



THE NEUROSCIENTIFIC BASIS AND THERAPEUTIC POTENTIAL OF INDIAN CLASSICAL DANCE: A REVIEW

Surabhi Kaipy* & Charu Gupta**

Centre for Fundamental Research and Creative Education, Bengaluru, Karnataka, India

Cite This Article: Surabhi Kaipy & Charu Gupta, "The Neuroscientific Basis and Therapeutic Potential of Indian Classical Dance: A Review", *International Journal of Interdisciplinary Research in Arts and Humanities*, Volume 10, Issue 2, July - December, Page Number 38-42, 2025.

Copy Right: © DV Publication, 2025 (All Rights Reserved). This is an Open Access Article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium provided the original work is properly cited.

DOI: <https://doi.org/10.5281/zenodo.15811421>

Abstract:

Indian Classical dance forms, or Nritya, encompass a rich connection between intricate movements and abhinaya - a form of storytelling by the dancer using facial expressions and mudras. While the aesthetic and cultural significance of Nritya embraces a deep philosophy of the existence and is well established, its potential impact and influence on the neural networks of our brain remains relatively unexplored. Therefore, it is important and instructive to delve into the intersection of Nritya and neuroscience to investigate how this ancient Indian art-form influences cognitive processes.

Drawing on the principles of embodied cognition, we explore how the multi-faceted aspects of Nritya training - encompassing physical movement, rhythm perception, emotional expression and mudra formations - impact various brain regions. We also examine potential benefits for cognitive function, such as self-awareness, memory, spatial navigation, and motor control. Additionally, in this paper we delve briefly into neuroaesthetics, and explores another important role of Nritya in leveraging the emotional well-being.

Unveiling the link between Nritya and neuro-cognition will not only deepen our understanding of this cultural heritage but also open a dimension for future research on the cognitive and therapeutic benefits of Indian classical dance.

1. Introduction:

Bharatanatyam, a timeless dance form of Southern India, is a tapestry of history, science, culture, and artistry. The name "Bharatanatyam" bears special significance, with each part denoting integral aspects of the dance form: Bha - Bhava (expressions), Ra - Raaga (melody), Ta - Taala (rhythm), and Natyam (dance). Bharata Muni's "Natyashastra" and Nandikeshwara's "Abhinaya Darpana" are detailed treatises on Bharatanatyam, written in Sanskrit, followed by dancers to master this art form.

The systematic teaching methodology of Bharatanatyam begins with learning the Namaskara (prayer), Hastas, and the Aramandi (half-sitting posture). Adavus (dance steps) are then introduced which involve new variations in: body movements (particularly the legs) and hastas. These adavus are set to specific Jaati(counts of 3,4,5,7,9), and Tala(rhythm), and performed in three Kalams (different speeds of increasing intensity). Dance pieces like the Alarippu, Jathiswaram, and Thillana test the dancers' expertise of adavus, while the Shabdham, Varnam, Padam, and Javali, involve Abhinaya (expression of emotions) and test the dancers' ability to convey stories and connect with the audience. This amalgamation of movement, Abhinaya, and Hastas, distinctive to Bharatanatyam, has been practiced for over 2000 years. Since the art form involves a complex yet well-developed interplay of various systems at once, a comprehensive understanding of the effect of the practice of classical dance on human brain may open up unexplored avenues wherein the classical dance forms can be proved potentially therapeutic for neurodegenerative diseases and disorders of the brain. Therefore, we urge the importance of probing further into the benefits and implications of Indian classical dance on the human brain.

2. Bharatanatyam and the Laws of Aesthetics:

Indian Classical Dance has been developed with a spiritual connotation in addition to being an art form and deeply imbibes one of the noblest emotions of beauty. But how does the human brain respond to beauty and aesthetics? According to the laws of aesthetics [14], appeal to beauty and aesthetics and thus to art is universal, breaking barriers across cultures. In this section, we apply these laws to Bharatanatyam and bring forth the neurological aspects of beauty related to the art form.

- **Grouping:** The Law of Grouping by Gestalt, is a set of principles that describes how humans group related elements to perceive visual information. One of the aspects of Indian classical dance forms is the intricate makeover of the dancers' appearance for the performance. The dancers use a red stain called alta, to highlight their feet and fingertips. While the reason for using this particular color has religious and cultural connotations, it is also based on the fact that red is the color that is most visible from long distances (longest wavelength, least scattered by the atmosphere). It is therefore easily visible to the audience seated far from the stage. The red colour from the extremities (hands and feet), paired with bright costumes and sparkling jewelry help the audience group these elements and create a cohesive image of the dancer.
- **Peak Shift:** This law states that people and animals are drawn to exaggerated or magnified versions of things and respond more strongly to exaggerated stimuli than to the original stimulus. This explains the application of black kohl to the dancer's eye that exaggerates the facial expression, especially the eye movements, which play a prominent role in effectively communicating the Abhinaya, a key aspect of Indian classical dance.
- **Contrast:** When juxtaposing colors or shapes are placed closely, the differences between the two are easily noticeable and draw attention. Contrast is seen both in makeup and costume of Indian Classical dancers. A great example is the facial makeup of Kathakali dancers who use the colors green, red, black and white to accentuate their expressions and draw the audience's attention. Another interesting use of contrast in Bharatanatyam is the expression of contrasting emotions throughout the repertoire and the difference in pace between Nritta and Abhinaya. This contrast, especially in long dance pieces like the Varnam, retains the attention of the audience and keeps them on their feet.

- **Isolation:** When a single source of information such as color, form, or motion is emphasized on by the artist, the other sources are deleted or mellowed. This ties in with the law of Peak Shift. The eyes of the dancer are highlighted in black and the lips a bright red, whereas the rest of the face has only a light pinkish hue so as to compliment the eyes and not divert attention away.
- **Peekaboo:** Sometimes obscurity leads to attraction. This law is based on the sense of joy one experiences upon solving or finding out an otherwise unobvious pattern or solution. This explains the captivating attention of the spectator and the sense of joy experienced by the audience as they decipher the meaning and story behind the complex interplay of expressions and movements, as the dancers convey it without explaining it through speech.
- **Orderliness:** The law of Orderliness states that the human brain prefers regularity and repetition to create a feeling of aesthetic pleasure. In design, this can be seen as recurring motifs on embroidered fabrics that are pleasing to the eye. Similarly, repetitive cycles of rhythm, lyrics, and dance steps invoke a predictive mechanism, “sweet anticipation” in the brains of the audience leading to positive emotions.[21] This is due to the phenomena of neural synchrony, which is the correlation of firing neurons within the same person as well as across people. This also increases the engagement of the audience with the artistes.
- **Abhorrence of Coincidences:** Any deviation from orderliness, contrary to our expectation of regularity, elicits a negative reaction. Both these laws go hand in hand as seen in music and dance. The rhythm and dance steps at the end of each section of a Bharatanatyam piece are generally in repetitive cycles of 3, 4, 5, 7, or 9.
- **Symmetry:** The human brain is wired to find symmetry and symmetrical objects more appealing. Indian classical dance is quite sculptural, drawing inspiration from sculptures of ancient temples. The postures and movements are physically technical and are symmetrical like the Natyarambha position of the hands and the Aramandi posture of the feet and knees.
- **Metaphor:** Metaphors are popularly known for their use in language and literature however, it is also extensively used in Indian classical dance and visual art. The lyrics of the music, the complimenting rhythm of the instruments, anklets and foot tapping of the dancer, the movements and expressions all contribute to these multiple metaphors that amplify each other and create a sense of internal resonance and harmony.

3. Dancers and London Cabbies’ Parallelism:

London cab drivers are known for their extensive memorization of over 25,000 city routes, otherwise called “The Knowledge”. This is a requirement for London Cabbies to earn their license. Intrigued by the effect of such an advanced ability to navigate, a team of researchers set out to study the brains of London Cabbies. Neuroimaging revealed that the posterior hippocampus (associated with cognitive and spatial processing) was larger in taxi drivers than in the control group of non-taxi drivers. [13] This ballooning of the hippocampus can be explained by the growth of new neurons or the formation of more connections between existing hippocampal neurons due to neuroplasticity, resulting in an increase in the volume of grey matter in this region.

Practicing Bharatanatyam involves performing and mastering a balance of intricate movements and expressions, which engages various parts of the brain simultaneously. Mastering the art form demands practice and training of several years. A parallelism between London cab drivers [13] and the practitioners of dance forms, thus suggests that the neuroplastic nature of the brain would lead to a significant structural difference between dancers and non-dancers. Several studies have been done to investigate such differences in the case of dancers. In [8], a comparison between dancers (with a mean of 15 years of training in styles including ballet, tap, jazz, swing, and ballroom dance) and non-dancers revealed that the dancers have a greater cortical thickness in superior temporal regions and grey matter thickness was positively associated with accuracy on tasks of dance imitation, rhythm synchronization, and melody discrimination. Similarly, a greater gray matter volume in the foot regions of the primary somatosensory and motor cortices was observed in ballet dancers [1, 10].

As stated [14] by V.S. Ramachandra “. . . art’s timeless appeal may be that it speaks a oneiric, right-hemisphere-based language that is unintelligible-alien, even-to the more literal-minded left hemisphere,” art, more specifically, dance involves almost the entirety of the brain, which might create a communion between the two otherwise separated hemispheres. Dance leads to larger axonal diameters, especially in the white matter tracts connecting sensory to motor regions and connecting one brain hemisphere to the other. [1] These enlarged axonal diameters suggest that dance may help support a faster speed of conductivity, which could enhance the brain’s ability to communicate information between different hemispheres.

Unlike other activities or sports such as Tennis, Golf, and Badminton- dance does not remain the same everywhere. It varies greatly, influenced by the history and culture of each region. Consequently, depending on the elements and style of the dance form, its effects on the brain and the body should vary too, a generalization thus would limit the possibilities of the potential effects accompanied by these variations.

Although a significant amount of literature and studies have been conducted to understand the neuroscientific implication of Western dance forms, such avenues remain relatively unexplored for Indian classical dances. Thus, in order to draw a hypothesis on the effect of Indian classical dance, specifically Bharatanatyam, on the brain, it is essential that we understand the nuances of Western and Indian classical dance, broadly. Firstly, the main aspects that set Bharatanatyam (or Indian classical dance, in general) apart from the West is the integration of Abhinaya (expressions) and Mudras (unique hand gestures used for various depictions in dance), with Nritta.

Dance forms from the West are formal while Bharatanatyam is an amalgamation of sharp angular moves - inspired by temple sculptures- and story-telling through Abhinaya and Mudras [22].

A characteristic difference between the Western classical dance (ballet) and Bharatanatyam lies in the degree of involvement of foot. Where ballet is characterized by its Pirouettes (turns) and jumps, Bharatanatyam involves intricate, precise, fast and rhythmic movements of the foot. Additionally, Indian classical dance forms are characterized by barefoot performance which essentially stimulates the nerve endings adding to the overall health.

Indian dance conceives movement of the human form in direct relation to the pull of gravity, it avoids huge leaps and gliding movements in the air. In contrast, a moment in space where the human form is free from gravity even if temporarily, is a characteristic of Western Ballet. [22]

Bharatanatyam is traditional and has a spiritual connotation, making it reflective. It gives expression to stories involving complex emotions. Another key characteristic of Indian classical dance forms is that one performer assumes and skillfully switches between several characters to depict a story, thus strengthening the balance of complex emotions, which distinguishes it from Western classical dance where different roles are portrayed and performed by different people [7].

Based on these distinctions we can hypothesize that owing to its multifaceted nature, Indian classical dance engages the cerebellum and the motor cortex to control balance, poise, footwork, and physical movement (similar to Western dance) while also uniquely engaging the limbic system as a result of the integration of Abhinaya. The limbic system consists of: the Hippocampus (muscle memory, spatial cognition, habituation), the hypothalamus (hormones, moods, body temperature, heart rate), the amygdala (regulating emotions, tying emotional meaning to memories, reward processing), and the limbic cortex (integrates components of pain and processes information on internal bodily state). Due to its continuous involvement in the practice over several years, the limbic system might be more developed in Bharatanatyam dancers resulting in its enlargement, strengthened neural synapses leading to greater myelination, and larger axonal diameters, for faster conductivity and enhancing the brain's ability to process emotions, thus may lead to high emotional well-being of the dancer.

4. Brain on formation of Mudras and Hastas:

Our brain's cerebral cortex is responsible for the majority of our intellectual functions and behavior. Hastas/ Mudras stimulate all three areas of our cerebral cortex: sensory, motor, and association areas. [12] The parts of the brain responsible for interpreting sensory information include the primary sensory cortex, visual cortex, auditory, and olfactory cortex. Sensory information about touch, pressure, proprioception, pain, and temperature from different parts of the body travels to the primary sensory cortex of the brain via somatic sensory pathways. The motor areas of the cerebral cortex are involved in the initiation of movement. The area of the motor cortex that processes information about the movement of your hands is even bigger than the one in the sensory cortex. Association areas are spread throughout the cortex. They interpret incoming data from multiple brain regions and coordinate a response (motor and cognitive). They receive information from different senses and construct cognitive maps of one's environment and body. They are involved in complex cognitive processes like language, artistic creation, decision-making, and even the formation of our personalities.

A unique aspect of Indian classical dance and yoga is the expression through the conscious formation of hand gestures, called Mudra / Hastas. Mudras and Hastas are various hand gestures used in yoga and dance. There are 28 singlehand gestures or Asamyuta hastas and 24 double-hand gestures Samyuta hastas in Bharatanatyam. Each hasta is used for the depiction of subtle emotional expression or for storytelling.

- The Alapadma: all five fingers stretched out and curved slightly like a flower in blossom, is used to show beauty, love, compassion, and nature.
- The Mushti: closed fist, shows strength, bravery, courage, and power.
- The Mayura: thumb touches the tip of the ring finger, and the other fingers are extended. It resembles the beak of a peacock and is used to portray peace, calm, and elegance.

These are some examples of hastas used in dance and the ideas they portray. Interestingly, the formation of mudras in Indian classical dance is not an isolated aspect, wherein the mastery of the dance form demands complete coordination between eyes and hands, as explained in the following lines from "Natyashastra":

"Yatho Hasta Tatho Drishti
Yatho Drishti Tatho Manaha
Yatho Manaha Tatho Bhavah
Yatho Bhavah Tatho Rasah"

According to this, Where the Hands go, the Eyes should follow, Where the Eyes go, the Mind should follow, Where the Mind goes feelings are generated, and where there are feelings, an emotional experience is evoked.

It is a well-known fact that the extremities of our body, fingers and toes, are highly sensitive to touch, pain and movement as they contain a large number of receptors per unit area and stimulate much larger regions of the cortex than less sensitive parts. [17] The formation of mudras works on this very fact. Application of light pressure to specific spots on the hand and folding of the fingers in a certain way, as is done in hand mudras / hastas, stimulates specific parts of the brain. The formation of the hasta and its movements in dance engages the motor areas, the visual reinforcement and tacitility of the hastas stimulate the sensory areas and the association areas are stimulated through coordination of both the motor and sensory areas; thus engaging all the areas of the cerebral cortex.

It has been observed that certain mudras strengthen the neural connections in certain parts of the brain. For instance, the "panchmukha mudra" affects the corpus callosum, the primary commissural region that connects the left and the right cerebral hemispheres [4]. Corpus callosum is composed of millions of highly myelinated nerve fibres and plays a significant role in the transfer of sensory, motor and high-level cognitive information between different parts of the brain. This suggests formation of mudras / hastas can significantly affect one's mental state and perception of the world.

In addition to the fact that this principle in the Natyashastra, when followed by the dancers, helps them express their emotions effectively, it enhances the self-awareness of the practitioner. This simple yet profound principle that has such significant implications on one's brain can be leveraged in certain cases of mental conditions like Post Traumatic Stress Disorder, wherein activities that enhance one's self-awareness has been proved highly effective in changing the state of the mind and lift the patient to a healthier mental state [20].

5. Dance in Therapy:

Humans are the only species that can speak and develop languages. Various literary devices were developed with the evolution of language, making languages more attractive. Metaphors are one such literary device that has become a part of our

everyday interactions now. The Broca's area is the centre for speech production and articulation while the Wernicke's area is associated with comprehension of the meaning of words and metaphors. Both these areas are set in the Inferior Parietal Lobe of the Human Brain. Any defects or damage to the Inferior Parietal Lobe or disorders such as Autism and Schizophrenia, may affect the speech of a person or failure to comprehend metaphors. [14] Indian classical dance can be attributed to "The Ultimate Metaphor" [19]. Metaphors are expressed in dance on multiple levels, through foot movements, Abhinaya, Mudras, and accompanying music. These amplify each other creating a sense of internal resonance and harmony. Dance comprises movements and gestures that are a part of our everyday usage, structured and codified through close observation. This aspect of dance opens doors to Dance Movement Therapy (DMT). Dance/movement therapy (DMT) is defined by the American Dance Therapy Association (ADTA) as the psychotherapeutic use of movement to promote emotional, social, cognitive, and physical integration of the individual, to improve health and well-being. It is based on the principle of brain-body connections, the link between a person's thoughts, attitudes, and behaviors and their physical health. Anxiety and pacing around, shaking legs, Vagus nerve stimulation and its control on heart rate and digestion, are common manifestations of brain-body connections.

Metaphors in DMT An integral element of DMT is Kinesthetic Empathy which can be best explained through this quote: "Patients offer metaphors through their movement and therapist responds in the same way without revealing it in words." - Dreyfus, 1996 [18].

The usage of metaphors in DMT has been successful in DSM-IV which deals with identity disorders, attachment disorders, trauma, PTSD and moods. It takes old experiences and opens new possibilities. The experience of movement gives fuel to prevalent emotions and metaphors that were connected with those. Language, meaning, and movement are interrelated through metaphors and have a great influence on the healing process. [25] DMT presents a unique and less daunting approach to therapy through dance especially through mudras. Mudras are so nuanced that they can be used as a parallel mode of communication similar to ASL (American Sign Language). A study indicated use of mudras for self-expression and as a body-based tool for projection. The option to build a story through mudras increased avenues for participation beyond verbal means. Participants who were reluctant to contribute verbally could convey their thoughts through mudras [2].

Dance Movement Therapists borrow elements from different Indian classical dance styles in her practice. When working with children with special needs, it was observed that through rhythmic activity, children could sustain their attention span and physical stamina for longer periods. Their self-esteem increased because they could dance to the rhythms that they had created. It reduced passivity and withdrawal to a large extent and promoted social bonding among group members [23]. In another therapy for Parkinson's patients, movement specialist Vonita Singh leveraged the power of simple mudra-formation to sustain mobility in the patients [2]. Mirroring, physical synchronization, rhythm, and social reciprocity are inherent behaviors in dance [6], and Ramachandran and Seckel [15] suggest that a dance intervention with an emphasis on mimicry may activate the "dormant" mirror neuron system in individuals with Autistic Spectrum Disorders (ASD). This is also backed by research that proves hyper activation in the right inferior frontal gyrus and left supplementary motor area in ASD during observation of biological motions.[5] We thus hypothesize that re-engaging developmental movement patterns in dance may be helpful to repattern oscillatory activity, leading to clinical improvements in ASD and other disorders with oscillatory activity impairments.

6. Clinical Implications of the Structural Difference between Dancers and Non-Dancers:

As showed in this paper, Indian Classical Dances, especially Bharatanatyam, are an intricate interplay of coordinated movements. This framework results in significant structural differences in the brain of dancers as opposed to a nondancers, as noted in the previous sections.

The study, as mentioned earlier, conducted on London Cab drivers is being repeated with updated tools to shed light on Alzheimer's disease, a common manifestation of which is spatial disorientation caused by shrinking of the hippocampus, in the early stages [16]. Understanding how navigation causes the growth of the hippocampus in cab drivers may lead to the development of diagnostic tools for early detection of Alzheimer's. In the same light, we speculate that studying further, the brains of Indian dancers may lead to better insights into the potential prevention of Parkinson's, Alzheimer's, and other neurodegenerative diseases, as the intricate and coordinated movement over long periods may lead to significant structural changes and healthy growth of the brain. Although there remains an extensive scope of exploration, [11] suggests a significant difference in the production of BDNF, the protein responsible for maintenance and creation of new neural networks.

Another study, conducted by the University of Hertfordshire [9], observed how dance psychologically affects people with Parkinson's disease, by inviting 60 people to dance three times a week for a year and the other 60 people to stretch. They discovered that the hippocampus of the dancing group grew by 1% - 2% over the year, therefore improving memory. This suggests that dance impacts the structure and size of the hippocampus, consequently strengthening one's memorization ability, declarative memory, spatial navigation, and emotional memory. Extrapolating this, we suggest that Indian classical dance forms would produce a similar or larger effect on the specific part of the brain, thus avoiding the possibility of neurodegeneration and helping in the treatment of neurodegenerative diseases.

Researchers discovered that dance can decidedly improve brain health and quality of life in those living with Parkinson's disease. The evidence strongly supports dance's ability to manage motor impairments. [3] Another study investigated the effect leisure activities had on the risk of dementia in the elderly. The researchers looked at the effects of 11 different types of physical activity, including cycling, golf, swimming, and tennis, but found that only one of the activities studied-dance-lowered participants' risk of dementia. Dance involves both mental effort and social interaction, this type of stimulation helped reduce the risk of dementia [24].

7. Conclusion:

In this paper, we discuss the prominent aspects of Indian classical dance, specifically, Bharatnatyam and its impact on one's brain. Although dance in general has been studied extensively, the potential impact specifically of Bharatanatyam and other classical Indian dances has been relatively less explored. In this paper, we present various aspects of the classical dance forms that can have immense therapeutic benefits, and thus we propose to advance the ideas mentioned in the article using fMRI scans and brain signals to test the effectiveness of Indian classical dance in the prevention and therapy of neurodegenerative diseases and

neurological disorders. Although there has been a comparative study on the production of the BDNF protein in dancers and nondancers, we suggest that a deeper and rigorous exploration of this may open unknown potential avenues that may provide simple yet immensely valuable treatments for neurodegenerative diseases. There is a great potential to further explore the clinical and therapeutic potential of Indian Classical Dance.

References:

1. Julia C Basso, Medha K Satyal, and Rachel Rugh. "Dance on the brain: enhancing intra-and inter-brain synchrony". In: *Frontiers in human neuroscience* 14 (2021), p. 584312.
2. Harshita Bhargava. "Therapeutic use of mudras in dance/movement therapy with children in a partial hospital program: The development of a method". In: (2020).
3. Anna M Carapellotti, Rebecca Stevenson, and Michail Dumas. "The efficacy of dance for improving motor impairments, non-motor symptoms, and quality of life in Parkinson's disease: A systematic review and metaanalysis". In: *PloS one* 15.8 (2020), e0236820.
4. Cain Carroll and Revital Carroll. *Mudras of India: a comprehensive guide to the hand gestures of yoga and Indian dance*. Singing Dragon, 2012.
5. Melody MY Chan and Yvonne MY Han. "Differential mirror neuron system (MNS) activation during action observation with and without social emotional components in autism: a meta-analysis of neuroimaging studies". In: *Molecular autism* 11 (2020), pp. 1-18.
6. Beatriz Menezes De Jesus et al. "Dance promotes positive benefits for negative symptoms in autism spectrum disorder (ASD): A systematic review". In: *Complementary therapies in medicine* 49 (2020), p. 102299.
7. Dieter H Jutting, Bernd Schulze, and Ulrike Müller. *Local sport in Europe. Proceedings of the 4th eass conference 31.05.-03.06. 2007 in Münster*. Waxmann Verlag, 2009.
8. Falisha J Karpati et al. "Dance and music share gray matter structural correlates". In: *Brain Research* 1657 (2017), pp. 62-73.
9. Carine Lewis et al. "Mood changes following social dance sessions in people with Parkinson's disease". In: *Journal of Health Psychology* 21.4 (2016), pp. 483-492.
10. Jessica Meier, Marlene Sofie Topka, and Jürgen Hänggi. "Differences in cortical representation and structural connectivity of hands and feet between professional handball players and ballet dancers". In: *Neural plasticity* 2016.1 (2016), p. 6817397.
11. N Mohan and A Sunder. "A comprehensive evaluation of brain derived neurotrophic growth factor gene on Bharatnatyam dancers". In: *Precis Med Res* 4.2 (2022), p. 6.
12. Jahangir Moini, Justin Koenitzer, and Anthony LoGalbo. *Global Emergency of Mental Disorders*. Academic Press, 2021.
13. Jordan Navarro et al. "Are Way finding Abilities Correlated With Specific Brain Anatomy? An Investigation on Regular Car Drivers Using a Navigational Map in an Unknown Environment". In: *Hippocampus* 35.2 (2025), e70000.
14. Vilayanur S Ramachandran. *The tell-tale brain: A neuroscientist's quest for what makes us human*. WW Norton & Company, 2012.
15. VS Ramachandran and EL Seckel. "Synchronized dance therapy to stimulate mirror neurons in autism". In: *Medical hypotheses* 1.76 (2011), pp. 150-151.
16. Candice MRoux, Marianne Leger, and Thomas Freret. "Memory disorders related to hippocampal function: the interest of 5-HT4Rs targeting". In: *International journal of molecular sciences* 22.21 (2021), p. 12082.
17. Noam Saadon-Grosman, Yonatan Loewenstein, and Shahar Arzy. "The 'creatures' of the human cortical somatosensory system". In: *Brain communications* 2.1 (2020), fcaa003.
18. Rosemarie Samaritter. "The use of metaphors in dance movement therapy". In: *Body, Movement and Dance in Psychotherapy* 4.1 (2009), pp. 33-43.
19. Shanta Serbjeet Singh. "Indian dance: the ultimate metaphor". In: (NoTitle) (2000).
20. Bessel A Van der Kolk. *The body keeps the score: Brain, mind, and body in the healing of trauma*. 2014.
21. Olivia Foster Vander Elst, Peter Vuust, and Morten L Kringelbach. "Sweet anticipation and positive emotions in music, groove, and dance". In: *Current Opinion in Behavioral Sciences* 39 (2021), pp. 79-84.
22. Kapila Vatsyayan. "The theory and technique of classical Indian dancing". In: *Artibus Asiae* 29.2/3 (1967), pp. 229-238.
23. Alka Vishwakarma. "Dance movement therapy and kathak in India". In: *Sanglap: Journal of Literary and Cultural Inquiry* 8.2 (2022), pp. 57-69.
24. Hui-Xin Wang, Weili Xu, and Jin-Jing Pei. "Leisure activities, cognition and dementia". In: *Biochimica et Biophysica Acta (BBA)-Molecular Basis of Disease* 1822.3 (2012), pp. 482-491.
25. Eleni Zachou, Heidrun Panhofer, and Theodora Bareka. "Metaphor and movement: exploring the unspoken with a group of frontline workers". In: *Body, Movement and Dance in Psychotherapy* 17.4 (2022), pp. 326-342.