



Can Drama Induce Neuroplastic Changes in the Brain? Implications for Future Research and Treatment



Will O Atiomo*

Jourdelays, Eton College, Windsor

***Corresponding author:** Will O Atiomo, Jourdelays, Eton College, Windsor, United Kingdom

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Opinion

Javier (a pseudonym) suffers from Autism. He attends the local school which offers a specialist unit for those suffering with the disorder. As an alternative to the conventional pharmacological treatments, the school decided to call on the visiting drama therapist to discuss their concerns regarding Javier's behaviour. Javier was entailed to express his emotions using feeling cards and sound. Initially withdrawn, Javier hesitated to engage with the therapist's activities. After a few weeks however, the drama therapist and the school alike noted a remarkable change [1]. This once socially awkward boy, who avoided communication and sporadically lashed out, now looked forward to spending time with his peers. In equal measure, he was no longer reluctant to communicate his fears when something went wrong.

Being an actor myself - I was fascinated by the concept of what induces emotional response and how actors manipulate this to their advantage. Because of my reflection and reading, my answer to why Javier improved following his few weeks with the drama therapist, lay in the possibility of neuroplasticity. Neuroplasticity is defined as the brain's power to alter and reorganize its structure in response to external stimuli. It is possible that neuroplasticity explained Javier's behavioural change - an alteration of cortical structure. This opinion piece argues that drama may be able to cause neuroplastic changes in the brain via the mirror neuron system and calls for more research into this field to underpin drama-therapy.

Neuroplasticity

Neuroplasticity is the brain's ability to reorganize its synaptic connections, particularly in response to learning new things or after sustaining injury [2]. Neuroplasticity is a relatively new phenomenon; some 25 years ago, it was widely believed that the brain granted to you from birth was the brain that you lived with until death, however the concept of neuroplasticity suggests this might not be the case. Typically, neuroplasticity can be described as manifesting in 3 different ways [3]. These are:

- A. Chemical changes - involving a change in what is secreted between synapses. This is often associated with a change in short term memory as well as short term motor skills.
- B. Physical changes - This involves the altering the brain's physical structure. This is often associated with facilitating long term memory or long-term improvement of motor skills.
- C. Altering function - Whole networks can be shifted and changing in favour of different pathways.

All these processes interact together to support learning and recovery after the brain sustains injury. Neuroplasticity can dually be both adaptive and maladaptive. Adaptive plasticity refers to when the brains alteration prompts an improvement in cognition, as seen through the process of learning. Maladaptive neuroplasticity dually refers to a reorganization of the brain associated with a worsening condition or poorer behaviour for example, drug addiction. Here, loss of functions can increase upon injury or when linked to a specific disorder.

The mechanisms underpinning neuroplastic changes are vast [4]. They can however be understood through 3 essential changes. These are synaptic pruning, synaptogenesis and the altering of synapses. Neuroplasticity as a principle has been ground-breaking for clinicians in recent years. Diseases previously thought to be incurable are now being treated through the application of neuroplastic principles. Some examples include stroke recovery and neuropsychological disorders. In stroke for example, neuroplasticity-based interventions are typically aimed at exciting the unused area of the brain. In this instance, the area clinicians would be after is the motor cortex, however the same principles exist for reinstating say language by stimulating the Broca's area or memory in the limbic system, affected through repeated activities. In this way, new synaptic pathways can be created. In neuropsychological disorders, cognitive behaviour therapy, are a popular type of psychotherapy - its aim being to alter thought patterns to improve behavioural outcomes [5]. This might mechanistically be through neuroplasticity.

Drama based therapy

Drama based therapy is an experiential based process which aims to improve patients through prompting them to alter their behaviour. It was borne out of the fact that the dialogue started in many therapy sessions often fell short of the desired outcome for affected patients. Something more visceral and cathartic was needed. Mechanistically, during drama, in the psychodramatic technique 'physical embodiment', the protagonist is asked to develop the scene, from its setting within the space and describes the sensory experiences to other actors within the scene. The protagonist is dually asked to undo the scene at the end of the process. This implies that they have personally engaged with the process and 'puts the mind in action'. The director prompts the protagonist to engage with the here and now of the situation through asking them to touch different stimuli and utilize props to emphasize the situation [6]. Other actors also step into the scene to help the actor develop a better image; this is called concretization. The process of other actors imitating is designed to help develop further contact with physical reality. The latter introduction of a second individual into the psychodramatic process is called a "soothing double" and is designed to calm down the participant when the scene becomes too complex emotionally. All this activity in psychodrama potentially facilitates cognitive development, affects emotional experience and could induce neuroplastic brain changes.

Drama and neuroplasticity

In my search of the literature (Google, PubMed and Google scholar), although there was indirect evidence, I could not find any research mechanistically directly linking drama therapy and neuroplasticity. However, one theory that stood out for me as a possible link between drama therapy and neuroplasticity was the "mirror neuron theory".

Mirror neuron theory

A mirror neuron is defined as a neuron that fires as an animal watches the same action performed by someone else. The discovery of mirror neurons occurred in monkeys during the 1990's by the physician Rizzolatti. Rizzolatti and his team at the University of Parma discovered the mirror neuron system initially through attaching electrodes to monkey's brain. After repeated experiments it was uncovered that observing the same action in others prompted the same signals being relayed in the brain as if the task was done by the monkey itself.

The mirror neuron theory forms a scientific basis for compassion; a term previously seen as elusive about its physiological origin in the human body. The relaying of the same signals down neuronal pathways in response to witnessing someone's own experiences could underpin the ability to empathise - the neurons are adopting someone else's point of view. Compassion and empathy alike act as critical traits for the realistic actor. The more that can be learned about the science behind acting is a very useful precursor to the potential applications of drama-therapy. These findings also support some of Moreno's initial musings on the self-reflecting others and

this theory might explain why Javier's Autism improved following drama therapy.

The mirror neuron mechanism is also thought to be involved in speech, which along with empathy is a key component of drama. With respect to speech, mirror neurons have been found in the part of the brain responsible for speech. Neuroscience indicates that human language may have developed through watching gestures and interpreting them for ourselves. The Broca's area of the inferior frontal gyrus is responsible for language in humans and it has been suggested that it is part of the mirror neuron system although this hypothesis has recently been challenged [7].

A series of techniques, from functional magnetic resonance imaging (fMRI), transcranial magnetic stimulation and more have been used to discern the existence of the mirror neuron system. From such research, scientists have been able to ascertain that the mirror neuron system is comprised of the precentral gyrus (which borders the human motor cortex) the front part of the inferior parietal lobe alongside the visual areas such as the temporal and occipital lobe. Mirror neurons fire off even when observing seemingly pointless actions and fundamental human imitation manifests in humans through the role of the superior temporal sulcus or STS. The mechanism works through the STS ordering visual processing of observed action, whilst the precentral gyrus within the mirror neuron system is responsible for the body processing and understanding the action seen, before then relaying the signals to the relevant motor neurons in order to induce replication.

Going back to Javier - what may seem like a simple behaviour outcome has indeed never been more complicated. Complete consistency in therapeutic techniques cannot be expected when the mechanisms underpinning them are not fully understood. The researcher or indeed clinician should be motivated to explore the precise alterations and neurologic mechanisms taking place when drama therapy is used with a patient. In this way, progress can be facilitated even further - and fewer children like Javier can feel sidelined.

In conclusion, this opinion piece has explored the brain's fundamental propensity to change. Challenges surround the real-life application of this body of knowledge. The neuroplastic changes theorized would have to be tested, most likely using MRI, during drama therapy to investigate whether any changes associated with the mirror neuron system are induced. A concrete body of knowledge could enable therapy to go beyond specifically dealing with psychosis, but dually with traumatic brain injury and other psychological disorders.

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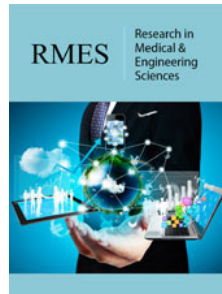
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