Rasa theory and Neural Mechanism

It is the East, and Juliet is the Sun

-Shakespeare-

Synesthetics[1] is a theory explaining the neural mechanism of aesthetic experience. It explains a set of neurobiological principles forming the very nature of human perception and its multiple modes of emotional experiences relating to external stimuli that evoke a specific functional reaction. Perception and its subsequent psychophysical reactions are neural functions of sensory phenomenon caused by genetically mediated persistent neural connections causing cross-wiring between brain maps (Ramachandran, Hubbard & Butcher, 2004; Hubbard & Ramachandran, 2003). Aesthetic and emotional responses to sensory inputs depend on hyper connectivity between the cortices and limbic system, selectively, *fusiform gyrus* and *angular gyrus* (Ramachandran, Hubbard & Butcher, 2004). The hyper connectivity between these brain regions involves the neural mechanism of metaphor, the same principle that explains synesthetia and artistic creativity. It is also consistent with data suggesting that the right hemisphere of the brain, which processes spatial and non-linguistic aspects of language, is more involved in the neural mechanism of metaphor (Anaki, Faust & Kravetz, 1998; Brownell et al., 1990). Taking an example from V.S. Ramachandran that when we read Shakespeare's "It is the East, and Juliet is the Sun", our brain instantly understands the meaning without mistaking the metaphor literally that she is a glowing ball of fire

Dr. Sreenath Nair is a Senior Lecturer at Lincoln School of Performing Arts, University of Lincoln. He is a visiting-Scholar at Tisch School of Arts, New York University in 2012 and the research advisor for Doctoral studies in Dance studies at University of Auckland, New Zealand. He was awarded the Leverhulme Study Abroad fellowship in 2011. His research focus including performance studies, Natyasastra, Indian theatre and embodied methodologies.

(Ramachandran, Hubbard & Butcher, 2004). This metaphoric structuring of thoughts and emotions is a creative expression reinforced by neural mechanism (Johnson, 1987, p. 13). Based on these results my intention in this essay is to demonstrate a range of possibilities explaining the biological bases of aesthetic experience in performance practice consisting of mimetic expressions, perception and meaning, the discourse that had long been dominated by phenomenological theories of perception.

Rasa and the Essence of Art

There is no literal translation of the word *rasa*. A closer understanding of the term appears as the *very essence of* something. According to Bharata, the mythical author of the Natyasastra, rasa is the very essence of the aesthetic experience of plays, performance and other artistic means such as music and poetry (Pisharoti, 1987, p. 245). In the *Origin of theatre*, the first Chapter of the Natyasastra, while explaining the Vedic origin of the art of theatre, Bharata explains the origin of *rasa* that it has derived from the *Adharva Veda*, one of the four Vedas dealing with occultism. In Sanskrit, the word is used for juice, milk, water, essence and a tasteful liquid. Once again Bharata offers a clear definition of the term as the combination of Determinants (*vibhava*), Consequents (*anubhava*), and Transitory mental states (*vyabhichari bhava*) (Pisharoti, 1987, p. 245). It is just the elaboration of this statement that makes the entire discussion in the Natyasastra in thirty six extensive chapters explaining various textual, physical and psychological elements that create rasa. The primary element is Determinants, the pure force of external stimuli that create rasa: it is the basis of emotional and aesthetic responses. It is potentially emotive causing rasa experience. These *vibhavas* are of two kinds: objective world including persons in which all the emotional experiences are based on (*alambana*) and specific environmental factors that stimulate emotions (*uddipana*). Characters are the repository of latent emotional tendencies (*bhava*) and the mimetic inter-

actions (*anubhava*) of a character with other dramatic persona and situations creates a series of transitory physical and mental states in a performance. The rasa experience is the *essence* of these vivid and complex dramatic events in a performance perceived and experienced by the audience (Pisharoti, 1987, p. 247). The second element in Bharata's definition of rasa is Consequences that are the elements of verbal and physical *re-actions* of the characters involved in a dramatic situation (Pisharoti, 1987, p. 267). Transitory mental states, which are the third component of rasa, are the varying emotional responses accompany physical *re-actions* in a performance, (Pisharoti, 1987, p. 269); sadness underpinning happiness and vice versa, for instance. In fact, rasa is about awakening of latent emotional tendencies and transiting them onto mimetic level of perceptible sensations through the means of acting (*abhinaya*) predominantly based on the body.

Rasa is a theory of mimetic communication through which a core emotion (*bhava*) is rediscovered through a series of perceptible sensory moments in a performance; the felt *essence* of this emotional evocation is *rasa*. The erotic rasa as the *essence* of the emotion love, for instance, is realised through a series of physical and mental properties presented in a performance. The physical presence of the lovers is the stimulus of the rasa. The surroundings or conditions in which the meeting is taking place function as the external stimuli evoking physical responses identical to the feeling that brings the lovers together. According to the classification of the Natyasastra lonely place, fragrances, music, cool and nice weather are some of the environmental stimuli for erotic rasa. In addition, physical responses of the lovers such as glancing, soft words and unintentional touches arouse interest

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and enthusiasm to pursue the feeling further in this direction. Based on who the lovers are, where do they come from, and what brings them as a result of this particular moment, the couple experience a series of transitory mental states keep the basic feeling growing. As we could clearly see, each one in this example is discovering what is going on with her or him and what the other person might be experiencing at the same time. The Erotic rasa as the essence of this situation of love is inherent within the characters as emotional instincts, but a realization of it can only be achieved through using performance as a medium (Tripathi, 1991, p. 15).

In a similar fashion, a performance unfolds as a multi-layered mimetic event which acts as the external sensory stimuli for the spectators to evoke their own latent emotional instincts, because the imagination is what connects the spectator and performance and "nothing in the real world happens or is affected" in a performance (Masson & Patwardhan, 1970, p. 24). Abhinavagupta, the 9 AD commentator of the Natyasastra, distinguishes between conceiving an emotion and actually having one. In theatre we are often removed from 'real' emotions and only experiencing induced feelings *about* expressed emotions perceived in a performance (Masson & Patwardhan, 1970, p. 35). Abhinavagupat builds up a series of arguments to establish the notion of the 'illusory drive' of the spectators arguing that the audience's experience of rasa is a perceptual experience of 'sympathetic responsiveness' knowing that the percept is unreal (Masson & Patwardhan, 1970, p. 18&36). The fundamental concept of Abhinavagupta's aesthetic philosophy is based on the notion that the perceptual experience is illusory (*maya*) and therefore, it is a metaphoric or symbolic understanding of the 'real world'. Taking an example from Abhinavagupta, a house in fire in a performance is only a metaphor of *a* house in fire and therefore, rasa is experiencing the *essence* of a 'real' event and not experiencing the 'real' event. Relating the illusory aspect of

rasa with dream, Abhinavagupta further argues that the objects appear in a performance is symbolic and metaphorically arranged because those objects do not confirming with the conventional standards of reality in the 'real' sense of the world (Pandey, 2006, p. 340). Many of Abhinavagupta's discussions on rasa are interestingly correspond to recent scientific studies on neural mechanism. To conclude, rasa is the very perceptual *essence* of aesthetic experience metaphorically mediated through *cross-activation* (in neural terms) or the *combination* (in the Natyasastra terms) of sensory objects and mimetic movements. Rasa stands for a metaphoric perception of the world.

Rasa and the Peak-shift Effect[2]

What does it mean when we say rasa capture the very essence of something in order to evoke a direct emotional response to the audience and how does rasa do this in terms of communication and what is it methodology? In acting, rasa is conveyed through different facial features. Erotic is a pattern of facial features that is different from Anger. Erotic discriminate certain features from anger and in each facial pattern we see a degree of amplification or exaggeration of specific facial muscular patterns evoking direct emotional response. Erotic amplify the difference from Anger. These amplifications of facial features activate the same neural mechanisms that would be activated by actual objects. Physiologist Zeki (1998) has noted that "the ability of the artist to abstract the 'essential features' of an image and discard redundant information is essentially identical to what the visual areas [of the brain] themselves have evolved to do" (Ramachandran & Hirstein, 1999, p. 17).[3] The same neural principle is applicable to rasa acting and according to Ramachandran there may

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be neurons in the brain that represent sensuous responding to amplified forms or patterns producing a correspondingly high limbic activation (Ramachandran & Hirstein, 1999, p.18). Highly stylized anatomical poses and postures in dance or other performances stimulate neural mechanism in the brain through amplification of essential characteristics of emotions. The acting of Erotic rasa, in this sense, is amplifying the facial features that, in turn, create the very essence of 'amorousness'. There are brain regions for remembering the body representations known as *posture space* and face perception known as *ventral stream*. In addition, a memory mapping exist in the 'dorsal' stream of visual processing which connects with the perceiver's own body representations while perceiving the facial patterns and the bodily postures of the other. The activities of all these regions are connected to the limbic systems in the event of perception, and as a result one can recognize an attack posture or a body position, which indicates bodily responses and subsequent emotions (Ramachandran & Hirstein, 1999, p.19).

The brain has other specialized visual modalities and functional specializations such as colour, depth and motion in relation to visual aesthetics. The visual brain is characterized by a set of parallel processing that are perceptual systems and a temporal hierarchy in visual perception (Zeki, 1998). When area V4, the colour centre, is damaged the consequence is an inability to see the world in colour; and when area V5, the motion centre, is damaged the consequence is an inability to see the objects when they are in motion, but other attributes of the visual sense function normally in both cases (Zeki, 1980). One of the specializations of the human visual brain is of visual motion and this specialization is centred on the V5 area in which all cells are selectively responsive to motion. Moreover, a grate majority of cells are also selective for the direction of motion corresponding vigorously when the stimulus moves

in one direction (Zeki, 1980; Zeki & Lamb, 1994; Livingston & Hubel, 1987; Allman & Kaas, 1971; Van Essen & Maunsell, 1980).

Movement is the functional modality of rasa-based acting that simultaneously generates visual aesthetics through limbic activation of the V5 area of the brain. In the Natyasastra each rasa is characterized by specific movements of six muscular regions in the face such as eyes, eyebrows, nose, lips, cheeks and chin (Pisharoti, 1987, p. 315). In addition, there are thirteen different clusters of head movements and there are clear directions indicating application of each cluster into variety of emotional situations. Erotic rasa, for instance, is illustrated as quick movements of the eye brows, fully opened eyelids and brining a pair of globular of the eyes to one side looking at the percept (Pisharoti, 1987, p. 320). Anger is portrayed as protruding eyeballs, arched eyebrows, lifted cheeks and shrinking lower eyelids (Pisharoti, 1987, p. 321). Although it seems to be pictorial in description all these are movement patterns meticulously activated constantly in performance. Each cluster of these exaggerated movements through *peak-shift effect* will create amplified facial patterns of emotions that function as 'releasing stimulus or 'trigger feature' in the neural mechanism of visual perception.[4] Rasa is not a representational act of creating resemblance. It does not create the imitation of a real object in the world. But rather, it creates mimetic metaphors by using the body as a medium of communication to induce the very *essence* of emotional experience.

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Peak-shift effect has particular importance not only to the rasa style of acting but also relevant to the core of the performance discourse proposed by the Natyasastra. According to Bharata, the art of theatre is the art of acting, and the rasa experience is the finest form of experience that the body can create. The Natyasastra has not given much importance to scenographic elements as much as it has given emphasis to kinetic and mimetic properties of the body such as rhythm, movements, bodily postures and other movement functions of the body. In *Kutiyattam*[5], the Sanskrit theatre of Kerala, a bare stage is chosen for the performance and then the actors using their body as the only means of communication will create all the visual imageries from mountain to forest to rivers to animals and insects. Hand gestures (*mudra*), eyes, foot and all dimensions and orders of the body will be engaged in performance in kinetic mode. The play unfolds between the actor and the audience through a powerful imaginary interaction with out much extra illusory accessories such as lighting and scenography. Rasa in performance does not work strictly in terms of signs; but rather it is the "representation of movements…capable of affecting the minds" (Deluze, 2001, p. 8). Each rasa is formed through a cluster of facial and body movements; and the perception of rasa is direct and un-representational mediated through a powerful "transfer of forces from body to body" (Artaud, 1989, p. 93). In the process of perception of complex postures or actions may require the audience initially re-enact or rehearse the action before it is identified (Ramachandran & Hirstein, 1999, p. 21). Also there are cells in the frontal lobes thought to be involved in the production of complex movements but which also fire when the animal perceives the same movements performed by the experimenter (di Pellegrino, G; Fadiga, L; Foggassi, L; Gallese, V & Rizzolatti, G 1992). Based on this finding together with Peak-shift effect, it is clear that the rasa acting and the performance style proposed by the Natyasastra may powerfully activate such cells in the frontal lobes. It is also clear that in the Natyasastra model that the actor-audience dynamics is powerfully manipulated through peak-shift effect

in which amplification of movements and imagination play important roles in the rasa experience.

Extracting Correlations: Perception and Limbic reinforcement in *Kutiyattam*

To discover and delineate objects in the visual field is one of the main functions of 'early vision' (Marr, 1981; Ramachandran, 1990; Pinker, 1998; Shepard, 1981). For doing this the visual areas rely on extracting correlations (Ramachandran & Hirstein, 1999). The very process of discovering correlations and of 'binding' correlated features to create unitary objects or events must be reinforcing for the organism in order to provide incentive for discovering such correlations (Ramachandran & Blakeslee, 1998). Audience in a *Kutiyattam* performance follow the same neural pattern of perception-discovering correlations and 'binding' correlated features to create unitary objects and events-in order to relish rasa experience. The performance structure and acting style of *Kutiyattam* particularly reinforce this limbic activation to a greater extent due to immense deployment of imagination at every moment of its performance and perception. Imagination draws ideas and emotions into concrete forms. Imagination is the foundation for a performance that brings neural function, cultural construction, memory, feeling and emotions into concrete physical situations in a performance (Rhonda Blair in McConachie & Hart, 2006, p. 177) and there are interesting interconnecting patterns between the performance structure of *Kutiyattam* and neural structure of perception.

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The visual field of *Kudiyattam* is a single enormous cluster of vivid and independent mimetic actions superimposed one with another. Performance devises such as dancing, singing, narrative and hand gestures (*Mudra*) incorporate individual scenes and connect them into a stream of mimetic actions. The dramatic scenes in *Kutiyattam* are presented through a series of stylized rhythmic body movements and hand-gestures, and it is this enactment of the actor that creates the visual elements in the performance including the scenography, objects and sometimes even other characters and dramatic events in the play. The performance structure of *Kudiyattam* is complex and aesthetically demanding: the actor by the power of his imagination visualizes, fantasizes, creates scenes or situations, and the experienced spectator follows every movement of the actor's eye, hands, feet in order to make rasa experience (Paniker, 1996, p. 8). With each moment in a *Kudiyattam* performance, the audience will be completely engaged with the performance looking for what each eye movements and hand-gestures meaning for. For the audience, each moment will be the moment of 'discovery' of *extracting correlations* leading to recognition of dramatic objects, situations and events. A hand-gesture coupled with movements of the eye show the blooming of a flower and the rising of the Sun. The dramatic reality, in this sense, is the perceptual reality imagined by the audience in a mental space somewhere between the hand-gesture and the memory of a 'real' flower. In 'colour space', perceptual grouping is explained as wearing a blue scarf with red flowers if you are wearing a red skirt; the perceptual grouping of the red flowers and your red skirt is aesthetically pleasing (Ramachandran & Hirstein, 1999). A similar principle may applicable in 'motion space' for the audience to identify similar grouping of actions that creates a flower or the raising of the Sun. Perceptual grouping of actions and movements are of importance when you consider the aesthetic enjoyment of a performance due to extracting correlations.

The following example will demonstrate the way in which the neural principles such as 'extracting correlations' and 'perceptual grouping' work in a performance. The enactment of lifting the mountain Himalaya (*Kailasodharanam*) in *Kudiyattam* demonstrates a number of clusters of perceptual grouping of actions leading to rasa experience. This particular scene in *Kutiyattam* is derived from the second act of the Sanskrit play called Coronation Play (*Abhisheka Natakam*) of Bhasa, the 2 Century BC Sanskrit playwright. No single play will be performed completely in the *Kutiyattam* style, but rather a single act from a play will be taken for performance and normally the performance of a single act will last for several days. *Kutiyattam* has a peculiar performance structure and acting style that support this mimetic elaboration based on relatively a small portion of the written play (See Paniker 1996 & Madhavan, 2010). This particular *Kutiyattam* play will take six days to complete the performance and the scene under discussion, *The Lifting of the Mountain Kailash,* appears in the second day of the performance. The scene will be enacted as follows: the actor looking at the mountain Kailash. Through a variety of eye movements, body positions, movements and the hand-gestures the actor shows the height, width and other spatial dimensions of the mountain including depicting the caves, rivers and trees in the forest in the valley of the mountain. Each object will be depicted elaborately in this acting making sure that the images are conveyed to the audience appropriately. Then the actor will start describing more details of the mountain demonstrating the animals living in the forest. Elephants, Lions, Peacocks and many other birds and flies will be enacted with incredible details. A flight will take place between an elephant and a lion. Once a detailed enactment is over the actor will look at the mountain once again showing the enormity by re-enacting the height and width as he did in

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the beginning. Now, the illusion of the mountain is clearly established. Then, as part of the play, Ravana, the demon King, with all his proud and mighty strength, begins to shake and lift the base of the mountain. Slowly, he lifts the mountain and plays with it.

A single actor, without other actors or visual supports, does the entire enactment of this scene: only using the body, the actor carefully develops each image in the visual narrative. Normally, the scene last for at least two hours and the actor has enormous freedom to improvise during the performance. The duration of the scene can be shorter or longer depending on the actor's skills. There are multiple layers of mimetic clusters in this scene: A) the actor establishing the size of the mountain which is the background cluster B) enactment of animals, birds and trees C) enactment of lifting the mountain. A is superimposed on another set of mimetic actions in B that are not directly related to the structural features of the mountain. Nevertheless, these two clusters together form a 'single enormous cluster' that is the mighty mountain Kailash. A is the background cluster in which geometrical features of height and width are put together whereas in B animate objects such as animals and birds are clustered together to highlight the intensity of the imagined object that is the enormity of the mountain Kailash. The cluster C is another grouping of hand movements coming into the visual field as another layer amplifying the enormity of the mountain as well as the 'valorousness' of the character. The discovery of the mountain is perceptually supported by constantly appearing of linking images that help the audience holding the imagination of the mountain persistently throughout in the performance. Each moment of discovering the mountain creates 'aha' sensation of the aesthetically pleasing moments during the performance. A limbic reinforcement is evoked at each and every stage in processing as soon as a partial 'consistency' and binding is achieved (Ramachandran & Hirstein, 1999). This would explain why we say 'aha' when the mountain is seen through different clusters of

mimetic actions. Once a particular movement of the actor or a series of hand-gestures become perceptually salient as a mimetic object in the performance, it may send a signal to the limbic centres in turn suggesting to 'hold on' to facilitate further computation. This example suggest that there may be direct links in the brain between the processes that discover such correlations and the limbic areas that give rise to the pleasurable 'rewarding' sensations associated with 'feature binding' (Ramachandran & Hirstein, 1999). Through watching a performance of 'lifting the mountain Himalaya' you are indirectly tapping into these neural mechanisms.

Recent studies in biological motion research shows that the visual system analyses locomotive actions in a rapid manner and the brain processes clear action representations by categories (Giese & Lappe, 2002; Vangeneugden et al., 2009 & 2011). Action analysis is more complex than static face images analysis due to its spatial and temporal involvement. Perceptual space of the body movements are also correlated with emotion space (Giese, Thornton & Edelman (2008) and the most important perceptual dimension in the emotion space correlated with kinetic movements of the arms (Pollick, Paterson, Bruderlin & Sanford, 2001). As Ramachandran explains the neural mechanism of clustering perceptual actions, there is always a tendency to follow the clue for something potentially 'object-like' signal that produces limbic activation and draws your attention to that region (Ramachandran & Hirstein, 1999). In *Kutiyattam*, the story of the each day's performance will be given to the audience in advance so that they have a hypothetical understanding of the performance as what they are going to watch for each day. The mountain Kailash is a hypothesis encouraging

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the audience ‘binding’ of corresponding actions, which in turn consolidates the final percept of the mountain. The audience feel happy when all the linking images of actions falls into proper places by revealing the hypothesis, the mountain Kailash. What the performer does in fact is a perceptual problem solving (Gombrich, 1973; Arnheim, 1956; Penrose, 1973) and although aesthetic experience is more than scientific explanation of neural mechanism, ‘temporary binding’ of perceptual actions send signals to the limbic system to reinforce the binding, which is one source of the aesthetic experience (Ramachandran & Hirstein, 1999).

Stylization in acting: Isolation and allocation of attention

Ramachandran noted that isolation of a single visual modality in order to allocate perceptual attention is an important neural principle of aesthetic experience. For instance, an outline drawing or sketch will be more effective as ‘art’ than a full colour photograph. Isolating a single area, ‘form’ or ‘depth’ in the case of painting and stylized use of the body including eyes, hand-gestures etc., in the case of classical Indian performance, for instance, allows one to direct attention more effectively to a particular set of visual clues. This, in turn, will allow you to notice the ‘enhancement’ introduced by the artists (Ramachandran & Hirstein, 1999). These enhancements would amplify the limbic activation and reinforcement. In other way, non- realistic and stylized artistic representation is more likely to create powerful limbic activation and reinforcement than the realistic art does. According to Ramachandran, one would expect that the richer clue available in the object the stronger the recognition signal and associated limbic activation. But, ‘more is less’ in art the argument which is supported the laboratory evidence of fMRI measured brain activation of the face area showing that greater activation has been measured for an outline sketch of a face than for a full colour photo of a face (Ramachandran & Hirstein, 1999). On the basis of this evidence one can clearly argue that the rasa acting and various other non-realistic performance

techniques of *Kutiyattam* can creates grater limbic activation and reinforcement due to their stylistic emphasise on minimal text and isolation of bodily skills in performance.[6] A *Kutiyattam* performance offers multiple layers of 'isolation' of visual modality: 24 hand-gestures, 21 eye movements, 48 sequences of movement patterns capable of creating different dramatic situations (*chari*)[7], 21 voice patterns and so on. Gender identity is created through gaits, and the female motion trajectories are isolated and subtract from the male in order to amplify the difference. In Kathakali[8], when male actors impersonate female characters, beyond the gender distinctions created by the make-up and costume, it is the motion trajectories that create an aesthetically pleasing experience of 'femininenes' in the male body. More astonishingly, in *Kutiyattam*, the actors are trained to show male and female flies only by using the eye movements and hand gestures, which is a subtle and delicate application of the isolation principle of motion trajectories and amplifying the difference (between a male fly and a female fly).

Contrast Extraction as Transitory Emotions in Reinforcing Rasa

Bharata classifies thirty-three transitory emotions (*vyabhicaribhava*) in the Natyasastra as impermanent and contrasting in relation to eight fundamental rasas (Pisharoti, 1987, p. 277-78). These transitory emotions are physicalized reactions of varying emotional attitudes corresponding to each rasa reinforcing the artistic communication in acting. The role of transitory emotions in the aesthetic experience of rasa and the ways in which they reinforce the emotional expressiveness in rasa acting is a topic of great interest and elaborate discussion in Indian aesthetics over the years. Bharata defines transitory emotions in kinetic

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terms (Pisharoti, 1987, p. 277-278) explaining them as a cluster of contrasting actions, indicative of emotions, selected for reinforcing a particular rasa. The transitory emotions for happiness (*harsha*), for instance, according to Bharata, are pleasing appearance of the face and bright eyes; sweet words; embracing; tears in the eyes (cry) and shivering (Pisharoti, 1987, p. 289-290). Tears in the eyes and shivering are emotions contrasting with the former group of emotions in the list corresponding to happiness. Pleasing appearance of the face, bright eyes, sweet words and embracing are actions suitable to the principal emotion that is happiness. Bharata, however, uses contrasting emotional expressions, crying and shivering in in this example, to reinforce the principal emotion of happiness. Anger in love, as well as sadness in anger, are juxtapositions of emotions reinforcing the expression of principle emotions in the Natyasastra. Bharata demonstrates his clear understanding of the role of contrasting emotions in aesthetic experience saying that the rasa experience is brought by the combination of various contrasting emotions. He further explains this by using the analogy of the Sun and stars saying that it is the Sun that brings the daylight as well as the stars in dark sky: the light comes when the Sun raises and the stars appears when it sets (Pisharoti, 1987, p. 277-278). A contrast, therefore, is essentially part of the unity or cohesion of rasa experience.

Discarding redundant information and extracting contrast features are important neural function and may be intrinsically pleasing to the eyes reinforcing aesthetic experience (Ramachandran & Hirstein, 1999, p. 25). Contrast is extracted autonomously by cells in the retina and the visual cortex to respond to it with the allocation of *attention.* Contrast information grabs more attention and more visually interesting than homogeneous areas or group of information. There are cells in the different visual areas for colour contrast or motion contrast (Allam and Kaas, 1971) and it might be coincidental that “what the cells find

interesting is also what the organism as a whole find interesting" (Ramachandran & Hirstein, 1999, p. 25) and experiencing as pleasing. Beyond the level of luminance and colour, contrast information can also emerge in dimensions. Using Ramachandran's analogy of 'jewels and naked skin', a nude wearing baroque gold jewellery is aesthetically pleasing than a complete nude woman or one wearing both jewellery and cloths (1999, p. 27). Homogeneity and smoothness of the naked skin contrast sharply with the texture of the jewellery. Contrast, in terms of colour or motion, occurs between dissimilar features that are physically close together can be visually rewarding in terms of the discovery of objects that is the main goal of vision.[9] Contrast extracting equally identifies recovery of the objects as well as their boundaries. In terms of *rasa*, the tears in happiness; the anger in love and the sadness in anger are groupings of opposite emotions, occurring in motion, mutually rewarding and reinforcing to the discovery of the principle emotion. Contrast extraction of rasa through transitory emotions in acting places two opposing emotions into play. Even though inconsistent, these opposing emotions complement one another in the process of discovering and intensifying rasa: tears intensify happiness, and anger intensifies love in the process of *recovering* a principal emotion. In this way, contrast extraction, through transitory emotions, intensifies limbic activation in the perception of rasa.

Symmetry and Logic of Perception in Rasa:

In visual processing, symmetry seemed to be extracted very early and it also testifies that symmetric proportions are aesthetically pleasing (Julez, 1971). Processing of symmetrical existence between biological objects such as predator and prey or mate is

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observed as the driving force in biological entities. Between predator and prey or mate, symmetry serves an early warning system to grab the attention to facilitate a full recognition of the other (Ramachandran & Hirstein, 1999, p. 27). In this way, symmetry is observed as one of the primary principles gearing towards discovering 'interesting' object-like entities in the world (1999, p. 27).[10] Based on these evidences, in a close observation, we see similar interlocking systems underlying the visual perception as well as rasa experience. Bharata establishes a symmetrical relationship between the audience and the actor in the entire discussion of rasa. In Bharata's aesthetic theory, audience perception is central to rasa experience as a process between the actor and the audience and between what is to be communicated and what is to be perceived. Rasa is a perceptual experience that is derived by the audience through their engagement with the Determinants (*vibhava*), Consequences (*anubhava*) and Transitory Emotions (*vyabhichari)*: these elements are objects of perception for the audience through which rasa experience is derived. Here, Bharata places the actor and audience as symmetrical others taking equal parts in the process of rasa experience. The signals transmitted at one end are fully received at the other end feeling the same emotions and thoughts. Audience is a special person who is equally knowledgeable, as the actor is about the performance, with competitive aesthetic refinement and sensibility prepared for feeling all emotions expressed by the actor (Pisharoti, 1987, p. 212). Performance being an object of perception, the audience sees the actor the symmetrical other in the visual world of performance in order for processing the signals to 'discover' objects and emotions appropriate for the rasa experience. Audience/actor relationship is like a chromosome pairing making the physical body of the performance complete, meaningful and enjoyable. While offering a systematic analysis of the rasa aesthetics, Abhinavagupta (950-960 AD) further clarifies the symmetrical entity of the audience/actor saying that the audience identifies and universalizes the mental and physical schema of the actor during the performance

(Vedabandhu, 1986, p. 227). Aesthetic enjoyment (*rasanam*) is a process of discovering and universalizing 'objects and emotions in the world of performance in order for experiencing *rasa* (Vedabandhu, 1986, p. 228). The objects and emotions appearing in performance are impersonal and therefore, they are universal and enjoyable: neither belonging to the actor nor to the spectator. Rasa is 'blending (*samyoga*) of different sensory qualia' (Ramachandran & Hubbard, 2001, p. 25) geared by the symmetric others-actor/audience-through their discovering of interesting object like entities in the perceptual world of performance.

There is a logical progression of perception involved in the process of discovering *rasa.* Each element that combines the rasa experience such as Character and dramatic situation (Determinants) in which the rasa experience is based; characters emotional responses (Consequences) and their voluntary and involuntary mental states (Transitory emotions) all need to be logically connected in a proper development of rasa experience. It is the logical progression of actions that creates the rasa, not the coincidences. In the example of the *Mountain Himalaya* in Kutiyattam, there is a clear logic of progression of actions that creates the enormity of the mountain. The height and width of the mountain ranges; the shape and movements of the caves and the rivers; patterns of trees and the detailed descriptions of various birds and animals, all are meticulously and logically enacted to create the illusion of the enormity of the mountain Himalaya. The enactment looks like a rigorous mathematical framework representing the physical and statistical properties of the body and the environment. The example offers a display of logically progressing optical illusions of the body following geometrical patterns of lines and curves. Vertical movements of the eyes and

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face, for instance, create the illusion of height and horizontal on the other hand creates the illusion of width.[11] Evidence based on studies in human perception approves the fact that very different objects can give rise to similar retinal images; and the same object can give raise to very different retinal images (Geisler and Kersten, 2002, p. 508). A circle and an ellipse, therefore, can produce the same retinal image of a circle slanted in depth, and also the same circle slanted in depth by different amounts can produce many different images (Geisler and Kersten, 2002, p. 508). In this way, the actor who enacts the mountain Himalaya in Kutiyattam uses a range of logically progressing optical illusions of the body to create rasa experience. From an audience point of view, as the symmetrical other, what interests them is the discovery of the object like entities within the optical display of enactment aiming to achieve the same mental image that the actor is holding during the performance. The actor has a complete mental image of the mountain Himalaya when the performance begins, but for the audience, it is a perceptual; process following each moment of the enactment discovering objects shapes and material distributed by the actor leading to a culmination of the mental image of the mountain Himalaya. There is an 'aha' in the audience response when the mental image of the mountain Himalaya is completed and the rasa is fully discovered. It is evident in this analysis that there are key interlocking systems and underlying principles can be found in common in rasa as well as visual perception and neural mechanism. Human visual system abhors suspicious coincidences (Barlow, 1980), and it relies entirely upon logic of perception.

Conclusion: Rasa as Metaphor

Based on unambiguous evidences derived from brain studies, metaphorically encoding the world is a basic cognitive mechanism (Ramachandran & Hubbard, 2001, p. 31). Objects and concepts are classified and categorized in visual perception in order to create a

single super-ordinary category: representation of a chair is linked to an abstract 'chairness' (Ramachandran & Hubbard, 2001, p. 31). The discovery of similarities and linking dissimilar events in the visual processing lead to limbic activation ensuring the process is rewarding (Ramachandran & Hubbard, 2001, p. 31). These activations lead to emotions in the amygdala, a part of the limbic system (Hirstein and Ramachandran, 1997) and once the object has been recognized and its emotional significance is gauged by the amygdala, a message is relayed to the autonomic nervous system (ANS) via hypothalamus so the subject is prepare to act-to fight, flee or mate (Ramachandran & Hubbard, 2001, p. 32). "A metaphor is a mental tunnel between two concepts or precepts that appear dissimilar on the surface (Juliet is the Sun)" (Ramachandran & Hubbard, 2001, p.31) but enabling us to highlight the crucial aspects that it represents symbolically. Juliet is not the Sun but she shares radiance and warmth with the Sun, a meaning that is suggested in the metaphor. This suggestive nature of meaning making is the basic cognitive mechanism encoding the perceptual world. Metaphors structure our understanding of the perceptual world and functions as a language for our interactions with the world. Rasa is metaphor embodied in the sense that it refers to neural mechanism underlying the visual perception and stimuli in performance practice. Rasa stands for a perceptual discovery of salient emotional evocative in a performance. Rasa is not actual representation of 'real' objects and events and environments, but it is a perceptual process of rediscovering 'objectness' and 'emotions' through performance. Rasa does not offer 'real' emotions of love or sad, but it offers loveness or sadness that are physical metaphors that are suggestive and stylized. Discovery of similarities linking dissimilar events would lead to limbic activation. It is the basic neural mechanism that one taps into, whether with puns,

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poetry or visual art (Ramachandran & Hubbard, 2001, p.31). In this way, what rasa offers in theatre and performance practice is a rich limbic activation through shifting the sensory modalities in the perception of objects and persons in performance. Rasa as a process of embodied practice as well as a mode of aesthetic relish pushing the functional boundaries of the actor's body, imagination and creativity, of both the actors and the audience, in performance may likely to activate sensory processors in the brain and stimulate cross-activation between neurons. The visual, tactile and kinetic elements of the Natyasastra based performance practice seem to provide a methodology for a comprehensive understanding of emotion and perception that follow the principles of neural mechanism of experience.

Endnote:

[1] The term Synesthetics is derived from a series of neurological studies on Synesthesia presented by V.S. Ramachandran & Willam Hirstein 1999; V.S.Ramachandran, E.M. Hubbard & P.A. Butcher 2004; V.S. Ramachandran & E.M. Hubbard 2001; V.S. Ramachandran & E.M. Hubbard 2003. These studies confirm that Synesthetia is a perceptual condition and an involuntary perceptual experience in one sensory modality which is normally associated with another perceptual modality or cognitive processing. A synesthete, for example, may experience a specific colour whenever he or she encounters a particular tone (C-sharp may be blue) or may see any given number as always tinged a certain colour (5 may be green and 6 may me red). Synesthesia is explained in these studies as a neural mechanism of perceptual colouring and metaphor making for encoding the world in minimal terms. In this Chapter I emphasise on 'a neurological theory of aesthetic experience' and elaborate the discussion to explore the neural mechanism of rasa theory of Indian aesthetics.

[2] V.S. Ramachandran and his fellow researchers developed a theory on human aesthetic experience mediated by neural mechanism. In order to explain the neural mechanism of rasa aesthetics, in the following sections I am referring to the Eight laws developed by Ramachandran and his fellow researchers.

[3] Peak-shift is a neural principle tested among the rats with a result showing that that animals respond to exaggerated training stimulus. If a rat is taught to discriminate a square from the rectangle, it will soon learn to respond more frequently to rectangle even if the object is longer and skinnier. The result implies that what the rat is leaning is not a prototype but a rule, i.e. *rectangularity*.

[4] Ethologists have long noted that a Seagull chick will beg for food by pecking at its mother's beak. Remarkably, it will peck just as vigorously at a disembodied beck with no mother attached to it or even a brown stick with a red dot at the end (the gull's beak has a vivid red spot near the tip). It is the same neural principle of peak-shift that works with rasa acting. As Ramachandran noted, what is even more remarkable was Tinbergen's discovery (Tinbergen, 1954) that a very long, thin brown stick, with three red stripes at the end is even more

effective in eliciting pecks than the original beak, even though it looks nothing like a beak to a human observer (Ramachandran & Hirstein, 1999).

[5] Kutiyattam is the only existing form of the Sanskrit theatre of India and the oldest existing classical theatre form proclaimed by UNESCO as the intangible heritage of humanity in 2001. The history of the performance will date back 200 AD. However, an unbroken history of the performance can be traced back since 10 Century AD by the Royal patronage of the King Kulasekhara of Cochin. The temple theatres (*Kuthambalam*) have been constructed for Kutiyattam since 14 Century AD. It is the only theatre form that exemplifies the principles of the Natyasastra in practice.

[6] Kutiyattam uses minimal text; the production scripts (*attaprakaram*) contain detailed descriptions of what the actor has to do every moment in the performance. One act can be performed for several days, and few verses can be performed for several hours. Sanskrit plays in general have minimal verbal structure and give more space for enactment and actor's improvisation. Performance becomes a sub-textual elaboration rather than representation of mimetic actions. There are several scenes in the Kutiyattam repertoire such as *the lifting of the mountain Kailash, the preparation of the war, flies and the lamp* etc that can be completed only by several hours with out using text.

[7] Mani Madhava Chakyar, the legendary actor of Kutiyattam listed 48 movement patterns (*Kriyas*) in his book *Natyakalpadrumam*, the book considered as the actor's manual (1973: pp. 22-36). In the Natyasastra, Bharata listed 32 movement patterns (*Chari*) (XI: 10-46). *Chari* means movements and *Kriya* means actions both are kinetic properties of the body.

[8] Kathakali is the dance-drama developed in feudal Kerala in the 15 Century AD. Owning performance techniques from Kutiyattam and aesthetic principles from the Natyasastra, the Kathakali flourished as an unique form of performing art of Kerala. Unlike in Kudiyattam women actors are not allowed in performance and therefore, male impersonations are common in Kathakali and there are well-known female impersonators are in the art form.

[9] V. S. Ramachandran explains two antithetical principles of vision that are mutually reinforcing and rewarding to the organism: grouping on the basis of similarity and grouping on the basis of contrast. Grouping can occur between similar features (e.g. colour or motion) even if they are far apart in space (the spots on the nose and tail of a leopard). On the other hand, contrast usually occurs between dissimilar features, which are physically close together. Even though, the two visual processes seem to be inconsistent, they are actually complement one another with the discovery of objects. According to Ramachandran, contrast extraction is concerned with the object's boundaries where as grouping allows recovery of the object's surface. See more details in Ramachandran & Hirstein, "The Science of Art: A Neurological Theory of Aesthetic Experience", *Journal of Consciousness Studies*, 6, No. 6-7, 1999, pp.15-51.

[10] Recent experiments in evolutionary biology suggest that when choosing a mate, animals and humans prefer symmetrical over asymmetrical ones due to fertility reasons. If this is the case, in humans, there is an inbuilt aesthetic preference towards symmetry. See more details in Ramachandran & Hirstein, "The Science of Art: A Neurological Theory of Aesthetic Experience", *Journal of Consciousness Studies*, 6, No. 6-7, 1999, pp.15-51.

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[11] Arya Madhavan offers a detailed study of how eye movements create rasa experience in Kutiyattam, see for more details "Eyescape: Aesthetics of Seeing in Kutiyattam", in *Asian Theatre Journal,* Vol. 2, Fall 2012 (Forthcoming).

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