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Mirror-touch synaesthesia: The truest form of empathy

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Mirror Touch Synaesthesia (MTS) has slowly sent shockwaves throughout the medical community. MTS was brought to the medical world's attention in 2005[1]. MTS is as weird as it is wonderful because feeling someone else's pain could be perceived as the best representation of empathy. MTS is defined as a person having a physical reaction or response to something that is happening to someone else[2]. 2% of the population live with MTS[3].

Synaesthetes are individuals who have synaesthesia[4]. Those with MTS are referred to as MT Synaesthetes; they can understand and identify facial expressions, and have enhanced social awareness[5]. However, MTS can be severely disruptive. Some synaesthetes become overwhelmed and distressed by their feelings as a result of others' experiences; this is known as sensory overload[6],[7]. Sensory overload is defined as receiving excessive input from all your 5 five senses which your brain struggles to cope with[8]. Coping mechanisms, like deep breathing exercises, seem to be effective for MT synaesthetes[9] [10]. Furthermore, many synaesthetes often assume that everyone is experiencing the sensations they experience[11].

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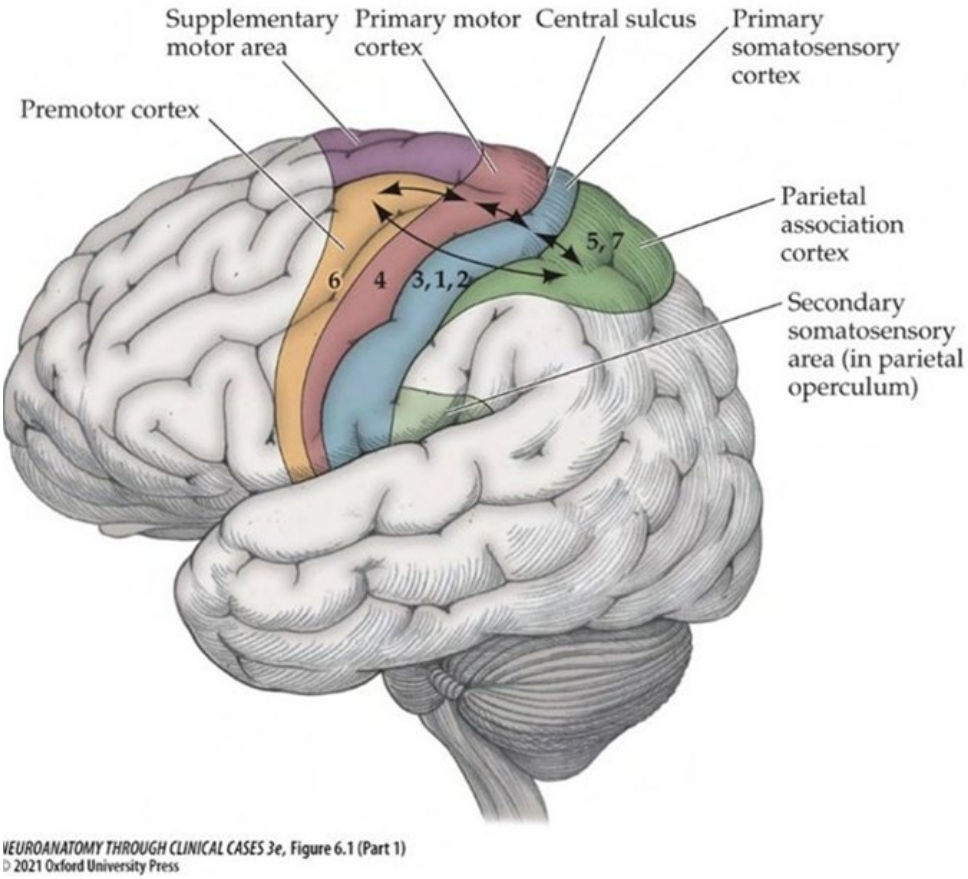

Figure 1: A diagram depicting the location of the primary and secondary somatosensory cortexes in the human brain[15].

The neurobiology behind Mirror-Touch Synaesthesia

MTS involves triggering the primary (SI) and secondary (SII) somatosensory cortexes within the synaesthete's brain (Figure 1)[12]. fMRI imaging showed that the same areas of the synaesthete's brain were activated as that of the individual performing the action[13]. However, the SII in the parietal operculum has more grey matter in the brains of MT synaesthetes[14]. fMRI also indicated that the activation of SI and SII was related to increased stimulation of the mirror- touch network[13]. Furthermore, the tactile mirror system, which links MTS and empathy, leads to synaesthetes to physically feel what others are feeling[13].

Dr Joel Salinas lives with MTS and is a neurologist in the USA[16]. He mentions that in MTS, the visual and touch centres of the brain are subconsciously merged and triggered[17]. MTS may occur due to mirror neurones in synaesthetes' brains[13].

Chicago Med provides necessary neuroscientific knowledge

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‘Chicago Med’ is a fictional show which provides an insight into a hospital’s Emergency Department. In Series 2, Episode 12 of Chicago Med, named “Mirror, Mirror”, MTS is represented[18]. In the show, two doctors encounter a character named Ariel who exhibits strange symptoms for no apparent reason.

Firstly, a male patient experiences a seizure, which Ariel “imitates.” However, a female doctor finds that Ariel is not exhibiting the signs of a seizure, such as nystagmus or asynchronous muscle movements. Ariel’s mother repeatedly tells Ariel to stop making a scene. Ariel is put into isolation. The male doctor tests a theory that he thinks may apply to Ariel. He has a conversation with Ariel, where he slaps his left cheek. As a result, Ariel feels the pain on her right cheek, a mirrored impact. The doctor diagnoses Ariel with MTS[19].

Showing the reaction of Ariel’s mother is important, because viewers may be able to identify how their reaction to such a situation would be similar. By incorporating MTS and the reactions to it within the storyline, Chicago Med has managed to bring this wonderfully weird condition into the spotlight. Perhaps viewers would feel inspired by the episode go on and learn more about MTS. Increased awareness of this condition could lead to more research interest, allowing research scientists to fully understand MTS through tests and clinical trials.

Reflecting upon mirror neurones

Mirror neurones replicate the sensory experiences, which happens at a heightened level in synaesthetes. These specialised neurones can also help us understand human behaviours and emotions[20]. Solid evidence of the existence of mirror neurones in humans has been obtained through many imaging techniques, including Functional Magnetic Resonance Imaging[21]. Mirror neurones are in the Broca’s area, inferior parietal cortex and primary motor cortex, as seen in Figure 2 [20] [22].

Mirror neurones are activated when we carry out an action, and when we observe others[24]. In addition, mirror neurones are motor or visuomotor[21] [25].

Visuomotor describes the coordination between the visual and motor aspects of the brain, specifically the eyes and the upper and lower limbs[26]. A visual stimulus would activate visuomotor neurones which results in a motor response such as limb movement[27]. Mirror neurones are one of two categories of visuomotor neurones[27]. Mirror neurones are part of an extensive mirroring network. When an individual replicates an action, the mirror neurone fires like it would have fired for the person who carried out the action[28]. It has also been discovered that mirror neurons play a part in sharing emotions[29]. Have you ever cringed when someone has fallen? You cringe because the mirror network crosses the threshold between conscious and subconscious thinking, making you think that you had fallen; thus, you respond accordingly. The mirroring experience intensifies and is a more conscious phenomenon[30].

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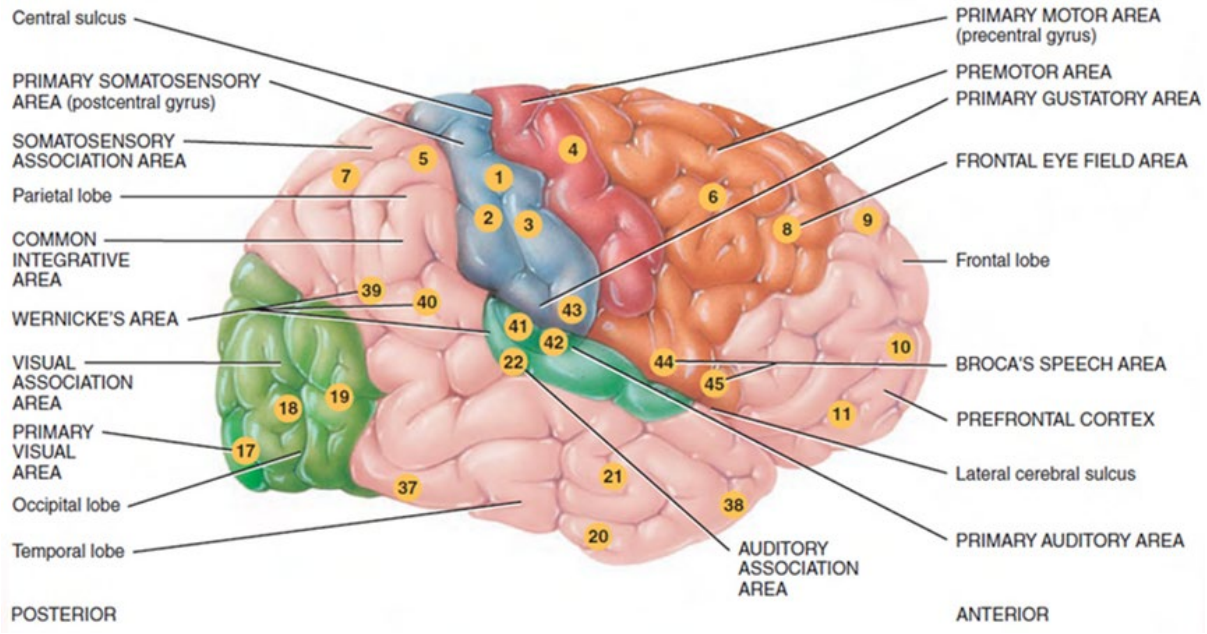

Figure 2: A depiction of several regions in the brain such as the Broca's Area and Primary Motor Cortex/Area where mirror neurones are located[23].

Dr Salinas explains that every human has a mirror network in their brains, but synaesthetes tend to have a more extensive network[17]. The mirror neurone network is also hyper-activated in MT synaesthetes. Additionally, the threshold between recognising your own body and someone else's with synaesthetes is extremely blurred, so MT synaesthetes feel sensations in regions where individuals may be experiencing sensations. Additionally, a synaesthete would see their body blend into their surroundings due to the threshold's blurring[30].

Somatic empathy: How it differs in MT synaesthetes

There are many types of empathy[31] [32]:

Cognitive empathy (putting yourself into someone else's shoes) Affective empathy (understanding and expressing concern for an individual's well-being)

Somatic empathy (physical reaction to someone else's experiences)

Somatic empathy is a response to something that someone else has undergone[32]. People experience somatic empathy all the time, and this may be in the subtlest ways possible. For example, if someone is embarrassed, you may react physically to this. You might have a feeling of uneasiness like it was you who was embarrassed. Somatic empathy is the most prevalent in MTS. However, in MTS, the patient feels the same sensation, but they feel it on the opposite side to where the impact occurred[33]. Intriguing, isn't it?

Mirror-Touch Synaesthesia is vital in neuroscientific advancement

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Usually, synaesthetes have developmental synaesthesia, meaning that they were born with synaesthesia or inherited it genetically[9] [11]. It may be acquired due to limb loss[10]. Phantom Limb Pain occurs when an individual loses a limb but still feels a sensation, or unpleasant pain, in the region of the amputated extremity (Figure 3)[34] [35]. However, the sensations only affect the phantom limb in amputees[36]. Moreover, the amputees only felt the sensations when humans were touched[36].

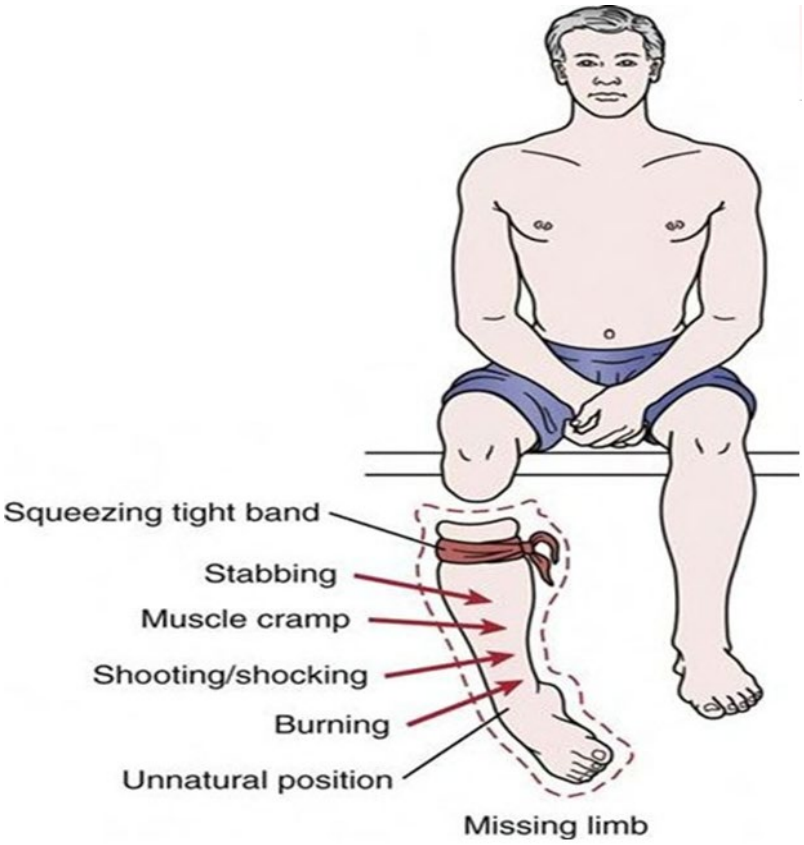

Figure 3: A visual representation of the sensations experienced by amputees with Phantom Limb Pain[37]

Those with autism spectrum disorder have a mirror neurone system dysfunction, leading to decreased mirror-neurone activity[38] [39]. As MTS is caused by elevated mirror neurone activity, researchers have suggested that MTS research may lead to novel autism research that could provide help for individuals with autism[40]. Researchers may discover how to increase mirror neurone activity by studying MT synaesthetes.

MTS occurs more prevalently in people with grapheme-colour synaesthesia[41]. Grapheme-colour synaesthesia involves the association of colours to letters or numbers[42]. Thus, MT synaesthetes can have MTS alongside other synaesthetic conditions; however, further research is required to reveal how this is possible[41].

Why is Mirror-Touch so important to the scientific community?

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MTS enhances social cohesion[43]. Social behaviour is heavily impacted by the human ability to understand what others around us are feeling[5]. This can enhance empathy within society.

It would be interesting to discover whether MTS is solely something you are born with, or whether it can be acquired during life. If the latter is found to be true it could be advantageous to healthcare, where a better understanding of patients' pain may lead to improvements in healthcare standards. Also, it may allow doctors to adapt treatment to suit patients and treat them holistically. Holistic treatment involves the patient's physical symptoms and emotional trauma to be treated simultaneously. Dr Salinas mentions that MTS helps him be more compassionate towards his patients due to understanding what the patient needs. He, also, uses MTS to strengthen his capability to provide the best care[30]. Dr Salinas also states that MTS helps him diagnose patients[17]. Dr Salinas has also authored "Mirror Touch: Notes from a Doctor Who Can Feel Your Pain"[44].

Mirror-Touch Synaesthesia – The ultimate superpower

MTS is a physical manifestation of empathy, which could be perceived as a superpower. Understanding one another in more empathetic ways could help us to better take care of one another.

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