfect vehicle through which art can benefit us, as it reaches numerous audiences in need of treatment for physical and mental illnesses and struggles. Despite its benefits, art therapy has been overshadowed by traditional therapies such as counselling or talking to a therapist. This raises the opposing question: How is art therapy any better than traditional therapy? The benefits from processing emotions, resolving trauma, and healing can result from any form of therapy, not just in art therapy. Traditional forms of therapy are arguably better researched, with more quantitative data to support them. Talking with a therapist is a straightforward, direct approach with no real risk of misinterpretation. The results from a session of therapy are more concrete and tangible, with talking, expressing, and goal-making all reliable methods of measuring change. Art therapy, on the other hand, is based on the overall experience of the individual and relies on the small and less perceived changes within the brain that patients may be unaware of. It seems that traditional therapy would be the most reliable and direct way to improve one's psychological health.

However, the most direct, straightforward approach is not always the best approach. Direct communication, in many ways, can be intimidating and sometimes impossible with certain audiences. The argument that art therapy is more beneficial pivots on the idea that it is an indirect way of accessing emotions and a safe, alternative means of communication. Art therapy is a significantly better method of communication because it can be catered to specific audiences. Direct, verbal communication is rare for patients with advanced stages of dementia and other mental illnesses. Their ability to feel and remain intact emotional beings remains far after their ability of speech has withered away. Therefore, their need to express these emotions only increases as their ability to verbalize them decreases, and art therapy is the perfect modality for that expression. Young children who are still developing their ability to speak would benefit from art therapy to aid in their communication of emotions, needs, and mental states. Likewise, youth at risk within communities are much more suited to art therapy because of their resistance to traditional therapy and lack of avenues for expression. Artistic expression is not only healthy for them, but also provides a means of safe communication in which they don't feel judged or pressured to conform or change in any way. As explained in the section titled, "trauma", people who experience trauma are quite literally unable to talk about their trauma (or at least strongly naturally deterred from it) because the part of their brain that is responsible for speech shuts down in the presence of that trauma. The same goes for all of these cases and for anyone who has experienced trauma before. In all of these situations, verbal communication is not the first reaction of the human brain. Instead, its reaction is to use the brain's numerous connections to creativity and physically and emotionally experience things in order to process them. We are wired to like and benefit from experience and expression more than just talking alone. This is why experiential therapies tend to be more effective in general. There may be more therapeutic value found in present experiences happening in the moment rather than just through verbal exchanges. This is why art therapy as a whole can be used to benefit society on a large scale. It combines the positive neurological effects of art with healthy communication to reach the far corners of society that traditional therapy cannot cover.

There are ways to implement art therapy into our society on a smaller scale as well. School is one of the clearest places to integrate therapeutic art activities. In an article from *Art and SPED*, there are several suggestions for the integration of art into schools. The first is to have “art breaks” throughout the day that would provide students with a periodic break to conduct art activities such a sketching and painting (Losinsky et. al 29). During this time, the brain would also be releasing stress and reducing anxiety. The second suggestion of the article is to use mandalas as subject matter. Mandalas have been found to reduce levels of anxiety and would be the perfect way to integrate art activity to children of all levels of artistic ability (Losinksy et al 29). They could create or color to the extent of their abilities, therefore gaining the benefits of art but not having the pressure to be “good” at art. The last suggestion is to let the students be intrinsically motivated and create free visual art of any subject matter or style that they please. This gives the students freedom of choice, full creative expression, and an opportunity to be highly-interested and motivated to create, which may be lacking in their ordinary school day (Losinksy et. al 31).

On an even smaller scale, art can be used to benefit us as individuals if we personally choose to take our own art breaks throughout the day and incorporate as much creativity into our daily tasks as possible. Art journaling is journaling using images and drawings to represent our feelings, scenes, or events throughout the day. It is an effective and creative way to process. Regularly engaging in art is exceedingly beneficial to our minds and our ability to handle stress and process emotions.

No matter how it is used, art is good for us. It is good for our psyche on a neurological level and subsequently good for differing groups within society and society as a whole. Art therapy can be used to impact audiences that traditional therapies cannot through utilizing the natural benefits of art on the brain and its ability to encourage nonverbal communication and expression. The drive behind art therapy and its positive benefits to society lie in the connections made in the brain while completing art and in the ways we neurologically and physiologically interact with art in order for it to impact us. Furthermore, art therapy is such an effective and beneficial form of therapy because it opens a door in the barrier of communication that we so often experience between us and the people we are trying to help. It could be as simple as someone who is not comfortable enough to talk about their experiences in the open having a way to explore their inner world in a way that is not only enjoyable, but enables them to start an introspective process within themselves. The crux of the advancement of society through art therapy lies in our understanding of how art impacts us and how we can better serve the world through it.

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