Reciprocity with the primary caregivers drives individual adaptive abilities towards the development of the most useful Personal Meaning Organization (P.M.O.) with respect to one’s developmental environment. Predictable and invariable caregiver behavior allows an inward focus and a physical view of reciprocity: when reciprocity is high, an inward “controller” P.M.O. develops; when it is low, an inward “detached” P.M.O. is generated. The “controller” P.M.O. is focused on the need of protection/exploration; the “detached” P.M.O. is focused on the need of expression during isolation. Non-predictable and variable caregiver behavior allows an outward focus and a semantic view of reciprocity: when reciprocity is high, an outward “contextualized” P.M.O. develops; when it is low, an outward “principle-oriented” P.M.O. is generated. The “contextualized” P.M.O. reads the changes of the relational environment one by one; the “principle-oriented” P.M.O. is centered on the classification of antithetical aspects of reality. In psychotherapy, by focusing on the P.M.O., it is possible to recognize and promote individual adaptive resources, thus improving skills regarding the control of perturbing emotions and the development of new and more flexible behavior strategies. Thanks to modern biotechnology (i.e. in the field of functional neuroimaging and genetic single nucleotide polymorphism) a scientific live study of P.M.O. is possible, providing biological correlates to the P.M.O. post-rationalist paradigm.

**Key words:** post-rationalist cognitive therapy, Personal Meaning Organizations (P.M.O.), functional NeuroImaging (fNI), Single Nucleotide Polymorphism (SNP).

**Introduction**

**The personal meaning organization (P.M.O.) paradigm**

Among constructivist approaches to psychotherapy, the post-rationalist paradigm constitutes one of the most innovative ones, proposing a useful epistemological theory of mental functioning with successful application in clinical practice. As known, this model was conceptualized by Vittorio F. Guidano in the 1980s (Guidano & Liotti, 1983; Guidano, 1987, 1991; Nardi & Pannelli, 2001).
As Guidano and Liotti wrote, the post-rationalist approach originated «from the perception of a discrepancy between the promising results of a psychotherapeutic practice making wide use of behavior therapy techniques and the limited explicative power of the learning principles forming the theoretical foundation of those techniques» (Guidano & Liotti, 1983). The major points of Guidano’s theory are: a) the importance of the subject’s way of arranging and self-referring immediate experience to develop a self-identity and the lack of centrality and impartiality on the part of the therapist-observer, and b) the therapist as a “strategically oriented perturber”, helping the subject to reach a more adaptive mental functioning; however, this result can only be obtained within the limits of the invariant modalities generated by the subject during his/her development. According to Guidano, there are “core organizing processes” on the basis of every human psychological – both physiological and pathological – experience (1987). Knowledge of the “self system” is central in clinical practice; it deeply influences both the attitude, assessment procedures and self-observation methods of the therapist and the structure and dynamics of therapeutic change; furthermore, it allows a subject-centered reconstruction of immediate experiencing, thus modifying dysfunctional patterns of self-perception and achieving substantive and lasting changes. When constructing the therapeutic setting, centered on the subjective way of self-referring experience, Guidano proposed the “moviola setting”, which consists in instructing clients to focus, in a significant scene, on the difference between “immediate experiencing” (“how”) and their “explanations” (“why”) during and after the scene. In fact, as Guidano observed, «the “how” has to do with the subjective experiencing, both in terms of how it is made up, that is, its ingredients (e.g. ongoing patterns of flowing imagery; multifaceted, opposing feelings; the felt sense of self) and in terms of how it comes about, that is, what perception of events or circumstances brought it on» (Guidano, 1991).

In such an approach, the conceptualization of “personal meaning organization” (P.M.O.) is central. It individuates «the specific arrangement of personal meaning processes by which each individual is provided with a sense of oneness and historical continuity in the course of his/her life span» (Guidano, 1987).

Despite successful application in clinical practice, both with neurotic and psychotic patients, only few scientific studies have been conducted to improve the P.M.O. paradigm. Furthermore, attachment was defined as direct referring despite the fact that univocal references from the two models do not exist.

In recent years the development in neuroscience has provided the P.M.O with the conceptualization of new possible physiological and adaptive references. Starting from the concept of P.M.O. introduced by Vittorio Guidano, Nardi proposed a new interpretation of the adaptive meaning of the different personality styles, both during the evolution of Homo sapiens and the development of each individual person (Nardi, 2000, 2006, 2007). What is central to this approach is that in Homo sapiens’ evolution the appearance of a specific P.M.O. allowed the best adaptation possible in one’s environment, generating the most useful attachment and
reciprocity. To underline the physiological significance of P.M.O. evolution, Nardi – who was one of Guidano’s fellows – proposed some new terminology to indicate Guidano’s main P.M.O.s: “controller” (for Guidano’s “phobic” P.M.O.), “detached” (for Guidano’s “depressive” P.M.O.), “contextualized” (for Guidano’s “psychogenic eating disorder” P.M.O.), and “principle-oriented” (for Guidano’s “obsessive” P.M.O.) (NARDI, 2006, 2007).

Therefore, the reciprocity with the primary caregivers drives individual adaptive abilities towards the development of the most useful P.M.O. with respect to one’s developmental environment.

Inward/outward P.M.O.

As our study showed (NARDI, 2007; NARDI ET AL., 2008), in similar situations showing laughter, anger, fear or sleep, the child perceives the caregiver (and, in general, his/her environment) as stable and predictable. Under these conditions, it is easy to recognize and predict experience. Furthermore, it is easy to decode the caregiver’s and one’s own facial expressions concerning basic feelings (fear, anger, sadness, and happiness).

Recognizing such activation allows to focus on some “nuclear scenes” that become the basis of the subject’s proto-self (TOMKINS, 1978; ABEelson, 1981); these “isles” of experience gradually join together defining a kind of “movie in the brain” and constituting the basis of identity (DAMASIO, 1999). According to Guidano’s work, by analyzing the sequence of images of a significant episode (in the “moviola” setting) it is possible to reconstruct the subjective immediate experience of perturbing events. Constancy and predictability of the caregiver’s behavior and emotional expressions allow a precocious decoding of the subject’s own similar activation. For example, the subject begins to perceive in which situations he/she feels secure or in danger, protected or alone; therefore, he/she reads through his/her internal activation what happens in the environment (internal focus: “inward” lecture of experience).

On the contrary, when the caregiver’s behavior and expressions are perceived as more complex and changing, depending on external situations, they are less predictable and more difficult to decode. The child needs to memorize more data and to update them continually; nuclear scenes must also be updated and reframed, and emotional activation is connected to a self-evaluating cognitive schema (guilt, sense of self-inadequacy, shame). Under these conditions, the self develops, starting from a preliminary evaluation of the environment which directs recognition of internal activation and self-perception (external focus: “outward” lecture of experience).

Therefore, along the processual developmental primary axis concerning inward/outward focus, predictability and variability of the caregiver (and, more generally, of the environment) drive each individual to reach the best adaptation possible; likewise, they drive the subject to develop invariant skills of assimilating and self-referring experience to maintain an internal coherence. In fact, there is not an adaptive pre-eminence of inward or outward focus, but each subject develops specific skills of decoding his/her self and environment in relation to the
major aspects perceived through attachment: inward focus is more useful when the external world is perceived as stable and predictable; therefore, its changes can generally be easily decoded in terms of physical protection or loneliness; outward focus, on the contrary, is suitable when environmental characteristics seem vague, complex or changing and, therefore, require the assimilation of more cognitive parameters. The development of emotional patterns is in line with this aspect: in general (when there are no emergency situations for survival) inward activation consists essentially of basic feelings for which no complex cognitive evaluation has to be expressed, while cognitive processes are developed afterwards to explain the feeling perceived by the subject (i.e. why he/she gets frightened or sad). On the contrary, in outward activation, cognitive self evaluation is essential to perceive emotions that are more complex and expressed as emotional schemata (i.e. shame or guilt needs a preliminary evaluation of one’s own behavior) (NARDI, 2006, 2007).

Obviously, inward/outward patterns occur along the same processual axis of development; therefore, they are more or less evident in different subjects, but in each individual one of the two is prevalent in any case, at least in specific categories of experience.

As Nardi highlighted, in inward development identical emotional reciprocity patterns are expressed in the same situations, and the ability to change decoding is conditioned by one’s own perceived managing skills. Communication is centered on physical reciprocity: distance and availability of the caregiver in terms of protection or detachment; therefore, reciprocity develops along a processual axis, from high to low patterns of physical reciprocity (high degree of protection and reassurance – loss and loneliness).

Evolutionary inward development allows the subject to center his/her behavior on perceiving and managing how protected or alone he/she is and, consequently, to redirect his/her exploratory detachment. During evolution inward development promoted two essential abilities of Homo sapiens: a) to develop an identity to individuate secure and reliable figures, to discriminate between friends and enemies, and to manage adversities and dangers, b) to cope with separation, loss, desertion, perception of loneliness as a starting point to develop one’s own abilities, to become aware of one’s own responsibilities, and also to take care of others.

According to Nardi, with respect to the above-mentioned considerations, the first P.M.O.s were the inward ones, which provide the basic skills for survival. In fact, inward subjects can handle: a) situations of proximity, availability of help, dependence, and social sharing or, b) situations of distance, unavailability of help, independence, and social isolation.

In inward development, when physical reciprocity is high (not depending on the quality – positive or negative – of significant relationships), the subject develops an identity to control how he/she perceives his/her need of protection or freedom: a separation from caregiver/environmental exploration is possible when the subject feels the situation under control and is therefore sure of himself/herself. In all these cases of inward development with high physical reciprocity the “controller” P.M.O becomes stable.
In inward development, when physical reciprocity is low (not depending on the quality – positive or negative – of significant relationships), the subject develops an identity to manage detachment and loneliness he/she perceives as the habitual condition of his/her life span, trying to find the necessary resources to realize himself/herself. In all these cases of inward development with low physical reciprocity the “detached” P.M.O. becomes stable.

As above-mentioned, according to Nardi’s paradigm, in outward development complexity and variability or ambivalence of environmental signals direct the development of emotional schemata by means of the relevant importance of cognitive self-evaluation. The subject learns to read information from his/her significant environment to update internal perceptions, in terms of acceptance or refusal, high or low amiability, and importance or insignificance. Communication is centered on semantic reciprocity, in terms of approval, decoding, rules, and values; therefore, reciprocity develops along a processual axis, from high to low patterns of semantic reciprocity.

Evolutionary outward development allows the subject to center his/her behavior on perceiving and managing how approved or confident he/she is and, consequently, to redirect his/her exploratory behavior. By allowing a person to focus on another individual’s internal world, evolutionary outward development has promoted two other essential abilities of Homo sapiens: a) to utilize (possibly anticipate) external judgments and opinions and develop successful behaviors, and to update them when styles and modes are changing, or b) to discover patterns and theories to understand and adequately reorganize human experience despite the contradictions observed and one’s own cognitive limits.

In outward development, when semantic reciprocity is high (not depending on quality – positive or negative – of the relationships), an identity is constructed in “real time”, step by step, based on signals perceived from the external context, in terms of approval or disapproval, agreement or disagreement, and success or failure. Relevant importance is given to comparisons with others, to the results achieved and to the adaptive exploration of persons, situations, and activities which enable the subject to develop the best self-esteem possible. In all these cases of outward development with high semantic reciprocity the “contextualized” P.M.O. becomes stable.

In outward development, when semantic reciprocity is low (not depending on quality – positive or negative – of the relationships), an identity is constructed based on precepts, rules and criteria about what is right or wrong, good or bad, and useful or useless. The subject directs his/her strategies to individuate a set of positive thoughts and behaviors in order to reach a stabilizing perception of the self and the world, and, at the same time, to keep out negative thoughts and behaviors. The fundamental parameter to evaluate his/her behavior is self-commitment rather than its results (as for contextualized outward P.M.O.). Research of reciprocity (consistent with the subject’s own emotional self-evaluation schema) is performed; the subject appears to comply with instructions and rules, but is also looking for a new and original theory on life concerning the significance of skills, relations, and goals. In all these cases of out-
ward development with high semantic reciprocity the “principle-oriented” P.M.O. becomes stable.
Therefore, each individual has variable and constant modalities of self-referring experience that are typical of each specific P.M.O.; furthermore, in many cases, it can be observed that a subject is able to show secondary modalities in some situations during his/her life span which are typical of a different P.M.O. (“mixed organizations”).
Due to other evolutionary secondary axes (“describers”) each individual is unique in his/her own way, with opinions, behaviors, and habits changing during life. These axes concern individual psychomotor reactivity, active/passive style, emotional or cognitive main channels, introverted/extroverted attitudes, practical or theoretical interests, and systems of values. In any case, these axes must be referred to the P.M.O. that determines their basilar patterns in making experience.
According to Nardi’s paradigm, each P.M.O. expresses adaptation abilities to cope with certain life span situations; on the other hand, each P.M.O. can lead to fragility when perturbing environmental stimuli cannot be integrated into the sense of self. However, a more positive or negative perception of the self is not directly related to a specific P.M.O., but to personal fragilities regarding the assimilation of experience; in any case, themes of self-referring narrations are consistent with the specific modalities of each P.M.O. (i.e. inadequacy in contextualized P.M.O.), and recognition of the specific organizational modalities of the subject allows the therapist to reorganize the subject’s experience in a more adaptive manner. Furthermore, the post-rationalist approach provides the therapist with an adaptive key to read mental disorders in which symptoms still represent an effort to adapt to difficult, unstable, and fragile conditions of making experience. Therefore, during psychotherapeutic work, by focusing on the P.M.O., it is possible to recognize and promote adaptive individual resources, thus improving skills regarding the control of perturbing emotions and the development of new and more flexible behavior strategies.

Is a scientific validation of the P.M.O. approach possible?
In recent years, progress in neuroscience has provided cognitive research with two new investigative fields: a) the possibility to observe real-time cerebral modifications during different tasks or conditions including emotional activation (functional NeuroImaging, fNI), and b) the faculty to individuate variations in DNA sequence (such as polymorphisms) through genetic investigations. We will refer to these two fields of research in the following paragraphs.

A. Neuroimaging investigations
Modern technologies of neuroimaging (especially functional Magnetic Resonance Imaging, fMRI and Positron Emission Tomography, PET) allow a scientific, real-time study of what happens when neurophysiological function swings into action or changes; likewise, it is now
possible to study what happens when an emotion starts and which are the cerebral regions involved in this subjective activation.

Using fMRI, a recent study by Bertolino et al. (2005) evaluated differences in individuals with different P.M.O.s (indicated as “personality styles”). In this study, in which personality styles were investigated by expert therapists, it was demonstrated that variability of amygdala activity is related to the personality style: in fact, when looking at facial expressions of fear, inward subjects show a higher activation of the amygdala, hippocampus and medial prefrontal cortex; on the contrary, outward subjects show a higher activation at the fusiform gyrus, dorsal-lateral frontal cortex, and occipital cortex.

Another study of this group (Rubino et al., 2007), performed with 14 inward and 14 outward subjects during presentation of threatening stimuli, demonstrated a higher activation of the medial prefrontal cortex in the inward subjects as a consequence of higher neuronal recruitment during cognitive evaluation of primary emotions.

Recently, in a study performed with fMRI, also our group (Nardi et al., 2008) has investigated cerebral activation induced by standardized emotional stimuli in healthy subjects, both when the subject perceives facial expressions of an unknown person (“third person experience”), and when he/she perceives the same expressions in his/her own face (“first person experience”). In detail, we examined the activation of the amygdala and other CNS structures in 10 healthy subjects when perceiving emotional expressions by seeing an unknown face and their own face. The results were also matched with inward/outward organization (studied in a clinical approach with MMPI2, QSP, and an “ad hoc” constructed questionnaire, MQOP). The study confirmed the importance of the amygdala in the processing of emotional stimuli, especially those with a social impact, as shown in other neuroimaging investigations performed with fMRI or PET scan (Breiter et al., 1996; Morris et al., 1996; Phillips et al., 1998; Whalen et al., 1998, 2001; Wang et al., 2005; Costafreda et al., 2007; Pérez-Edgar et al., 2007). With respect to similar studies, the presence of bilateral activation (Vuilleumier et al., 2003) or activation of the left amygdala (Morris et al., 1996) can be explained by the fact that the study subjects could be inward or outward, exhibiting different patterns of activation as shown by Bertolino et al. (2005), Rubino et al., (2007) and our group (Nardi et al., 2008).

As shown in Fig. 1, inward subjects as opposed to outward subjects respond to anger in a more intense and univocal pattern; they usually activate the right amygdala rather than cortical areas. Like in other investigations which demonstrated a varying activation for first or third person experience (Vogeley et al., 2000; Schulte-Rüther et al., 2007), in our study both inward and outward subjects showed a higher activation when looking at facial expressions of unknown people than at their own facial expressions, probably due to a “surprise effect” and a higher attention towards aesthetic details unknown in the sight of their own image. When a subject sees his/her face, he/she generally activates both amygdalas. If rage is expressed, a higher activation of the right amygdala can be explained by the fact that this emotion does not need a cortical semantic decoding for activation. Facial expressions of happiness activate the left
amygdala or both. Since the left amygdala is connected with language cortical systems, happiness seems to be a more complex and less direct emotion requiring a semantic codification.

Fig 1. Activation in the right amygdala, marked by interception of two axes, produced by the presentation of facial expressions of anger. A) Activation observed in an inward subject after presentation of an unknown face expressing anger (third person experience); B) Activation produced by the same stimulus in an outward subject. C) Activation observed in the inward subject of A looking at his/her own face (first person experience); D) Activation produced by the same stimulus in the outward subject of B. According to radiological standard convention, the left hemisphere is depicted on the right-hand side (from NARDI ET AL., 2008).
Therefore, all three studies on P.M.O.s (BERTOLINO ET AL., 2005, RUBINO ET AL., 2007, and NARDI ET AL., 2008) demonstrated that inward and outward organizations have different patterns of emotional activation. In inward subjects, rage usually activates the right amygdala according to the clinical experience that in these individuals the basic feelings (such as rage) are predominant and used to decode whether the environment is in a positive context or not. In our study, a neutral facial expression activated the amygdala only in inward subjects (with a higher activation rate when seeing their own face). This fact also confirms that inward subjects are centered on internal perceptions on the basis of which they evaluate environmental situations: the simple fact of seeing his/her own face can produce an emotional activation in the inward subject.

On the contrary, outward subjects show a lower activation of the amygdala, but recruit more cerebral areas for facial expressions of both rage and happiness. In outward subjects who show a higher semantic codification of emotions than inward subjects, a higher activation of the verbal hemisphere was observed for happiness. Such results are in line with the clinical experience that inward subjects develop relationships on physical reciprocity, while outward subjects will base them on semantic reciprocity.

**B. Genetic investigations**

As known, in recent years many studies have been performed focusing on genetic differences among several individuals, concerning both normal and pathological behavior. Furthermore, differences in phenotypic expressions of human genotype were studied to understand responses to pharmacological and/or psychotherapeutic treatment. In particular, the Single Nucleotide Polymorphism (SNP), which is the most common form of DNA sequence variations (> 1%), was investigated. In fact, in human genome, SNPs occur every 1000 bases along the 3-billion base genome. Even if many SNPs seem to have no effect on cell function, some SNPs may confer an individual susceptibility to develop diseases, determining their severity and progression and affecting their response to pathogens, toxins, and chemicals, or drugs and other therapies. Therefore, SNPs have become of great value for biomedical research in order to attain a personalized form of medicine. Using this approach it will be possible to recognize who could fall ill of which disease, the most effective treatment, and the prognosis. Nevertheless, the huge number of polymorphisms to evaluate and the large number of experimental data necessary to obtain a significant assessment from the statistical analysis make these evaluations expensive and time-consuming. Therefore, usually only few SNPs are selected for genotyping in association studies.

As part of the constructivist framework, some recent papers show a correlation between the genotype of certain SNPs and inward or outward P.M.O. Therefore, such data support the hypothesis that inward or outward P.M.O. also has a specific genetic basis. This is a new interesting perspective to develop in future investigations which might be useful to better understand the efficacy of psychotherapy and its epistemological paradigms.
In the above-mentioned investigation of Bertolino et al. (2005), different patterns of processing fearful stimuli were discovered in the amygdala, depending on inward or outward personality style, with regard to the function of a serotonin transporter 5’HTTLPR polymorphism. In our first-step study (Piva et al., 2008), we implemented bioinformatics methods for predicting the severity of a SNP and evaluating which biological process could be affected. In another study, which is still in progress (performed by the Departments of Psychiatry, Biology and Genetics, and Forensic Medicine of the Marche Polytechnic University, Italy), we will investigate possible relations between SNPs concerning serotonin receptors and transporters on the one hand and inward or outward P.M.O. on the other.

**Conclusions**

As mentioned above, progress in neuroscience allows to individuate new lines of research to highlight biological correlations for personality patterns like those individuated in the paradigm of P.M.O. Thanks to new technologies it is possible to observe that useful psychotherapeutic approaches such as the post-rationalist constructivism have not only a solid theoretical and epistemological basis, but are also confirmed by specific neural patterns (i.e. biological differences in emotional activation between inward or outward subjects) and genetic polymorphisms; these facts can explain that attachment processes do not only have a learned basis, but are also driven by behavioral genetic patterns.

In conclusion, progress in neuroscience can be useful to validate psychotherapeutic paradigms (not only “rationalist”, but even “post-rationalist”) and throw a light on what happens in the mind as a consequence of psychotherapy. Thus it can lay the foundations of a bridge between biological (i.e. psychopharmacology) and psychological (i.e. psychotherapy) approaches to mental disorders.

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