Neuroesthetics: a Step Toward the Comprehension of Human Creativity?

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Art and Science are expressions of the extraordinary creative imagination and uniqueness of the human mind. With painting, sculpture, poetry, and music, Man expresses, in works of very high aesthetic levels, the most elevated concepts, passions and madness, pleasure, torments, and the intimate thoughts of the human soul. With science, he unveils Nature's enigmas, managing even to interact with the physiology of his own body, producing remedies for numerous pathologies. In the specific area of the Sciences that study the brain and the nervous system (the Neurosciences), researchers have taken incredible steps forward in the comprehension of the physiology of the brain, thanks above all to the recent development of medical technologies. For example, functional magnetic resonance imaging (fMRI) has permitted visualization of brain activity in vivo while we carry out an action, think, or become emotional. Together with other techniques, the fMRI has allowed the study of the pattern of activation of different areas of the brain, revealing that each of the cerebral structures is specialized for one or more specific tasks, like the elaboration of sensorial stimuli (visual, tactile, auditory, etc.), the planning and execution of motor processes, or the perception of determined emotional stimuli. Yet, despite these developments, Science does not yet enable us to open the box containing the most arcane and untouched secrets that philosophers and scientists have been debating for millennia: the mysteries of the human mind.

Neuroesthetics

About a decade ago, the celebrated Neuroscientist Semir Zeki (University College of London) championed the launching of a new type of neuro-scientific research, called "Neuroesthetics," to investigate the biological mechanisms of aesthetic appreciation (Ticini, 2003a). Already in past centuries writers and philosophers tried to grasp the intimate essence of an aesthetic experience and to define the concept of beauty. Plato, Immanuel Kant, or art historian Johann Joachim Winckelmann, to name a few, come to mind. Still, these important figures of Western thought never had the opportunity to directly see what happens in our brain when, for example, we are in front of work of art. Today we can do this. Research has identified the origins of some elementary perceptions common to us all. Before a work of art, each person has a different aesthetic experience: feelings, memories, and perceived pleasure have a

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strong individual character because they are attached to genetic and cultural components. Nonetheless, today we know that many areas are activated in analogous ways in all human beings when they are before the same object or they experience identical emotions. This common basis, before art, puts us on the same interpretive plane, allowing us to communicate – through art – profound impressions and emotions, which at times we would be unable to express in words. Knowing the mechanism that permits appreciation of art, like investigating the biological reasons for which certain works are more popular than others, undoubtedly has an artistic and commercial value. Vice versa, studying the nature of aesthetic appreciation also helps to better understand the mechanisms of perceptions and the strategies that our brain uses in facing the stimuli coming from the world around us. Many researchers dedicate themselves to neurobiological study of the emotions and pleasure, not only in relation to aesthetics. For example, a few years ago, a study by Semir Zeki and colleague Andreas Bartels received a great deal of attention in the international press because it allowed us to identify the areas of the brain involved in romantic and maternal love (Bartels & Zeki, 2000a; Bartels & Zeki, 2004; Zeki, 2007). The researchers demonstrated that love (both romantic and maternal) stimulates the cerebral regions that generate the sensations of pleasure and reward. This explains why love (and also art) creates euphoria and makes us feel good. What's more, Zeki and Bartels noted that while some areas of the brain activate, others deactivate: among the latter are the frontal lobes, which allow us to have critical judgment about people. This observation is particularly important, since it could explain why our judgment of the person that we deeply love is not objective but mitigated, if not partially suspended. Not only this, it could also explain why mothers tend to be less critical of their own children. In the domain of art, a similar study has not yet been conducted. I would not be surprised to discover that persuasive external factors (social-cultural, for example) can cause an inhibition of the frontal lobes, making us less impartial in our aesthetic judgments. If it were demonstrated that socio-cultural influence deactivates the frontal lobes and thus modifies aesthetic judgment, we would understand, scientifically, how we come to re-evaluate more positively a work of art we do not like when it is placed in a context known to us (for example, when we realize who the artist is and that the artist is universally respected). Today Neuroesthetics is principally concerned with art, but in the near future it will approach other fields like religion, morality, and jurisprudence. In this way, with new methods, the answers to old questions fundamental for the person who seeks to understand himself, his past, and his future will be sought.

Creativity and Synesthesia, When Sounds Take on Colors

One of the more interesting subjects – in my opinion – is the study of creativity and its cerebral mechanisms. Very often, I find myself having to respond to the following question: the neurosciences say that every area of the brain has a specific function; is there, then, an area (or multiple areas) of creativity? And if so, is it more developed in creative people? Unfortunately, yet today neuroscientists are unable to explain many cerebral phenomena, notwithstanding the opportunities provided by technological advancement. We are therefore in a situation similar to that of Galileo Galilei, who, thanks to a potent instrument like the telescope, was able to admire the stars and remote planets. Being able to see the heavenly vault in detail, however, does not mean being able to deduce the laws that regulate the interactions between celestial bodies, or understand why stars are luminous. In order to exhaustively understand the human mind and the brain's functions, today a multidisciplinary approach is used: philosophers, physicists, engineers, doctors, and biologists – who collectively we call neuroscientists – dedicate themselves to synergetic research to comprehend cerebral phenomena, the activ-

ity of millions of neurons and their interactions. Great efforts are made, but establishing a neurobiology of creativity, of multiple mental and emotional states, is still an enchanting illusion. Perhaps the neurosciences are so fascinating because there is still so much to discover. For now, then, all that remains is the possibility of speculating on these surprising peculiarities of the mind. Synesthesia (from the Greek syn, "together" and aisthánestai, "perceive") is a rhetorical process that consists of new associations, within a single image, between nouns and adjectives belonging to different sensorial spheres. Valued in poetry, synesthesia is not just a rhetorical figure but also a real perceptive phenomenon that manifests itself as a mixed and uncontrolled perception of the senses. A well known form of synesthesia is that between colors and sounds (that here we refer to as "type A"), in which a person, hearing a particular sound or note, perceives a color superimposed on the images he or she is looking at, even if that color is not actually present in the visual stimulus. Wolfgang Amadeus Mozart and Wassily Kandinsky, to name a few, "suffered" from this intimate correspondence of colors and sounds, which surely contributed to their artistic creativity. For Kandinsky, synesthesia was the point of departure for artistic inspiration: in his "symphonic" compositions, colors become a sonorous medium that together with forms "resonate and vibrate" in the work. The artist describes his overwhelming synesthetic experience attending a performance of Wagner's "Lohengrin" at the Moscow Court Theatre: «[…] it seemed like I had all my colors before my eyes. In front of me inordinate, almost absurd, lines formed». The combined association of colors and sounds is taken up again in the next passage: «The sun melts all of Moscow down to a single spot that, like a mad tuba, starts all of the heart and all of the soul vibrating. But no, this uniformity of red is not the most beautiful hour! It is only the final chord of a symphony that brings every color vividly to life, which, like the fortissimo of a great orchestra, forces all of Moscow to ring out». The image of such a landscape becomes even more extraordinary if we consider that it is not only a poetic vision but the description of a real perception that dictates it. It is not yet clear how such mixtures of perception are created. However, an approach for understanding synesthesia undoubtedly passes through a knowledge of brain physiology. Long ago Hippocrates understood how perceptions, feelings, and creativity were intimately correlated to the mind but even more so to its most tangible physical element, the brain. If this is so, then synesthesia could be understood through the study of the interactions of the areas of the brain that mediate the perception of sounds and colors. In general, the brain is characterized by dozens of areas separate from the others that allow recognition of difference aspects of perception like color, movement, faces, and sounds. The area that permits us to see colors – called V4 – does not have direct access to the auditory areas, and colors and sounds travel different perceptive paths. So, chromatic experience has to do with the area V4 (Zeki et al., 1991; Bartels & Zeki, 2000b) while the auditory area relates to the auditory cerebral cortex (De Yoe et al., 1985). And yet in "type A" synesthetes, listening to sounds determines the activity in V4 (Nunn et al., 2002), provoking a chromatic perception without there being an apt stimulus. Perhaps there are anatomical peculiarities in the brain of synesthetes (Bargary & Mitchell, 2008); perhaps there exist structures of contact (like particular nerve fibers) between physically distant cerebral centers, or between these areas communication inhibition is lacking (Weiss & Fink, 2008; Cohen Kadosh & Walsh, 2008). If synesthesia gives us license to know the world in such an extraordinary manner, maybe even aesthetically more fascinating, without doubt it can influence the creativity of an artist, superimposing a vivid perception of colors, sounds, or tastes on the objects truly present in the environment. Seeing the colors of a symphony or tasting the flavor of a form surely increases the aesthetic value of a work (Ticini, 2003a). Synesthesia and creativity are noticeably different, even if they have a probable common origin: synesthesia generates an explicit and spontaneous experience tied to perception (the "type A" synesthete is obligated to perceive a color in the presence of a sound); creative imagination, on the con-

trary, is confined to the limbo of imagination, on the level of concept, rather than being experienced through the senses. Thanks to its abstract nature, the ideas born from the creativity of few may be transmitted through the generations and shared by different civilizations, becoming a value in the development of culture. Conversely, the uncommon perceptions of synesthetes are relegated to the minds of a few and are not universally knowable. I think it is interesting to associate creativity with synesthesia, proposing a correlation between the physical structure of the brain and creativity. Perhaps also creativity, if considered an extreme example of synesthesia, depends on the specific relationship between the areas of the brain and on the presence of particular connections that lend the individual the capacity to identify new relationships. The definition of creativity tied to the richness of anatomical relationships is intuitive and not new (Ramachandran & Hubbard, 2001), but what I consider new is the hypothesis on the existence of connections at the same time supplementary and atypical. The presence, in other words, of cells predisposed in a particular way to unite even remote perceptions and concepts, present in greater numbers only in more creative persons. The propensity to creativity certainly has an inestimable value for artists, scientists, philosophers, and in general any thinking creature. Without being synesthetes, but sharpening sensibility and involving all of the senses in a perceptive ensemble, it is possible to conquer the inspiration and emotion that emerge in the whirling flows of productivity. Modern technology comes to our aid: today more than ever before an artist can paint, sculpt, or write while, for example, listening to good music, which can serve as a muse. What's more, an artist can add elements that evoke multi-sensorial experiences to works of art, increasing its emotional value. In fact, recent research seems to suggest that aesthetic judgment is elevated when we are exposed to simil-synesthetic perceptions (Ward et al., 2008). In this way, harmonizing scents, colors, and sounds into a perceptive whole, works take on a synesthetic valence, gratifying the spirit and the intellect (Ticini, 2003b), delighting the eyes through scenographic forms and the knowledgeable use of color, stimulating touch with rare materials, reawakening smell and taste (intimately associated) and pleasing the hearing.

Comme de longs échos qui de loin se confondent
Dans une ténébreuse et profonde unité,
Vaste comme la nuit et comme la clarté,
Les parfums, les couleurs et les sons se répondent.

Charles Baudelaire, *Correspondances*

Like long echoes that mingle in the distance / In a profound tenebrous unity, / Vast as the night and vast as light, / Perfumes, sounds, and colors respond to one another

Translated by Patricia Garborik

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