

Mirror Neurons and the Art of Acting

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ABSTRACT

Mirror Neurons and the Art of Acting

Andrea Brassard

This theoretical paper explores the parallels between the mirror neuron system and the art of acting. It aims to establish a fruitful multidisciplinary encounter between actors, neuroscientists, and drama therapists which will allow them to compliment and deepen each other's exploration of being human, and to add to the current literature on drama therapy. Consistent and pervasive throughout all the acting literature is the message that the art of acting requires a profound understanding of human nature, and the astute observation and understanding of others as well as oneself. Modern neurological findings tell us that understanding of self and others relies to a large extent on the mirror neuron system. This study will look at the mirror neuron system as a means of clarifying and expanding our understanding of the art of acting. The mirror neuron system provides another level of abstraction at which to understand the art of acting, thus broadening our understanding of the art, and the processes which drive it. A deeper understanding of the processes of acting leads to a greater understanding of the role of drama in therapy, and of drama therapy in the larger community.

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Mirror Neurons and the Art of Acting

How can recent neurological findings on mirror neurons clarify and explain the processes at work in the art of acting? What do the findings suggest about the art of acting for human development? What are the therapeutic implications for the art of acting, specifically in drama therapy, according to these findings? The following exploration and comparison of mirror neuron findings and the literature on acting elucidates these questions, and aims to instigate more interest in the overlap of acting and neuroscience, and to provide a theoretical premise for further investigation and research into the convergence of these phenomena. It shows that mirror neurons provide the first scientific framework for the processes at work in the art of acting, from which acting can be conceptualized as an art of expanding consciousness that is integral in human development. The use of acting methods in drama therapy and the value of drama therapy in the broader therapeutic community are reinforced by these findings. This comparison makes the wealth of behavioral knowledge in the theatrical canon more accessible to positivist scientific thinkers of this day and age, and may lead to further insights in the fields of neuroscience and human behavior.

Method

This historical-documentary research paper allows a comprehensive overview and analysis of the mirror neuron and acting literature. Such a review is meant to provide the reader with the information necessary to form a basic understanding of both areas of study. The interdisciplinary nature of this time and place in history, and of drama therapy, is congruous with the interdisciplinary approach of this research, and fits the notion of paradigm crossing in research advanced by Morrow (2007). By investigating and

comparing the relatively new field of inquiry into the mirror neuron with the ancient art of acting, new possibilities for human development are revealed and discussed. There is no prior research published on this topic. The phenomena under investigation involve complex processes that require in depth and detailed illustrations, which at this stage can only be provided by qualitative historical-documentary research (Morrow, 2007).

The data collected is the knowledge and information recorded in the historical cannons on acting and mirror neurons. It is sourced from all published and accessible articles and books. The data comes from theoretical as well as experimental contexts. All data has been retrieved in written form. Due to the qualitative nature of the research, data collection was guided by a purposeful choosing of sources, terms, themes and perspectives which simultaneously formed the emerging discussion (Morrow, 2007). Sufficiency of data limited the data selection process, and was determined by two constructs: redundancy of data (new data does not equate to new findings), and theoretical saturation (the themes discussed account for all the data found as well as the complexity of the phenomena being studied) (Morrow, 2007). This paper emerged through an “alternating cycle of induction and deduction” (Morrow, 2007, p.215) and reflects a recursive analysis of the data. The investigation of both sets of data in the same context has lead to thought and insight into their relationship.

Findings

The Mirror Neuron System

The discovery of mirror neurons and interdisciplinary interest.

Mirror neurons were discovered by accident over a decade ago while researchers were studying the behavior of macaque monkeys (Gallese, 2007). In these experiments a

group of scientists in Italy discovered that the same neural networks firing in the macaque when they performed a goal-directed behavior were also firing when the macaques observed the same behavior being performed. This finding led to an outburst of research into the possible homologue of this system in humans. Subsequent findings on the human mirror neuron system have unveiled what is said to be one of the most significant discoveries in the neurosciences; what DNA was to biology, mirror neurons are said to be for psychology (Sylwester, 2002).

The discovery of the mirror neuron has incited discussion and interest in a diverse array of disciplines. The multimodal sensory-motor functions of the system seem to parallel the multidisciplinary applications of its discovery. The mirror neuron system (MNS) is being discussed in the literature as a human mechanism for social cognition, self-recognition, imitation, empathy, action understanding, identification, intentionality, theory of mind, and the evolution of language, as instigator of the new fields of neuro-politics, neuro-marketing, neuro-ethics, and neurophysiologic phenomenology, and for its clinical implications in psychology and psychoanalysis (Gallese, 2007; Gallese, Keysers, & Rizzolatti, 2004; Gallese, Eagle, & Migone, 2007; Iacoboni, 2008; Iacoboni & Dapretto, 2006; Olds, 2004; Rizzolatti & Craighero, 2004; Rizzolatti & Sinigaglia, 2008; Rizzolatti, Fogassi, & Gallese, 2001; Rizzolatti, Fogassi, & Gallese, 2006).

One of the key theoretical constructs accompanying mirror neuron research is the phenomenological school of thought founded by Husserl (Rizzolatti, et al., 2001) and espoused by Merleau-Ponty and Heidegger (Iacoboni, 2008). Phenomenology is a way of understanding the world by paying attention to the phenomena and objects of the world, especially to our personal experience of these phenomena and objects (Iacoboni,

2008). It is also defined as a philosophical movement “dedicated to describing the structures of experience as they present themselves to consciousness, without recourse to theory, deduction or assumptions from other disciplines, such as the natural sciences” (Rizzolatti, et al., 2001, p.667). Mirror neurons have opened up a new field called Neurophysiologic Phenomenology in order to reconcile theoretical constructs of the brain with mirror neuron properties (Iacoboni, 2008). Many brain scientists are now exploring the brain from the perspective of neurophysiologic phenomenology rather than the longstanding mechanistic computational model of the brain. They have completely broken out of the “box” of compartmentalizing and into the experience of phenomenology.

Brain imaging techniques and the anatomy of the mirror neuron system.

A large number of neurophysiological and brain imaging studies have been used to ascertain the existence and function of the human MNS using varied techniques such as electroencephalography (EEG), magnetoencephalography (MEG), transcranial magnetic stimulation (TMS), and functional magnetic resonance imaging (fMRI). For more information on how these techniques work see Rizzolatti & Craighero (2004), and Rizzolatti et al. (2001).

From these studies, the anatomy of the MNS has been mapped out, and the core of the human MNS has been identified in the rostral area of the inferior parietal lobule, the lower area of the precentral gyrus, and the posterior area of the inferior frontal gyrus (Rizzolatti & Craighero 2004; Rizzolatti, et al., 2001). The MNS is comprised of a complex network which connects these cortical regions, which function primarily in motor activity, to the occipital, parietal, and temporal sensory areas of the brain.

Traditionally these areas have been construed as having separate functions, however the mirror neuron findings challenge this notion of the brain as made up of separate compartments which deal with separate information. For a more detailed account of the neuroanatomy of the MNS, as well as discussion of the risks of cytoarchitectonic interpretation of these studies, see Rizzolatti & Craighero (2004). It is worth noting that an area of the brain that has been identified as exclusively dedicated to speech production, Broca's area, is considered an important motor area of the MNS (Fadiga, Craighero, & Olivier, 2005; Gallese, 2007; Rizzolatti, et al., 2001).

Types of mirror neuron and basic functions.

There are different types of mirror neurons: somatosensory, visual, bi-modal (somatosensory and visual), auditory, audio-visual, and speech-related echo-neurons (Gallese, 2005; Rizzolatti & Craighero, 2004). They are activated by sense-specific cues in the environment which trigger the motor representation of the observed action in the MNS. This process was introduced as the direct-matching hypothesis which proposed that action understanding is predicated on the mapping of an observed action onto the observer's motor repertoire (Rizzolatti, et al., 2001). This process is also called embodied simulation, simulation, or mirroring, and is likened throughout the literature to an innate form of imitation.

Since the discovery of mirror neurons the brain can no longer be parceled into sensory, motor, and cortical areas, but demands to be understood in a more holistic way (Iacoboni, 2008); a way in which sense, act, and thought are embedded in the same neuronal cell, in one acting body. Amazingly, there is technology that can measure cellular activity in the brain at the single cell level, and it has been used to study the MNS

in macaques and in humans (Iacoboni, 2008). Using single cell technology, mirror neurons have been measured that fire for specific actions, regardless of which muscle body performs the action (i.e. right hand versus left hand grasping) (Iacoboni, 2008). These mirror neurons code specifically for the act (i.e. grasping). For example, the cell that codes the act of grasping will fire regardless of who is grasping and what is being grasped (subject or object). Mirror neurons will also specifically code for the type of grasp necessary for an act (Rizzolatti, et al., 2001; Rizzolatti & Sinigaglia, 2008). This type of mirror neuron is called strictly congruent. There are also mirror neurons which register action more generally, they focus on the broader goal or intention of an act. These are more common and are called broadly congruent mirror neurons (Iacoboni, 2008; Rizzolatti, et al., 2001).

Neurons that fire specifically in recognition of an object have also been discovered. These are called canonical neurons and they are similar to mirror neurons in their multi-modal function. Canonical neurons fire both during grasping behavior and at the sight of an object that can be grasped (Iacoboni, 2008). What differentiates these from mirror neurons is that they will respond to stationary objects, whereas mirror neurons seem to be specifically responsive to actions (Iacoboni, 2008; Rizzolatti, et al., 2001).

The intensity of the MNS' response to an observed action depends upon the observer's motor repertoire (Calvo-Merino, Glaser, Grezes, Passingham, & Haggard, 2005; Rizzolatti & Craighero, 2004). This has been demonstrated in a study of ballet and capoeira dancers observing their own and the other style of dance (Calvo-Merino, et al., 2005). Dancers observing their own style of dance had stronger mirror neuron responses than they did when watching the other dance form. Dancers in general also resonated

more strongly than non-dancer control subjects to either form of dance (Calvo-Merino, et al., 2005). It has also been shown that subjects MNS' respond more strongly to species to which they are more closely related (Gallese, 2007) and to individuals' with whom they identify (Iacoboni, 2008). Another study showed that words spoken in conjunction with gestures with like-meaning are communicated and received in stronger impulses, than in control situations where words are not paired with gestures with like-meaning (Gallese, 2007). In a study with infants, both live and televised actions evoked MNS response. However the live actions had a significantly stronger resonance than televised (Iacoboni & Dapretto, 2006). Mirror neuron firing is for the most part not affected by distance - firing as long as an act is observable (Iacoboni, 2008).

Embodied simulation.

Embodied simulation is a term that has risen out of the findings on mirror neurons in order to explain their function, and is prominent in the more recent literature reviewed (Gallese, 2005, 2007; Gallese, et al., 2007; Iacoboni & Dapretto, 2006). Mirroring or simulation are words that are also used to describe the same process (Iacoboni, 2008, Rizzolatti & Sinigaglia, 2008).

Embodied simulation is the process of internally replicating an observed action and/or emotional state. This replication is not iconic, belonging to the visual domain, but is a pre-motor simulation, experienced viscerally and in body-states. It is a process of *direct mapping of the actor's emotion/action onto the same neural structure in the observer*, and is likely the outcome of the direct matching hypothesis described by Rizzolatti, et al. (2001). Embodied simulation is a direct understanding of the inner world of the other; the MNS is its neural correlate (Gallese, 2007). The MNS is a completely

unreflective, instantaneous, form of internal simulation, that is not dependent on conscious recognition of others, but on which such recognition is dependent (Gallese, 2005). Embodied simulation (mirroring) precedes the conscious perception of others' actions and emotions.

Through the process of embodied simulation, the MNS provides the neurological foundation for body awareness and basic social and emotional understanding (Gallese, 2005). Embodied simulation also allows human beings to share intention, meaning, and reference, and in this way to meet the parity requirements for the development of language (Gallese, 2007; Iacoboni & Dapretto, 2006). Phenomenologists have also conceived of action understanding in a similar way, as a sort of immediate experiential understanding (Gallese, et al., 2004; Rizzolatti, et al., 2001). Olds (2004) applies this capacity for shared meaning to psychoanalysis and the processes of identification, intentionality, and theory of mind.

Empathy.

The MNS is tightly linked to the limbic system (Iacoboni, 2008; Rizzolatti, et al., 2001) which is considered the center of emotions in the brain. Although the limbic system as a cohesive and connected unit is contested (Ledoux, 1996), for the purposes of this paper it will be considered a valid construct for the emotional center of the brain. The insula, defined by its many cellular connections throughout the brain and its role in visceral functions and autonomic processing (Berrol, 2006), is the anatomical area which connects the majority of the limbic system with the MNS (Iacoboni, 2008). In his "mirror neuron hypothesis of empathy" (Iacoboni, 2008, p.119), Iacoboni hypothesizes that mirror neuron simulation of other's emotional facial expressions triggers the associated

networks in the limbic system, thus activating the internal-visceral sensations of the emotion as well as the motor representation. In this way one experiences other people's feelings through an innate imitative function, and this awareness/experience allows one to then act empathically towards others (Iacoboni, 2008). A good imitator by this definition, is skilled at identifying other's emotions, and therein has more capacity to empathize with others. A relationship between an individual's propensity to imitate and their capacity for empathy has also been demonstrated by a high correlation between imitative behavior and empathy (Iacoboni, 2008).

Without an embodied simulation the limbic system may not be activated, resulting in a lack of the experience and identification of emotion, and a lessened capacity for empathy. This dynamic is further explored in the discussion of emotions, memory, and mirror neurons later in this paper. A completely accurate cortical representation of the emotional state of the other could still be described, but this would be devoid of the emotional connection recognized as empathic (Gallese, 2005), and would resemble the kind of processing described in people with anti-social personality disorders and psychopaths.

Mirror neuron perception is astonishingly astute and subtle. Iacoboni (2008) goes as far as to suggest that mirror neuron activity can be used as a biomarker of social competence and empathy. He emphasizes how remarkable this is given that empathy is a personal/internal experience (Iacoboni, 2008). An increased mirror neuron capacity positively correlates with increased emotional empathy and increased interpersonal competence (Iacoboni, 2008). The benefits of these abilities are undeniable in a world where social esteem and status are known to mediate stress and health (Peterson, 1999).

Perception and experience.

The MNS is a neural circuit which maps the acting body in space on an unconscious level, but which is also necessary for conscious awareness of the body/self (Gallese, 2005). In reference to theoretical discussions of motor activity in spatial awareness and empirical research carried out on animals and humans with various forms of brain lesion causing motor and perceptual deficits, Gallese (2005) demonstrates the role of sensory-motor experience/perception in conscious perception. In other words, he shows that a person must be able to experience something in order to perceive it (Gallese, 2005). Gallese breaks down the dichotomy between body-schema (as an unconscious concept of the body in space) and body-image (as a conscious concept of the body in space), highlighting the fact that the somatosensory system is vital and inseparable from the process which creates self-awareness. Body schema and image are thus integrated in a more comprehensive understanding of self/other perception. Other authors writing on the MNS also emphasize the necessity of experience in perception (Gallese, et al., 2007; Iacoboni, 2008; Rizzolatti & Sinigaglia, 2008; Rizzolatti, et al., 2006).

It is critical to understand that perception and experience cannot be separated at the neural level; acting and observing both function through the activation of the same neural circuits (Gallese, et al., 2007). The first and third person experience of emotions and actions are bridged via the MNS (Gallese, et al., 2004). The MNS codes actions and is as indiscriminate to the subject as a verb is. It doesn't matter if it is I or she or he that is doing something, but it is the doing that is recorded in the MNS. Interestingly, the MNS is also activated by action sentences. Thus the very saying of an action verb, such as "running", activates the pre-motor sequence which defines that verb for the observer

(Gallese, 2005). Furthermore, it has been shown that mirror neuron activation actually facilitates motor evoked potentials (MEPs) measured in hand muscles (Fadiga, Fogassi, Pavesi, & Rizzolatti, 1995). Theoretically then, mirror neuron activity achieved through semantic expression, “running”, translates directly to the motor cortex and the muscles involved in action execution.

The act necessary to obtain or use an object is the means by which we identify and understand the object (Iacoboni, 2008); action-experience-perception. By breaking down the dichotomy between perception and experience, such that an observer sees an object as a potential act, the MNS allows us to conceive of sight as a form of action; “the sight of the cup is just a preliminary form of action... and so identifies it in function of the motor opportunities it encompasses” (Rizzolatti & Sinigaglia, 2008, p.49). The other senses function in the same way, mapping the world in terms of potential actions.

What can be said for perception and action can also be said for perception and experience: they are inseparable in the brain (Iacoboni, 2008). Perception is not limited to conscious awareness as we so often assume, but occurs more primarily at a pre-conscious level as is recorded by experiments with people who have spatial neglect (Rizzolatti & Sinigaglia, 2008). Mirror neurons have forced us to understand the brain as indivisible from the body and from the external environment. In short, it is inevitable that we understand the world from a holistic perspective, even in our most abstract, cerebral, cognitive capacities.

Conceptual reasoning (thinking) does not play a part in the MNS, whose functions though they lead to body-awareness/consciousness, are subconscious, sub-cortical, and are not dependent on visual representations of the action/emotion observed (Gallese,

2005; Gallese, et al., 2004). Much of the literature expresses that although cognitive reasoning does not play a part in the MNS, it remains a valid construct for understanding others, at a different, less immediate, level of abstraction (Gallese, 2005, 2007; Rizzolatti & Craighero, 2004; Rizzolatti, et al., 2001). Gallese elaborates on the distinction between embodied simulation and cognitive processes as means of understanding others, emphasizing that only the former allows for intentional attunement with the observed agent. The MNS is described as a means by which a person can know how it feels to perform an observed action, and via this experiential knowledge can attune to the other's intention: the driving force of the action (Gallese, 2007). The MNS has also been described as a sort of scaffolding from which more cognitive understandings of behavior are built (Gallese, et al., 2004; Rizzolatti, et al., 2001).

It is important to note that the MNS is a complex and somatotopically vast system in the brain. As a result it seems to serve a wide array of processing - conscious and unconscious, cognitive and emotional (Gallese, 2007). A more detailed discussion of the MNS, consciousness, and unconsciousness will be entered into in section four of this paper.

Intentions.

Intentional attunement is an important concept in the literature (Gallese, 2005, 2007; Gallese, et al., 2004; Gallese, et al., 2007; Iacoboni & Dapretto, 2006; Olds, 2004). It is closely affiliated to embodied simulation/mirroring, and is part of the process whereby the observation of another's action leads to motor resonance in one's own brain-body system. Presumably, when one executes an action, the goal and desired outcome of the action is already determined (Gallese, et al., 2007; Rizzolatti, et al., 2001). Intentional

attunement describes how a goal-directed organism resonates with the goal/desired outcome of another observed agent's action. Intentional attunement is predicated on the procedural knowledge of the agent and of the self as goal-directed organisms and the process of embodied simulation (Gallese, 2005, 2007). The outcome of the observed act and the intention of the act are known (subconsciously at least) before the act is completed. The sub-cortical systems orient the observer towards the target object as though they were the active agent (Gallese, 2005, 2007). This phenomenon is true for both macaques and humans, and empirical evidence has demonstrated that the MNS responds specifically to the intention of the action (Gallese, 2005, 2007; Iacoboni, 2008; Rizzolatti & Sinigaglia, 2008).

In experiments conducted on monkeys, the MNS responds to goal-directed actions, regardless of whether the object of the goal is visible. For instance, the macaque MNS responds to the act of reaching for a piece of food behind a screen when the food is present, however, when the food is not present the MNS does not respond. The food is hidden by the screen, yet the monkey is still able to differentiate between the object-directed action and the visually identical scenario which is not object-directed. It is therefore concluded that the MNS responds specifically to the intention of the action (Gallese, et al., 2004; Iacoboni & Dapretto, 2006; Rizzolatti & Craighero, 2004; Rizzolatti, et al., 2006).

The human MNS is more sophisticated than the macaques and codes not only for the goal of the observed action, but also for the way in which the action is performed (Gallese, et al., 2004). This may explain how humans can distinguish the goals of intransitive actions (discussed in detail further in this section), and understand abstract,

complex, and social motivations like jealousy. Imitation studies with young children have demonstrated that learning through imitation is strongly supported by goal-directed actions (Iacoboni, 2008). In other words, an obvious intention/goal facilitates imitation learning. This also supports theories that human beings are essentially goal directed, intentional, creatures (Peterson, 1999).

The ideo-motor model of action (Iacoboni, 2008; Rizzolatti, et al., 2001) views intention as the beginning of an action, contrary to traditional sensory-motor action theories which view sensory stimulation as the initial phase of action (Iacoboni, 2008). Mirror neurons seem to be as much, if not more, concerned with coding the intention of an action, as the action itself (Iacoboni, 2008), and the two are not separate in the ideo-motor model. The action is the intention. In the MNS, individuals send and receive information using the same format: actions (intentions) (Iacoboni, 2008). Individuals understand others and communicate, using a vocabulary-of-acts (intentions) (Rizzolatti & Sinigaglia, 2008). Everything an individual perceives has been translated into action; into what it signifies for an individual's acting body in space (their intention). There is a temporal dimension as well which registers the sequence of necessary actions required to achieve a greater intention (Gallese, 2005). Experience itself is driven by intentional states, which are more often than not unconscious. In every act one is experiencing, perceiving, and intending something, even if one is unaware of one's intention. It would be impossible to function if one had to be consciously aware of all one's intentions (Peterson, 1999). Imagine having a conscious awareness of every move one makes, nonetheless every move one makes is motivated by something, and this motivation is a part of what the mirror neuron system registers.

Transitive and intransitive action.

There is a critical distinction between the MNS of macaques and that of humans. Both the macaque and the human MNS respond to transitive (object-related) actions, however the human MNS is also highly responsive to intransitive (not object-related) actions (Gallese, 2005; Rizzolatti & Craighero, 2004). The human MNS codes for all actions not just those that are directly aimed at an object. The capacity to simulate and understand an intransitive action, allows the observer to experience something that is not materially present, for instance a person perceives that a mime is drinking from an imaginary cup (Gallese, et al., 2007). It is this responsiveness to intransitive actions, pantomime and gestural communication, that according to some evolutionary theories developed into the human capacity for speech (Gallese, 2005, 2007; Rizzolatti & Craighero, 2004), and which allows the human imagination to play a role in experience.

The intransitive act allows humans to experience/perceive without a tangible object, “as if” the object were present. The necessity of experience for perception, and the human MNS’ unique responsiveness to intransitive actions, theoretically allows for the manifestation of experience through this capacity to experience/perceive the intransitive (the capacity to imagine).

Both monkeys and humans need to do to see; one’s motor repertoires translate into what one is capable of perceiving (Gallese, 2005, 2007; Gallese, et al., 2007; Rizzolatti & Craighero, 2004; Rizzolatti, et al., 2006). Humans however, can also imagine doing and in this way extend what one is capable of perceiving. One can induce abstract experiences in one’s motor repertoire. This is demonstrated by our MNS’ responsiveness to intransitive actions. This definition of imagination occurs at all sense

levels, and is not strictly image/visually dependent (Rizzolatti & Craighero, 2004). It is based in the sensory-motor structures of the brain, and depends on the embodied simulation of abstract concepts.

Mirror neurons can be conceived of as a form of body imagination. Just as the mind internally represents an image in imagination, the body forms internal motor representations of actions it perceives, and even those it imagines (intransitive actions). It does this through the language of the vocabulary-of-acts in the MNS (Rizzolatti & Sinigaglia, 2008); through one's motor repertoire. The body imagines in physical terms. It can simulate acts it has never done and then go on to perform these acts. It does so by breaking down an observed act into components which are present in the observer's motor repertoire, and rearranging the observed act into a sequence of acts that the observer can identify and perform (Rizzolatti, et al., 2001). The capacity to identify intransitive acts also implies a capacity to represent the intransitive in motor terms, and therein to fill in the blanks of an observed action that is outside one's motor repertoire with a kind of physical/motor imagination. Acts of the body, if they have never been performed are manifestations of something completely new. One's body is constantly in conversation with the environment through its vocabulary-of-acts (Rizzolatti & Sinigaglia, 2008), and assimilating knowledge through this conversation. As long as the body is alive it is interacting with the environment at some level, even when conscious control over the body is lost. Mirror neurons are a major neuronal component of this action dialog.

The mirror neuron system maps the peripersonal space of the body. This means it creates a map of the body and space around it in terms of potential actions (Iacoboni,

2008). Any object or person which enters into this space, the area of which varies in accordance to different parts of the body, will be registered in the MNS based on the potential acts that can be done in relation to this object or person (Iacoboni, 2008).

As demonstrated by experiments with people with spatial neglect, the peripersonal space can also be extended with the use of tools (Rizzolatti & Sinigaglia, 2008), making it by definition, or defined by, that space in which the acting body (tool included) can act. For instance, if driving a car, the car then becomes an extension of one's body, and is defined by the space in which it can act. A moving vehicle is a dangerous tool and it allows one to act at high speeds over great distances. It is a tool one learns to manipulate with great dexterity, and it provides the driver (and passengers) with the opportunity to experience-perceive-act on the world on a larger level. As anyone who has flown on an airplane for the first time will attest, it does the same, allowing experience to take on a whole new level of resolution. Gallese (2005) demonstrates that an agent perceives and responds to the environment to the extent in which they have agency.

The internet, as a communicative tool, has extended the (virtual/intransitive) space in which an individual can act communicatively, to the whole world. This has interesting implications for one's capacity to influence and be influenced by agents one has never seen or met, but with whom one's affiliation through the internet gives one a sense of self in mirrored intentions and virtual (intransitive) acts. One's MNS codes space in accordance to one's capacity to act (Gallese, 2005), and technology has immensely widened the grasp of those who have access to it.

Peterson (1999) argues that the extended capacity to act in the world, provided by technology, has not been accompanied by an equivalent social moral development. The consequences of human action have been heightened without an elevated sense of responsibility. A possible solution to this moral dilemma is to facilitate in-person interaction with an emphasis on mirroring/imitation. Interaction of this kind is recognized as the most adequate way to stimulate the MNS (Iacoboni, 2008), and therein an important component of moral development.

Language.

Iacoboni (2008) discusses the intimacy between gestures and language. Gestures appear to be involved in the process that leads to language and formal understanding, and the ability to communicate more advanced levels of understanding (Iacoboni, 2008). They are often used when a person is trying to convey a difficult concept (Iacoboni, 2008). In this way gestures form a bridge between knowledge and a semantic expression of this knowledge. A person can know something and express it physically in gesture, without being able to articulate it verbally (Iacoboni, 2008). One of the examples given by Iacoboni (2008) is that babies use communicative gestures before their first words. This also exemplifies that gesture is more primary than language in human functioning. Iacoboni (2008) also states that mirror neurons are probably the most essential brain cells for the ontogenetic and phylogenetic development of language.

Embodied cognition, embodied semantics, and the entire notion that cognition and language are bodily processes is reinforced by the discovery of the MNS (Iacoboni, 2008). These theories allow us to understand thought and language as rooted in physical acts and experiences. In such models an individual's biological existence is not separate

from their conscious conceptions of existence. Experience can be modified and manifested through the imagination, but is always based in bodily acts/experiences.

Mirror neuron functions suggest that the private experience of one's body is also in some respects a public one, thus connecting people in their most basic acts/experiences. In an interesting analysis of mirroring and imitation in human conversation, Iacoboni (2008) draws a similar parallel, articulating that we share private experience through language.

Many studies have demonstrated that human beings mirror each other extensively while conversing (Iacoboni, 2008). In reference to a school for deaf children in Nicaragua where hundreds of children created their own fully developed sign-language, Iacoboni (2008) illustrates that face-to face communication is the most effective context for mirror neuron activation and language development. Iacoboni (2008) also explains that every conversation involves the creation of a shared meaning, a kind of new language, in which people adjust their understandings of words to match each others' in order to communicate. It is also shown that one understands another's speech by simulating that they themselves are saying it (Iacoboni, 2008).

Experiments have demonstrated that when listening to another person speak one's tongue moves as though they themselves were speaking (Iacoboni, 2008). In a fascinating study, TMS, a brain technology that can create temporary lesions in subjects' brains, was used to temporarily eliminate subjects' motor speech areas, and in consequence their capacity to perceive/hear speech was reduced, despite the fact that the "hearing" areas were left intact (Iacoboni, 2008). This finding led Iacoboni (2008) to conclude that one must mirror speech in order to perceive it; demonstrating once again that mirroring (the equivalent of embodied simulation) is necessary for perception. When

subjects were asked to hold a pencil in their mouths while witnessing emotional expressions of others, these subjects were less able to detect emotional changes than normal subjects, due it seems to their preoccupied musculature (Iacoboni, 2008).

Imitation, intersubjectivity, and self-recognition.

Imitation is defined in the literature in a variety of ways that involve both conscious and unconscious processing, and in connection to action understanding, social processing, and learning (Iacoboni, 2008; Rizzolatti & Sinigaglia, 2008; Rizzolatti, et al., 2001). Imitation is also described as a form of response facilitation: an automatic reproduction of an observed action that is not dependent on understanding the meaning of the action (Rizzolatti, et al., 2001). Response facilitation is a survival mechanism that facilitates motor action and is observed in animals as well as humans (Rizzolatti, et al., 2001). Evidence for response facilitation has been found in mirror neuron studies. Fadiga et al. (1995) measured the twitching of hand muscles during action observation, and demonstrated that mirror neurons in the pre-motor cortex have an influence on the motor cortex and muscle activation (Iacoboni, 2008). The actions we observe subtly move our bodies through the innate imitation mechanism of the MNS.

The capacity to recognize and identify the self has been measured through various mirror recognition tests and is connected to the mirror neuron system (Iacoboni, 2008). These tests which measure an animal's capacity to recognize itself in a mirror show that animals raised in a social context have a capacity to recognize themselves, whereas those who are not do not (Iacoboni, 2008). Essentially this demonstrates the necessity of a social context for the existence of the self. Without a social context, the concept of self seems irrelevant. The mirror neuron system, which has been implicated in the capacity to

self-recognize (Iacoboni, 2008), cannot develop outside a social environment without opportunities to imitate (mirror/simulate). Isolation seems to eliminate self-recognition and abundant social environments facilitate it (Iacoboni, 2008). Social exposure develops the mirror neuron system and all of its functions, including imitation, empathy, language, and sense of self (Iacoboni, 2008).

It is very important to note that mirror neurons fire much more strongly for self-performed actions than for the observation of others' actions (Iacoboni, 2008). Mirror neurons code for both observed and self-performed actions, but at different intensities; thus containing in one mechanism both the interdependence and independence of a self-other continuum (Iacoboni, 2008). The mirror neuron system itself is formed through imitation (Iacoboni, 2008), a process which embodies the classic self-other dilemma.

Dijksterhuis, a well known imitation researcher, says that "Relevant research has shown by now that imitation can make us slow, fast, smart, stupid, good at math, bad at math, helpful, rude, polite, long-winded, hostile, aggressive, cooperative, competitive, conforming, non-conforming, conservative, forgetful, careful, careless, neat, and sloppy" (as cited in Iacoboni, 2008). This type of "high-road imitation" as it is termed, is said to be controlled by super-mirror neurons (Iacoboni, 2008).

Super mirror-neurons are hypothesized to control the regular MNS, in a way that allows an individual to define themselves to some degree, by distinguishing the acts an individual performs from the acts an individual solely observes. Though both these acts are registered in the MNS, the super mirror neurons fire when an individual performs actions and shut down during acts that the individual observes (Iacoboni, 2008). In this way super mirror neurons distinguish between performed and observed acts. Without a

control mechanism like that hypothesized in the super mirror neurons, it is hard to describe how human beings would execute choice over their actions, especially given the large body of evidence for the influential role of imitation in behavior (Iacoboni, 2008). In fact, even with the super mirror neuron hypothesis, mirror neuron activity throws basic notions of free will into question (Iacoboni, 2008); “the more we learn about mirror neurons, the more we realize that we are not rational, free-acting agents in the world” (Iacoboni, 2008, p.209).

Calvo-Merino et al.'s (2005) study which compares ballet and capoeira dancers, as well as a subsequent study which compares male and female ballet dancers, show that an individual's motor repertoire affects their mirror neuron activity (Iacoboni, 2008). The more an individual's own motor repertoire matches the observed sequence of actions, the higher the resonance in their MNS. Another study conducted on facial recognition, used computerized images of the subject's own faces combined with those of people they knew. These images were incrementally adjusted to contain more and more of the individuals' own face (Iacoboni, 2008). In this study individual's mirror neuron systems fired more rapidly in response to their own face, demonstrating that the MNS responds more actively to the observer's own image, and images which closely resemble the observer (Iacoboni, 2008), than to those that are different. This relates to the self-recognition capabilities of the MNS. An explanation for this phenomenon is that when the MNS maps the observed face onto into its own motor system, its own face will make a more perfect match, resulting in higher resonance (Iacoboni, 2008). Taken together, these studies emphasize that the quality of resonance in the MNS is affected by both the degree to which the actor resembles the observer and the content of the observer's motor

system. An individual will identify more with someone who resembles them and who performs acts that they too can execute. For this reason the MNS is also related to social belonging and the sense of being more closely affiliated to specific groups in society than to others (Iacoboni, 2008).

An interesting discovery in mirror neuron studies is that of another brain network that seems to connect the self and the other: the default network (Iacoboni, 2008). This network activates when subjects seem to be resting and are not performing any specific tasks, and deactivates when subjects are involved in cognitive tasks (Iacoboni, 2008). This default state entered into when individuals' do nothing is involved in social processing (Iacoboni, 2008). It is proposed that while the MNS processes the physical aspects of the self/other dynamic, the default network deals with social aspects of the self/other, including social roles and relationships which are fundamental to one's understanding of self (Iacoboni, 2008).

Mirror neurons are described as the biological premise of intersubjectivity (Iacoboni, 2008), exemplifying the primacy of intersubjectivity in human experience. Iacoboni (2008) also discusses mirror neurons in relation to attachment theory and infant caregiver relations. He proposes that the development of the mirror neuron system in infancy continues throughout life in the form of a neural framework that represents the initial conception of caregiver-baby symbiosis (attachment) (Iacoboni, 2008).

Iacoboni (2008) also discusses mirror neuron activity as a form of identification and affiliation in relation to television commercials. The mirror neuron system is recognized as a sort of index which measures the level of affiliation an observer feels with an actor (Iacoboni, 2008). Greater activity in an observer's MNS is a result of

greater identification with the actors in television advertisements, regardless of whether these actors are performing actions (Iacoboni, 2008). Mirror neuron activity in these experiments seemed specifically related to the identification process, even more so than the recognition of actions and intentions (Iacoboni, 2008).

Iacoboni (2008) also presents the hypothesis that mirror neuron dysfunction is responsible for autism spectrum disorders, and that imitation is beneficial in treatment of these disorders. *Deficits in mirror neuron function have been confirmed in autistic individuals (Iacoboni, 2008), and a strong correlation has been found between the level of mirror neuron activation, and the severity of autism impairment; with low levels of activity correlated to higher impairment (Iacoboni, 2008). Techniques based in imitation are highly recommended for treatments aimed at helping people with autism in the social arena (Iacoboni, 2008).*

Interestingly there have been connections made to hemispheric activity in the brain's MNS. The mirror neuron circuit in the right hemisphere has been shown to resonate more strongly with the generation of emotional expression and identification of emotions, whereas the left circuit has been identified with conscious displays of emotion (Leslie, Johnson-Frey, & Grafton, 2004). The authors discuss the possibility of a left-brained mechanism which controls facial expression of emotion, and relates more closely to "putting on a face" or "masking" emotion, than to actually experiencing and expressing emotion. The bilateral activation of the MNS during intentional imitation is connected to this kind of conscious and deliberate mimicking of behavior, whereas the heightened activation in the right hemisphere during observation of emotional facial

expressions indicates unconscious embodied simulation and emotional resonance (Leslie, et al., 2004); conscious versus unconscious forms of imitation.

Summary.

The mirror neuron literature is rapidly expanding, and findings are becoming more in depth, concise, and far reaching. From a revolutionary mechanism which measures both performed and observed actions in monkeys, to a human system that codes intentions and emotions, and which now incorporates a self/other scale and an inherent identification/affiliation marker, the implications and applications of this discovery are continually widening. The new fields of neurophysiologic phenomenology, neuro-ethics, neuro-politics, neuro-marketing, and existential neuroscience (Iacoboni, 2008) emphasize the importance of mirror neurons in a modern understanding of human being.

The Art of Acting

Theatre and acting styles.

The art of theatre can be interchanged with the art of acting if one views the two as inseparable. Grotowski (1968) in his reduction of all that is superfluous to the theatre arrives at the conclusion that the only necessary element of theatre is the actor. Though this may appear to simplify the art, if one agrees with Bear, Connors, & Paradiso (2001), there is nothing in the world more complex than a human being. A well-produced play is an extraordinary accomplishment which marks the degree to which the art of the actor can be elaborated. The art of acting is one of the most difficult and demanding practices in existence. Consciously creating a character, another human being, is a challenging intellectual, emotional, and physical feat. For an actor, like a human being, there is no definitive end to their development.

Acting theory is convoluted. There are as many different styles of acting as there are actors, and with each of these, different performance objectives range from creating the emotional life of the character as described by Stanislavski (1936/1964, 1961, 1989), to the more objective construal of character as laid out by Brecht (Boal, 1979). Some artists even try to combine styles in the same performance (Boal, 1979). How can there be a consensus on what acting is, when it comes in so many and varied forms? An actor chooses those techniques that will meet their needs in the context of a production. The director, the audience, and the style, all have their influence on the actor's choice of how they will represent/present their character. Actors also have their own style and techniques, and are often hired based on the quality of their work, and how well it matches up with the production ideas. Ultimately the final product depends on the intentions of those creating the work.

Ideally the intention of a performance is the meaning that is communicated to an audience (Boal, 1979). The means by which artists communicate the intended meaning is their acting style. Actors' intentionally choose to act in a style which conveys specific meanings to their audiences. Stanislavski's (1936/1964, 1961, 1989) Method acting aims for the audience to identify and empathize with the actor/character, whereas Brecht's style encourages the opposite, a sort of de-identification from which the audience can objectively analyze the actor/character, and their social situation. Regardless of what variation of style an actor uses, every act in the theatre is (ideally) intentional. In this regard the art of theatre is astutely aware of itself, and of its social nature and influence.

Representational and presentational acting.

The art of acting can be broken down into two traditional schools of thought. The first school is that of representational acting. This form of acting is said to work from the outside in, and involves the deliberate and conscious pre-determination of the character (Hagen, 1991). The actor puts on the character, by consciously shaping and modifying the various aspects of their physical demeanor and appearance to mimic or represent their idea of the character. The actor is conscious and highly aware of the form their characterization takes (Hagen, 1991). The second school is called presentational acting, and is said to work from the inside out. In this type of acting, also known as the Method (Stanislavski, 1936/1964, 1961, 1989), the actor draws from their own psychological makeup and history to identify and empathize with the role. Through a combination of techniques, the role and the actions develop out of the moment to moment experience of being in character in the circumstances of the play (Hagen, 1991; Stanislavski, 1936/1964). The Method has an intuitive component which depends on the actor's capacity to detect and act upon subtle movements and shifts in their emotional body (Bates, 1986).

The intuitive and self-revealing nature of presentational acting depends on the actor's ability to use their emotional body. The actor must feel what it is like to be the character, since their performance rides on the display of whatever feelings they experience as actor and character during the play (Hagen, 1991). For the most part both schools of acting are espoused in actor training today, and actors use all the techniques available to them as they attempt to understand and develop their roles. When emotional resonance and identification do not occur, the rational prescription of how a particular

moment in the play “should” appear supplements the art, and vice versa. At times conscious mimicking of a behavior activates congruent emotions and the actor experiences the feeling of their role through the rationally crafted artifice of it (Hagen, 1991); a sort of amalgamation of representational and presentational acting.

Technique.

According to Stanislavski (1936/1964), all creative work begins with relaxation. If the body is tense, then the creative process for an actor cannot ensue. This makes sense because the body is seen as the actor’s instrument, and a relaxed body is more flexible, expressive, and receptive (Stanislavski, 1936/1964). If an actor’s instrument is their body (self/entire being), then it is necessary that they understand the mechanics of this instrument. A piano player knows when they strike a key or chord that this will translate into sound via the strings of the piano. Actors learn how to strike notes and chords inside themselves through their technique. What are the mechanics of an actor’s instrument, and how is an actor’s technique used to play upon their instrument, their self?

The actor’s body is said to be so sensitive and perceptive that it reverberates and amplifies the slightest emotional stirring and subliminal thought so as to exude the experience to the far reaches of an auditorium (Lewis, 1993). An actor uses a variety of techniques in order to achieve this degree of expressivity. Relaxation is used to eliminate habitual tensions in the actor’s body and therein to foster responsiveness in acting and the communication of subtle emotional expressions (Lewis, 1993). The capacity to imagine allows the actor to immerse themselves in images that reinforce the character, helping them to believe in the dramatic reality and to act “as if” the scene they play is real (Stanislavski, 1936/1964). Visualization techniques are used to promote imagination and

to incorporate autonomic responses to imagined stimuli into the art form (Cohen, 1978; Hagen, 1991; Stanislavski, 1936/1964). Through imagination the actor can produce physical sensations at will (Hagen, 1991). The greater an actor's imaginative capacity, the more likely they are to evoke autonomic responses that cannot consciously be controlled (Cohen, 1978). This capacity to evoke and use the body's unconscious expressions (those controlled by the autonomic nervous system) is typical of presentational acting.

According to Stanislavski (1936/1964), an actor's emotion cannot be created for its own sake. Only when an actor directs all of their conscious effort and attention to the given circumstances of the character in the play will their emotion arise naturally. The given circumstances include the character's inner state-of-being, relationship to the other characters/actors, and relationship to the environment (Stanislavski, 1936/1964). For authentic emotional expression a detailed analysis of the character's environment is necessary in addition to understanding the character's inner state of being, and relationship to the other characters in the play (Benedetti, 1970; Stanislavski, 1936/1964). An actor in their work on a character must therefore apply a great deal of active conscious intellectual work achieved through conceptual, cognitive reasoning. In this sense the art of acting requires the full use of the actor's brain-body system - both conscious and unconscious processing are integral.

The actor is seen by some to be a sort of emotional athlete, who must exercise their emotional system in order to embody and transmit the heightened state of the characters they represent (Bates, 1986). A range of acting exercises are used to facilitate the emotional experience of a character. Emotional and sensory awareness are a priority

for the actor, whose craft relies on attention to these sub-rational processes (Hagen, 1991). The physical senses are intrinsic to the art of acting (Hagen, 1991; Lewis, 1993; Stanislavski, 1936/1964). The more conscious an actor is of their senses, the more they will perceive, experience, and react to the environment through them (Hagen, 1991). An actor is continuously engaged in a complex feedback loop that takes into account every move, gesture, and expression, down to the slightest physiological reaction, in the world of the play (Cohen, 1978). Countless exercises are devoted to developing body/sensory awareness and sense-memory/sensory-recall in the actor (Spolin, 1999). These skills are then drawn on and integrated in the actor's imagination to create the inner life, the demeanor, and the behavior/action of the character (Hagen, 1991; Lewis, 1993).

Closely related to work with imagination and the physical senses, are exercises used to develop the focus of attention and concentration. Attention must be heightened both inwardly and outwardly, as the actor is expected to be especially sensitive to and perceptive of others actions towards them and their own reactions to others (Stanislavski, 1936/1964), as well as to the imaginary reality they create.

State-of-being is another important term for the actor, who continually adjusts their creation of the character based on the state-of-being in which they perceive their character to be. State-of-being in this sense is a subtle and complex emotional, physical, and psychological experience. It is something that simply is in a present tense. It is also a prerequisite for any conception of the character as goal-directed. In order for the character to have needs and objectives it must exist in a state that is insufficient in some way; this functions in the same way described by Peterson (1999) for human goals and behavior.

Actors often use a technique of ascribing intentions to the acts of their characters (Stanislavski, 1936/1964). The character's actions are defined down to the smallest intentions in moment to moment interactions with other characters, and all the way up to their life-aims, including in this analysis the author's objective in writing the play; these are called objectives and super-objectives (Stanislavski, 1936/1964). All of these objectives are identified in a verb form, in order to be most effective and active (Stanislavski, 1936/1964).

Intentions/objectives.

The study and ascription of intentions/objectives is a core aspect of the actor's technique. The terms objective and intention are interchangeable (Benedetti, 1970), and are used by actors to prescribe from moment to moment the purpose behind every act of the character. Objectives are considered so vital to the actor's art that one does not move on the stage unless one has a valid reason/intention for moving. No act goes un-intended; even stillness is an act with a specific purpose for an actor on the stage (Stanislavski, 1936/1964). It is the actor/character's objective, and its interplay with others' characters and the context of the scene that calls forth the actor/character's sincere emotional response (Stanislavski, 1936/1964).

An objective stems from the idiosyncratic needs and wants of the character as understood by the actor. All actions are brought about through chosen objectives and are rooted in achieving the characters' basic needs and wants (Benedetti, 1970). The most effective objectives are those that are directed towards a single, immediate, and personally important goal (Benedetti, 1970). Therefore the more precise an actor is in their ascription of intentions, the more effective they will be.

A tactic is the way in which a character chooses to pursue their objective, and is defined using action verbs and simple transitive verb phrases (Benedetti, 1970). For example, a child may whine, cry, plead, demand, or ask politely to obtain a cookie from their mother. Each of these is a different tactic through which the child attempts to achieve their objective (the cookie). A tactic is the way or act through which characters (and people) seek to obtain each objective leading to their ideal futures (Cohen, 1978).

Like human beings, the character is conceived of as a goal-directed being. Characters pursue their goals following a pattern that can be overlaid on the schema devised by Peterson (1999) which depicts human activity as goal-directed. The immediate objectives of the character rise out of the character's underlying value systems in a way that parallels human behavior. According to Peterson (1999), all human beings exist in an imperfect state of being and orient themselves towards an imagined ideal state of being. There is always something inadequate about the current state that a person is constantly trying to overcome (Peterson, 1999). The same axiom can be applied to characters in a play.

There is an important link between objectives/intentions and interpersonal relationships in the art of acting (Benedetti, 1970; Cohen, 1978). Actors are instructed to form objectives that require some kind of noticeable change of behavior from their scene partner (Cohen, 1978). By formulating objectives in relation to other characters/actors, the relationship between them becomes a focus for the actor. The subtle communication and interaction that goes on between actors as they apply their character's objectives upon each other, results in compelling acting. This principle is said to engage the actor's entire organism in the role, and is central to the art of acting (Cohen, 1978). A term used

to describe this phenomenon is *relacom*: relationship communication (Cohen, 1978). Acting requires an active focus on understanding and deconstructing relationships, using procedures that are both conscious and unconscious. In the end it is the actor's own emotional responses to their fluctuating relationships in the play that are communicable to an audience (Cohen, 1978).

As the actor uses all of their faculties to obtain their objective from another actor, the audience perceives this true desire and is drawn into the action on multiple levels. It is emphasized that when the action in a play comes out of the specific intentions of the character, the audience will come to understand the character's inner world (Benedetti, 1970). This understanding is said to be more immediate and more powerful than an understanding arrived at via deductive reasoning (Benedetti, 1970).

Application of techniques.

How does an actor create another experience, experience another self, or more specifically experience the self in the circumstances of another? An actor must immerse themselves in and believe in the character's life, their moment to moment intentions, their thoughts (subtext), their words (the text), and their interactions with the other characters/actors (Stanislavski, 1936/1964). The accumulation of all of these techniques can be powerful, creating a complex simulation of the other's experience. This simulation is not simply physical, emotional, or cognitive - it is all of these.

The cognitive and the physical are the most straight-forward to access. Thoughts and the physical body can be controlled by conscious cognitive means, granted that they are free of emotional interference. Physical demeanor is put on as a costume or mask, like sitting up straight when an individual feels like slouching, it can be applied. However, it

is the emotional experience of the actor that truly captures an audience's attention. This may be because the emotional and arousal/attention systems in the brain are highly interconnected (Jacoboni, 2008, Ledoux, 1996). Whatever the reason, emotion produces highly compelling physical and mental renditions of characters. Audiences resonate with and hail the emotional states of actors/characters, and immediately recognize when an emotion portrayed by the actor is not real, not actually felt by the actor.

In acting, the conscious imposition of facial expressions sometimes works to trigger genuine emotions, but in this case it is still the actual emotion that is conveyed, once it has been activated through the musculature. The use of intentions/objectives seems to be a much more direct, and a highly effective, route to stimulating emotions and actions (Stanislavski, 1936/1964). The "thought-life" of the character is another route. Actors use all of these alleys to try to create a living experience of their characters. Putting on a face is a technique, but usually not the most effective one. It is too easy to see through the artificial mask to the genuine emotion. At all times the actual experience of the actor is what shines through. Although it is possible to activate and influence emotional experiences through the musculature, the reverse is more profoundly true: emotional experiences influence and activate musculature.

The danger of the actor's art lies in the sub-conscious material with which an actor works. By definition this material is beyond an actor's control, and their influence over it is always indirect. Actors affect their behavior through their environment, through the acts they perform, the intentions and the thoughts they create in themselves in order to live in the reality of a given character, and the stories they create around the character to supplement their experience and history. The same can be said for how people shape

themselves, only the conscious creative aim and intention of the actor is not usually present, and for these people much of the process of creating themselves is unconscious and left to chance and circumstance.

The techniques used to attune the actor to their inner world (sense-memory and recall) can also be misused and indulged in for the mere display of emotions, rather than to serve the whole of the play (Hagen, 1991). An actor must function as a conduit to the audience for the emotional experiential life of their character from the clearly delineated confines of the play. Ideally they will communicate to the audience on multiple levels, combining their emotional and experiential knowledge of the character into a sequence of behaviors that fit into the logical progression of the play (Benedetti, 1970).

Communication.

The importance of the community in acting and the theatre is widely recognized throughout the literature (Bates, 1986; Boal, 1979, Brook, 1968). Some artists describe a quintessential center within the audience that communicates with an equivalent center in the actor (Bates, 1986). On this level a sort of thought-transference is supposed to occur. The focal point of a play is not supposedly on the stage, or in the audience, but in a state of consciousness that bridges the two (Bates, 1986). This state is said to be reached by the actor moving into and through their self. Some artists describe a sensation of extraordinary communication that lives in the air between actor and audience (Bates, 1986).

Many theatre practitioners espouse that the audience needs to enter into the performance using their own emotional faculties and imagination (Bates, 1986; Cohen, 1978). It is the actor's work to draw the audience's interest and imagination into the play

by appealing to the audience's emotional resonance. The actor commands the audience's attention by engaging in the intuitive exploration of the character rather than the rational (Bates, 1986; Stanislavski, 1936/1964). The rational intellect has been said to interfere with the imagination and creative process of the actor in performance (Chekhov, 1953/1985) though it is a necessary aspect of the preparatory work on character.

Acting is physical actions.

Acting is a phenomenological means of understanding human behavior. The Theatre Laboratory of Jerzy Grotowski and Thomas Richards is an acting research center dedicated to the art of acting (Grotowski, 1968; Richards, 1995). In the line of Stanislavski, Grotowski's work at the Theatre Laboratory explored primarily the use of physical actions (Grotowski, 1968; Richards, 1995). At the end of his career and life, Stanislavski considered the study of physical actions to be the most important part of the actor's craft, and Grotowski's experiments with actors are seen as a continuation of Stanislavski's life work (Grotowski, 1968; Richards, 1995). Acting in this context is the phenomenological study of physical actions (the motor system).

Artaud was one of the first theoreticians to emphasize the physical nature of the actor and theatre (Grotowski, 1968; Richards, 1995). Artaud (1964/1993) analyzed the theatre as a language of signs, gestures, and postures, which represent ideas that are inexpressible through words. His description of the language of the theatre seems to parallel descriptions theoreticians give of the origins and development of language; basic gestures and mimicry develop alongside sound, to create their own meaning (Gallese, 2007; Iacoboni, 2008; Rizzolatti & Sinigaglia, 2008). This "language of symbols and

mimicry, this silent mime-play, these attitudes, and spatial gestures, this objective inflexion” (Artaud, 1964/1993, p.29) is what Artaud considered to be essential to theatre.

Artaud (1964/1993) espoused a Theatre of Cruelty that should be used to force audiences to see themselves accurately, and to become self-aware. Artaud more closely associated the language of theatre to that of dance and music, and differentiated it from the psychological dramas of his time, which he saw as restricted to the expression of conscious states. The theatre, he believed, should express those elements of life that are more primary than consciousness (Artaud, 1964/1993). He thought theatre should be an inversion of life, a breaking down of barriers, constructs, and forms, that brings one closer to chaos, and forces one to check themselves, and to become self-aware. It should be a bodily language, not based in words, but in emerging signs (Artaud, 1964/1993). He stressed the physical nature of the theatre (Artaud, 1964/1993), and his ideas infused experimental theatres around the world. His work led to an understanding that the body, emotions, and the self, function in subconscious processes and in turn allowed actors’ to learn to trust fundamental creative (self-propagating) drives and instincts.

Grotowski carried on the work of Artaud and Stanislavski until his death, and today the work is carried out by a select group of actors led by Thomas Richards at the Theatre Laboratory in Italy. What is most striking about this work is the heightened degree of physicality required of the actors (Grotowski, 1968; Richards, 1995). The theatrical productions themselves are based more in the body than on scripts, and emerge as completely as possible out of the internal representations of the actors, as these translate into movements and sounds (Grotowski, 1968; Richards, 1995). The actor’s process is arduously physical. It is ritualistic, methodical, and extremely disciplined

(Grotowski, 1968; Richards, 1995). This is one of the most disciplined practices of observing the body and mind known to humankind. It has utilized principles of yoga (postures), and modified and incorporated these into its own acting method which focuses more on expressing and communicating internal states through the body, than on simply observing them (Grotowski, 1968).

What differentiates this type of physical theatre from dance, likely resides in the theatre's propensity for language out of physical gesture. Where dance tends towards sub-semantic expression, the theatre tends to focus on semantic emergence, to bridge and incorporate sub-semantic and semantic expression, conscious and unconscious expression, the body and the word.

Conscious and Unconscious Processes

In order to understand the role that acting can play in human development through the mirror neuron system, it is important to have a realistic notion of how much and how little conscious awareness defines human behavior. Ledoux (1996) points out that from an evolutionary vantage point consciousness and language are relatively new developments in the human brain, and that unconscious non-verbal processing "is the rule rather than the exception throughout evolution" (Ledoux, 1996, p.71). Ledoux (1996) also maintains that unconscious processes cannot be well understood through conscious processes like verbal reports. Unconscious processes are vital to our functioning and survival as individuals and as a species, and yet they cannot be accurately understood through verbal processing. Insight into unconscious processes is gained by using their own sub-conscious languages. Acting involves the study of human behavior at a sub-

semantic level and serves as a sort of bridge between unconscious states and verbal expression.

Emotion and acting.

From a neuro-anatomical perspective emotions are described as “the no-man’s land between the hypothalamus and the neocortex, the lowest and the highest (in structural terms) regions of the forebrain” (Ledoux, 1996, p.101). The hypothalamus is recognized to be involved in the bodily expression of emotions (visceral experience and autonomic responses), whereas the neocortex is seen as involved in the conscious experience/awareness/identification of emotions (Ledoux, 1996). Emotions can therein be conceived of as a sort of in-between form of knowing. Like the art of acting, they can be conceptualized as a form of bridge between the body and the mind, the visceral and the abstract, the unconscious and the conscious.

Emotions can be used as a way to mediate and to bring together the body and mind so that thoughts and actions coincide and are not dissonant. As a bridge between thoughts and actions, emotions can be seen as a guide towards resolution of cognitive dissonance (a psychological state which exists when actions, thoughts/beliefs don’t match). To become aware of our acts, thoughts, beliefs, and emotions, a person can use practices that draw attention to body states, thoughts, and emotional experience. Acting, dance, yoga, meditation, martial arts, massage, and other forms of body work are all practices that involve such awareness at different levels.

Ledoux (1996) points out that human beings have little control over their emotions, citing the efficiency with which an emotional state can occupy the “mental spotlight”, consciousness, replacing whatever day to day thoughts might be present. He

also cites emotions as “powerful motivators of human behaviors” (Ledoux, 1996, p.19). With this in mind, it is easy to see the value of being able to work with emotions so that they may facilitate rather than hinder accomplishing one’s goals. Is there anyone with more (phenomenological) experience working with emotions than an actor?

It is worthwhile to note that Darwin conceived of evolution by observing the world around him (Ledoux, 1996), and in a similar manner actors come to know their being. Though it may not be empirical, the natural human capacity for observation does lead to ingenious insights. It is no coincidence that both actors and neuro-psychologists study animals for insight into human behavior. Where a neuro-psychologist will look at running, swimming, and flying as different tactics through which animals accomplish the same objective (escape from a fear stimulus) (Ledoux, 1996), an actor explores the different tactics through which different characters accomplish their objectives (also motivated by fear and other emotions). Actors explore an indefinite breadth of human behavioral responses.

From a neuro-psychological perspective, emotions mediate behaviors that are necessary for survival in both animals and humans (Ledoux, 1996). In humans, social status has been shown to be directly linked to health, and social behavior is directly associated to survival and evolution (Peterson, 1999). For humans social situations are survival encounters (Ledoux, 1996). It is therefore no wonder that human emotions are highly reactive to social problems and that “mental illness” by definition consists of behaviors that are asocial. According to Ledoux (1996) what defines the human capacity for emotions is the combination of an evolutionary survival system with an ability to be conscious and aware of oneself in the world.

Feeling is aware of itself as sensation, and therefore conscious and unconscious, a body and a mind state. According to Ledoux (1996) there are three main components of emotion. The first is the amygdala's influence on the cortex (conscious/cognitive processing), the second is arousal triggered by the amygdala (attention/implicit memory) and the last is bodily feedback (visceral and autonomic responses/states). Without these three components a person cannot experience emotion (fear) (Ledoux, 1996). The important thing to note is that there is a conscious, an unconscious, and an arousal (attention) element to the experience of emotion. If we are unaware of the emotion we do not experience it as such, even if the body otherwise responds the same.

The actor's development of attention and concentration develops their capacity to be aware of their feelings. "Several contemporary theories equate consciousness with focused attention." (Ledoux, 1996, p.279), if this is true then the basic concentration and attention exercises, with which an actor begins their training in order to have a greater capacity for observation, are right on par for a training program aimed at developing human consciousness. Acting training for human development is precisely what is being proposed here.

As it stands, humans have little cognitive control over their emotions, and the brain connections from the amygdala (the fear center) to the cortex are drastically greater than the reverse (Ledoux, 1996). It has been suggested that as we evolve as a species, the connections from the cortex to the amygdala will grow stronger, leading to a more balanced state between reason and passion (Ledoux, 1996). Nonetheless we would be mistaken to believe that we are currently in such a position. From an actor's perspective, the capacity to develop direct cortical control over the emotions has not been effective

(though many try). This may be possible on an evolutionary scale as Ledoux (1996) suggests, but during the lifetime of an individual it is more realistic to attempt to use cognition to indirectly influence the emotional body as an actor does, through various applied techniques.

Memory and acting.

Ledoux (1996) speaks of conscious memory, also defined as declarative and explicit, and unconscious memory, also defined as procedural and implicit. These memory systems work together but often also work independently of each other. The experience of emotions combines conscious and unconscious memory systems. Ledoux explains that “without the emotional arousal elicited through the implicit system, the conscious memory would be emotionally flat” (Ledoux, 1996, p.201). This gives new meaning to Stanislavski’s insistence that a person cannot simply create an imaginary environment for the character, but must also activate emotional memories in order to give life to the character; “Our whole creative experiences are vivid and full in direct proportion to the power, keenness, and exactness of our memory” (Stanislavski, 1936/1964).

The implicit and explicit memory systems are anatomically divided into the amygdalic and hippocampal systems respectively (Ledoux, 1996). Any stimuli that is processed strictly subconsciously will activate the amygdala without activating the explicit memory system, in other words without engaging consciousness. In such a situation an individual will be in an aroused and hyper-attentive state, but will not consciously know why or even what they feel. The tendency in such a situation is to cognitively attribute feelings to the aroused state based on environmental cues (Ledoux,

1996). This kind of situation is common given that the implicit memory system has a longer and larger memory than the explicit system (Ledoux, 1996). The chances that one remembers life experiences sub-consciously are greater than that one consciously remembers them. Individuals will react to those experiences they remember sub-consciously without knowing why they are reacting. This may explain how emotional states often seem to come out of nowhere.

Ledoux (1996) explains that if at the time of memory formation for a traumatic event a conscious memory is not formed, and the entire event is registered solely in the implicit system, then it is impossible to recover or to make conscious such trauma. The traumatic memory will exist only in the implicit memory system and will not be able to become conscious; if a conscious memory was never formed it does not exist (even though the event does). Insight therapies have nothing to work with in such circumstances.

Explicit memory is formed through what an individual attends to in a situation and implicit memory captures other elements of the same situation that the individual is unaware of (Ledoux, 1996). Emotions are a sort of pre-conscious awareness (because to be aware of the emotion is to have a certain degree of consciousness), imbedded in the implicit memory system; in this way emotions bridge explicit and implicit memory. The art of acting, in a sense, plays with these two memory systems, juxtaposing conscious contrived images of the circumstances of the character in the play with implicit emotional memories, in order to forge a complete picture of the living character. Often the actor's explicit work on the character will trigger their own implicit experiences, and the

juxtaposition of the experiences may be more real for the actor than they are even aware of.

It is impossible to differentiate between fabricated memories and actual ones (Ledoux, 1996). A fabricated memory is a genuine experience for the person having the recollection; the only thing that separates it from other memories is that it is false (Ledoux, 1996). This again sheds light on Stanislavski's Method (1936/1964), which asks that actors fabricate entire lives for their characters and then use these imaginary experiences to supplement the imaginary circumstances of the play, and to foster real emotional experiences in a performance.

Extinction, as defined by Ledoux (1996), involves cortical control over the implicit memory system, suppressing but not erasing a memory. This is why extinctions have been known to spontaneously reoccur in times of stress, when the energy aimed at suppressing the (traumatic) memory becomes occupied elsewhere (with another problem). In his words, "Unconscious fear memories established through the amygdala appear to be indelibly burned into the brain. They are probably with us for life" (Ledoux, 1996, p.252). Ledoux (1996) goes on to suggest that the best we can do to help people with anxiety disorders (whose disorders presumably rests on various conscious and unconscious fears) is to find a way to help them gain control over their fears.

The level of arousal accompanied by an emotional state is what makes it difficult to focus and concentrate on doing anything else when a person is in this state (Ledoux, 1996). Arousal can lock a person into an emotional state as in generalized anxiety disorders, and once the so-called fear system is activated it can be difficult to turn off (Ledoux, 1996). Emotions demand close attention and observation, and might be

encouraged to recede from conscious space if they are given a purposeful role in a meaningful creative process. In other words, if an emotion is given a fruitful role in the individual's life, despite its negative traumatic origins, it may relinquish some of its control over behavior.

Ledoux (1996) explains that amygdala-mediated fear conditioning (implicit traumatic memory) is particularly resistant to extinction. Acting can be a means through which such overpowering memories can be used in a positive, creative way. It's possible that the creative process gives meaning/usefulness to such memories and transforms their negative potency through sublimation - in the end returning control to the artist (individual) who uses these memories to serve their creative process. The memory no longer intrudes into consciousness, because it is actively engaged in by consciousness.

An individual can become aware of a symptom, an automatic response to an implicit memory, as an experience itself. By studying the symptom in order to use it for a creative purpose an individual can gain control over the symptom's expression (i.e. the individual writes stories about what could have caused them to experience this symptom, to have this deep implicit fear). An actor might use a symptom, like the sensations of a panic attack, in their character's response to a particular moment in a play, or more generally as an aspect of their character's personality routed in a plausible imaginary history. In so doing, the active working of the symptom might lessen its grip on everyday behavior. By giving the symptom a positive expression and meaningful (or at least useful) place in the individual's life, control is gained over the symptom's expression. Such a theory in no way presumes to eradicate the experience or the implicit memory of the trauma, but rather to incorporate it into healthy functioning. The experience has been,

and therefore is. Acknowledging it as a part of the individual (with or without explicit definition), and furthermore using it in a constructive way, may reduce its expression, as opposed to the natural impetus to disassociate from the trauma or symptom (and thus from an aspect of the self's experience).

For an individual suffering with post traumatic stress disorder (PTSD), acting techniques cannot be used to change that person's initial experience and recollection of their trauma. However, acting techniques might be used to interrupt the repetitive pathways (behavioral/cognitive) that are causing the person to re-experience the trauma in their daily lives, and even to add new positive experiences to that person's life - experiences that might eventually take precedence over the trauma. Essentially by learning to influence ones internal experience and thoughts using acting techniques, one might forge in the brain a precedence of new memories and experiences over the old, and/or use the old memories in a new way.

It has been shown that heightened degrees of stress cause amnesia for a trauma and amplifies the formation of implicit memories. The body goes into a protective state where it prepares to react to danger quickly - implicitly, sparing the time required for thinking about it - explicit awareness (Ledoux, 1996). Therefore the more traumatic an event, the more likely memories of the event will be implicit more so than explicit. It is no coincidence that actors work to access their implicit "emotional memories" when searching for substance for their roles. Despite the fact that such memories may be associated to traumatic events in actors' lives, actors use them to represent times of heightened (dramatic) conflict in their character's lives. Actors use their own reality to "give life to" the character. This is attained primarily through the body, through

procedural (implicit) memory, through work with physical actions (Grotowski, 1968, Stanislavski, 1936/1964). Grotowski (1968) views the actors' art as a sort of peeling away of layers, taking away all the superfluous, leaving only the body and its memories, associations, and responses to the work.

In Ledoux's (1996) model emotional states are aroused in connection to current experience. These emotional eruptions are a form of recognition that the current experience is related to an implicit memory. Emotions alert one to the potential danger of a situation defined because it resembles a past situation that has been harmful. The emotional state will take over consciousness because the implicit system deems it vitally important. One's memory, attention, and perception of the current event will all be affected by the activation of the implicit memory system. One's sub-conscious memory powerfully affects one's conscious experience/perception. This is why any attempt to gain control over sub-conscious processes are most effectively directed at the body and at procedural experience or at a process which bridges implicit and explicit memory, conscious and unconscious states, rather than at thoughts and other conscious content.

A phenomenon called translational dissociation occurs when an experience cannot be put into words (Jacoboni, 2008). Translational dissociations are common, as most things cannot be fully conveyed through language alone, especially emotional content. Verbal overshadowing occurs when the words used to describe something impair the actual memory of it (Jacoboni, 2008). These are further examples of the primacy of implicit over explicit memories.

Ledoux (1996) also references Damasio's idea of "as if" loops; the "as if" loop theory posits that feelings are influenced by imaginary bodily feedback. For instance, an

individual imagines that their heart is racing, and then goes on to manifest/experience a full-fledged panic attack (Ledoux, 1996). Actors have been working with this premise, in a constructive way, at least since the beginning of the 20th century, when Stanislavski published his own “as if” theory as a means to exert control over the body’s autonomic responses.

Emotion, memory, and mirror neurons.

Emotions are incredibly difficult to describe as a process on their own (Ledoux, 1996). When one adds emotional mirroring and the MNS to the equation, it becomes even more complex. The facial-feedback hypothesis discussed by Iacoboni (2008), may not account for the full complexity of the MNS’ role in the experience of an emotion. This hypothesis suggests that the simulated facial expression in the MNS goes through the insula to the limbic system thus resulting in an emotion (Iacoboni, 2008). The generation of an emotion requires a conscious element, in addition to the activation and bio-feedback from the autonomic nervous system, and the activation of attention systems through the amygdala (Ledoux, 1996). The musculature, or facial feed-back alone, would likely be connected to the bio-feedback element of experiencing an emotion. This however is only one part of the process, and not necessarily the most powerful activation circuit for the amygdala.

The MNS plays a more direct role in the experience of emotions when it is conceived of as a part of the perceptive apparatus that initially triggers the amygdala, rather than strictly as a bio-feedback mechanism. If emotional mirroring is relegated to a facial-feedback hypothesis, then it only accounts for a part of the emotion circuit; however if it is primarily viewed with a perceptive function, then it becomes a part of the

initiating impulses that drive the emotional system. This view also accounts for the instantaneous and unconscious nature of the MNS. The perceptive capabilities of the MNS are based in motor simulation/mirroring processes (Iacoboni, 2008) which supports this more global hypothesis.

In this hypothesis a motor act or its representation in the MNS is what initially activates the amygdala in an emotional situation. A motor representation is in effect an action potential, and therein is readily transferable into action. Motor representations are the language of the human body and in this way they are the most direct means of communicating actions. This allows the body to react instantly to a situation that is threatening, or otherwise emotionally relevant and/or vitally important. The amygdala-driven emotional system's response would be facilitated by a physical vocabulary like that of the MNS, which explains why the MNS might be construed as the perceptive organ of the amygdala and the entire limbic system.

If mirror neurons are conceived of as a sense mechanism (for emotions), perhaps the renowned sixth sense is the mirror mechanism of the MNS; intuition may function through the MNS. Mirror neurons provide an immediate identification mechanism for action, intention, and emotion. The MNS allows an individual to perceive and experience another individual's emotional state both consciously and unconsciously. This requires an activation of all the components of an emotion, including the conscious element, the attention system, and the autonomic arousal and bio-feedback. When an individual attempts to hide their feelings, the observer still perceives/feels what the individual is actually feeling, and not what they are showing (Ledoux, 1996). Therefore the MNS must have an emotional correlate, not based solely in the expression of emotion (facial

feedback), but in the full-fledged experience of the feeling itself. This might explain why when confronted with an emotional individual, another individual also loses a degree of conscious reflexivity, and is in a sense sucked-in to the emotional state of the other.

The MNS is more finely attuned than structural imitation. The MNS picks up on the actual feeling and intention of the other person/actor, despite the presence of a cognitively imposed imitative facial musculature (Leslie, et al., 2004). Iacoboni (2008) exemplifies this with the experiments measuring facial expressions in Japanese and American subjects with and without the presence of an authority figure when presented with videos containing horrible content. In the authority figure condition, Japanese subjects displayed false smiles presumed to please the observer; however, these were interrupted by genuine expressions of fear/disgust at the horrible content of the video they were watching (Iacoboni, 2008, Ledoux, 1996). A conscious display of emotions is not convincing, and false poses in acting are not effective. The true emotional state is what an observer perceives through the MNS.

Given the knowledge that the cortex has very little control over and connections to the limbic system, specifically the amygdala (Ledoux, 1996), it is possible to assume that it is the vocabulary-of-acts (intentions-experiences) in the MNS which activates the limbic system in an empathic process. An emotional state can more readily be induced by influencing, triggering, or activating the amygdala through action/intention/experience, or embodied simulation of action/intention/experience, than through cognition. This explains why it's so difficult to cognitively control one's emotions, and yet how easy it is to catch what another person is feeling - to experience emotional contagion. This is especially true when one has an experiential repertoire for an experience; any feeling or

experience an individual has had will be easier to identify and empathize with in others. For instance, it is difficult to know what it feels like to lose a close loved one unless one has experienced such loss, and simultaneously this sensation will more easily be retrieved when one witnesses others in similar situations of loss. Other examples of unique and heightened experiences, such as giving birth, also illustrate this point well.

Studies clearly show a human mirroring function for emotions (Iacoboni, 2008). The mirror neuron system was studied using pain as the emotional experience, and revealed a comprehensive mirror neuron system which “produces a full simulation – even the motor component – of the observed painful experiences of other people” (Iacoboni, 2008, p.124). Somatic and affective mirroring systems have been discovered and explored to the extent that Iacoboni (2008) concludes that the human brain is made to mirror, and that mirroring is the only way to grasp a deep understanding of others feelings.

Over the last century the effort to understand and describe emotion has resulted in various models given by psychologists and other cognitive and brain scientists (Ledoux, 1996). However none of these models have been capable of explaining how instantaneously an emotional state is perceived and experienced. In direct contradiction to computational models of human emotion which have dominated cognitive science and seek to understand emotion as computational sequences from stimulus to feeling (Ledoux, 1996), mirror neurons demonstrate that the stimulus is the perception, is the feeling, and is the (re) action. It is an immediate happening, devoid of complex calculations in the brain (Iacoboni, 2008).

It is a curiosity whether there are more connections from the limbic system (emotions) to the body than there are from the body to the limbic system (emotions). A quick look at the spinal cord suggests that there are as many sensory pathways leading from the body and extremities up into the brain as there are motor pathways in the other direction (Nolte & Angevine, 2000). The concept of the MNS as a “bidirectional flow of information” (Iacoboni, 2008, p.95) is supported by the structural primacy of both ascending and descending pathways in the body. It is as primary to sense/perceive the environment, as it is to control our actions in it, and the two mediate each other.

Conscious of our unconscious.

Iacoboni (2008) clearly explains how mirror neurons define behavior through automatic unconscious imitation, “uncontrollable biological automaticity” (Iacoboni, 2008, p.213), or neurobiological dictation. However, despite the fact that “our sociality makes us social agents with limited autonomy” (Iacoboni, 2008, p.209), one’s consciousness or awareness of this, gives one agency to choose behavior within the variety of the social world one inhabits. And to the extent to which one’s social world is varied, one can have more autonomy. The powerful language which Iacoboni (2008) uses to describe mirror neurons are a testament to the challenge of being conscious in the world. Iacoboni (2008) also suggests the possibility of bridging implicit and explicit experience through the explicit insight provided by mirror neuron studies into the implicit functioning of the mind. Our implicit nature is now exposed on a reflective level (Iacoboni, 2008), and thus can be used conscientiously.

Discussion

Mirror Neuron System and Acting

“I do not think that we should try to destroy the mystery that we are accustomed to wrap around our moments of inspiration. Mystery is beautiful in itself and is a great stimulus to creativeness” (Stanislavski, 1936/1964, p.175). An attempt to understand the art of acting through mirror neurons does not mean to undermine the sense of mystery referred to by Stanislavski, but rather like Stanislavski, is an attempt to define the art of acting in a language that is understandable and communicable. Today, empirical science is a dominant ideology; people believe that it is an effective means of knowing our world. In the art of acting it is imperative that the actor believes in the role/character and actions that they are undertaking (Stanislavski, 1936/1964). Neuroscience can help individuals to understand and believe in the process of acting; in the sub-conscious processes that are at work while they work on a character, and in those sub-conscious processes in general as they effect every other endeavor in their lives.

The discovery of mirror neurons challenges the reign of the mind and the Cartesian brain/body divide (Iacoboni, 2008, Rizzolatti & Sinigaglia, 2008). Brain scientists are coming to understand that the body reasons as it were; that most of the “thinking” people do is done at sub-conscious level, and that consciousness equates for a very small portion of one’s day-to-day functioning and interactions, be they with other people, objects, and/or the environment (Iacoboni, 2008, Ledoux, 1996, Peterson, 1999, Rizzolatti & Sinigaglia, 2008).

Regarding this sort of sub-conscious reasoning and wordless communication, Stanislavski says, “My difficulty here is that I have to talk to you about something I feel

but do not know. It is something I have experienced and yet I cannot theorize about it” (Stanislavski, 1936/1964, p.211). In an extraordinary prediction of future scientific discovery, he then indicates this verse spoken by Ophelia in Shakespeare’s Hamlet:

He took me by the wrist and held me hard;
 Then goes he to the length of all his arm,
 And with his other hand thus o’er his brow,
 He falls to such perusal of my face
 As he would draw it. Long stay’d he so;
 At last, a little shaking of mine arm
 And thrice his head thus waving up and down,
 He raised a sigh so piteous and profound
 That it did seem to shatter all his bulk
 And end his being: that done, he lets me go:
 And with his head over his shoulder turn’d,
 He seem’d to find his way without his eyes;
 For out o’ doors he went without their help,
 And to the last bended their light on me. (Stanislavski, 1936/1964, p.211)

He comments on this verse: “Can you sense, in those lines, the wordless communion between Hamlet and Ophelia... What name can we give to these invisible currents, which we use to communicate with one another? Someday this phenomenon will be the subject of scientific research. Meantime let us call them rays...” (Stanislavski, 1936/1964, p.212). Today in neuroscience Stanislavski’s rays are called mirror neurons, and as he predicted they are the subject of a multitude of scientific inquiries. Stanislavski

(1936/1964) suggested that actors explore these rays through careful study of physical sensations. It appears that Stanislavski's focus on the physical life of the actor was not misguided (given the motor nature of mirror neurons) and it is possible that discoveries regarding the art of acting can also shed insight into the exploration and understanding of the mirror neuron system.

Neuroscientists at the forefront of mirror neuron research are not blind to the association between actors and theatre and mirror neurons. In 2007 in New York there was a round table discussion titled *Acting and Mirror Neurons* which brought together neuroscientist Vittorio Gallese, several prominent theatre practitioners, and drama therapist Robert Landy (*Philoctetes*, 2007). In the cover description of Rizzolatti and Sinigaglia's (2008) book *Mirrors in the Brain*, Peter Brook, the famous theatre director is quoted as saying that mirror neurons shed light on the communicative space between actors and audiences. Furthermore the preface of this book on mirror neurons explores Peter Brook's conceptions of theatre and acting and how intimately these are connected to, and how adequately described by, the functions of mirror neurons (Rizzolatti & Sinigaglia, 2008).

It appears that acting and neuroscience have a great deal in common in addition to their subject matter: the understanding of human behavior. They are in fact reflective of a philosophy of science that conceives of "experience and science as two necessary poles of understanding" (Varela, Thompson, & Rosch, 1991, p.14). Not only can we benefit from the actor's technique imbedded in a phenomenological understanding of human being, as well as from the high-tech and extraordinarily sensitive and complex devices used in neuroscience to measure brain activity, but the two approaches may be more than

complimentary, even necessary, to form a satisfactory understanding of human behavior today.

It is interesting to note that mirror neurons first were identified by Vittorio Gallese, a neuroscientist who is also a member of an opera ensemble (Iacoboni, 2008). Iacoboni (2008) attributes the critical role Gallese played in the discovery of mirror neurons to the breadth of his interests and his capacity to think outside the box. It may also be that Gallese's involvement in opera had something to do with his capacity to put himself in another's position (his capacity to empathize and to act) and therein his insights into the mirror neuron discovery - a discovery that has changed the way scientists understand human perception and social existence (Iacoboni, 2008).

Convergence.

An individual really can take part in someone else's joy and sadness and the whole spectrum of their emotional life. This exciting possibility - suggested by the mirror neuron studies, has been long experienced and articulated in acting texts (Bates, 1986; Benedetti, 1970; Boal, 1979, 1992; Cohen, 1978; Chekhov, 1953/1985; Hagen, 1991; Lewis, 1993; Stanislavski, 1936/1964, 1961, 1989). An individual's motor repertoire, imagination, and ability to assimilate procedural memories into a kind of mosaic of others' experience defines their ability to understand others, empathize, and to act.

The parallels between the processes described in the art of acting (Artaud, 1964/1993; Bates, 1986; Benedetti, 1970; Boal, 1979, 1992; Brook, 1968; Chekhov, 1953/1985; Cohen, 1978; Grotowski, 1968; Hagen, 1991; Lewis, 1993; Mamet, 1997; Richards, 1995; Spolin, 1999; Stanislavski, 1936/1964, 1961, 1989) and those in the mirror neuron literature are almost innumerable. The more one reads the more one finds

the processes described in acting explicable to some extent by the MNS. Directions given to the actor such as, “If you want me to sense the general meaning of your feelings, you must be experiencing what you are trying to transmit to me” (Stanislavski, 1936/1964, p.215), convey a truth that is explicable by mirror neuron functions.

Gallese, Merleau-Ponty, and Stanislavski are all connected by their use of “as if” in their approach to understanding human behavior. Gallese says, “it is as if the other becomes another self” (Iacoboni, 2008, p.78). Merleau-Ponty says, “it is as if the other’s intention inhabited my body, and mine his” (Iacoboni, 2008, p.78), and Stanislavski’s entire system is an illustration of the process by which the actor acts “as if” they were another (Stanislavski, 1936/1964).

The process Stanislavski (1936/1964) describes as irradiation, based on the unseen rays transmitted between communicating parties (between actors on the stage and between actor and audience), can be likened to the concept of transference and counter-transference in psychoanalytic theory, and of course to the MNS. Stanislavski (1936/1964) even describes a capacity to identify the physical sensations of absorbing others’ feelings, as well as the physical sensations of transmitting one’s own feelings to someone else. He seems to be describing a conscious awareness of mirror neuron activity, and the actor’s capacity to develop and use this awareness in order to communicate.

Human mirror neurons have been differentiated from those of other primates by their ability to code intransitive actions and action phrases (Gallese, 2007). The fact that the MNS is activated by action sentences has interesting implications for the transmission of cultural knowledge through story and narrative (Gallese, 2007), drama and otherwise

in the imaginative realm. The empathic process described in the MNS is at work in an actor reading from a script. The coding of action sentences allows an actor to feel what they read because words are acted out internally, just as is any perception. The MNS represents in motor simulations the actions of the characters in the script and simultaneously activates the actor's limbic system which provides the emotional content of the script. Actors then expand on these initial impressions in their embodied work in rehearsals.

Actors use their bodies, actions, and intentions to manipulate their emotional systems likely because the connections between the MNS (the motor and pre-motor cortices) and the limbic centers are stronger than the cortical connections are - thus facilitating the emotional life of the character. It is possible that through their craft actors induce more mirror neuron activity and reduce boundaries defining the self at a neuroanatomical level. They may also develop a greater awareness of the intersubjectivity and interconnectedness of the human condition. It is notable that self-awareness is not separated from awareness of others, neither in reference to actors nor to anyone else. Though the self/other connection through theatre has been articulated since Aristotle (Boal, 1979), mirror neurons provide evidence for this connection.

The concept of intentional attunement and the ideo-motor model of action as discussed by Iacoboni (2008) are also highly relevant to the art of acting. In an ideo-motor model, actions come out of intentions, just as they do in Stanislavski's method of acting (Stanislavski, 1936/1964, 1961, 1989). The notion of human beings as goal-directed (intentional) organisms (Peterson, 1999), is relevant at every level of analyses of behavior - in life, in acting, and in the MNS. Both mirror neuron studies and the acting

literature suggest that intention is a key component of how an individual can exert control over their behavior and gain say in defining themselves.

The differentiation between the right hemisphere activity of experiencing emotions and the left hemisphere activity of masking them is highly pertinent to the two traditional schools of acting. The deliberate and conscious manufacturing of representational acting requires the functions of the left hemisphere of the brain, and is reminiscent of the kind of masking described by Leslie et al. (2004) with regards to mirror neurons.

Stanislavski (1936/1964) tries to explain how an observer experiences an actor's feelings, as do mirror neuron studies. Stanislavski (1936/1964) describes the study of communion with an intransient object; the MNS responsiveness to mime and other imaginary acts (Fadiga, et al., 2005), provides a biological marker for this communion. There is even a great deal of overlap in the vocabulary used in these two seemingly distinct disciplines. The word resonance is often used to describe both acting and mirror neuron processes. Embodiment is a central concept in the description of the MNS as well as an integral notion in the art of acting. Embodied simulation is the functional mechanism of the MNS (Gallese, 2007). Actors in a play are the embodiment of their characters; through embodiment, the actor communicates the experience of the character to the audience in a comprehensive way (Lewis, 1993). The technique of captivating an audiences' attention through studious use of intentions closely resembles the phenomena of action understanding through embodied simulation in the MNS (Gallese, 2007). Finally, action is integral in both disciplines.

The space between actor and audience.

The MNS is so perceptive that an audience picks up on the inner workings of the actor's brain-body system; their intentions/motivations, emotional states, and forthcoming actions. Human beings are highly attuned to one another - they feel and know what is going on with each other sub-consciously. The actor on stage is the focal point for the audience. What the actor experiences on stage is what will be conveyed (Stanislavski, 1936/1964). If the actor is thinking and feeling about some aspect of her daily life that is not connected to the play, it will be evident. For this reason it is crucial that the actor be wholly involved in the action of the play. An actor's work (training and rehearsal) leads up to this capacity to attend solely to the character in role in the play. The degree of attention and concentration required to maintain this focus through every living moment on the stage is exceptional. The audience's mirror neuron systems attune them to the actors in such a way that they know what the actors are experiencing, and whether or not this is relevant to the play.

The similarity between the description in acting literature of communication between actor and audience, and the mirror neuron findings are almost as astonishing as the processes described. Instead of perceiving the communication to be taking place in the air, the MNS gives us another means of conceiving of this extraordinary communicative faculty; a faculty which actors are meant to possess to a heightened degree (Bates, 1986; Cohen, 1978; Hagen, 1991; Stanislavski, 1936/1964). In fact the MNS is said "to offer, for the first time, a unitary experimental and theoretical framework within which to decipher this form of shared participation that the theatre provides and

which is fundamentally the basis of our common experience” (Rizzolatti & Sinigaglia, 2008, p.xiii).

Findings linking mirror neurons to identification and affiliation (Iacoboni, 2008) suggest that a theatre that wants to alienate their audience should hire performers that do not represent the audience and have them perform actions that are unrelated to the audience’s lives. This may explain the prevalence of “deadly theatre” in the world as described by Peter Brook (1968). On the contrary, a theatre that wants to “move” their audience must hire performers who resemble their audience, and have them engage in actions that relate to the lives of those in the audience. A theatre that wants to literally move their audiences, and promote individual and/or social change, is best to engage in some form of participatory theatre akin to those described by Boal (1979, 1992), playback theatre, developmental transformations, and the many other embodied forms utilized in drama therapy (Emunah, 1994; Jones, 1996; Lewis & Johnson, 2000). Even the term “being moved” is recognized as a pre-reflective semantic understanding of the MNS (Iacoboni, 2008). Theoretically the same constructs apply to film, but because of its nature film does not have the participatory capabilities that theatre does.

It is no wonder that Boal (1979) posited that theatre is a powerful weapon of political control. Mirror neuron studies highly support this idea, given that theatre involves live action between people (the most powerful resonance in the MNS occurring with the observation of live actions). This makes the theatre an optimal means for transmitting behavior, culture, norms, and ideologies, as Boal (1979) suggests. The theatre has its greatest impact in participatory forms of theatre. When the audience’s only role is to observe the action (a state in which the super-mirror neurons disengage) they

will identify less with the action than when they too are active and imitating in the process (a state in which the super-mirror neurons will be engaged and the individual will identify to a greater extent with the action). These findings support the use of therapeutic theatre, theatre of the oppressed, psychodrama, drama therapy, and all action psychotherapies as presented by Landy (2007), which actively engage participants in dramatic action. Social control is more powerfully achieved through social participation than through social observation, though both do have notable influence on individual behavior as evidenced by mirror neuron studies (Iacoboni, 2008).

Language.

In a discussion on the value of the actor's personal feelings in acting, Spolin (1999) expresses the opinion that these should be of no concern. However, she goes on to say that it is the direct physical communication of the actor that must be of utmost importance (Spolin, 1999). For anyone informed on the mirror neuron mechanism, the contradiction in this speculation seems clear; the MNS is a form of direct communication between the physical and emotional systems of the actor/observer. This is an example of why and how the specificity of the neurological language might help to clarify the processes involved in acting.

The experiential nature of the art of acting makes it particularly difficult to describe. This is evident in the variety and breadth of terms used in the acting literature. The benefit of comparing the MNS to the art of acting lies partly in its ability to clearly define what may be the underlying processes of acting. Though the MNS provides no more of an explanation for the astounding ability of human beings to take on other's emotions and behaviors, "characters" as it were, it does provide a precise, measurable,

and concise way of describing and imagining the abstract processes involved in the art of acting. The MNS gives one another way in which to deconstruct and hopefully understand the art. It even supplies an analogy for what one's "understanding" is made up of - an internal simulation of experiences. This analogy compliments the art of theatre and of acting, which are both also simulations.

The language used to describe acting is often ethereal or spiritual, and the processes are described with an array of psychological and esoteric terms. Regardless of how it is articulated, the authors describe a concept comparable to the MNS. Many theatre artists have reflected on the capacity of science to explain the art of acting however they seem to discredit the idea (Hagen, 1991). The astounding insight, perception, and seeming clairvoyance experienced in great acting is said to be unfathomable to science (Bates, 1986), but as science becomes more abstract and astounding itself, the art and the science seem less distinguishable. The level of introspection required of acting, is distinctly heightened from normal self-awareness (Benedetti, 1970), and the level of analysis and observation in the sciences is becoming more and more precise (Iacoboni & Dapretto, 2006). From two very different vantage points, these disciplines form complimentary understandings of behavioral and emotional patterns in human beings.

The word empathy comes from a German root word that means "the relationship between a work of art and its observer" (Iacoboni, 2008, p.108). If our understanding of language is indeed embedded in our bodies, then it is no coincidence that the word empathy is derived from the relationship between an artist's work and the audience, nor in the use of the creative process to develop an individual's capacity for empathy.

Acting for Human Development

The role that the MNS plays and has played in the phylogeny and survival of the species, as well as the ontogenetic development of the individual (Gallese, 2007) is of particular relevance to theatre and the art of acting. It is from this developmental perspective that one can view the art of acting as a means of exercising the MNS and furthering the social development of the individual.

Acting is consciousness.

The first presentation on the topic of mirror neurons was titled “Toward a Science of Consciousness” (Iacoboni, 2008). The connection between mirror neurons and consciousness is pivotal in the conception of the art of acting for human development. Ledoux (1996) makes an interesting point when he says that every phenomenal experience is by definition based in conscious awareness. If the actor’s art is a phenomenological understanding of human behavior, then it is also defined by the actor’s consciousness. The art of acting may also be described as an art of expanding or developing consciousness. From this vantage point one can clearly see how it may be applicable to psychoanalytic goals of resolving conflict between the id, ego, and the superego, as it is a process whereby the self can come into awareness. An art of developing consciousness is applicable to any insight-based therapy.

Acting is a creative process through which an individual can become self-conscious, and then use this awareness artistically. Becoming self conscious is a characteristically unpleasant process. Self-consciousness is the beginning of a journey towards a purposeful and creative expression of self which harbors health and well-being. Human beings do not only need to become self-aware, but they also have a need to assert

and express themselves creatively in a social context. Creative expression is a broad concept which is not limited to the fine arts, and can be construed of as any process in which something is built, created, or re-organized in a new and intentional way. By using the self in a purposeful and creative way an individual can draw meaning from their experience, and make some “good” of it no matter how “bad” it is. Whatever that “good” is, is defined by the individual, and embodied in the medium/art form and the act of communicating it with another human being. In acting, the individual is the medium that embodies the creative process, the meaning making, the “good” experience. Acting involves using life in a creative way. It is a way of life (Stanislavski, 1936/1964) and consciousness is the first step in the process.

The MNS gives one a way of conceiving of consciousness that emphasizes the active physical nature of one’s experience/perception. One must view procedural knowledge as a type of consciousness. What one makes a habit of, what one does, becomes representative of one’s level of consciousness. From this perspective an acting body represents an unconscious level of consciousness. The degree to which the body is at ease acting in the world is the degree to which the individual is procedurally conscious. An acting body is always intentional. Most of one’s actions in the world are unconscious, but not unintentional.

The art of acting is a process that teaches one to focus one’s attention on behavior, in order to become conscious. In other words, the art of acting teaches one to attend to one’s experience: actions, re-actions, intentions, interactions, emotions, energy levels, moods, relationships, and every imaginable aspect of one’s environment, thus broadening one’s capacity for experience/perception, and therein consciousness. An actor works to

become so attuned to themselves, others, and the environment, that they might even come to perceive the workings of their own MNS - of the internalization of other's feelings and experiences.

One would think that the study of the unconscious (including emotional states) might be left to psychoanalysts in the tradition of Freud, or to brain scientists and cognitive psychologists, but in fact, the study of the subconscious is a fundamental part of the actor's work (Stanislavski, 1936/1964). It is also an important dimension of the creative process in general, and therefore a necessary component of all artists and creators lives. The actor's craft is a means by which the actor can influence their subconscious; however the subconscious is never something that the actor can directly control (Stanislavski, 1936/1964). What is astonishing and relevant for therapists, psychologists, and brain scientists, is the degree to which an actor can learn to shape and mould their behavior through their influence over their subconscious. Since human beings are largely driven by sub-conscious factors (Iacoboni, 2008, Ledoux, 1996, Peterson, 1999, Rizzolatti & Sinigaglia, 2008), if one aims to have some control over one's behavior, then it makes sense to look at the actor's craft for pointers as to how one might gain such control. To the dismay of those who readily turn to drug therapies, the actor's craft does not supply a quick fix for control over behavior. But for those who recognize that change and development are the consequence of time and labor, the discipline required of the actor's craft may be a welcome and reasonable alternative.

More reasons to act.

Like psychoanalysis, acting is a lengthy process of self-discovery, self-reflection, self-consciousness, and development. In addition it can be its own reward. A person can

be drawn to the art for pleasure and self-esteem, in addition to the values of self-awareness and change. Acting involves the acquisition of skills for artistic reasons which compliment an individual's development. In this way acting is a skill, as much if not more than it is a cure or intervention. If nothing else, the self-reflection skills garnered through the acting process can be extremely helpful.

The most promising aspect of the actor's craft in human development is the fact that it is attainable to some degree by people functioning at every level of development. The techniques, exercises, and games used by the actor can be simple, playful, and engaging. Most of them appeal to children as well as adults and one can participate and enjoy oneself regardless of one's developmental capacity. Whether the target is concentration, attention, sense-memory, or relaxation, participants engage at their own level and develop from the practice - from the act. One can take these simple games/activities, and apply them in a more and more complex and challenging way until one reaches the level of a master actor. However, this level of control over the body and behavior is difficult to achieve. Nonetheless the method is clear. Anyone who wants to be able to shape their own behavior, like an actor, must practice. The practice of the actor always consists of beginning at whatever developmental level a person is at (Vygotsky's zone of proximal development), and involves the very basic mastery of concentration and attention. There are many people for whom just this is a major challenge in their lives (those diagnosed with learning disorders like attention deficit hyperactive disorder or developmental disorders), and for them, concentration and attention exercises, which often engage the entire body, help develop these capacities which will in turn help them in other facets of their lives.

Individuals going to therapy often face both personal and social challenges. Acting is an art of self-awareness that is invariably social, or one could say it is an art of social-awareness that is invariably self-conscious. The use of acting techniques in a therapeutic context allows a therapist to confront both the personal and social causes of an individual's problem. Boal (1979) emphasizes the social nature of personal problems and the power of theatre as a tool for social change and personal empowerment.

Changing behavior.

It is possible to play upon oneself like an instrument, and to create memories, emotions, and even experiences (via the MNS), which can only be differentiated from reality if the entire process is monitored in a controlled setting (Ledoux, 1996). One creates/manifests experiences and memories in subtle ways all the time. All of one's experiences are to some extent created by one's sensory perceptual system, memories, state of being, and various other factors. Given that to an extent one is always creating their moment to moment experience, how can one use this knowledge to create experiences one desires? The art of acting can guide one in such an effort. An actor uses their technique – plays their emotional, sensory, and cognitive instrument (the mechanics of their self) – to create the experience of being another. One can harness these skills and in doing so create a desired self and/or existence. This is not to say that this is an easy process or that acting is an easy craft.

One can “manifest experience”, not in the sense that one can control the physical, tangible environment and make apparitions, but through playing on the figurative strings of one's physiological and neurological makeup. One can induce and create internal states-of-being, memories, stories, and experiences, that enrich life and stabilize

emotions. Of course, this power can also be used in a self-destructive way, and this is where all actors and anyone who aspires to use acting techniques must be careful.

The MNS is a mechanism which defines an enormous quotient of human behavior sub-consciously. Our developing knowledge about how the MNS works allows us to some degree to use this system to consciously define ourselves. This is what actors do in their work. They use their knowledge of how their emotional/sub-conscious bodies influence their behavior, in order to consciously influence their behavior. This is not only challenging, but also a dangerous endeavor which constantly deconstructs and reconstructs the self. The actor's aim is to be "everyman", and in that aim they may at times lose themselves, but they will also discover themselves. If a capacity for ambiguity defines healthy mental life (Landy, 2000), then there are none healthier than a good actor who acknowledges and lives as many selves. In the actor, the social-self continuum is explored regularly. It would be paradoxical to find a great actor that is not an extraordinarily empathic individual, with a capacity for putting themselves in the position of, and understanding, even the most villainous people.

Metaphorically actors are playing with fire as they manipulate their own internal life experiences to serve their art. For this reason, safeguards such as de-rolling are used to help actors maintain their psychological integrity. Unfortunately this is not always effective, as one might surmise from popular icon Heath Ledgers' death while working on the film *The Dark Knight* (Nolan & Nolan, 2008). Other similar tragic stories are not uncommon. The behavioral nature of the changes made through acting can significantly alter an individual's bio-chemistry.

Consciousness and control.

It is fascinating that in this discussion of human behavior, of theatre and acting, and of therapy, that the concept of control is predominant. Control, though it inspires fearful images of tyranny, is in essence a conscious process. Without consciousness there is no control. So whether one refers to an individual's control (consciousness) over their own behavior, or society's control (consciousness) over the individual's behavior, in essence one is looking at the mechanisms of consciousness, and the means by which people have attempted to use consciousness to define themselves and others, and as we have seen from the MNS, themselves via others. This is in contrast to the very large arena of an individual's life that is not subject to control/consciousness.

The propositions in this paper violate some highly valued notions of self in recognizing that humans are enormously defined by social relationships. However, this is the message conveyed by the evidence of mirror neuron studies. Despite the insight these studies provide into human nature, the information is not entirely welcome. It's nice to think that one can alter the behaviors that one dislikes through social interaction, but the flip-side is that these same behaviors are created and magnified through the same mechanism. Controlling one's behavior may only extend as far as one can control one's social environment (except of course for the small degree of one's day-to-day functioning that is conscious).

Imagination in experience.

Actors often indirectly influence their internal states by manipulating their physical and imaginary environments. Can anyone do this in an attempt to consciously define themselves? Do all people even have equal access to environments of their choice?

In the physical world evidently they do not. However anyone can influence what they perceive about their environment. An environment is defined by what a body can do with it, and therein perceive in it. An individual can perceive their environment at whatever level of resolution they are capable of, and can also use their imagination in shaping their environments as actors do. The human capacity to respond to intransient acts, allows the imagination to play a role in experience. An individual can consciously place themselves in an environment (mental/physical) that is likely to influence them in a specific way, even if this environment is imaginary – like in visualization exercises.

These arguments may be offensive to some readers because they confront basic materialist assumptions, and contend that truth in a traditional materialist sense is not necessary. The tangible, material, and scientifically empirical world is not as straightforward as it seems. When it comes to human well-being fabricated experience can be as fulfilling and/or detrimental as what some might call actual experience. Furthermore, fabricated experience is based in actual physical experiential memories (and motor repertoires), and the process which fabricates can lead to a greater awareness of the body and self in the material world, and therein a greater experience of self in the world - one which is defined to some extent by what we can imagine for ourselves.

This kind of emphasis on the value of imagination and introspective work is not uncommon, as it is a part of age old practices like meditation and is also explored in contemporary art. For example this idea is espoused by Jean Dominique Bauby in his memoir *The Diving Bell and the Butterfly*. In this true-life story, Bauby who had what is called locked-in syndrome, a state of complete physical paralysis except for the capacity to blink, lived through his imagination. Not surprisingly, he only lived on memory for a

brief period without the use of his body. He did however demonstrate that a person, restricted almost entirely to his internal world, can create, live, and communicate a fascinating existence in a world beyond the material (Schnabel & Harwood, 2007).

An imaginary world may not be an accurate description of reality for some individuals, but if accuracy doesn't create well being then why insist on it? Here one might argue that deception causes pathology, which is true. Paradoxically, acting is not a deceptive process, the actor is aware at all times that these states and feelings, "the character", are manufactured. An actor knows that the character isn't real, so to speak. The acting process is not about lying to oneself, but rather about arranging the truth so that one can create another truth. These fabricated experiences, become actual experiences, they become electrical impulses in the brain, they become associated images and memories, and they become real in a tangible way. They are not divorced from the conscious process which gave rise to them, and are therefore not deceptive in any way. In fact, if an actor does not believe in their own experience and action on the stage, then it will be obvious to anyone witnessing that they are not having success in their work. Actors have to wholeheartedly immerse themselves in their experience on the stage for it to convey any message with any validity. The actor has to find a way to believe in the life of the character, in order to manifest/create that life.

Social context.

The powerful influence of social observation should not be underestimated, and can be a force for self (social)-destruction as much as it can be for self (social)-development. There is extensive data suggesting that media violence leads to violent behavior (Iacoboni, 2008). In fact the correlation data between media violence and

imitative violence is so strong that it greatly exceeds similar data on lung cancer and passive smoking, bone density and calcium consumption, and cancer and asbestos exposure (Iacoboni, 2008). We do not broadcast the former results with the same kind of gusto as the latter three because it indicates a lack of autonomy that is uncomfortable to admit (Iacoboni, 2008). This discomfort can be seen as a sign that there is something in our impressionable social nature that we yet do not understand and should start paying attention to. The power of social observation is not given its due credence.

The messages (images) one receives from the media and other technologies are represented internally in the MNS. However, if they are foreign to one's vocabulary-of-acts and because they are not live, they will not resonate/register as strongly as live actions do. Therefore those events that happen far away, that one hears, reads, or sees on the news, do affect one, but not as strongly as those that one witnesses first-hand, like theatre. Mirror neurons give deeper meaning to this use of theatre as a social mirror. Iacoboni (2008) goes as far as to question our basic notions of free will. Boal (1979) agrees with Iacoboni that most of one's actions are dictated by social sources. His understanding of the power of theatre for social coercion is based on an understanding of how profoundly human beings are affected by witnessing others' actions, and the forms and structures in which this witnessing occurs (Boal, 1979).

Mirror neurons are also said to play a role in addictive behavior (Iacoboni, 2008), and provide evidence that the social context of an addiction is one of its most powerful forces. For instance when an ex-smoker observes someone lighting a cigarette, those neural pathways required to light the cigarette are re-ignited in the observer's MNS, making them more likely to perform the action, to also light up a cigarette (Iacoboni,

2008). As long as an individual inhabits the environment of their addiction, a smoking room for smokers, a bar for alcoholics, a shopping mall for shopaholics, their chances of abstaining are significantly decreased. Addicts might learn from actors who control their behavior and emotions indirectly, and often through their environment.

The capacity to exercise the faculty that manifests and transmits emotion suggests that it is possible to develop and extend this faculty in individuals in which it is not adequately developed. These implications reach to special populations like those affected by autism (Iacoboni, 2008; Rizzolatti, et al., 2006) but also range from the general public to international politicians, who may benefit tremendously from an extended capacity for empathy and social understanding.

An actor's body is their instrument. It is important to remember that the body is also every individual's means of expression and of experiencing life. What is fundamental for the actor's art can in this light be seen as equally important for the art of living. Well-being is attained through bodily awareness and activity. Behavior can be modified by practicing new behaviors, and this requires awareness of the current state of behavior, the target state of behavior, as well as the emotional space required to act in the body. Emotional space is created by attending to emotional states. Emotions can not be controlled directly or gotten rid of, but if one pays attention to them they will eventually recede or change.

Ironically a science that is so apt at observing and measuring from the outside-in, using highly sensitive and technologically advanced equipment, has "discovered" and described a phenomena inside the human being that is also capable of observing others at such high (likely even higher) resolution from a phenomenological/experiential vantage

point. This suggests that we innately understand behavior, and that it is valuable to pay attention to those feelings we have when faced with others; feelings which are indicative of others' emotional states and behavioral motivations (Gallese, et al., 2007; Iacoboni, 2008; Rizzolatti & Sinigaglia, 2008).

Applications in Drama Therapy

The mirror neuron system provides a traditional scientifically valid premise for the sub-rational processes that are espoused and used in actor training. This validation can be extended to the same sub-rational techniques as they are used in drama therapy. For instance, an understanding of how an actor develops and uses empathy and communication in their work can be applied by a drama therapist in a clinical setting to help a client develop similar qualities. A more evidence-based understanding of the therapeutic value of the art of acting may lead to more use of acting techniques in drama therapy, as well as more validation for the use of drama therapy within the larger community.

Traditional positivist science is a powerful force for valuation and means of understanding in most of the world. By framing the use of sub-rational acting processes through the dominant worldview this information is more accessible to those who need tangible evidence to understand intangible processes. In a way, this is an interpretation between two distinct languages - thought processes - ways of knowing; acting and neuroscience. The processes of acting are translated into the language of neuroscience via the mirror neuron findings. Clinically this ability to translate is very relevant for drama therapists who need to explain their process and work to people in the health professions, social policy makers, the field of education, and various other plausible employers.

Imitation.

Iacoboni (2008) discusses the natural human tendency to imitate and places it within a therapeutic context, suggesting that when a therapist imitates a patient, they may activate the client's MNS, which facilitates the client's ability to literally see/perceive the therapist (Iacoboni, 2008). The ability to achieve this basic level of recognizing the presence of another person is essential to all therapy, and is inherent in drama therapy. Drama therapists are well versed in acting techniques based in imitation (Emunah, 1994; Spolin, 1999), and in applying these techniques specifically in therapeutic contexts. Berrol (2006) also discusses the prominence of imitation constructs in the creative arts therapies. Studies have clearly demonstrated that the conscious use of imitation promotes pro-social behavior and may provide life-changing advantages for children with autism (Iacoboni, 2008).

Embodiment.

The body is extensively explored in drama therapy theory (Jones, 1996; Johnson, 1986, 2000) Embodiment, a term used in both acting and mirror neuron literature, is also prevalent in drama therapy. Jones (1996) writes about embodiment and the dramatic body as the fundamental means of communication between self and other. He also discusses the use of drama therapeutic activities to help individuals relate to their bodies, and to develop through their bodies, and recognizes the conscious and unconscious levels through which the body communicates (Jones, 1996). The body in action is the primary means through which an individual gains knowledge in drama (Jones, 1996). This argument is highly supported by the findings on mirror neurons. In congruence with mirror neuron authors/researchers, Jones (1996) also argues to reconcile the body and

mind in one process in the acting body. Embodiment in drama therapy includes the way an individual's identity is embodied, the way an individual physically expresses themselves and interacts with others, the way an individual develops through their body, the potential for change through embodiment, and the social/political influences on the body (Jones, 1996).

An individual's physical presence in a dramatic representation facilitates their capacity to verbalize related unconscious dilemmas (Jones, 1996). This is an example of how phenomena like translational dissociation can be interrupted by embodied work, as well as the benefit of the breadth of representative means accessible in drama therapy. Embodiment in drama therapy, like mirror neurons and acting, is described like a bridge between sensory and emotional experience and abstract reflection (Jones, 1996). The concept of play in drama therapy is also viewed as a kind of intermediary (Jones, 1996).

Play.

Play is said to mediate between inner and outer reality, as a form of reality testing (Jones, 1996). It is a process whereby an individual can manipulate experience and thus experience new things in a safe way (Jones, 1996). This capacity to manipulate experience is another way of describing the use of imagination to form experience through the MNS. Play is also involved in the creation of shared meaning discovered through enactments and shared physical action (Jones, 1996), and is an important part of the gestural process whereby language is said to be developed. The mutual meaning described by Jones (1996) is relevant to the shared meaning described in mirror neuron studies (Gallese, 2007; Iacoboni, 2008; Rizzolatti & Sinigaglia 2008). Embodied play is a way of assimilating motor experience, which can then be used by the MNS to facilitate

understanding. Experience is essential to perception (Gallese, 2005) and play is neither inner psychic experience nor outer reality, but a middle ground that mediates the two (Jones, 1996). If one plays out a problem, one experiences it, and can therein perceive it. The neuroanatomical correlate of this process is likely the MNS. The play-drama continuum as defined by Jones (1996) proceeds from sensorimotor and imitative play through pretend and dramatic play, to full-fledged drama. This developmental continuum corresponds to findings in the MNS that base development in the motor system and in imitative learning (Iacoboni, 2008).

Role.

The experience of taking on different roles in drama therapy gives an individual the opportunity to feel and respond differently (Jones 1996); to think, feel, and act differently. Through this experience an individual broadens their role repertoire (Landy, 2000), a concept which is evocative of the vocabulary-of-acts/motor repertoire in the MNS. By broadening one's role repertoire, and one's range of feelings, thoughts, and actions, one is essentially broadening one's being in the world, and the means through which one experiences, perceives, and relates to the world. The findings on default networks (Iacoboni, 2008), reinforce the exploration of social roles as they are conceived of in role theory (Landy, 2000), a principal theoretical concept of drama therapy.

Social influence.

The audience is as important in drama therapy as it is in theatre (Emunah, 1994). Drama therapy audiences' own sensory and emotional systems are said to engage along with the protagonist (Emunah, 1994) through the same mechanisms evoked in theatre. Again, mirror neurons provide the neurological evidence for this engagement. The

communication that takes place between actor and audience in a drama therapy context, may be even more profound than that which takes place in the theatre, because the actors are directly playing out their own life experiences and motor repertoires - potentially resonating at a higher magnitude than they would in an “as if” situation with a fictional character.

Emunah (1994) discusses the enmeshment of the performer and medium/artistic product in the performing arts, and points out that this is heightened in acting where the artist’s body is the instrument which creates the artistic product. Empathy, as it is etiologically depicted as the process between art work and audience (Iacoboni, 2008), is heightened when the artist is the product. This effect is further elevated in drama therapy performances, especially in the case of self-revelatory performance, wherein the material performed is always personal (Emunah, 1994). “The very essence of self-revelatory performance, in which traditional boundaries – between actor and self, actor and audience, theatre and real life – are dissolved, begets an authenticity and immediacy that can be theatrically riveting” (Emunah, 1994, p.290) - likely the experience of a heightened mirror neuron response, which indicates a powerful sense of identification and affiliation with the performer. This kind of communion fosters understanding and empathy, and can be used to promote social harmony at any level. Emunah (1994) indicates that this identification is a reflection of deep self-analysis in the audience. As Emunah (1994) expresses, the line between art and life is that much thinner in drama therapy, and the resonance between actor and audience is that much greater.

Emunah (1994) also draws parallels to Grotowski’s work with actors, and bases self-revelatory work in Grotowski and Artaud’s ideas of theatre. She then goes on to

quote Roose-Evans' prediction that the boundary between professional and amateur actor will soon dissolve as the theatre comes to be known as a meaningful and worthwhile activity for all people (Emunah, 1994). This idea is strongly supported by mirror neuron findings. Emunah (1994) warns of the danger of theatre that mirrors rather than illuminates life. When theatre simply represents life, without demonstrating an active capacity to change or transform, it can reinforce stagnation rather than transformation (Emunah, 1994). This shows an awareness of the dual-nature of mirroring and imitation, the fact that whatever is observed is mirrored - value free - "good" or "bad". It is worthwhile to reiterate here the importance ascribed in the acting literature to intentions/objectives in defining character's behavior, the central role that intention seems to play in the MNS, and the implications this holds for using intentions/goals to understand and shape behavior in therapy and in life.

Mirror neuron studies show the necessity of social environments for mirror neuron development (Iacoboni, 2008). This implies that people suffering with various disorders or disabilities which segregate them from society may be significantly helped through group experiences that emphasize social interaction. Drama therapy is an ideal group form for this, with many exercises geared specifically towards social interaction and interpersonal development (Emunah, 1994; Jones, 1996; Landy, 2007; Lewis & Johnson, 2000).

Developmental transformations.

Perhaps most the most striking comparison between the drama therapy literature and mirror neuron findings is the body-based approach of developmental transformations (DvT). Developmental transformations is an "embodied encounter in the playspace"

(Johnson, 2000, p.87) based in Grotowski's ideas/work with actors. DvT aims "to facilitate a renewed flow or link between Source, Self, and Other" (Johnson, 2000, p.89). The embodied encounter with the therapist leads the individual to discover themselves and reconnect to their source (Johnson, 2000). The idea of connecting to oneself through an embodied encounter with another is evidenced by mirror neurons, and can be explained theoretically by the MNS. In this framework the body is explored in four facets: body as other, body as persona, body as desire, and body as presence (Johnson, 2000). Each of these conceptions of the body might be further explored through mirror neuron findings. In DvT the transformational–play nature of the therapy is emphasized (Johnson, 2000). It is the playspace that allows individuals to act out new and transformational behaviors, and thus to experience therapeutic change. DvT is highly physical, interactive, and imaginative and is therein an elite workout for the MNS.

Further exploration.

Drama therapy encompasses an eclectic theoretical effort to understand human behavior. There are many aspects of drama therapy that could be elaborated and explored in relation to the mirror neuron system. Most recently, Landy (2007) refers to the connection between mirror neurons, drama therapy, and other action based psychotherapies. He recognizes the primacy of action in individual change, and the potential of exploring the neurological foundations of this process through mirror neurons. The theoretical constructs that underlie much of the drama therapy literature are congruous with the mirror neuron findings and there is a wealth of information overlap between these two disciplines that could be further explored.

Conclusion

The existence of mirror neurons exemplifies the complexity and interconnectedness of brain functions, and of the internal and external experiences of human beings. The environment is as much a part of the person as they are capable of perceiving and interacting with it, and the greater this capacity for experiencing the environment, the more it is a part of the person, and the broader a person's experience, knowledge, and self. An imaginary world can also be a rich environment (source of experience) for an individual; the greater one's capacity to imagine and thus experience imaginary reality, the greater also the breadth of their existence. There are many ways to live and experience in this world, but none are divorced from the body, which at some level is always interacting with an environment.

“When we encounter each other, we share emotions and intentions. We are deeply interconnected at a basic, pre-reflexive level” (Iacoboni, 2008, p.268). By making explicit the implicit human mirroring mechanism, mirror neuron studies are articulating what artists of all kinds have maintained in order to make meaning of their work. What has had to be taken at face-value in theoretical concepts of acting is now deconstructed and laid out in neuroscientific evidence on mirror neurons. Actors and artists of all kinds have paid homage to, studied, and attempted to maneuver the sub-conscious processes embodied in mirror neurons for hundreds of years. Now they have even more reason to believe in the power of their art forms – it has been empirically measured.

It is unfortunate that there is a need for empiric observation, statistical proof, scientific analysis, objective, tangible, and explicit evidence, to give value, truth, and worth to processes that one knows implicitly, and which define one's behavior so greatly.

It would be great if an individual in our society could simply trust their own experience, and use this wealth of information to guide their behavior and existence in the world. In many ways this is what artistic, meditative, and psychotherapeutic practices teach. They validate personal, emotional, implicit experience. What one feels is indicative of a truth, whether one understands the matter explicitly or not. Nonetheless, “society is built on explicit, deliberate, reflective discourse” (Jacoboni, 2008, p.270), and now mirror neurons are a part of this discourse. The understanding of empathy, emotion, action, imitation, self-awareness, language, intention, experience, perception, art and culture, and consciousness has all been broadened by mirror neuron studies. These concepts light far into the abyss of human existence.

It makes sense that neuroscientists and actors should come to the same conclusions regarding human behavior. If they didn't then one form of knowing, or its results, would be invalidated. It is reassuring to find that the discovery of mirror neuron properties coincides exceptionally with the teachings and techniques actors use. It reinforces the use of the art of acting and the acting literature and world as a rich, complete, holistic source for insight into human behavior. It is proposed here that the art of acting is the most extensive and effective way to facilitate mirror neuron development, and all the individual, social, and interpersonal benefits of a healthy mirror neuron system.

Limitations

Factors which pose limitations to the generalizability of this research include the interpretive and subjective nature of the acting process. The author's experience (as an actor) affects her understanding, interpretation, and integration of both the literature on

acting and on mirror neurons, and bias's this paper towards her personal understanding of the processes at work in the "acting body". It may be difficult to find an audience that is interested in conceptualizing this topic, given the seeming disparity of the disciplines. Finally, there is a limited, though rapidly expanding, amount of analytical discourse on mirror neuron research due to the relatively early stage of their discovery.

One might also argue here that a significant proportion of artists and creative people struggle with mental illness, and that artists might not be the best models for imitation. If there is a correlation between artists and mental illness, this is probably due to the devaluation of artists and artistic processes in our society, and the repercussions of this on artists' mental health, more so than a valid criticism of using artistic processes for human development. If anything the mirror neuron findings exemplify the powerful influence of societal prejudice on an individual. The well-known connection between creativity and mental illness is likely the outcome of a helpful coping mechanism and a self-propagating instinct, which reinforces the use of artistic processes for human development. It may also be that artists do not use their work with the intention of attaining or maintaining well-being, and that the intention driving an artist's work is what defines their well-being.

Recommendations

Theatre director Peter Brook says of Grotowski "no one else in the world, to my knowledge, no one since Stanislavski, has investigated the nature of acting, its phenomenon, its meaning, the nature and science of it's mental – physical – emotional processes as deeply and completely" (Grotowski, 1968, p.13). If this is true, then the Theatre Laboratory houses, and its actors embody, the most complete phenomenological

library for the study of human actions. If neuroscientists are looking for insight into human action, into how intention, action, and language interact and evolve, the Theatre Laboratory is an optimal place to search.

Mirror neuron research that compares an actor's mirror neuron system to that of a non-actor's would be an interesting place to start. It would also be a worthwhile experiment to see if the degree of resonance in the mirror neuron system is higher in those who are relaxed while observing an action than those who are tense. Such a physiological experiment could be conducted and may lend credibility to Stanislavski's (1936/1964) maxim that relaxation is necessary. Experiments could also be designed to measure many of the actor's techniques and exercises (Spolin, 1999) in relation to the MNS, to see if neurologically these exercises are effective in heightening interpersonal communication and self/other-awareness. Hypothetically such experiments would provide empirical evidence that the actor's art supports the existence and functioning of the MNS and facilitates its development in individuals. Such findings might solidify the use of acting techniques in a drama-therapy context, and of drama therapy at large. These results might also lead to further investigation of the extensive theatrical cannon, for insight into how the social brain works.

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