

Heuraesthesia: When Synaesthesia Fertilizes the Mind

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Abstract Heuresthaesia, a neologism composed of the terms “heuristic” and “synesthesia” is proposed here as a concept that can assist the comprehension of a specific field of intuition. In certain creative subjects, heuresthaesia would facilitate the access to objective knowledge and skills, thanks to elementary sensory processes incorporated into multimodal conscious representation. This chapter will sketch the theoretical framework of heuresthaesia and detail some intuitive supports for this concept, leaving to future works the task of assessing its scientific validity.

What is the purpose of all that? asks Anthony.

The Devil:

The knowledge of things comes to thee only through the medium of thy mind. Even as a concave mirror, it deforms the objects it reflects; and thou hast no means whatever of verifying their exactitude. Never canst thou know the universe in all its vastness: consequently it will never be possible for thee to obtain an idea of its cause, to have a just notion of God, nor even to say that the universe is infinite,—for thou must first be able to know what the Infinite is! May not Form be, perhaps, an error of thy senses,—Substance a figment of thy imagination? Unless, indeed, that the world being a perpetual flux of things, appearance, on the contrary, be wholly true; illusion, the only reality. But art thou sure thou dost see?—art thou even sure thou dost live? Perhaps nothing exists!(...)

St. Anthony:

But Substance being unique, wherefore should forms be varied? Somewhere there must be primordial figures, whose bodily forms are only symbols. Could I but see them, I would know the link between matter and thought; I would know in what Being consists.»

Gustave Flaubert (1910), *The temptation of Saint Anthony* (1874).

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The White Noise of the Universe

We would be strained if we had to imagine a living body that would simultaneously and without order perceive all the information it captures through its senses. At once sounds, images, tastes, cold and hot sensations, multiple textures, movements, would all be added together and intermingled to compose the picture of the world as it would stand if we were not able to sort, categorize, or make sense of the information. What would most resemble this incomprehensible amount of stimuli could be the “white noise” that we sometimes hear between radio frequencies: a kind of breath or crackle that may also have been experienced on the old poorly tuned TV sets as an incomprehensible fog. White noise is the random and simultaneous transmission of a wide spectrum of sound or visual frequencies. Something is noticeable, but we cannot know exactly what it is.

In Physics today, randomness seems to be the proper description of the fundamental state of the Universe in its innermost structures (on the quantum scale). The objects we know, with which we interact, are merely the result of the permanent measurement the Universe makes of itself, the linking of stable objects producing the “decoherence” of the first undifferentiated entities. This understanding of the deep structure of the world invited philosophers and epistemologists to compare the process of physical decoherence to the processes of thought and interpretation of reality (Bitbol 2009). The analogy is possible and surely fertile. Constructing the object for reality, for the body or for the mind would perhaps stem from the same formal movement: property does not precede measurement or objectivity, the relevance of the world is only fathomable in the permanent verification of the quality of the established link.

We are subjected, as living beings, to this constraint of relation and of measurement, the only way for objects to attest the possibility of their own existence. If the undifferentiated comes first and cannot be known beforehand, its comprehension arises from the history of interactions between our perceiving bodies and reality, which does not say anything spontaneously of itself.

Shape¹ is always a reconstruction.

Almost every thinker that reflects and meditates notices in himself (in other words, in the universe, man being a microcosm) a kind of void, terrible at first, all the hypotheses of philosophies and religions superimposed as shadowy vaults, causality, substance, essence, the amorphous dome of abstraction, mysterious doorways open to infinity, and at the bottom, a glow. Little by little, lineaments take shape in this mist, promontories appear in this ocean, fixities rise in this depth; a sort of affirmation slowly emerges from this chasm and this vertigo. This phenomenon of inner vision is intuition.

Victor Hugo (1860), excerpt from *Proses Philosophiques*

¹The terms “shape” and “meaning” (signification, causality) will be used in the same way to designate the sets of information enabling the relevant integration of reality for adaptation. Shape is always a carrier of meaning.

Shape Emerges from Probability

Doubtless, my present state is explained by what was in me and by what was acting on me a moment ago. In analyzing it I should find no other elements. But even a superhuman intelligence would not have been able to foresee the simple indivisible form which gives to these purely abstract elements their concrete organization. For to foresee consists of projecting into the future what has been perceived in the past, or of imagining for a later time a new grouping, in a new order, of elements already perceived.

Henri Bergson (1911)

Our species, in line with other species gifted with the ability to represent the world they perceive, must make a formal sense of the world in order to understand it and to be best adapted to it. We know how to foster perceptions that lead to a relevant response, we know how to inhibit parasitic and secondary sensations (Sacchet 2015). We know how to shape the white noise of our senses.

Subject to the constraint of performance, the human being also inherits from his filiation the optimization processes of his adaptation, especially in terms of speed of response and energy saving criteria. During its development and based on the screening and selection of relevant information from the world, which is already a primitive shaping, our brain executes probabilistic calculations in order to determine, ahead of the upcoming action, a statistically coherent “picture” of what may happen (Frith 2007). Our nervous system predicts the dynamics of reality as best as it can from its own statistic reality, accelerating and specifying its adaptive response.

For human beings and surely for other species as well, low-pitched sounds are predicted as coming from below and high-pitched as coming from above. This originates from what we have engrammed from statistical reality: in nature, high-pitched sounds come more often from above whereas low-pitched come from below (Parise 2014).

The result of this perceptual anticipation is relevant and efficient for adaptation because only our nervous system’s probabilistic calculations that allow the perpetuation of relevant probabilistic calculations are preserved. Sense (meaning) is a continuous construction that is perpetually confirming itself, eschewing possible errors by correcting the process as it goes.

This comprehension of brain function and of the anticipatory construction of representation foreshadows a new ecology of shape. Visual perception can now be understood as a more complex perceptual phenomenon than a simple “stimulus-response” one. It is the permanent production of a highly multimodal representation that would only make sense in a relational context:

The ecological approach of visual perception stems from the fundamental principle that the object of perception is the same as that of action, otherwise the animal would be unable of finding his bearings in its environment and survive: this object is not a phenomenon “in the head” or “in consciousness”, but it is the actual environment itself, that which the animal shares with his fellows and with the members of other species.

Claude Romano, postface to Gibson (2014)

Reality has stable intrinsic properties. The probability of events occurring can be predicted and living and human beings construct in advance an ensemble of representations, as isomorphic to reality as possible, in order to obtain a correct adaptive response.

Synaesthesia: An Aesthetics of Probable Shape

First, from a physiological standpoint, each of us is a model republic whose parts are interdependent, and in which ‘he who affects one, affects the other’. Nothing could therefore happen in our body, and especially in our nervous system, that the whole would not feel to some degree.

Théodore Flournoy (1893)

Synaesthesia is a particular neurological condition that displays to consciousness, for about 4 % of the population, the common work of the different sensorial and cognitive integration modalities. It can be understood as the conscious manifestation of the low levels of information processing, in all the richness of their multimodal expression. Some synaesthetes combine letters or numbers with colors, some perceive temporal sequences in abstract and geometric forms. Other “see” or “taste” sounds or even visualize geographically and tridimensionally time and the most abstract of thoughts. Studies on synaesthesia confirm that it is not associated with any pathological profile and that it accompanies adaptation without ever hampering it or only on rare occasions, its difficulties frequently arising from the association with disorders of another kind: autism (Baron-Cohen 2013), schizophrenia...

If today’s models struggle to explain the reason for the conscious and irrepressible presence of these synaesthetic objects in a portion of the population, the fact that they follow the process of making sense of reality with the aim of a coherent adaptation suggests that they are also the products of a relevant formal and causal treatment (Mroczko-Wąsowicz 2014). Synaesthesia may be the evidence of low level integration processes in the subject, invisible to most of the population but who are at work in everyone. They are perhaps the persistence of multimodal associative scaffolding processes of knowledge and skills, which operate at an early age and usually become more discrete with the maturation of the nervous system.

We can especially understand the categorical, linguistic and cognitive (such as visual thinking) synaesthetic associations, as both the permanence of combinations of percepts associated during learning (an A is yellow because it is associated with a specific game or schoolbook on which it was written in yellow) and as the associative engram of these learning experiences on a multimodal organization matrix, which carries the history of the efficiency in relating to the world. A study also shows that the synaesthetic shape could originate from a topographic matrix that would be visible as far as the level of brain tissue structure. Indeed, IRM observations have managed to show that some neural populations had a topography that was exclusively devoted to numbers, similar to the neural topography that enables the treatment of information coming from the different senses (Harvey 2013).

In any case, synaesthesia seem to accompany in a perfect, solid and stable way the work of probabilistic interpretation performed by the brain. The synaesthetic shape always makes sense (Nikolic 2009).

We may all hold a formal prototypical associative pattern (not conscious to the neurotypical and more or less accessible to the synaesthete), originating from both our phylogeny and our own experience, that would have an automatic function of accelerating our reactions all the while ensuring them, thus facilitating and optimizing our adaptation. For a synaesthete, it is not possible to interfere in the automaticity of combinations, to modulate their responses or to willingly act upon them. They are so faithful to the meaning of the world that they could sometimes assist in better understanding it. This prototypical pattern not only optimizes instantaneous adaptation but it is useful, for some people, to acquire skills or intricate knowledge of the world.

Heuraesthesia: An Aesthetics of Discovery

Heuraesthesia (a contraction of the Greek word εὐρίσκω (eurisko) meaning “I discover” and of αἴσθησις (aisthesis) “perception from the senses”) is a particular condition that, in some subjects, brings together the abilities of shaping perceived natural elements (sounds, shapes, colors, textures, movements, raw percepts...) shared with animal filiation, with cultural elements (languages, elaborate and exclusive concepts...) that compose human singularity. It is this common work of the senses and the mind that supports the heuraesthete in acquiring knowledge or an objectifiable skill.

Here is what Richard Feynman, Nobel Prize in Physics, said of the link between thought and shape:

When I see equations, I see the letters in colors – I don’t know why. As I’m talking, I see vague pictures of Bessel functions from Jahnke and Emde’s book, with light-tan j’s, slightly violet-bluish n’s, and dark brown x’s flying around. And I wonder what the hell it must look like to the students.

Richard Feynman (2001)

The objects we think about, sometimes highly complex and appealing to the highest elevations of the mind, were all acquired first through sensory channels. When R. Feynman questioned reality to extract clues about its physical qualities, his thoughts manifested to him not as numerals and signs arranged from left to right as they are usually arranged on paper. These objects seem to emit their own aesthetic clues that are compatible with the meaning of the calculations and which could even provide information on the natural properties that govern the interactions.

In the brain, the rules are entangled with the symbols themselves whereas, on a sheet of paper, symbols are static entities manipulated according to rules that are in our heads.

Douglas Hofstadter (2000)

Claire Petitmengin proposes to consider adaptation in general as a transmodal treatment performed by the nervous system and the body “of the smallest common informational multipliers” from reality: rhythm, movement, intensity, shape.

Sounds, scents, colors, vibrations etc. are first “syncretized” into subsets of basic information, and the deployment of these data subsets for each modality would be enough to obtain a valid response from the whole body (Petitmengin 2001).

Heuraesthesia stands as a support for this integrated treatment of “basic units of meaning” (Mignerot 2014) that, when certain events manifest as synaesthesia to consciousness, would take part in the discernment of the response, not only for the body this time, but for the entirety of the adaptation project of body and mind. Laurent Mottron names “veridical mapping” this first matrix on which knowledge is arranged and structured among itself (Mottron 2013), when Daniel Tammet mentions the “unique weaving” of his own perception (Tammet 2007).

Subjected to the need for optimization, as every processing tool for information coming from reality, heuraesthesia has an economic target in adaptation. The formal result generated by the joint work of the basic representations and the elaborate functions of the mind seeks to achieve the manifestation of a perceptual balance, in hopes of homeostasis. The heuraesthete is a shape optimizer and heuraesthesia favors creativity because it aids the correction of the disharmony of the perceived shape, by the implementation of basic, simple, probabilistic and automatic treatment levels.

The aesthetic experience of heuraesthesia, initially intimate and impossible to share as such, must be confirmed by way of a structured, transmissible and verifiable production in order to be qualified as heuraesthesia. A heuraesthesia makes sense for the one who experiences it as well as for the community who receives its result. It is the result of the joint work of the brain and of statistician senses, which provides relevant information to make it available as it is itself statistically relevant to someone else.

Scientific Heuraesthesia

Among the most brilliant and fertile intuitions in the history of science, many have authors that attest having experienced them first in presymbolic forms, inaccessible to languages, very sensorimotor and abstract. The heuraesthesia one can qualify as scientific are those whose result, after transcription of the multimodal experience, can be verified by a neutral third party, following objectifiable and generalizable methods.

Certain mental calculators such as Daniel Tammet seem to be authentic heuraesthetes: they are capable of executing complex calculations much faster than the time needed for retrieving the results from a calculator. Daniel Tammet says about an operation performed “in his head”:

So, when I raise 37 to the fifth power ($37 \times 37 \times 37 \times 37 \times 37 = 69\,343\,957$), I see a big circle, composed of small circles rotating clockwise, from its top. When I divide two numbers, I see a spiral that expands downwards in circles that are increasingly concentric and deformed. Each division produces spirals of different shapes and sizes. (Tammet 2007)

For Paul Lidoreau, also a prodigious calculator, a mental operation appears as “a sort of spatial layout where numbers are the elements of a multi-link network, and where networks and links allow a kind of immediate consciousness of all possible relations.” (Michel 1964)

Even if we may never be certain that the thinkers that have left only written or reported records were authentic synaesthetes and heuraesthetes, we can investigate the value of what they expressed of their intuitive experience.

The creative experience of Giordano Bruno also invites questions:

If one talks about ‘magic’, one must talk about ‘mental magic’, in other words this particular type of genius ability of seeing the world through a different eye: an eye that captures images and knows how to transform them into active mental structures. These structures will have the capacity of informing (even in the sense of ‘giving form, shaping’; from the latin in- [inductive] and forma) the world, in a process that amplifies all the reflections in a spiral. This is, ultimately, that extraordinary thinking activity that transforms the disorder of sensory impressions into lucid and ordered knowledge.

Giovanni Fontana (2007)

Albert Einstein himself said that he did not develop general relativity by using only the regular mathematical language:

Words or language, written or spoken, do not seem to play any role in my mechanism of thought. The psychic entities that serve as elements to thinking are, in my case, of a visual and sometimes muscular type. Conventional words or other signs must be laboriously searched for in a second stage...

Albert Einstein (1959)

The difficulty Einstein felt in describing on paper what he perceived internally during the sensory manifestation of his thought is in line with the frustration of the artist that only rarely finds in what he has done all the richness and the infinite dimensions of what he has felt.

Artistic Heuraesthesia

Artistic heuraesthesia are perhaps more difficult to authenticate than scientific heuraesthesia because their result is not objectifiable, in so far as it is by nature not generalizable, art falling within a context of varied appreciation. Art is never really universal, nor is it permanent. The expectation of the public evolves, similarly depending on what artists may have produced in the past. But if the brain performs probabilistic calculations based on past experience and it tries to obtain a coherent result for adaptation, the relevance of this result is also subject to the quality of the setting and the natural variability of the environment... even if this environment is only cultural, local and variable.

The process of heuraesthetic intuition remains pertinent, especially since artists’ accounts are often similar to those of scientists. What is perfectly comparable is the

course of the creative act: a multimodal sensorimotor preform presents itself to the conscious perception and guides pen or brush, a composer's ear or a musician's gesture.

It is almost impossible to express in their exact limits the abstract evolutions of the brain. The inconvenience of words is that they are more marked in form than ideas. All ideas have indistinct boundary lines, words have not. A certain diffused phase of the soul ever escapes words. Expression has its frontiers, thought has none.

Victor Hugo (1869)

The dimensions of the heuraesthetic experience, shared with those of synaesthetic experience, are similar to those described by Victor Hugo. Sensory objects do not have the bounded nature of languages and concepts. They evolve in an edgeless space and naturally, by their appearance, lead to a connection to objects other than themselves. Their mere manifestation to the mind is enough to engage an opening movement, an exploration. From a multimodal object perceived, the impetus towards another is irrepressible, satisfaction attained only by following the global shape mentally from link to link until the picture obtained is sufficiently harmonious so we could stabilize the movement.

The terms "picture" and "movement" describe in this case both the inner experience of the creator as well as the result produced, especially by a painter. A pictorial heuraesthetic work will be that for which the author will have followed the directions of the multimodal shapes (colors, textures, movements...) statistically selected according to their relevance to produce the result that will be most likely to please the cultural context that will receive the work.

Vassily Kandinsky was maybe not a synaesthete, at least not according to the still rigid definition of the neurologic condition that this text may help evolve, yet certain of his works are, to him, the pictorial shaping of the impalpable, of the musical invisible, and the result moves the public in the sense of rhythm, of texture and movement. A multimodal inspiration seems to make sense and be aesthetic to both artist and viewer.

As painted by Kandinsky, heuraesthesia in music could be the preformation of the structure, as it is presented before composition as a complete sensorimotor object, non-linguistic but perfectly coherent as a perspective of rhythmic and melodic production. We may also never be certain that Mozart was a synaesthete. But we can recollect his words qualifying the pictorial representation of a musical composition:

Even if it is a long piece, I embrace it all in my mind in a glance, as if I saw a beautiful picture or a beautiful human being: in my imagination I do not hear it in order of succession, as it should come after, but I take everything so to speak in one shot.

Wolfgang Amadeus Mozart (1789)

Some contemporary musicians give evidence that their synaesthetic perceptions guide them to what they call a satisfactory result, as opposed to other times when synaesthesia does not occur to them which they feel as less satisfactory. Franck Avitabile, pianist and composer, as soon as he plays his instrument of choice and

the acoustics of the room are good, “sees” the notes and chords on top of the piano. He himself says that the perceived shapes and the emotions he feels match the generated harmonics, which “guide” his improvisation to build a coherent play on the fly.² If we can ask whether such an experience is truly a heuraesthesia, it would be interesting to study whether the public also perceives a qualitative difference in listening to an improvisation of Franck Avitabile when he himself follows synaesthesia and when he does not.

Musicians may also allow the characterization of an artistic heuraesthesia with near scientific value. It has been shown that having a perfect pitch is frequently associated with synaesthesia (Loui 2012). The richness of the potential multimodal association and the strength of the engram between the sensory information (the note) and the object of knowledge (the name of the note) suggest that perfect pitch is an almost prototypical experience of heuraesthesia. The solidity of the occurrence probability of phenomena in the world (a frequency of 440 Hz is always an A) is perfectly intuited in both perception and language. For some musicians, a note is a color, a texture (always the same for the same note), a proprioceptive position in the body (that sometimes helps distinguish between a high-pitched and a low-pitched A) and the name of the note, the whole constituting a single indivisible object, perfectly coherent and still formally connected to all the other notes. The verifiability of the accuracy of this experience by a third party allows the comparison of this heuraesthesia with that of the prodigious mental calculators mentioned earlier. It certainly contributes to the talent of many musicians.

However is there not something else? The emergence on the screen (of the work) of non-linear forms, three-dimensional sculptures which are neither only curves or surfaces, but which are as objects recalling the physical and mathematical mental representations (potential wells, tori and topological handles), infuses the idea of a topology of the mind or thought. As if one perceived the world at the Planck scale. Below this scale (10^{-33}), it becomes chaotic, fluctuating, ceasing to be a smooth space-time. Thought and mind are necessarily coupled (we do not know how) to the physical Universe. He, who can achieve the junction between these diverse and complementary concepts, can produce a work.

Louis-José Lestocart (Kapoula 2011)

Heuraesthesia proposes a path to explore the unknown elements of this particular coupling of body and mind, so frequently mentioned in the creative act and which cannot be neither magical nor incoherent.

Generalization

Following the link between probabilistic aesthetics, creativity and heuraesthesia, we can mention a recent study that seems to show that the feeling of beauty generated by mathematical logic activates the same cerebral regions as the feeling of artistic

²Interview by the author.

beauty (Zeki 2014). A common intention could motivate every creative movement: following a logic that is intrinsically carried by the adaptation process, whose functional ambition would be the quest for an aesthetic coherence providing pleasure once it is achieved, regardless of the field in which it is expressed.

We are progressing then towards the reconstruction of an “ecological theory of the mind” (Mignerot 2014), which would allow to reinsert the aesthetic experience among the behavioral attractors of the subject, enabling him to determine from the information reaching him which is most favorable to maintain satisfactions and stimulation of the brain reward areas at their highest level. Certain artworks “obtain access to the neural substrates concerned with the self-access which other external stimuli normally do not get” (Edward 2013). Synaesthetes give evidence of this feeling of intimate relation with their synaesthesia. They are at the same time entities of which they have no control, coming from outside the subjective sphere, and also an integral part of the definition of the self: it would be difficult to be defined without them.

I think, in fact, that to understand what consciousness is, one must discover the nature of the ‘isomorphism’ upon which meaning depends.

Douglas Hofstadter (2000)

Conclusion

Heuraesthesia is the implementation of the ability to infer coherence to representation based on the expectations of the context (of knowledge or, in a more general perspective, of culture). It proposes shape and meaning to the subject where there is none yet, according to the most probable correct outcome based on what already exists and the new fitting configuration. This process of multimodal meaning implementation seems relevant for the mathematician, the physicist and the philosopher as well as the novelist, painter and musician.

Heuraesthesia opens a way for the exploration of the phenomena that occur upstream of us, over which it seems we have little control but which are pertinent to our adaptation and even benefit the community. Heuraesthesia also intends to distinguish the intuitions whose result leads to heuristics from those that are akin to fantasy, sometimes esoteric, that push some to charlatanism.

The rules governing communication between perceptions and thoughts, which seem to be the source of all creative movement, may remain forever imperfectly known. But the processes involved in intuition are not irrational nonetheless and certain—incredible—skills, often discredited for lack of a means of legitimizing them, can henceforth be studied: heuraesthesia is an eminently rational process.

Indeed, the proposed interpretative framework invites consideration of object, meaning and their investment in the creative movement as being subjected to a deterministic project that goes beyond the individual. Creation is finally just a

product that is statistically optimized according to an external requirement, and it is also subjected to the need of making sense out of the “white noise” of undefined reality in a relevant way. The heuraesthetic process exceeds perhaps the whims of intentionality and free will. The fact remains that any creative act, whatever the secret intuition may keep to itself, is always carried by an emotion (Palmer et al. 2013), and it is this emotion that transports us far beyond the sole logic and the sole determinism.

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Aesthetics and Neuroscience

Scientific and Artistic Perspectives

Kapoula, Z.; Vernet, M. (Eds.)

2016, XIII, 311 p. 82 illus., Hardcover

ISBN: 978-3-319-46232-5