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MIRROR NEURONS: A BIOLOGICAL GENESIS OF RELATIONAL

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La génesis de la complementariedad se explica desde complejos sistemas neuronales entre los que se encuentran las neuronas espejo. Esta red es mucho más que un espejo ya que, en su interacción con otras áreas cerebrales, posibilita configurar relaciones simétricas y asimétricas. Las primeras, son a partir de la mímica, incidental o intencional, que se despliegan conductas basadas en la mínima diferencia respecto de las percibidas, como también, al contagio emocional y a la empatía. Las segundas, son a partir de la inhibición de la mímica que controla las respuestas motoras de este sistema sensoriomotor. En cada caso se detallan las áreas y circuitos cerebrales involucrados. La originalidad se alcanza al entrelazar los diferentes subsistemas de acción neuronal con los tipos de relación que conforman la complementariedad. Asimismo, se afirma que todas las relaciones son complementarias desde un metanivel relacional. Además, estas conclusiones son plasmadas en la praxis de la psicoterapia sistémica, para reflexionar sobre el sustrato neurobiológico de las relaciones disfuncionales de los pacientes, como también, sobre las diferentes posiciones relacionales que puede adoptar el experto de manera estratégica.
Palabras clave: *Complementariedad, Sistema top down, Neuronas espejo, Relaciones simétricas, Vínculos asimétricos, Psicoterapia sistémica.*

The genesis of complementarity is explained based on complex neuronal systems among which are mirror neurons. This network is much more than just a mirror because, in its interaction with other brain areas, it makes it possible to configure symmetric and asymmetric relationships. Symmetric relationships are based on incidental or intentional mimicry behaviors based on the minimum difference with respect to the displayed and perceived actions, as well as emotional contagion and empathy. Asymmetric relationships, however, are based on the inhibition of mimicry, which controls the motor responses of the sensorimotor system. We present the brain areas and circuits involved in each case. In this paper, originality is achieved by interlacing the different subsystems of neuronal action with the types of relationships that make up complementarity. It is confirmed that all relationships are complementary from a relational meta-level perspective. In addition, these conclusions are shown in the optics of systemic psychotherapy, in order to reflect on the neurobiological substratum of patients' dysfunctional relationships, as well, on the different relational positions that the expert can strategically adopt.
Key words: *Complementarity, Top-down system, Mirror neurons, Symmetric relationship.*

RELATIONAL COMPLEMENTARITY

The human being carries out actions that have effects on the interlocutor in each moment and context, configuring relationships based on almost equal behavior (symmetrical relationships) and difference (asymmetric ones). In both cases, people interact in a pragmatic way to achieve this symmetry or asymmetry in a complex complementarity.

The perception-action process is the basis of our daily experience and the source of interaction with others and with the world and this process is possible thanks to mirror neurons in interaction with other neuronal subsystems (Campbell, Mehrkanoon, & Cunnington, 2018; Gallese, Fadiga, Fogassi, & Rizzolatti, 1996; Gallese, 2001; Rizzolatti & Fogassi, 2014; Umilta et al., 2001).

Initially, mirror neurons were linked to mimetic responses typically defined with emphasis on the strict motor congruence between the action observed and the action performed. Nevertheless, this strict sensorimotor congruence, known as automatic mirroring, fails to respond to the complexity of human interaction (Campbell et al, 2018; Brass, Derrfuss, & Von Cramon, 2005; Brass, Ruby & Spengler, 2009; Kilner, Paulignan, & Blakemore, 2003).

Currently, a large body of evidence shows that mirror neurons are not a simple copying mechanism based on sensorimotor congruence (Oztop, Kawato, & Arbib, 2013). These neurons act by mirroring through a dual path: the first path is automatic and acts incidentally; the second, the indirect route, acts intentionally. In this way, congruent responses may or may not respond to the intent to imitate. Moreover, the mirror action can be inhibited when it responds according to one's own demands or goals, and thus, "selfish mirror neurons" manage to configure incongruent actions with respect to the ones perceived (Campbell et al, 2018; Braver, 2012; Cross & Iacoboni, 2014; Cross, Torrisi, Losin, &, Iacoboni, 2013).

In the same vein, the automatic tendency to imitate by

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performing actions compatible with the stimulus can be strategically suppressed when it could interfere with one's own objectives. The modulation of the automatic action of mirror neurons is possible through the activation of a control system, called the "top down" system (Campbell et al., 2018).

Then, the people in interaction can imitate the perceived movements achieving an almost strict congruence. They can also develop behaviors in a seemingly opposite direction, from the deployment of movements inconsistent with those observed. This is why it is necessary to think of mirror neurons acting as a subsystem aligned with the action of other neuronal areas in order to be able to explain, as a whole, the neuronal action that underlies relational complementarity, be it symmetric or asymmetric, intentional or incidental.

To understand relational complementarity, it is necessary to immerse yourself in the theoretical developments in the field of neurosciences in general, and of mirror neurons in particular. "Relational complementarity" is understood as coordinated actions complementary to the actions of the other (Iacoboni et al., 2008; Newman-Norlund, Bosga, Meulenbroek, & Bekkering, 2008; Noordzij et al., 2010). Likewise, it can be defined as a process of perception and action that configures relationships that occur as a response to neuronal processes where mirror neurons are the main protagonists (Gallese et al., 1996; Ferrari, Gallese, Rizzolatti, & Fogassi, 2003; Ferrari & Rizzolatti, 2014).

The actions of two people can, just for didactic purposes, be understood as a behavior that originates in response to another that precedes it, and in this sense, the response behavior can be understood based on whether it is equal or unequal with respect to the first behavior. It should be noted that, at a pragmatic level, relationships are circular, so one person's behavior is the cause and effect of the other's, delineating a recursive circuit that cannot be understood only based on linearity. This is why "[...] the interventions of one and the other produce in the interlocutor response effects as a recursive set of reciprocal influences" (Ceberio, 2009, p.162).

In this direction, Bateson (1979) transferring the general theory of systems and cybernetics to the human sciences observed and described the phenomenon of the interaction of people showing the differentiation of the individual behaviors resulting from this communication process. On this basis, later, Watzlawick and his team spoke of the axioms of human communication describing in one of them, symmetrical and complementary interaction (Watzlawick, Beaving, & Jackson, 1981).

A relationship adopts, in this sense, different characteristics. On the one hand, when "[...] participants tend to equate their reciprocal behavior specifically so their interaction can be considered symmetrical" (Watzlawick et al., 1981, p.69). On the other hand, when "[...] the behavior of one of the participants complements that of the other constituting a different type of gestalt, it is called complementary" (Watzlawick et al., 1981, p.70).

It is clear that one's behaviors, in relation to those of the other, can be based on almost equality or maximum difference, observing a symmetry or an asymmetry when the actions are compared. Understanding that behaviors always complement each other, regardless of whether they are based on equality or difference, it will be appropriate to use the terms symmetric interaction and asymmetric interaction here, since the compound word "complementary relationship" could be easily confused with the complementarity in which all the types of relationships unfold from a meta-level.

To briefly exemplify the above, when one person lowers their voice and the other acts similarly, lowering their tone of voice, they establish a symmetric relationship. On the contrary, when one lowers their voice and the other elevates theirs, an asymmetric relationship is established.

Complementarity in relations, both asymmetric and symmetric, is observed in a particular assembly. For example, in the relationship of asymmetry, at first glance, two behaviors can be seen that are so opposite as the withdrawal of the body that is resting, sitting on a seat in apparent contrast to the body of the other that is stretching out upright, extending the hand to offer help. However, the two behaviors are complementary, and one is possible thanks to the other with which it is brought together.

Intervening in this complementary assembly are emotions, cognitions and actions, configuring asymmetric or symmetric relationships at a given moment of the relationship. For example, relational complementarity can develop in equality of behaviors: by sustaining the silence that equals the silence of the other, the body position that is mirrored, the emotion shared. Or it can develop in behavioral inequality: beginning to speak to break the silence, increasing body movements that are clearly distinguished from the stillness of the other and displaying a different emotional experience, such as anger when faced with sadness.

The marvel of complementarity in human relationships is possible thanks to the relational biological complexity in which mirror neurons are one of the main protagonists. It is opportune then, to carry out a brief conceptual tour and then continue, hand in hand with neuroscience, with the findings that allow us to understand the richness of human interaction.

MIRROR NEURONS: A COMPLEX NEURONAL NETWORK

The mirror neurons make up a neuronal network that is activated both when the person performs an action and when he or she observes it, in both cases the premotor cortex is activated in the same way, as if the person were carrying out the action.

Rizzolatti and his team coined this name when, in 1996, they performed an experiment in their laboratory in which they took the record of the neuronal activity of the premotor cortex of the apes that performed different actions (Gallese et al, 1996). Later, new laboratory studies showed that also by means of auditory stimuli the receiver formed a representation of the movement of the other through the activation of the mirror neuronal network (Iacoboni et al., 2008; Kohler et al., 2002; Rizzolatti & Graighero, 2004; Umilta et al., 2001).

Initially a brain region was identified in apes, equivalent in humans to Broca's area 44, an important region for the planning and selection of movements that enables the coordination of actions (Iacoboni et al., 2008; Rizzolatti & Arbib, 1998). These novel findings opened the doors to different studies regarding motor resonance (Fadiga, Foggasi, Pavesi, & Rizzolatti, 1995; Fogassi, 2005, 2010).

Today, a large amount of evidence shows that this network of mirror neurons is located in the inferior frontal gyrus (IFG), the ventral and dorsal part of the premotor cortex (vPM, dPM), the superior and inferior parietal lobule region (SPL, IPL) and the superior temporal sulcus (STS) (Molenberghs, Cunnington, & Mattingley, 2012).

Regarding the functions of this network, two important conclusions emerged showing their complexity. In the first, it was affirmed that they are the basis for understanding the actions of others through ideomotor representations and behaviors of strong similarity framed within mimicry (Iacoboni et al., 2008). In the second, when observing the intention of an incomplete behavior or action, a motor representation is produced (which gathers the observed action and the archive of other kinetically memorized ones) that completes the action (Rizzolatti & Graighero, 2004). This completed action does not necessarily have to coincide with the real completion of the interlocutor's action, since it is the product of what is stored in the recipient's hippocampus.

The first of these two functions allows us to mirror the observed behavior by means of a replica and occupies approximately two thirds of the total of the mirror neurons. It was given the name: "strictly congruent mirror neurons" (SCMN). The second function, occupying the other third of the mirror neurons, is called "broadly congruent mirror neurons" (BCMN), (Gallese et al., 1996; Iacoboni et al., 2008; Rizzolatti & Graighero, 2004).

Having mentioned that mirror neurons are set in motion when perceiving a small movement, we are clearly in the field of non-verbal communication, especially when it is expressed through gestures. So, gestures are the raw material that activate this complex mirror neuronal network.

Nonverbal language originates in periods more archaic than verbal language itself and has a strong and primary biological and instinctive component, as well as an imitative and cultural component, learned in interaction with the social context (Andolfi, 1994). It mainly comprises gestures—as well as the cadences and tonalities that are added to speech—, gross mobility: the most ostentatious or notorious movements we can see, and also a series of micro movements almost imperceptible to the awareness and these are the movements captured, so to speak, by mirror neurons (Ceberio & Rodriguez, 2017).

Facial expressions, through small muscular movements that make up sequences, are a source of motor representations by the observer through a complex prescriptive process and the coding of these expressions (Decety & Lamm, 2006; Ferrari et al., 2003; Morris et al. al., 2001). When observing a gesture, the visual stimulus is primarily created in the occipital region, in the visual cortex, integrating other functions, for example, by being encoded in the upper region of the temporal cortex and this information travels to the posterior parietal region where the movement is encoded, information that is sent to the lower part of the frontal cortex, especially to Broca's area.

The actions are deployed in micro movements, carried out in less than a second, to movements that reach a large breadth to configure facial and body gestures. They are presented as a starting point for the process of perception-action that starts from the activation of the mirror neurons of the receiver and that can culminate in imitation, in mimicry.

FROM MIMICRY TO SYMMETRIC INTERACTION: THE INCIDENTAL AND INTENTIONAL ROUTE

Without the will mediating, the human being tends to copy the actions of another because after the activation of the mirror neurons, especially the SCMN, through ideomotor representations, strong similarity behaviors are produced framed within mimicry (Iacoboni et al., 2008). Thus, this system of perception-action allows us to mirror, incidentally, the observed behaviors, producing from mimicry to emotional contagion, in both cases configuring symmetrical relationships through the almost equal behaviors.

In mimicry, together with mirror neurons, the occipital middle region and the lower part of the parietal lobe are significantly activated (Campbell et al., 2018; Brass et al., 2005; Brass et al., 2009; Kilner et al., 2003), followed by the insula and the cingulate cortex with less activation (Dosenbach, Fair, Cohen, Schlaggar, & Petersen, 2008; Harding, Yücel, Harrison, Pantelis, & Breakspear, 2015).

Although the automatic activation of mirror neurons, when they are not modulated by cognitive control systems, is shown in movements that are congruent with those observed, it is not only through the incidental route that mimicry is possible.

When there is a prior intention to imitate, for example, when thinking about copying the movement that will be observed, not only is the mirror neuronal network activated, which is alien to all intention, but also, as we indicated, the medial occipital area and lower part of the parietal lobe are significantly activated (Campbell et al., 2018; Cross & Iacoboni, 2014). This could be due to the fact that the intention to imitate requires a more refined observation process that recursively facilitates the performance of the imitation responses. It should also be noted that the activation of these brain areas is greater in intensity than when incidental mimicry is performed (Cross et al, 2013; Cross & Iacoboni, 2014). So, we can conclude that intentionality requires greater activation of the posterior areas of the cerebral cortex.

An example of intentional mimicry is observed in a person when he or she learns a new movement in a sport, for example perfecting the serve in tennis. The player sharpens their observation to then be able to imitate the motor sequence that the expert will perform. We also observe intentional mimicry in the mockery performed by a child, where the objective could be to expand the movement that his or her motor neurons captured incidentally.

In human interaction, we do not always imitate the other's behaviors by establishing symmetrical relationships, posing a question about the neurobiological substratum that underlies asymmetric relationships, which cannot be explained only based on the action of mirror neurons, but also based on a system of perception-action understood as a whole.

When we are not imitating and relational asymmetry occurs, the system known as "top down" is activated (Campbell et al., 2018; Dosenbach et al., 2008; Harding et al., 2015; Cross et al., 2013). Taking into account the complexity of human interactions, it is logical to think that the perceived movement will not always be mirrored, generating actions that are congruent with those observed. This is because it is sometimes necessary or convenient to perceive the actions of another while preparing an action different from that of the interlocutor to be carried out (Newman Norlund et al., 2008). Then, the imitation can be suppressed when the automatic behaviors could interfere with the objectives themselves (Cross & Iacoboni, 2014).

This modulation is done both incidentally and intentionally, establishing a dual route of inhibition, the direct and indirect route. In the first, the incidental or direct route, the modulation of the motor action of the mirror neurons is carried forward by the participation of the insula and the cingulate cortex (Cross et al., 2013; Cross & Iacoboni, 2014). In the second, the indirect or intentional route, mirror motor inhibition, while being performed by the mentioned areas, the emphasis is on the activity of the middle area of the cingulate cortex, adding to the frontal areas of the cortex when intentionality results in incongruous behavior. These findings were initially led by Iacoboni and Cross (2014), through studies conducted with fMRI, followed by a large body of evidence that continues to today, for example with the research recently conducted by Campbell et al. (2018).

It can then be thought that when the observer performs an incongruent action with respect to the observed behavior, be it intentional or incidental, areas of the frontal cortex including the insula and the cingulate cortex that form the "top down" control system are activated (Campbell et al. al, 2018; Dosenbach et al., 2008; Harding et al., 2015; Cross et al., 2013). An example of this is a couple dancing, practicing a new sequence of steps in which, when the female dancer performs a dorsal extension, tilting her body backwards, the male dancer in response performs a dorsal flexion, tilting his torso forward (Newman Norlund et al., 2008).

This dynamic shows the flexibility not only of the behaviors but also of the mechanisms in which the mirror neurons are involved (Miller & Cohen, 2003). In this way it becomes clear that the natural tendency to imitate can be regulated to give rise to actions that are incongruent with respect to those perceived.

In conclusion, inhibiting the imitation response of mirror neurons produces incongruent response actions to perceived behaviors, establishing asymmetric relationships as a result of the action of the dual path of cognitive control. This is possible through the control system in which the insula and the cingulate cortex are significantly activated in their anterior and middle areas.

It is clear that the neurological substrate of symmetric complementarity is based on the activation of the mirror neurons accompanied by the action of the occipital in the middle zone and the parietal in the inferior zone. These latter areas form a subsystem that is activated even more in intentional mimicry, increasing the observation and mimicry of perceived behaviors.

Also, the neurobiological basis of asymmetric complementarity is produced by the activation and subsequent inhibition of mirror neurons together with the great synaptic activity of the control system. The latter is composed of the insula and the cingulate cortex. It should be noted that greater intentionality produces greater neuronal activation in these brain areas.

On the other hand, although it exceeds this development in which the bases of symmetric and asymmetric responses are explained as a result of the observation, it is necessary to mention that in the first observation phase the SCMN and the BCMN are activated, together with other neuronal subsystems, based on the intentionality attributed to the actions, to configure response behaviors. It should be mentioned in this regard, following the findings of Rizzolatti and Fogassi (2014), that the attribution of intentionality to an action is due not only to the activation of mirror neurons, particularly the BCMN, but also to their interaction with neuronal subsystems made up, for example, by the prefrontal areas of the cortex, the hippocampus, and the superior temporal gyrus.

In this direction, the perception of actions, their attribution of intentionality, and the elaboration of response behaviors or motor actions, cannot occur without prior experience, the context in which actions are carried out, the desires, beliefs, values and expectations placed on the relationship. Thus, the doors are open to future research in relation to the interaction of these circuits to explain the different levels of understanding of behaviors, to which we add, the understanding of the behaviors chosen as a response to those perceived in a given context.

Both symmetric and asymmetric relationships respond to the objectives themselves, although the truth is that relational homeostasis establishes the tendency to repeat relational styles that are not always functional. In this case, they sustain and generate a problem, constituting dysfunctional relationships between two or more people where the recurrence of symmetry or asymmetry is part of the unsuccessful solutions attempted.

COMPLEMENTARITY, DYSFUNCTIONAL RELATIONSHIPS AND MIRROR NEURONS

Communication, and especially nonverbal language, has a high degree of complexity and therefore relational dysfunctions are a difficult problem to address from a linear perspective. In these interactions, different behaviors can be observed but they always repeat certain patterns of interaction that end up giving the same results, contrary to the expected ones.

These are dynamics that from a neurobiological point of view are produced by rigid repetition in the activation of specific neuronal circuits in specific moments and contexts. In this line, it is the mirror neurons and control systems that delineate a certain pattern of activation by building homeostatic circuits of solutions that fail, in which cognitions and emotions intervene.

For example, a behavior as tiny and almost imperceptible as a wink, a slight pout, or wrinkling the forehead, can be the trigger for a domino effect of behaviors, in which each of the pieces of the relational game collapse in an overwhelming way (Ceberio, 2009). This relational exchange is observed in the psychotherapy session when patients display behaviors that originate and—recursively—generate the problem they manifest. It should be remembered that whenever a person carries out a behavior the other responds by complementing it, either equaling it or generating an unequal behavior, placing themselves at a higher or lower level of this asymmetry.

In our research we observed—using a one-way mirror in sessions of families, couples and individuals—a repeated behavior when two people disagree: in general, they sit on the couch with their torso facing outside of the limits of the chair. This position is accompanied by a similar one in the other person, who will also increase the orientation of their body out of the relationship.

It could be hypothesized that mirror neurons in their incidental action and as such not intercepted by cognitive controls, when capturing the beginning of the body attitude, configure a similar behavior that complements the other person, constituting a relationship based on symmetry. In this case the almost equality of behaviors results in a dysfunctional relationship since reiterating these behaviors prepares the scenario for the disagreement that constitutes the manifest problem.

On the other hand, when complementarity in relationships is based on behaviors of inequality—also delineating asymmetric relationships which are dysfunctional—a sequence of repeated unequal actions could be seen. For example, in the consultation attended by two brothers denouncing the impossibility of speaking and reaching agreements, it was observed that when one of them began to gesticulate and raise their voice, the other maintained complementarity through unequal behaviors: he kept his hands still and almost rigid between his legs and began to respond in an increasingly lower tone until he was inaudible.

There would be innumerable examples that we observed in the psychotherapy session to illustrate relational complementarity, both when it is functional or dysfunctional to the growth of the system and its individuals. It is known that in the session of psychotherapy not only do the behaviors of the members of the system that attends the consultation complement each other, but also a complex complementarity develops between them and the therapist.

THE POSITION OF THE EXPERT: BETWEEN SYMMETRY AND ASYMMETRY

In the field of psychotherapy, movements in the space between communicators, gestures, tonality, and modulation of the voice, among other non-verbal elements, are sources of various interventions and interactions (Andolfi, 1994; Ceberio, 2009). One of the pioneers in this field was Milton Erickson who spontaneously observed the communication in his clients and then developed behaviors with the purpose of intervening strategically (Andolfi, 1994; Watzlawick, 1980).

The fact that mirror neurons "capture" essential elements of communication in psychotherapy allows the creation of a bond that will not only captivate the attention of the client but will also allow the therapist to penetrate the semantic universe of patients, causing modifications, in this case, in the behaviors that make up the particularities of relational complementarity (Ceberio & Watzlawick, 1998). In this sense, the therapist may intentionally "mirror" or inhibit the patient's behavior by configuring a symmetric or asymmetric relationship at different times of the session. The variants in these two relational positions will allow him or her to plan different work strategies

For example, giving free rein to natural mimicry, putting into play the sensorimotor action of the mirror neurons, allows one to speak the patient's language through movements similar to those they perform. This mirroring is the bridge to empathy, and emotional contagion, creating a relationship on an equal emotional level that allows us to build strong foundations in the therapeutic bond.

In contrast to this, the expert will adopt an asymmetric position placing him- or herself in a higher position in the relationship, a "one up" position, to guide the patient moving outside of homeostasis (static equilibrium) at the pragmatic and emotional level. From there, the therapist will be able to redefine dysfunctional reality constructions and prescribe tasks, inviting the patient to carry out new actions that are outside of the unsuccessful solutions that have already been tried.

Both symmetric and asymmetric relationships are necessary in psychotherapy. For this reason, moving intentionally and strategically between the two positions allows us to break with relational inertias that can constitute a therapeutic homeostasis that limits the change.

CONCLUSIONS: MIRROR NEURONS AS THE GENESIS OF RELATIONAL COMPLEMENTARITY

The interaction in every human system is complementary because the behaviors of the interlocutors influence each other, whether based on a behavior of equality or difference, establishing symmetrical and asymmetric interactions. It will not only be the mirror neurons, but also the neuronal processes led by them, that are responsible for the behaviors that we execute and the type of relationship that we establish.

Mirror neurons are activated automatically and ideomotor representations are generated, although the result in terms of behavior is not always mimicry. On the one hand, mimicry can occur automatically or intentionally, producing behaviors that are congruent with those of the interlocutor. In this case, the relational complementarity is based on symmetry. On the other hand, the mirroring is inhibited, automatically or intentionally, when the top down system is activated, which is mainly composed of the insula and the cingulate cortex. Here we can see the incongruence between the behavior of the sender and the receiver and a relational section based on the difference, the asymmetry.

Relational problems are constituted in repeated sequences of complementary behaviors, which, although dysfunctional, are held up as attempted solutions that failed. These behaviors develop not only in relational complementarity but also in the repetition of learned sequences of behaviors. These communicational sequences are configured based on the perception of fleeting movements produced by the activation of the mirror neurons and the neuronal subsystems with which they enter into action. Thus, the reiteration of behaviors is sustained over time, since after each perception and attribution of meaning, the relational modality is reinforced.

A proposal for psychotherapy is to guide the patients' behavior so that they configure congruent or incongruent actions through an intentional route, achieving symmetrical and asymmetric interactions. In this sense, based on the repetition of repeated behavior sequences, psychotherapy would facilitate the formation of new memories and new patterns of behavior. At the same time neuronal circuits will be established neuroplastically, and with their repetition they will be able to activate (based on the incidental route) establishing relationships that oscillate between symmetry and asymmetry.

The expert reaches the symmetry produced by incidental mimicry that allows him or her to establish a therapeutic bond based on empathy, equality, understanding, and emotional contagion. In addition, he/she can intentionally establish symmetry by strategically choosing movements of their patients that he/she will then imitate. On the other hand, the therapist, through the implementation of the intentional route can establish an asymmetric relationship where, from a one-up position they will implement strategic interventions ranging from redefinition to the prescription of tasks.

It should be noted that the interaction between the therapist and those that attend their consultancy develops under a complex neuronal interaction. This complexity is based on perception, memory and learning. They can then try new behaviors and ways of relating, "training" mirror neurons to configure actions that make it possible to increase the repertoire of responses, which results in more functional relationships.

So, the mirror neurons, the insula, and the cingulate cortex act together to allow behaviors that range from asymmetry to symmetry, intentionally or incidentally. These actions are combined in order to achieve complementary behaviors to those of the other, seeking—in the best of cases—adaptation in terms of functionality.

In short, mirror neurons are the genesis of relationships, constituting the basis of relational complementarity, both in the symmetric, or almost equal, interaction and in the asymmetric, or unequal one, which constitute the different relational modalities. The interaction between brain areas is, in part, the director of human interactions: from neuronal recursivity to relational recursivity. And vice versa?

CONFLICT OF INTERESTS

There is not conflict of interest

REFERENCE

Andolfi, M. (1994*). Terapia familiar [Family therapy].* Buenos Aires: Paidos.

Bateson, G. (1979). *Mind and nature. A necessary unity.* New York: E. P. Dutton.

Brass, M., Derrfuss, J., & Von Cramon, D.Y., (2005). The inhibition of imitative and over-learned responses: A functional double dissociation. *Neuropsychologia,* 43, 89–98.

Brass, M., Ruby, P., & Spengler, S. (2009). Inhibition of imitative behaviour and social cognition. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *364*(1528), 2359.

Braver, T. S. (2012). The variable nature of cognitive control: A dual mechanisms framework. *Trends in Cognitive Sciences*, *16*(2), 106-113.

Campbell, M. E., Mehrkanoon, S., & Cunnington, R. (2018). Intentionally not imitating: Insula cortex engaged for top-down control of action mirroring. *Neuropsychologia*, *111*, 241-251.

Ceberio, M. (2009). *Cuerpo, espacio y movimiento en psicoterapia. Uso del cuerpo del terapeuta como recurso de intervención [Body, space and movement in psychotherapy. Use of the therapist's body as an intervention resource].* Buenos Aires: Ed. Teseo.

Ceberio, M. R. & Watzlawick, P. (1998) *La construcción del universo [The construction of the universe].* Barcelona*:* Herder.

Ceberio Rodríguez, M., & Rodríguez, S. E. (2017). Expresiones faciales y contexto. Reglas sociales que condicionan la espontaneidad de la expresión facial de las emociones [Facial expressions and context. Social rules that condition the spontaneity of facial expression of emotions]. *Revista Mexicana de Investigación en Psicología,* 9(1), 55-72.

Cross, K. A., & Iacoboni, M. (2014). To imitate or not: Avoiding imitation involves preparatory inhibition of motor resonance. *Neuroimage*, *91*, 228-236.

Cross, K. A., Torrisi, S., Losin, E. A. R., & Iacoboni, M. (2013). Controlling automatic imitative tendencies: Interactions between mirror neuron and cognitive control systems. *Neuroimage*, *83*, 493-504.

Decety, J., & Lamm, C. (2006). Human empathy through the lens of social neuroscience. *The Scientific World Journal*, *6*, 1146-1163.

Dosenbach, N. U., Fair, D. A., Cohen, A. L., Schlaggar, B. L., & Petersen, S. E. (2008). A dual-networks architecture of top-down control. *Trends in Cognitive Sciences*, *12*(3), 99-105.

Fadiga, L., Fogassi, L., Pavesi, G., & Rizzolatti, G. (1995). Motor facilitation during action observation: A magnetic stimulation study. *Journal of Neurophysiology*, *73*(6), 2608-2611.

Ferrari, P. F., Gallese, V., Rizzolatti, G., & Fogassi, L. (2003). Mirror neurons responding to the observation of ingestive and communicative mouth actions in the monkey ventral premotor cortex. *European Journal of Neuroscience*, *17*(8), 1703-1714.

Fogassi, L., Ferrari, P. F., Gesierich, B., Rozzi, S., Chersi, F., & Rizzolatti, G. (2005). Parietal lobe: From action organization to intention understanding. *Science*, *308*(5722), 662-667.

Fogassi, L. (2011). The mirror neuron system: How cognitive functions emerge from motor organization. *Journal of Economic Behavior & Organization*, *77*(1), 66-75.

Gallese, V., Fadiga, L., Fogassi, L., & Rizzolatti, G. (1996). Action recognition in the premotor cortex. *Brain*, *119*(2), 593-609

Gallese, V. (2001). The 'shared manifold' hypothesis. From mirror neurons to empathy. *Journal of Consciousness Studies*, *8*(5-6), 33-50.

Harding, I. H., Yücel, M., Harrison, B. J., Pantelis, C., & Breakspear, M. (2015). Effective connectivity within the frontoparietal control network differentiates cognitive control and working memory. *Neuroimage*, *106*, 144-153.

Iacoboni, M., Woods, R. P., Brass, M., Bekkering, H., Mazziotta, J. C., & Rizzolatti, G. (1999). Cortical mechanisms of human imitation. *Science*, *286*(5449), 2526-2528.

Kilner, J. M., Paulignan, Y., & Blakemore, S. J. (2003). An interference effect of observed biological movement on action. *Current Biology*, *13*(6), 522-525.

Miller, E. K., & Cohen, J. D. (2001). An integrative theory of prefrontal cortex function. *Annual Review of Neuroscience*, *24*(1), 167-202.

Molenberghs, P., Cunnington, R., & Mattingley, J. B. (2012). Brain regions with mirror properties: A meta-analysis of 125 human fMRI studies. *Neuroscience & Biobehavioral Reviews*, *36*(1), 341-349.

Morris, J. S., Friston, K. J., Büchel, C., Frith, C. D., Young, A. W., Calder, A. J., & Dolan, R. J. (1998). A neuromodulatory role for the human amygdala in processing emotional facial expressions. *Brain: A Journal of Neurology*, *121*(1), 47-57.

Newman-Norlund, R. D., Bosga, J., Meulenbroek, R. G., & Bekkering, H. (2008). Anatomical substrates of cooperative joint-action in a continuous motor task: virtual lifting and balancing. *Neuroimage*, *41*(1), 169-177.

Noordzij, M. L., Newman-Norlund, S. E., De Ruiter, J. P., Hagoort, P., Levinson, S. C., & Toni, I. (2010). Neural correlates of intentional communication. *Frontiers in Neuroscience*, *4*: 188.

Oztop, E., Kawato, M., & Arbib, M. A. (2013). Mirror neurons: functions, mechanisms and models. *Neuroscience Letters*, *540*, 43-55.

Rizzolatti, G., & Arbib, M. A. (1998). Language within our grasp. *Trends in Neurosciences*, *21*(5), 188-194.

Rizzolatti, G., & Craighero, L. (2004). The mirror-neuron system. *Annual Review of Neuroscience*, *27*, 169-192.

Rizzolatti, G., & Fogassi, L. (2014). The mirror mechanism: recent findings and perspectives. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *369*(1644): 20130420

Umilta, M. A., Kohler, E., Gallese, V., Fogassi, L., Fadiga, L., Keysers, C., & Rizzolatti, G. (2001). I know what you are doing: A neurophysiological study. *Neuron*, *31*(1), 155-165.

Watzlawick, P. (1980). *El lenguaje del cambio [The language of change]*. Barcelona: Herder.

Watzlawick, P., Beaving J., & Jackson, D. (1981). *Teoría de la comunicación humana [Theory of human communication]*. Barcelona: Herder.