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Some reflections on the new technologies, the *Self* and the *Otherness*

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Abstract. In this paper, some reflections, basically having a philosophical and socio-psychological nature and concerning the impact of the new technologies on human society, are collected together, basing the discussion on the two central social psychology constructs of Otherness and Self. In Part I, we argue on human-computer interaction in relation to the concept of *Otherness*, while in Part II some socio-psychological aspects of web activities are briefly outlined in relation to the notion of *Self*.

Part I

1. Introduction

Social and human sciences, above all anthropology, social psychology and sociology, all agree in considering the interpersonal relations as founding human personality. But, with the coming of ever more invasive and capillary technology, new form of interrelations have giving rise, which are quite different, in many respects, from the typical interrelations of the usual type human-human, which is subsumed in the wider notion of *otherness* or *alterity*. Nevertheless, the rising of new technologies has however modified a part of this notion of *otherness* or *alterity*, that is to say, has entailed an extension of it, if one takes into account the new human-computer interaction which, in a certain sense, has surely changed the nature and the number of the possible interpersonal relationships.

The even more pervasive diffusion of media, has surely repercussions on social influence and this fact, on its turn, exerts modifications on the individual traits of character of every single human. The influence of media seems even to have effects similar to those exerted by people groups, according to a process almost similar to that described by sociology¹ but that builds up, so to say, a digital reality quite different from the one just socially shared as this latter turns out just to be seen in a fashion quite distorted from how it really is. The new media have certainly changed structurally the social interaction and its field of action, above all lowering the capability to may identify spatially the interlocutor with whom one has established a digital communication, so interpersonal relation is depauperated in the meaning we assign to such a relation when it is digital. Analogously, the concept of *presence* is radically changed with the rising of the new media of communication.

This justifies the use of a new proper denomination for this new way of communication, just said to be communication through media, which has its own features that distinguishes it from the other ways of communication, providing it of typical meanings, symbols and rules which are quite fluid, not rigid, rapidly shared by all the members of the given virtual groups involved in this type of communications which therefore now assumes the typical characteristics of a real social process, not only as a simple communication way, hence inherent a certain social context, equipped with a given symbolic order which is not fixed or rigid, but instead quite fluid and continuously changeable but immediately acquired by all the group member just thanks to the rapidity with which information circulates among the group interested by this virtual communication process, without the rigid constraint of the physical presence of the interlocutors.

Anyway, as psychological aspects of every human being are closely depending on the various interpersonal relations with which such a social actor is involved, this should be valid too for these new communications ways, so it is primary therefore to study this latter question from social psychology standpoint. In particular, studies have pointed out above all the sense of freedom, irresponsibility and deindividualization, which instead are usually not present in a real material presence. At the same time, other features of the personality of every member of the group, might

be put in evidence, just for the lowering of those rigid, social rules and schemas which generally exert an inhibition. Moreover, social differences may be attenuated, so giving major possibility of expression to all the group members. On the other hand, even in these communication modalities, social classes and membership categories are not fully eliminated but still persist although in other forms of expression².

From this, it follows that the concept of *Otherness* (or *Alterity*), generally meant as what goes beyond individuality, may undergo to changes in relation to these new modalities of communication. Therefore, in the next sections, after having previously given a synthetic but complete outline of the notion of *Otherness*, to be meant as a central one in the study of every human relationship, we then discuss what might be a neural basis – i.e., *mirror neurons* system – for this concept and, in this framework, what changes may arise in the case of these new modalities of digital communication provided by media, also calling into question *mirror neurons networks* just meant as a new type of neural networks simulating motor actions. In particular, since mirror neurons are closely involved in the rising of ethic sense and empathy, above all in the real (embodied) presence of the *Other*, we may argue on the possibility to implement the latter dimensions (i.e., ethics and empathy) in these new types of communications which, from certain standpoints, turn out to be just lacking of these features.

2. Background

On the basis of the logical models of 19th-century positivism, the psycho-social sciences started to interpret psychological phenomena through a pattern centred on the principle of linear *causality*. Along the route of the next 20th-century, a new paradigm gradually arose, this time centred not longer on the principle of causality but rather upon the *interactive-relational principle*, based on the new concepts of *interaction* and *relation* among human beings, whose study is necessarily interdisciplinary³.

The history of social psychology shows up a crucial turning point when, in the basic axis of the dual pair *Self-Other* – in which every psychological phenomenon was sketched up – the attention was shifted from the pole of the *Self* (subjectivity) toward the opposite pole of the *Other*, so opening a new direction for social psychology⁴. From this moment onwards, the main theme of social psychology is how thoughts, feelings and behaviours of a human being are influenced by the objective, implicit or simply imagined presence of others⁵. This gets on well with the main assumption that human being is basically a relational subject⁶ who cannot do without being into relation with other humans⁷.

The basic dual pair *Self-Other* synthesizes either the individuality (or subjectivity) of each human being – in the pole of *Self* – and her or his relation nature – in the pole of *Other*. The dual elements of this pair are one inseparable of each other and in dialectic relation⁸: for instance, the *Self* cannot arise without individual has to do, in some way, with others⁹, so the social components with which every individual gets into contact with others are fundamental to determine the personality of each human being¹⁰.

Indeed, all the relations with the *Other* are just structurally founding for the psychological construction of the reality¹¹, so that social dimension with the related relations established by each individual, play a primary role in building up her or his cognitive processes and her or his personal identity¹². This central task played by social dimensions of the life of every human being has been besides highlighted too by sociology, which has pointed out on the coercive role exerted by social

institutions on human actions, hence moulding the psyche of people, their subjectivity (so that, in this case, the society is considered as a subjective reality), which, collectively considered, give rise to a society also considered as a objective reality¹³.

On the other hand, the notion of *Other* is already present in the history of philosophy as well as in the history of anthropology as it is an its founding notion¹⁴. As regard philosophy, then, the notion of *Other* is closely related with that of *Otherness* or *Alterity*¹⁵, which has a proper philosophical origin and its early own roots in the deepest meanderings of history of philosophy. The *Other* is furthermore a pivotal concept of psychoanalysis, above all after the work of Jacques Lacan¹⁶, which however started from philosophy. Therefore, it seems that in the philosophical context should be searched the early roots of the concept of *Other* which nevertheless is much wider than the concept of *Otherness*, which is only one out of the many meanings that the notion of *Other* has in philosophy¹⁷. So that, we now provide a synoptic view of the concept of *Otherness* or *Alterity*, as meant by philosophy, as it is that meaning of *Other* which is the nearest to it, and that enables us to relate it to the argument of the human-computer interaction, as we shall see in the next section.

To be precise, *Otherness* (or *Alterity*) refers to the *Other*, in the sense, to be other, or to put as other. It is a more restricted concept than that of diversity, but more extended than that of difference (so we have formally the inclusion chain $difference \subset alterity \subset diversity$). This last chain is due to Aristotle, in whom thought, as revisited by Medieval philosophy, the term alterity is used in opposition either on the one hand to *identity*, so alterity is also meant as synonymous of diversity, on the other hand to *unity*, so alterity is also meant as synonymous of *multiplicity*. In the modern philosophy, instead, alterity is in reference to all the reality which does not identify with the subject (and in this sense, alterity is a concept much nearer to the one of the many meanings of the *Other*), and that, therefore, identifies what is said to be *person*. Therefore, broadly speaking, alterity refers to that is other from what is given: as unity, as identical, as subject, and as person. Thus, respectively, alterity: with respect to what is given as one, refers to multiplicity (*ontological alterity*); with respect to the identical, refers to the opposite (*logic alterity*); with respect to the subject, refers to the object (*epistemological alterity*); and finally with respect to a person, refers to the Other (*transcendental alterity*). So, alterity (or otherness) is a key term of philosophical thought in that it constitutively refers always to establishing however relationships among the various, possible terms of the being¹⁸.

3. Possible future research directions

Recent discovery of mirror neurons opened insightful new directions and perspectives in many disciplines. Among these, surely they have provided a neurological basis just for the interpersonal relations which characterize human species, so mirror neurons have surely played a central role in social sciences and neuropsychology. Mirror neurons are a system of neurons closely related to those of brain cortex deputed to movements and actions (mainly, parietal area) and perception. Furthermore, it seems that mirror neurons system is also strictly connected with the intentionality and meaning of movements, not only to the simply observation of the mechanical action, so that this system elaborates both execution of a movement and the related information which is carried out by this action.

Mirror neurons work mainly at automatic level, so acquisition of mechanical articulation and execution's information are retrieved at unaware level, hence automatically simulated. Furthermore, they are able to infer the meaning and aims of an observed action also when this last is only

partially observable directly or is not completely performed. Mirror neurons have been also associated with the rising and evolution of human language, coming from the communicative meaning undergoing motor actions and gestures in higher primates, to which emotional counterparts are also associated. This latter hypothesis gets on well with the so-called gestural-motor origin of human language, also correlated to the main fact that each time a human being sees the actions of another human, her or his mirror neurons system activates, i.e., resonates¹⁹ with the mirror neurons system of the observed human, so that an emphatic relations establishes among them²⁰.

As already said in Section 1, recently new neural network types have been proposed just based on mirror neurons to simulate their functioning and aims applied to robotics and cognitive informatics²¹, so it seems not inappropriate to think to implement computationally emotive-affect dimensions just by means of such a new type of neural networks based on running of mirror neurons systems which are, as has been said above, related with these psychological dimensions which, in turn, are closely related to social relationships upon which relies the most typical feature of human beings.

On the other hand, behaviour recognition and generation processes have one each other a close relationship in the human brain, so recent research has shown that human brain understand the meaning of behaviour and create symbols through a co-development of recognition and generation processes²². In (Inamura et al., 2002), it has been proposed a new method just for the integration of behaviour patterns and symbols using associative memory in order to realize or achieve the above co-development processing into a model where either behaviour recognition and generation process are based on a mutual or reciprocal dynamics. The validity of this model has been confirmed, together the feasibility of the method, on humanoid simulator.

The research on humanoid robots has had a long route along which has accumulated a lot of literature. The target of early research efforts was mostly turned to the dynamics, motion planning, and control of biped walking, and although it has not yet reached the level of complete solution with full of liability and adaptability, the hardware technology has been notwithstanding that established for building the autonomous humanoids. The focus of humanoid research has been then extended to the research on human-like intelligence, among which is placeable mirror neuron system, found in the frontal lobes of humans and primates. Mirror neurons run not only when an individual observes a specific behaviour of the others, but also when he or she intends to personally perform the same behaviour. Furthermore, mirror neurons are located in neither motor area nor sensory area but rather in the Broca's area which has close relationships with language field. This implies that either the behaviour perception and the behaviour generation process might be integrated as an organization which has a close relationship with symbolic function (upon which relies also language development).

In the context of cognitive science, then, the hypothesis of mimesis has also been taken into consideration. Mimesis is a primitive form of communicative intelligence closely based on imitation, upon which, in turn, learning relies, so allowing understanding the others' behaviours and the construction of self-behaviours. Especially, the primates which cannot eliciting speech languages can yet perform social communication forms through behaviour imitation. On the other hand, the anthropologist Terrence W. Deacon²³ has put forward the hypothesis that the brain of the human being has coevolved with symbol communication, in other words, humans' high-degree intelligence couldn't be realized without symbolic function. As a result of this, it follows that the

origin of human intelligence springs out from the capability of learning by imitation as a combination of either behaviour perception and generation.

Inamura and co-workers (2002) believe that the theory of integration between behaviour perception and generation leads to the breakthrough for the synthesis theory of artificial intelligence, like an embodiment of humanoids, symbol grounding problems, and so on. But, although many humanoid researches treated the relation of learning by imitation with intelligence, a few outcomes have yet been got on the connection of behaviour cognition with behaviour performance. In this regard, following this route, Inamura and co-workers have proposed an integration model for behaviour perception and generation using Hidden Markov Models, although the related mathematical background of this system is quite far from the concept of mirror neurons system.

Anyway, the work of Inamura and co-workers (2002) has surely provided a mathematical framework of mimesis as a computational model of mirror neurons, based on associative memory using recurrent neural networks, remarking either advantages and issues of time series data recognition and generation just based on associative memory. They have also proposed a novel extension method for the associative memory which enables the system to memorize much more data and try to decrease the calculation time, also describing and explaining the mechanisms of memorization, generation and recognition, with the support of experiments on humanoid simulator, hence proposing several improvements in order to may create a suitable computational model of mirror neurons which integrates behaviour recognition, generation and memorization, at the same time confirming the feasibility of the method through actually implemented framework and experiments on a virtual humanoid.

Mirror neurons systems, which have been found in humans and even in songbirds as well as in the macaque, seem to respond to both the observation and the performance of the same action. It has been suggested that their matching response properties have evolved as a phylogenetic adaptation for action understanding, and, alternatively, these properties may be arisen through sensorimotor experiences. Other recent researches suggest that mirror neuron responses may be modified through experience, and that sensorimotor experiences are the critical type of experience for producing mirror neuron responses²⁴.

When an individual observes other people in action, reliably a network of brain regions comprehending human premotor, inferior parietal and middle temporal cortex, is activated. In particular, frontal and parietal components of this network are those containing most of mirror neurons. The function of the human mirror neuron system (in short, MNS) has been deemed to mainly concern comprehension and prediction of other people's actions. This interpretation assumes that the participant is primarily a passive observer (as often is, for example, the case during fMRI) and ignores two key factors. First, in real life people do not just observe passively but rather respond and engage in social interactions. Second, the MNS is mainly embedded within, and intimately linked to, the motor system. In this regard, Hamilton (2013) suggests that an important purpose of the MNS is not to understand or even to predict, but rather to respond, in real-time and in a socially appropriate fashion, to the actions of others²⁵. Further, a recent TMS study provides exquisite evidence that MNS engagement is driven by social reciprocity (Sartori et al., 2012).

Behavioural evidence for a human MNS is largely derived from the studies on automatic imitation achieved by Cecilia Heyes (2011). Automatic imitation is nothing but a kind of stimulus-response compatibility effect in which the topographical features of task-irrelevant action stimuli facilitate

similar, as well as interfere with dissimilar, responses. Behavioural, neurophysiological and neuroimaging research on automatic imitation, has revealed that automatic imitation is a covert form of imitation, distinct from spatial compatibility, as well as it has indicated that, although automatic imitation is subjected to input modulation by attentional processes, and output modulation by inhibitory processes, it is yet mediated by learned, long-term sensorimotor associations that cannot be altered directly by intentional processes. Automatic imitation provides an important tool for the investigation of the mirror neuron system, motor mimicry, and complex forms of imitation.

Neurophysiology has revealed the properties of individual mirror neurons in the macaque while brain imaging reveals the presence of mirror systems (not individual neurons) in the human being. Current conceptual models attribute high level functions such as action understanding, imitation, and language to mirror neurons, and only the first of these three functions is well-developed in monkeys and primates. On the other hand, distinguishing conceptual models on mirror neuron function from more detailed computational models, in (Oztop et al., 2006) it is assessed the strengths and weaknesses of current computational models in addressing the data and speculations on mirror neurons (macaque) and mirror systems (humans). Conceptual models often overlook the computational requirements for posited functions, while too many computational models adopt the erroneous hypothesis that mirror neurons are interchangeable with imitation ability. So, in (Oztop et al., 2006), it is pointed out the gap between conceptual and computational models and underlines the research effort required from both sides to reduce this gap.

4. Conclusions

In this contribution, we have first discussed the basic relational nature of human being upon which relies the construct of *Otherness* (or *Alterity*), hence we have briefly outlined the close relationships of it with the neurobiological functioning of mirror neuron systems (MNS), which provide a neurological correlate to this construct. On the other hand, affects system of human being has its deep neurological correlates just supported by MNS, so we have simply highlighted what fundamental role might be played by the latter, if sufficiently implemented computationally (for instance, through certain neural networks), in simulating *affects* in humanoid (i.e., another typical feature of human being), hence in trying to build up a kind of kind of *virtual Otherness* thanks to which make human beings even more near or similar to robots or humanoids. In conclusion, we simply point out the need to look at mirror neurons systems (MNS) deeper if one wish to try to take into account typical affect dimensions of every human being for humanoids.

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Key terms and definitions

Mirror Neurons, Cognitive Informatics, Emotions, Affects, Feelings, Empathy, Otherness, Neural Networks

Endnotes for Part I

¹ See (Berger & Luckmann, 1966).

² See (Contarello & Mazzara 2002, Cap. VI) and (Anolli 2010, Cap. IX).

³ See (Scabini & Iafrate 2003, pp. 9-10). See also (Hinde, 1981) and (Contarello & Mazzara, 2002).

⁴ See (Emiliani & Zani 1998, Cap. 1, § 1.1).

⁵ See (Hogg & Vaughan 2016, Cap. 1, § 1.1).

⁶ See (Donati, 2004; 2009).

⁷ See (Moghaddam 2002, Cap. 1).

⁸ See (Hinde, 1997).

⁹ See (Caprara & Gennaro 1994, Capp. X, XI), (Brown 2000, Cap. 8), (Arcuri & Castelli 2000, Cap. 5), (Palmonari et al. 2002, Cap. IV), (Moghaddam 2002, Cap. 3), (Pfanner 2007, § 3), (Fiske & Taylor 2009, Cap. 5), (Northoff et al., 2014) and (Hogg & Vaughan 2016, Cap. 3). See also (Arcuri, 1985), (Palmonari, 1989), (Boca et al., 2003), (Trisciuzzi & Billi, 2004), (Aronson et al., 2006) and (Attili, 2011).

¹⁰ See references of the previous footnote.

¹¹ See (Amerio, 1995).

¹² See (Scabini & Iafrate 2003, pp. 9-10) and (Galanti 2012, Cap. 3, § 3.2).

¹³ See (Izzo 1991, Vol. III, Cap. IV, § 9), (Crespi 2002a, Cap. 2; 2002b, Cap. 10), (Cuche, 2006), (Sciolla 2012, Capp. V, VI). See also (Iurato, 2015b).

¹⁴ See (Tullio-Altan, 1971; 1983), (Remotti, 1996; 2000), (Fabietti & Remotti, 1997), (Rivière, 1998), (Fabietti, 2004), (Aime, 2008) and (Dei, 2016).

¹⁵ See, above all, (Costa, 2011).

¹⁶ See (Laplanche, 1998).

¹⁷ See (Abbagnano, 2013).

¹⁸ See (Iurato, 2015a).

¹⁹ In the sense that, an observed action belonging to the set of possible (also for analogy) movements of human being, induces an automatic (or implicit) activation of the cerebral zone

corresponding to such an action. This explains why mirror neurons are so important in studying human social behaviour, and play a considerable role in the social learning by imitation, hence they provide a neural correlate for the simulation mechanism, said to be an *embodied simulation*.

²⁰ For mirror neurons and their implications in emotions and feelings, see (Cozolino, 2006), (Rizzolatti & Sinigaglia, 2008), (Siegel, 2012), (Ammaniti & Gallese, 2014), (Ammaniti, 2014), (Ginot, 2015) and (Craighero, 2017).

²¹ See (Wiedermann, 2003), (Wermter et al., 2009) and (Rebrová et al., 2013).

²² See (Inamura et al., 2002), which we herein follow closely.

²³ See (Deacon, 1997).

²⁴ See (Catmur, 2013).

²⁵ See (Hamilton, 2013).

Part II

1. Introduction

Mirror neurons have been discovered in 1990s and play a crucial role in establishing the close relationships between *execution* and *observation* of human actions. So, the neural systems of mirror neurons allow to put into relationship external actions performed by an another human being with the own internal set of actions owned by the observatory, or else, the simply observation of an external action executed by a human being activates the same neural circuits simulating its execution. Mirror neurons are neurologically placed mainly into the pre-motor cortex area as well as into parietal cortex area, and are also related with auditory cortex area; furthermore, such neurons are involved in communicative relations and for understanding the intention of an action. They are also involved in language processes. Therefore, mirror neurons systems are also closely related with *intersubjectivity* functions¹, like social cognition and empathy, so that mirror neurons just form the neurological basis for the *alterity* or *otherness*, which characterizes, by means of resonance mechanisms, human beings. Hence, mirror neurons enable simulations of internal states as well as imitations of the behaviours of others².

Amongst other things, one of the most remarkable and outstanding outcomes of the discovery and the study of mirror neurons systems, also in accordance with the pioneering results obtained by Gerald M. Edelman and Ant3nio Dam3sio³, is the close relationship existing between (personal) identity and mirror neurons systems⁴ as well as among affects and mirror neurons systems⁵, hence between cognition and mirror neurons systems, when human beings live usually, and mainly, in a three-dimensional real environmental space where otherness explicates. But we ask how all this does change when human beings interact in a virtual space. In trying to do this, we shall consider the *Self*, which is the wider psychological construct comprising most of the other psychological components of human psyche.

Indeed, as already Kant had pointed out⁶, the three-dimensionality of usual space-time environment is an a priori needed presupposition for the knowledge, which is seriously prejudiced by social media. Moreover, just this virtuality of social media world makes very difficult the subsistence of the bases of the so-called *embodied knowledge* and *cognition*⁷. So, the body with its real presence influences considerably the cognition of every human being, so that it is clear that its absence, like in the virtual world, has deep and important repercussions for the cognitive capabilities of every human being and, in general, for many other aspects of her/his personality⁸.

In what follows, we mainly outline, although briefly, the main concepts of the psychology of Self, being, this last, the chief psychological construct that comprehends and unifies the most of the psychic components of human psyche, then, we shall try to put into relations the Self with the new, fundamental neurological discovery of mirror neurons, highlighting the crucial importance of three-dimensionality for the right functioning of the systems of these new type of neurons, hence the importance of real human contact as they work just rightly, and what consequences are instead entailed by virtual worlds just in regard to these systems of new neurons and their close relations with human psyche and its deep relational nature (otherness).

2. Background

In the psychological context, the *Self* is a general construct whose complexity is due to the many components and related meanings which may be assigned to it through the as many numerous perspectives from which it may be approached and defined. Anyway, almost all the possible definitions of *Self*, which may be assigned to this construct, agree in seeing in it the basic nucleus of personal identity of every human being, which on the one hand refers to impersonal and objective reality while, on the other hand, refers to the subjective reality and the personal life experience, that is, to the awareness of the own inner world.

The psychological construct of *Self* comes from philosophy and the concepts of soul and spirit, to denote the alterity of these latter from the human body. It has been William James to retake this philosophical notion, and considers it as denoting that permanent nucleus of personality which remains invariant with respect to somatic and psychic changes which characterize individually every human being. From this first use of the concept of *Self* by James, psychoanalysis has gradually used this construct in regard to the personality and its main components and aspects, above all narcissism and, in general, personal identity and subjectivity.

The construct of *Self* seems to refer to a basic structural, cohesive principle of the whole psychic system which harmonizes and unifies its main components; from this perspective, which is also retaken by analytical psychology of Carl G. Jung, the *Self* then becomes a natural and spontaneous psychic agency which is often considered as overlapped to self-consciousness. According to Jung, the *Self* is just the place of the psychic totality in which all the psychic affective complexes are harmonically tied together and where all the other psychic personal and transpersonal components, conscious and unconscious, are then regrouped toward the reaching of final individuation process which is the highest level of human psyche, where human being reaches as much highest ethical and moral levels. In the history of psychology, however, the construct of *Self* has been seen from many, various and different perspectives which have led accordingly to as many definitions and interpretations, above all falling into social psychology domain.

On the other hand, from a more proper psychoanalytic perspective, the virtuality of world wide web and its media allows to every user of this net to have a wider possibility to alter own identity with a loss of certainty on the real identity of the user, so being able to hidden own identity easier with the consequence to make more free and less inhibited the own, various bad narcissistic tendencies (like omnipotence, egoism, exhibitionism, perversions, mythomanias, etc.) which – being Super-Ego's barriers quite slack – might go often to detriment of the collective interests and of social morality and ethics, with the possibility to reach easier illegality. All this entails a passive behaviour and development just of those components of *Self* strictly involved in the psychological

processes establishing relations among humans, hence, in particular, with a consequent inactivation of affective psychic components⁹.

3. Possible future research directions

So, as mirror neurons systems play a truly fundamental role in establishing personality, to be precise, its relational aspects (*alterity* or *otherness*), the final question we point out is how this main function changes or modifies with the even more increasing pervasiveness use of social media, hence with the increasing interaction with a not well-known, virtual two-dimensional environment rather than operating within a more known, real, usual three dimensional environment. These changes obviously will have remarkable repercussions on the personality of each human being whose life is, by now, considerably spent into this virtual environment even to may consider a specific, new psychic component of human psyche, hence a new component of the *Self*, having directly to do with such a new virtual reality.

4. Conclusions

We have outlined a brief but complete discussion ranging from mirror neurons systems to the psychology of Self and embodied knowledge in the dependence on the possible life environments, with particular attention to the real one on the one hand and the virtual one on the other hand. The Self is the main psychological construct inherent the personality of every human being, which comprehends the main components of human psyche, above all those related to relationships (*otherness*) and affects (*empathy*), which, in turn, are closely related with mirror neurons systems. These latter, then, neurologically work thanks to motricity circuits, hence are fundamentally based on three-dimensionality of space and time of the usual, real life environment, dimensions which are lost or, however, impaired in a virtual environment like that spanned by social media. So, we suppose that the latter, in a certain sense, may compromise or prejudice the basic empathic dimension of human relationships, so fundamental and crucial for good, pacific, civil and cooperative relations among humans¹⁰.

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Key terms and definition for Part II

Self, Personal Identity, Narcissism, Social Media, WWB, Mirror Neurons, Human Psyche, Virtual World

Endnotes for Part II

- ¹ See (Cozolino, 2006), (Rizzolatti & Sinigaglia, 2008), (Siegel, 2012), (Hamilton, 2013), (Ammaniti & Gallese, 2014), (Ammaniti, 2014), (Gazzaniga et al., 2014), (Ginot, 2015) and (Craighero, 2017). See also references of next endnote ⁹.
- ² See (Iurato, 2019).
- ³ See (Damasio, 1994, 1999, 2003, 2010) and (Edelman, 2006).
- ⁴ See (Gallese, 2005) and (Rizzolatti & Sinigaglia, 2008).
- ⁵ See references of the previous endnote ¹.
- ⁶ See (Vattimo et al., 1993), (Abbagnano, 2013) and (Galimberti, 2018).
- ⁷ See (Varela et al., 1992) and (Lakoff & Nuñez, 2001).
- ⁸ See (Maffei, 2014, 2016, 2018), above all (Maffei, 2016) for the negative consequences of virtual world.
- ⁹ See (Berger & Luckmann, 1966), (Hinde, 1979, 1987), (Moscovici, 1984, 1994), (Gergen & Gergen, 1986), (Caprara & Gennaro, 1994), (Amerio, 1995), (Arcuri, 1995), (Deacon, 1997), (Gulotta & Boi, 1997), (Fabiatti & Remotti, 1997), (Emiliani & Zani, 1996), (Moghaddam, 1998), (Speltini & Palmonari, 1999), (Arcuri & Castelli, 2000), (Brown, 2000), (D'Urso & Trentin, 2001), (Contarello & Mazzara, 2002), (Crespi, 2002a,b), (Palmonari et al., 2002), (Zamperini & Testoni, 2002), (Scabini & Iafrate, 2003), (Boca et al., 2003), (Gennaro, 2004), (Fabiatti, 2004), (Trisciuzzi & Billi, 2004), (Donati, 2004, 2009), (Cucho, 2004), (Aronson et al., 2006), (Molinari, 2007), (Fiske & Taylor, 2008), (Barone & Bacchini, 2009), (Anolli, 2010), (Hogh & Vaughan, 2010), (Attili, 2011), (Costa, 2011), (Galanti, 2012), (Calamari, 2013), (Myers & Twenge, 2013), (Northoff et al., 2014) and (Iurato, 2015, 2019).
- ¹⁰ See references of the previous endnote.