

emotional resonance: a mirror system for emotions of children with autism spectrum disorders

The international scientific community classifies autism as a behavioral syndrome caused by a developmental disorder. Our research is directed to investigate the role of genetic and environmental factors, and their mutual interaction; in particular, we have focused on the study of the brain through neuroimaging techniques to understand the role of the image, both structural and functional, processed in the brain, and then displayed the same in order to analyze and study the relationship between the activity/function of certain brain areas, and the activity of mirror neurons. The data collected by research have allowed to understand various relevant systems approach to the treatment of disorders such as Floor Time. In education, the effectiveness of interventions is measured directed to children with this disorder, and it is also effective among all forms of psycho-education and intervention based on training not only behavioral but including developing motor intentionality and communicative self. The current project is developed by alternating moments of observation and direct work with the child in the class meetings for discussion and exchange with the teachers and parents. Each meeting was organized on a monthly basis and last for 4 hours, and the goal was to monitor and redefine individual effort through the identification of new targets to pursue. There is an empathic link between an individual and other person that's why we talk about emotional resonance. Rehabilitative prospects of the development of early intervention is hypothesized to be effective as which can enhance the mechanisms originating in autistic disorder and change radically.

Introduction

The international scientific community classifies autism as a behavioral syndrome caused by a developmental disorder, according to the manual of the APA (American Psychiatric Association) or the DSM-IV (Diagnostic and Statistical Manual of Mental Disorders Fourth Edition). This disorder falls into the category of Clinical investigation of "Pervasive Developmental Disorders", biologically determined, and makes its appearance in the first three years of life. The main areas affected by an abnormal develop-

ment are those delegated to the social communication, social interaction and reciprocal in symbolic play and functional. Children with autism can have impairments in mild, moderate and severe form, which can vary from impairment in the language up to a total absence of the same. Children with autism demonstrate significant difficulty or inability to express emotional reciprocity, in respect of either adults and peers. All these traits can fall in different categorization of "autism spectrum disorders" (ASD). The comorbidity of mental retardation, mild, moderate or severe form is not unusual and can accompany the subject throughout his life. After about seventy years after the identification of autistic symptomatology,¹ there are still significant debate in terms of etiology, the clinical picture, points of differentiation in common with similar syndromes, differential diagnosis, and prognosis. Based on current research statistics, geographical region, ethnic minorities are found not statistically significant factors, and they are prevalent equally in all populations in the world, without distinction of race, and social and cultural background. On the other hand, it is found that the person's gender is a factor as it is prevalent in male 3 to 4 times higher than females, and also it is the psychiatric disorder with the highest rate of heritability (> 90%). The genetic studies are currently focused on certain regions of chromosomes 7 and 15. Hypothetical risk factors which causes autism are genetic disorders and metabolic dysfunction of the MPs that are recorded in the areas of social regulation actions. Molecular abnormalities have a role in the transmission of nerve impulses in brain, which can be a contributing factor of autism along with others such as previous episodes of autism or pervasive developmental disorders in the family, the pre-term birth of a baby, and a distinct lack of vitamin D during pregnancy. Autistic children do have an apparent lack of interest and reciprocal relationships with others, a strong tendency to isolate, a substantial indifference to emotional stimuli, hyper-excitability, and extreme difficulties in establishing direct eye contact. One of their biggest obstacles is to have a conversation or be bound by these

shifts, and their expressions on many occasions are fragmented and abnormal, or consisting of words, sounds or repetitive phrases (immediate or delayed echolalia). Although imitative abilities are intact, these people often have greater difficulty in learning to use new things constructively in a situations different from those previously experienced situations.

The current research was directed to investigate the role of different factors associated with genetics, environmental, and their mutual interaction; in particular the research is focused on the study of the brain,² through neuroimaging techniques, both structural and functional processes in the brain and then displayed the same in order to analyze and study the relationship between the activity of certain brain areas, in particular, the activity of mirror neurons, and specific brain functions. The data produced by research have allowed to hypothesize on various relevant systems approach to the treatment of disorders such as Floor Time.³ We found that the severity and mainly the symptoms of autism varies greatly from individual to individual and in most cases tends to have a regressive phase with age, especially if mental retardation is mild or absent, and a valid treatment is not undertaken at an early age.

Problem of Research

These factors and possible field of applications of the theory expounded by us point out certain formal problems which are necessary to discuss. Actually up until now few researches on the autism were focused on internal and external elementary and functional aspects of brain which contains the metamessage in a communication process or the chance of considering the reaction capacity of an autistic individual who answers the same stimulus in a different way. We wondered based on what perception and from what source I draw the information which transmits the brain. Many theories instead, with respect to ours, only considered the communication ways strictly as fairly good and not other types of systems what that analogic and one iconic. In fact the event itself "perceived" by the autistic subject can communicate

his happen.⁴ Furthermore the distinction commonly traced between perception and action, belonging and efferent, entry and exit, is not valid if related to autistic people who are in complex situations.

Research Focus

Every action element can be taken back either to the outside senses or the proprioceptive mechanism to the central nervous system. It is well known that the perception can be certainly changed by the experience. The research hypothesize that several adaptive stimuli of interaction strategies and changes of the mirror neurons in order to settle the skein of problems which covers the study of certain human mental capacities with functionality as complex as it happens for the autistic subjects can enhance the capacity to imitate and understand the other and the possibility of sharing the reciprocal emotions. In particular, our research was centered on finding the importance of stimulating the "communicative mirror neurons",⁵ so as to discover verbal communicative difficulty in the autistic ones.

Methodology of Research

Symptoms of the child with autism diagnosis may increase overtime, with severe limitations in self and social life and can persist into adulthood, although with time he/she acquires new skills, however, are "shaped" by/and the noise and still have a quality "autistic".⁶ Any intervention by type of approach we should have detected thorough and objective, to encourage the maximum possible development of different skills impaired in syndrome: the timeliness and specificity of the intervention are key. Guidelines for action on autism published by the (National Research Council, 2005) argue that there is no single intervention that works for all autistic children of any ages and can answer all the many demands directly or indirectly related to 'autism. On the other hand, the continuity and quality of the therapeutic interventions are key by certain features highlighted: the involvement of parents across the path, the choice of ongoing milestones to be reached, the interventions to be activated (diachronically), coordination at every stage of development of the various actions identified to achieve the objectives (synchronic perspective), and the verification of the strategies put in place within each program. Our research team were involved for years in the study of strategies of education systems, both at school

and university, aimed at the integration and inclusion of individuals with disabilities and specifically as described in these case studies than to subjects with autism spectrum disorder. In educational system, in fact, the effectiveness of interventions in the form of all types of psycho-education are established. Taking up the study of a group of researchers at the University of Parma (coordinated by Rizzolatti, 1996), the fundamental characteristic of autism is the inability of social interaction that combines imagination and an inability to a repetitive pattern of behavior which has been suggested that in the brains of autistic children there is a total/partial absence of the mirror neurons. These neurons, found in monkeys and humans, does not only gets activated when you perform an action, but the same action done by another does "resonate" in the interior of the perceiver. These neurons may be important for understanding the actions of other people and learning through imitation. The human system of mirror neurons coding motor acts transitive and intransitive, i.e. it is capable of encoding both the type of action that the sequence of movements of which it is made.

General Background of Research

Studies of "psycho-genetic" indicate the need for building new bridges between neurobiology, human behavior, emotions, and social contexts, which means re-establishing the developmental psychopathology as well as the clinical understanding and treatment of autism in children. It is now possible to consider the social relations as factors that may exert an action on the brain through a feedback mechanism that is to modify gene expression, protein synthesis, cell function, and thus the cortical functions, feelings and behavior. From this principle it follows that the treatments should be understood as a means to change the functions and brain structures, and not as simple and forced behavior modification. The exploration of mirror neurons⁷ that are activated in both cases when we perform a given action in first person and when we see others doing it, are studied through the techniques of neuro-imaging investigation and has not only led to the observation of the same changes in blood flow in areas of brain being observed during the action, but also the precise location of the neurons. The measures and support materials useful to verify the existence of such a mirror system in humans are: EEG,

electroencephalography; TMS (magnetic stimulation transcranial), MEP (motor evoked potentials), the Brain Imaging, PET (positron emission tomography) and fMRI (functional magnetic imaging resonance). The close link between visual and motor responses indicates that the mere observation of the action performed by others in the observer's brain evokes a motor action potential, a kind of "internal motor representation." The function of mirror neurons is to make possible the recognition and understanding, which is seen as pragmatic and non-reflective understanding of the meaning of "motor events" i.e. of others. The mirror neuron system plays a role both in the imitation and learning via imitation, which are located in the inferior parietal and frontal lobe, All this happens due to a control system on mirror neurons that plays a dual role: facilitation-inhibition. This system facilitates the transition of the action potential, encoded by neurons mirroring the performance of the motor itself.

It was possible to study experimentally the mechanism of mirror neurons⁸ by virtue of some primary emotions. The results clearly showed that the observed event of manifestation of pain or disgust in others activated the same neural substrate underlying the perception in the first person of the same type of emotion. There is an empathic link between an individual and others that's why we see emotional resonance between them The others action gets mirrored in us constantly with perception. In case of actions/perception of "cold" there is no emotional significance, unlike the case of actions/perception of emotionally "hot".⁹ This supports our hypothesis that mirror neurons exist for every human expression, but it still appears to be an assumption on which we are conducting an experiment.

Emotion is the focal point of social interaction, and therefore becomes the basis on which to base the psycho-educational intervention. Among the methods proposed for the activation of mirror neurons in children with autism spectrum disorder has been identified as a valid treatment, which includes Floor Time intervention proposed by Greenspan and is based on the DIR model - Developmental Individual Difference. DIR can be inscribed between evolutionary approaches because it underlines the importance of teaching new skills to follow the normal developmental milestones and points to the enhancement of cortical circuits¹⁰ rather than behavioral conditioning surface. It is based on the game regardless

of the dynamics with which it is developed, and assumes an important role in re-socialization and rehabilitation of the disabled child,¹¹ and spontaneous interaction between adult and child.

For comprehension of others emotion, mirror neurons plays a very important role to allow an autistic individual to mirror the emotion of another person through activation of its specular neuron mechanism. The empathic sharing at various levels orients our behaviors and relations. The inter-individual relationship and social gains create a condition that helps children with autism which is studied as different types of intervention in our study.

Sample of Research

The Project, which saw the participation of 10 families, was born by the expressed need of those families to make the 'school placement for their child effective and functional to address the children's specific needs in the area of educational improvement, social communication, strengths building, and promoting an overall qualitative life experiences.

Subject involved in the project were four preschools from the Naples area, ward, Health, and six primary schoolers from within the same district. The direct ben-

eficiary were 10 children and teachers involved in the management of children's activities of the schools involved. The indirect beneficiaries were the families of children involved in the experiment, the classmates of children with autism, the faculty pertaining to each class group as well as educators and local doctors / specialists.

(.....to be continued in next issue)

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References

1. Fullplus BW. Characterisation, isolation and purification of cholinergic receptors. In: Theselff S Ed., Motor innervation of muscle, 2nd ed. London: Academic Press 1976; 11-26
2. Kanner L. Autistic disturbances of affective contact, Nerv child 2:217-50. "Reprint". Acta Paedopsychiatr. University Children's Clinic in Vienna: Germany; 1943; 35(4): 100-136.
3. Corona F. The Triune Brain: Limbic Mind, Mind Plastic, Emotional Mind. American Medical Journal, New York, USA Science Publications 2011; 2(1): 51-53.
4. Mugno D, Mazzone L, Tonnini K. Floortime. In: Neuropsichiatria Infantile dell'Università di Catania, Azienda Policlinico e Ambulatorio Autismo, Neuropsichiatria Infantile dell'Ospedale Maggiore di Bologna, Strategie d'intervento per l'autismo infantile, Guida pratica per le famiglie. Arti Grafiche s.r.l.: Salerno; 2004.
5. Russo PL. So quel che senti. In Neuroni specchio, arte ed., empatia. Edizioni ETS: Pisa; 2009; 120.
6. Rizzolatti G, Fadiga L, Matelli M, et al. Localisation of grasp representations in humans by PET. 1 Observation vs execution. Exp. Brain Res, University UCLA, California 1996; 111: 246-252.
7. Williams JHG, Whiten A, Suddendorf T, et al. Imitation, mirror neurons and autism. Neuro Div Rev 2001; 25: 287-295.
8. raighero L. Neuroni Specchio. In Collana "Farsi un'idea" il Mulino Ed.; Bologna; 2010.
9. Dapretto M, Mari DS, Jennifer HP, et al. Understanding emotions in others: mirror neuron dysfunction in children with autism spectrum disorders. Nature Neuroscience 2006; 28-30.
10. Iacoboni M. I neuroni a specchio. Come capiamo ciò che fanno gli altri. In: Bollati Boringhieri Ed., Torino; 2009.
11. Gallese V, Fadiga L, Fogazzi L. Action recognition in the premotor cortex. Brain, Oxford University Press 1996; 119: 593-609.