EMBODIED SIMULATION AND IMAGERY AT WORK IN HYPNOSIS: ERICKSONIAN PSYCHOTHERAPY AND ITS UNIQUENESS

Renzo Balugani

Psychologist/psychotherapist, Società Italiana di Ipnotisi

Abstract

Recent neuroscience findings regarding phenomena including perception, action and imagery are discussed. In each of these phenomena, a form of neural simulation is involved, which sheds a new light on our traditional knowledge of brain function, and can also be interpreted as the mechanisms underlying many forms of physiological and pathological human behaviour. In the last section, the implications of such concepts for the practice of hypnotic psychotherapy are discussed, giving us a more solid understanding and confirmation of techniques currently being used by Ericksonian psychotherapists. Copyright © 2008 British Society of Experimental & Clinical Hypnosis. Published by John Wiley & Sons, Ltd.

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Action, perception and simulation

About 10 years ago, a group of neurophysiologists from Parma (Gallese, Fadiga, Fogassi and Rizzolatti, 1996) discovered three classes of neurons in primates’ brains, which belong to functional circuitries that on one side lay within the premotor cortex. Each of them demonstrated unsuspected multimodal properties associated with the execution of a specific action: their activation occurs both during the actual execution of this action, and during the perception of some of its specific aspects.

Action-location neurons are given their name because they control the execution of specific actions which take place in a specific position within peri-personal space (the space surrounding the body in which is possible to interact with objects). Their newly discovered property is their response to visual, auditory and somatosensory stimulation coming from that specific position (Fogassi, Gallese, Fadiga, Luppino, Matelli and Rizzolatti, 1996). These neurons belong to the macaco F4-VIP circuit which extends anteriorly to the F4 premotor area and posteriorly to the intraparietal sulcus of the inferior ventral parietal cortex. Specific neurons in this circuit control the execution of a specific, transitive action related to a specific position (e.g. brushing a fly off a table with one’s arm). They are also, however, activated when the subject merely sees an object inside the same spatial coordinates (i.e. a fly close to the dorsal side of the right arm), when they receive tactile information from that sensorial area (i.e. they feel the fly touching the skin on their arm) or even when they hear a sound coming from the same area (i.e. a fly buzzing near the arm). In other words, the very same neurons controlling an intentional action also respond to the sensorial information related to the specific position of the object involved in that action.
Visual, auditory and tactile stimuli indicating the presence of the fly activate the premotor neuron controlling the ‘brush the fly away’ action: this elicits the preparation of the most suitable plan to be put into action. This plan is a kind of simulation: not in the sense that it is a deliberate and abstract mental act, but an automatic, preconscious process of multimodal activation. Instead of being integrated into specific supra-modal associative areas (as postulated by traditional neurophysiology), motor and sensory information is simultaneously coded in a multimodal space created by the activity of these circuits. We therefore refer to this simulation as an embodied one, i.e. primarily coded into the organism’s sensorimotor coordinates. Its existence and way of functioning have also been discovered in the human brain (Bremmer et al., 2001).

A second class of neurons, called canonical, is activated both during the execution of a specific action involving an object, and during the simple observation of that specific object. Different neurons belonging to this class respond differently to the physical characteristics of a given object, such as shape, dimension and weight. In fact, different characteristics create different organism/object interaction possibilities, called affordances (Garbarini and Adenzato, 2004). In the parietal premotor circuitry, whose extremities lie in F5 and AIP areas (Luppino, Murata, Govoni and Matelli, 1999), the specific neuron firing during the actual execution of an action (e.g. picking up a pencil between two fingers), even fires when the object is merely sighted. It is the result of the perception of the affordances which enables a subject to execute that action (Grèzes, Armony, Rowe and Passingham, 2003).

Clearly, a functional mechanism of simulation is implicated here: the potential most suitable plan of action toward an object is activated by simply observing that object’s physical qualities. As is the case with action-location neurons, this mechanism is embodied, and thus possesses sensorimotor (multimodal) characteristics.

The third and most extraordinary class of neurons recently discovered is situated in the premotor cortex (BA44) and the posterior parietal areas (Gallese, 1996). Here, specific neurons controlling the actual execution of actions performed by mouth, hand and foot, also fire when the subject observes someone performing the same action. They are called mirror neurons because their activation is an internal representation which strictly corresponds to the action observed. Seeing someone performing an action automatically and unconsciously makes us simulate it in our sensory motor coordinates in a special way, as if we were performing that action. First discovered in transitive actions (grasping, biting, kicking), these functional properties are now being found in intransitive and communicative actions (Ferrari, Gallese, Rizzolatti and Fogassi, 2003).

Furthermore, in the entire class of neurons, a percentage of them specifically responds to auditory stimuli (i.e. hearing the mirror crashing) which are related to the specific action performed by the agent (i.e. throwing a stone at a mirror). A second, unsuspected ability of these neurons emerges from their behaviour when the vision of the final phase of the observed action is artificially hidden by the experimenter: a percentage of them discharge until the end of the action, even in the absence of its complete perception. It is quite remarkable that mirror neurons can discharge as a result of being able to anticipate an action (and its final phase): hence, we can argue that the brain can simulate the final state of an action in advance, as well as the purpose for which it is performed (Iacoboni, Molnar-Szakacs, Gallese, Buccino, Mazziotta and Rizzolatti, 2005).

Therefore, if observing or hearing an action performed by others causes us to infer the purpose of that action (the final state) even when this purpose is not immediately perceived, it corresponds to a representation of the agent’s purpose (Fogassi, Ferrari,
Gesierich, Rozzi, Chersi and Rizzolatti, 2005). The ability to automatically infer the purpose of an agent’s action by means of this simulation mechanism is called by Gallese intentional attunement. In other words, it is as if the observer is the one who performs the action he/she perceives, by means of an automatic ‘putting him/herself in the other’s shoes’ mechanism, embodied in his/her sensory motor apparatus. Mirror properties have also been found to exist in touch-respondent experience circuits, activated both in the first person and while observing others being touched (Keyser, Wicker, Gazzola, Anton, Fogassi and Gallese, 2004).

Other circuits have indeed shown to respond to specific emotions either first hand or observed in someone else. The same area of the anterior insula, in the frontal lobe, is activated both when feeling disgust, and when observing someone with a typical expression of disgust in their face (Wicker, Keyser, Plailly, Royet, Gallese and Rizzolatti, 2003). While witnessing someone feeling pain, the anterior cingulate cortex is activated as well as the insula cortex (Singer, Seymour, O’Doherty, Kaube, Dolan and Frith, 2004). These areas play a vital role in coding the affective, motivational and attentive value of stimuli: they are strongly connected with the inferior nuclei controlling the visceral functions (think about retching evoked by someone vomiting, or stomach cramps brought on by the physical pain a loved one is experiencing).

**Embodied simulation, imagery and behaviour**

Many implications from the mirror neurons mechanism can throw a new light on the study of human behaviour.

In Gallese’s opinion, through the embodied simulation mechanism a shared manifold would emerge, that is an interpersonal space in which our skills of sharing experiences with others can take place. This interpersonal space would allow us to overcome the self/other distinction, solving the old problem of where the ‘I’ and ‘you’ perspectives of human experiences meet each other (Gallese, 2001; 2006). From his point of view we are neurally predisposed to share the same representation in a we-mode perspective. If this mechanism was absent, there would not be any difference between observing someone doing things and any other physical movement (Becchio and Bertone, 2004). The correct attribution of who is doing that action is caused by the incomplete matching of the two activation patterns (performing that action vs. just seeing someone performing that action).

An essential component in the individual development and in the primate’s fitness to the environment is the acquisition of new skills: in learning via imitation, for example, mirror neurons give us a great advantage. When an adult performs a new action, an inexperienced infant automatically perceives that action as if they were to perform it by an internal representation: this is perhaps the most effective and immediate way of learning the complex adult motor repertoire (Gallese, Keyser and Rizzolatti, 2004). As already seen, primates are biologically prearranged to read the other’s mind, in the sense that they can (at different degrees of sophistication) comprehend different states of the other’s mind via an automatic, preconscious and embodied representation of the actions performed by them.

Psychology classically theorized that mind-reading is the result of complex cognitive abilities, called Theory of Mind as a whole, lying in a hypothetical cerebral area, the TOMM: Theory Of Mind Module (Baron-Cohen, 1988). Empirical confirmations of such a cerebral module are scant, while we can now ascribe the theory of mind to the effects of the innate mechanism enabling us both comprehension and learning.
This parsimonious explanation indirectly receives confirmation by some observations from the autistic spectrum disorders, as we will show further. Let us summarize: the observation of someone being touched or suffering in a body part is translated in an embodied simulation of them in my mirror system. Furthermore, even the simple imagination of being touched or suffering in that body part elicits a similar embodied simulation. Hence, I can understand what I am seeing via an internal representation build up as if it was me experiencing it.

This is very close to the concept of empathy, even if ‘being in the other’s shoes’ means the self predisposition to reach their phenomenological horizon, rather than really feel their emotion. The study of an innate or acquired malfunctioning of these areas, as well as the absence of their neural simulation, can help us to understand how different our experience would be if we were deprived of this mechanism. This is why we will now talk about some pathological conditions.

In the autistic syndrome spectrum, the social cognitive functions outlined above are impaired at different levels of severity: spontaneous imitation is scant, there is a lack of theory of mind and the competence to correctly infer the cognitive or emotional state of others (empathy) is absent. Autistic patients show deficits when they have to ‘put themselves in the other’s shoes’, when they have to assume a point of view different from their own, when they have to understand the intentions lying under the other’s actions or just emphasize with another’s emotion.

This is why we are tempted to hypothesize a selective damage of those cortical areas involved in the mirror system (Gallese and Goldman, 1998). Highly functioning autistic patients, inside the spectrum, show the previously described deficits as well as a relative preservation of abstract thought and reasoning: thanks to these vicarious competences they can infer the other’s mind state, by a use of artificial and complex cognitive constructs.

So, we are not surprised by the recent results coming from ElectroEncephaloGraphy (EEG) and Transcranial Magnetic Stimulation (TMS) showing in the brains of these patients clear signs of malfunctioning specifically in the cortical areas belonging to the mirror system (Oberman, Hubbard, McCleery, Altschuler, Ramachandran and Pineda, 2005; Theoret, Halligan, Kobayashi, Fregni, Tager-Flusberg and Pascual-Leone, 2005).

In patients suffering from a frontal syndrome, a more or less circumscribed involvement of specific cortical areas as the result of acquired damage: they have lost the control and inhibition of a range of behaviours directly related to the embodied simulation. Examples are the ‘imitation behaviours’, both motor and verbal, during which the patient cannot prevent themselves from imitating what is performed by the clinician in front of them, or repeating sentences just heard. During ‘utilization behaviours’, instead, the patient automatically brings everything that is set inside their peri-personal space, and perseveres in this behaviour even if strongly instructed not to repeat it (remember the description of action location and canonical neurons).

In the psychiatric experience, we have some examples about the effects of a deficit in the sensorimotor mis-matching (which, as seen, allows the correct attribution of the agent of an action or an emotional experience): if this incomplete matching of activation patterns is lost, the schizophrenic patient can make errors in the automatic recognition of the agent (he/she vs. someone else). During auditory hallucinations an internal voice is experienced as if it was an external, independent, ego-dystonic one (Dierks, Linden, Jandl, Formisano, Goebel, Lanferman and Singer, 1999); during the delusion of being controlled by others, an external causal attribution replaces the correct attribution to the self of an action or a thought (Spence et al., 1997).
In the field of rehabilitative science, an application of mirror system properties has been recently proposed for the rehabilitation of patients suffering from paralysis after stroke (Buccino, Solodkin and Small, 2006). An experimental study gives the first empirical support: while a group received a daily administration of arm and hand action observation in addition to the classical physiotherapeutic treatment, the control group underwent the physiotherapeutic treatment as usual. Results showed in the former a significant increase in motor function recovery as well as a wider increase in activation of motor areas (including mirror ones), as revealed by the fMRI scan (Ertelt, Small, Solodkin et al., 2007).

A brief description of mental imagery will now take us back to the field of physiological human behaviour.

In addition to execution and observation of hand actions, mental simulation of hand actions, such as imagined grasping (Grezes and Decety, 2001) and reaching (Filimon, Nelson, Hagler and Sereno, 2007) has also been investigated. Imagination can elicit analogue cortical activation patterns to those already discussed in observation and execution, including those having mirror properties. Mental imagery is a kind of simulation: a representation of a perception is internally created without its actual sensorimotor counterparts. In addition, during mental imagery the same (premotor and parietal) areas implicated in observation and execution of real actions are active. In contrast to the automatic, unconscious activation of action location, canonical and mirror neurons, mental imagery is a voluntary, controlled, conscious process. During both visual and motor imagery, otherwise, imagined contents undergo the very same rules and properties of the physical world, as if they were real. The imagined scanning of a place in a panoramic view requires a time proportioned to dimensions and richness of details of the correspondent visual percept. Similarly, the imagined rotation of a cube needs a time strictly correlated with the dimensions and the degree of rotation, as if it was real (Decety et al., 1989). Jeannerod calls S-states as a whole those mental states in which an action is not actual, but merely simulated. Some of these states are conscious and controlled (e.g. to estimate the feasibility of a certain action, or to imagine the manipulation of an object), while others are unconscious and automatic (e.g. to observe an object and its physical properties, or to observe another performing an action). All of them involve a common brain network, including the premotor cortex, the supplementary motor area, the basal ganglia, and the cerebellum. Merely imagining a movement will lead to a variable percentage of activation of each area, while the actual execution of the movement will be prevented by a sub-threshold activation of the effectors or by cortico-spinal inhibitions (Jeannerod, 1994; 2001).

What is important to remark here is that, at a functional level, action perception and action execution are not mutually segregated from imagery in our brain.

Implication for hypnotic psychotherapy

Recently, the contribution of the mirror neuron system to the comprehension of some central element in the psychoanalytical technique has been discussed: its functioning is supposed to play a major role in projective identification, in empathic mirroring, in affective attunement and in transference-countertransference interactions (Gallese, Eagle and Migone, 2007).

We here assume that such concepts, rather than merely belonging to the theory of psychoanalytic technique, deal with universal relational characteristics. Therefore, we will now discuss some application of the previously described neural mechanisms in the
comprehension of the hypnotic psychotherapy, with special attention to Ericksonian therapy.

The first issue is that this form of psychotherapy shows a unique feature: it is embodied in nature. From the first contact, the therapist’s efforts are focussed on those elements displayed by the patient that will allow him to formulate a hypnotic diagnosis (Zeig, 1984): such a diagnosis will be the map the therapist will use to tailor the hypnotic intervention. Among these elements, the patient’s attentive style (widespread vs focussed) as well as the perceptual inputs they preferentially adopt in the interaction with the world (visual vs auditory, vs kinaesthetic) are some examples of the sensory motor (and so, embodied) code that the therapist has to recognize and to use when constructing an effective intervention for that particular patient. The embodied nature of hypnosis is clear also when the therapist uses the ideomotor and ideosensorial phenomena spontaneously shown by the patient. Through an online fine assessment of these minimal cues, the therapist can monitor the patient’s responsiveness, the results in the actual hypnotic induction, as well as changes in the ongoing therapy. Lastly, hypnosis is embodied in nature by the means that the same therapeutic aims are often inscribed in the patient’s body coordinates. This is true when the therapist directly faces the somatic expressions of certain pathological conditions: think about the excess of arousal in a patient suffering from psychogenic impotence, or the muscle tension correlated to anxiety, or the facial flushing linked to feeling shame in social situations. Otherwise, this is true when the therapist indirectly wants to change the patient’s condition through a strategic modification of such bodily aspects: think about arm levitation aimed to make a depressed patient wake up, or catalepsy intended to elicit the need not to do anything in a borderline patient, preventing them from acting out their drives.

Given that hypnosis is both a state and a relationship, its embodied nature concerns both the patient and the therapist. However, the therapist’s body is rarely considered as a crucial part of the therapy. Which facial expressions are customarily shown? Is facial mimicry rich? Which is the usual nonverbal repertoire? Are they used to emitting paraverbal signals? Their voice has which intonation, intensity and rhythm? Which rhythm, amplitude, and deepness has their breath? The strong need to consider the therapist as an actor has been recently outlined (Zeig, 2006).

If the therapist holds the responsibility (as we think he does) about technical aspects of what is happening between them and their patient, another question needs to be answered: ‘Which are my body’s characteristics that I can use in an aware, competent, strategic way in order to facilitate the patient’s changes?’ In Zeig’s words: ‘Traditional therapists do not use their bodies to communicate. They don’t use gestures to emphasize points. They fail to be evocative in therapeutic communication. The purpose of dramatists is to evoke: to evoke sentiment, to evoke perspectives, and so on, and they do this through actors, who use their bodies, as well as spoken lines, to empower their messages. Therapists can use their bodies as part of the evocative art of communication-to intentionally evoke emotion, realization, perspective’ (Zeig, 2006).

We should remember the peculiar use that Milton Erickson made of his tonal deafness, his chromatic blindness as well as his constriction to the wheelchair in his very last years of career.

Even before a matter of opportunity, the question is an imperative aim for every Ericksonian psychotherapist. In order to facilitate rapport (that intense, mutual, highly responsive relation between patient and hypnotist) they have to mirror their patient. Mirroring with the Ericksonian technique means imitating the patient’s breath frequency,
heart rhythm, body temperature, trunk posture, muscle tone, facial expressions, body movements, voice tone, as well as speech intonation (Gordon and Meyers-Anderson, 1984).

If the mirror system allows us to represent an observed action in a first person perspective, as well as an emotion, this strongly calls clinicians to be aware of the use of their body. This point leads us in the second issue of this part: the role of simulation during hypnosis.

In summary: embodied simulation is the functional mechanism underlying the following experiences: action execution, action recognition, empathy and mental imagery. Inside hypnotic therapy each of these human experiences frequently occurs: let us discuss some.

A visual access to the patient’s mirror system can play a crucial role in the pre-induction phase, in the posthypnotic ‘grey phase’ (when the patient’s responsiveness to suggestions is still enhanced) and in somnambulic trances: in all these conditions, the open eyes allow the therapist to facilitate a willed response in the patient.

Concepts such as pacing and leading, shaping and modelling, are not merely technical aspects, but real interaction paradigms, now grounded on a more solid neurophysiological base. Through modelling, the therapist is a real (as well as neural, we now know) model for the patient’s behavioural responses, in an unconscious, not directly controlled way.

The pacing and leading technique can now be better understood as a reciprocal, alternated simulation of the two partners: while the therapist follows the patient’s behaviour and reasoning, he is attuning with him in a sensory-motor fashion; once attuned, the therapist can carry the patient slightly (in a strategic, conscious way) to experience a little change. This alternated dynamic is not the collapse of action in its exact copy as mirrored by the observer, but a process in which the regulation and the modification are reciprocal for the partners.

The key point of the success of such a technique lays in the therapist’s ability to attune with the sensory-motor code of the patient (mirroring), in order to slowly shape its manifestations, and be a model for the patient. In a more limited way, this is true also about auditory stimulations: Erickson used to imitate the particular inspirations preliminary to the yawn, in this way eliciting a yawn from the patient (Rossi, 1980).

A note about empathy and emotional contagion: if enriched with appropriated verbal, prosodic and gestural connotations, the expression of emotional states by the therapist can better facilitate in the patient a more effective and congruent emotional resonance. Recent studies demonstrated that hearing paraverbal, affectively connotated vocalizations activate the mirror system of the face perception, and elicit a motor preparation of the congruent oro-facial gestures in the observer: this facilitation seems to be stronger for positive emotions (Warren et al., 2006).

Lastly, we would discuss the role of imagination: the more ritualized forms of hypnotic induction (available in any classical manual of hypnotic techniques) include a wide range of imagery: examples are going down a stairway, or watching a relaxing panorama. What is important to remember here is that imagery undergoes the very same rules of the real phenomena of which it is a simulation. In order to gain a more realistic effect, the guided imagery has to obey those temporal and physical bonds underlying the real experiences. In addition, the effectiveness of guided imagery increases if the subject’s peculiar knowledge and ability are respected: the more he/she is familiar with the imagined percept, the more vivid his/her representation.
In conclusion, let us examine the peculiarity of Ericksonian psychotherapy. On one side we have analytical oriented therapies and those aimed to reach the highest levels of awareness: therapeutic changes lie in the getting in touch with unconscious material previously unavailable and transforming it in a new, conscious, declarative way. Otherwise, the change Ericksonian therapists offer to their patients deals with modifying procedural memories and the limitative schema that maintain pathological behaviours, emotions and thoughts about the self and the world of the patient.

In such a way, formal and relational aspects of the therapy, rather than its explicit, verbal contents are the primary field where the chance of a change is played. A psychotherapy becomes an Ericksonian one, thanks to its embodied nature and the use it makes of simulation. Embodiment and simulation taken together allow an easy, direct use of the neural mechanisms physiologically involved in action, perception and learning by the human being.

Ericksonian psychotherapists are firmly persuaded that the modified state of consciousness they elicit in their patients permits a facilitated access to these mechanisms, and that the effectiveness of the therapeutic change relies in its action on this same basic computational level.

Notes
1 The emotional contagion, the transmission *ipse facto* of an emotion from a person to another is attributed to different cerebral circuits (on the subject of the yawning, see Schürmann, Hesse, Stephan, Saarela, Zilles, Hari and Fink, 2005).
2 ‘Without the embodied simulation caused by the activation of the mirror systems they can not give experiential content to the other’s affective world; so, it remains accessible (whether possible) just by a theoretical-cognitive interpretation of an external event sensorial registration’ (Gallese, 2006).
3 See the cited article by Gallese et al. (2007) for a confrontation of the same dynamic during a psychoanalytical therapy, and for the description of the mirroring process in the mother–infant communication.

References
Embodied simulation and imagery at work in hypnosis


Address for correspondence:
Società Italiana di Ipnoti Dr Renzo Balugani Via Tagliamento
25, Italy 00198 Roma
Email: renzo.balugani@libero.it