

Is There an Aesthetic Sense?

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Abstract

Is there an aesthetic sense? Not if what is meant by an aesthetic sense is some property of sensation that situates aesthetic appreciation and understanding in a particular sensory modality or collection of sensory modalities. Rather, aesthetic appreciation and understanding are the operation of higher cognitive functions in communion with the body. These higher cognitive functions, nonetheless, are reliant on the senses and importantly shaped by culture and by experience. I examine what an aesthetic sense might be like through the lens of the terpsichorean, musical, and visual arts and the experience of the oenophile. What we know about the properties of brains and the properties of bodies suggest that an aesthetic sense is universal in human experience. This is so because all individuals in all cultures can potentially appreciate the beauty of a sunrise or sunset or the beauty of music or dance or visual art because they are undergirded by minds, brains, and bodies that are ubiquitous and universal features of human understanding.

Keywords: Aesthetics; Dance; Music; Visual Art; Embodied Cognition

Introduction

Pablo Picasso once said that “we have discovered nothing new in art in 17,000 years” [78]. If Picasso was right and nothing really new has been added to representational art since the Magdalenian period in early human history eighteen thousand years ago, then the practice of aesthetics and the evolution of a human aesthetic impulse—opposed to the formal study of art and beauty—has a very long history. Bas-relief sculpture, perspective drawing, molded clay, sculpture in the round, engraving, shading and false relief, oil- and water-based paints, fired ceramic figures, charcoal drawing, stamping, stenciling, and brush painting all existed by this period [78]. Might there have been a special aesthetic sense that evolved in humans?

What is an Aesthetic Sense?

What would an aesthetic sense comprise? What might differentiate an aesthetic sense from the simple cultivation of discrimination or taste, as David Hume, the 18th century British philosopher, proffered [27,38]. Is the aesthetic sense tightly coupled to the individual sensory modalities on the presumption that taste and discrimination are, at the very least, based on the cultivation of the senses? If so, what might the aesthetic sense consist? For instance, in dance, might it be closely coupled to

proprioception and the vestibular senses [49]. In the culinary arts or winemaking, does it represent the fine honing of gustation and olfaction given the putative importance of both sensory modalities in the appreciation of food and drink [4,58]. In music, is it principally a faculty of audition [70]. In painting, sculpture, architecture, fashion, and film does it primarily rest on the eye and the associated visual apparatus [44,79]. In the theatrical arts, does acting and directing involve some combination of proprioception, audition, and the haptic sense [6].

Alternatively, is such an aesthetic sense a proxy for institutional practice that educates the senses [40]. The issue of institutional practice has been discussed elsewhere so I will only briefly touch on the subject here [68,69]. That is to say, the disciplinary or occupational domain transmits and shapes artistic abilities, skills, and products. Such domains include the choric and culinary arts, painting, sculpture, the crafting of buildings, fashion, filmmaking, music-making, and acting. One might think of a domain as a “stable cultural realm that preserves and transmits new ideas or forms.” For example, one can learn the complex skills of a pastry chef employed at an upscale restaurant by immersing oneself in the day-to-day activities of the pastry making: The biology of and chemistry of foodstuffs, the technology of baking, the art of glazing, and so on.

Nevertheless, it is the collection of social institutions or, rather, the social and cultural organization of a domain that legitimates the creative products of an individual artist or creator. These social institutions encompass collectors and philanthropists, critics and curators, museum directors and gallery owners, scientific review panels, professional and trade associations, and industry and academic leaders. Thus, the field can be conceptualized as panoply of social and political institutions that “select from variations produced by individuals those worth preserving.” Pablo Picasso’s first significant works of art as a young artist were initially recognized and promoted by a small group of patrons in the Artworld. In advanced capitalist cultures the individual is situated within a matrix of market relations and market competition. Artistic creativity emerges within a larger social and institutional matrix in which visual and creative ideas are commodities and their value in the marketplace is both galvanized or suppressed by existing politico-social organizations and institutions.

The Role of the Mind-Brain-Body

To this end, I want to consider what role the mind-brain-body (MBB) might play in the functioning of an aesthetic sense. Immanuel Kant, the 18th century German philosopher, believed that the operation of the higher cognitive functions shape what the senses transduce. The notion of an aesthetic sense may thus be a misnomer ignoring the central importance of the operation of the higher cognitive functions on the information that the senses provide. To that end, what role does beauty play in an aesthetic sense [45]? Is it a surrogate for some property of apperception—a synthesizing or constructive activity of the mind [22]—that intervenes in the interpretation of a percept? If so, is there such a thing as an aesthetic universal that permeates all mind-brain-bodies [13]? I explore these various questions, in turn, below.

Initially, Kant regarded the aesthetic sense as an intuitive and pleasurable experience that guided human conduct [32]. He maintained that an aesthetic experience was not just a sense pleasure but a property of subjective intuition. He linked his central aesthetic concepts—the sublime and the beautiful—to the classic temperaments of melancholy, sanguine, choleric, and phlegmatic. The beautiful aroused joy in the observer such as viewing a bouquet of red roses. The sublime aroused awe and wonder such as viewing an evening sunset over the ocean. A sanguine individual, who is cheerful and optimistic, would be attracted to the beautiful but only the surface appearance of people and things. On the other hand, a melancholic person, who experiences dysphoria and sadness, would be attracted to the sublime such as the tragic plays of Shakespeare. In his later work, Kant [32] argued that taste was not an intuitive but a logical judgment, uniting understanding, judgment, and reason and was founded on one that was aesthetic but undergirded by feelings of pleasure and desire. Thus, for Kant, an aesthetic response resided in the faculty of judgment and in the higher cognitive functions and did not originate directly in the senses.

An Aesthetic Sense Underlying Dance

Proprioceptive sense

Proprioception, the body's internal feedback with regard to the position of its limbs, is linked to special kinds of nerve cells in the brain called mirror neurons that may provide the basis of the aesthetic sense in dance [30]. Aristotle, of course, argued that there were five external senses [1]. In reality, however, there are also myriad internal senses. One of these, proprioception, provides feedback to the brain from sensory receptors in the muscles, joints, tendons, and skin that makes available to the brain information about the position of the limbs in space and time and the weight and position of objects with which the body interacts [16,53,72]. Mirror neurons in the premotor cortex receive information from the somatic nervous system, principally information from the proprioceptive and vestibular senses, enabling humans to model external events such as things seen or heard in self-initiated motor behaviors as in copying the movements of others or mimicking auditory rhythms through rhythmic movements of one's own [65,71].

Nevertheless, such an aesthetic response is underrepresented by proprioception linked to mirror neurons in the brain. For one thing, we don't necessarily experience an aesthetic response in everyday, garden-variety motor activity and feedback, so proprioception and mirror neurons can't be doing all the work of any genuine aesthetic response. Proprioception and mirror neurons are necessary, but not sufficient conditions, for imitative behavior, namely, the conversion of visual input into motor output [31]. The origin of imitative behavior—a central component of aesthetic movement—is actually not fully understood. Nevertheless, two cortical mechanisms for imitation have been recently proposed to account for imitative behavior. The opercular region in the inferior frontal cortex seemingly codes the observed action with respect to a movement's intended goal and the right superior parietal cortex appears to code the kinesthetic components of movement [28].

Vestibular sense

On the other hand, the vestibular system is immensely important to human movement and cannot be discounted. It provides information about the position and motion of the whole body in space principally through specialized motion cells in the inner ear. These mechanoreceptors as they are called impart information to the brain and spinal cord about self-motion, head position, and the spatial orientation of the body relative to gravity as well as contribute to the stabilization of posture, gaze, and position of the head in relation to the body as a whole. The vestibular-ocular reflex focuses the eyes on visual targets as the head moves, an important component of dance movement [53]. Indeed, the integration of the vestibular and somatic systems as well as input from the visual system is central to movement of the whole body in space not just proprioception alone.

Cognition and cortex

Nevertheless, following Kant's thesis that an aesthetic response is inexorably grounded in cognition and not an intuitive response based on fashionable appeals to the senses, the higher cognitive functions are no doubt central to, and indispensable for, the coordination and modulation of complex sequences of movements as well as their precise timing and spatial accuracy and comprise the core of aesthetic expression or appreciation. The senses, in any individual sense, are thus accessories to an aesthetic response. Proprioception—really a gloss for mechanoreceptors in the muscle spindles, Golgi tendon organs, and joint and cutaneous receptors—provides feedback to the brain and spinal cord with regard to musculature force, tone, and length and comprise the so-called stretch or deep tendon reflexes.

Even in rare cases where an individual has been deprived of a proprioceptive sense, this does not result in individual lacking an aesthetic response when viewing an artistic work. Nor does such an individual lack embodied concepts such as the notions of up or down or in and on [7]. This is so because one is not deprived of an aesthetic sense because there are other intact sensory modalities, both internal and external, that provide sensory information and feedback. In the rare case of a patient deprived of proprioception from the neck down, the individual was able to draw as well as

write poetry. His movements were consciously controlled by higher-order cognitive faculties with sensory feedback primarily from vision and audition. Then there is the case of Ian Waterman, a 49-year-old male deprived of a proprioceptive sense at the age of nineteen due to an unusual disorder that resulted in the degeneration of afferent pathways from the body to the brain but spared efferent pathways controlled by the motor system to the body. He could see and visualize his body but couldn't sense its movement. He learned to move by learning to control his body's movements by use of his vision. He capitalized on another sense.

"Ian's enjoyment of any kinetic melody—in a child, a puppy, a ballerina—may have been heightened by his illness. Rather than making him shun the beauty of movement, his experiences seem to have given him a finer and deeper appreciation of it. He had to think about his movements far more intensely than any choreographer. His interest in such graceful animals as deer is hardly a coincidence" [7].

Similarly, when limbs are lost one is not deprived of an aesthetic response to dance movement. The brain generates phantom limb sensations when limbs are missing and does so by remapping cortical areas. An area in the brain comprising deep thalamic nuclei reorganizes itself to take over a former area that subserved the missing limb [54]. The missing limbs, then, are really not missing at the level of the higher cortical centers.

Corollary discharge

Likewise, a little known phenomenon called corollary discharge or reafference presets the sensory system to anticipate motor acts. Higher cortical centers not directly connected to motor acts—the frontal lobes—monitor sensory feedback for just a brief moment before the motor cortices produce movement [37]. Loss of frontal lobe function disrupts sensory feedback and radically affects movement production. Conversely, Gilles de Tourette Syndrome, which is characterized by uncontrollable facial and bodily tics and vocalizations as well as unremitting exploration of the environment, is often accompanied by heightened cognitive abilities as a way of handling difficult social situations as real-life "touretters" attest [23].

Like the proprioceptive system, the vestibular system, which receives feedback from mechanoreceptors in the inner ear, makes available to the brain and spinal cord information about the position of the head and body relative to outside influences on body position and stability. The actual planning and initiation of voluntary movement, however, takes place in the motor cortices, including the primary motor, premotor, and supplementary motor areas together with support from the basal ganglia and the cerebellum, both subcortical structures.

Motor abilities and cortical representation in the brain

In addition, there is mounting evidence that motor abilities are directly correlated with the volume of cortical tissue subserving those abilities in the brain. Increased use of a body part has been directly linked with greater representation of that body part in the cortex. In music, for example, left-hand finger digits in right-handed string players have a larger representation

in the motor cortices than in non-musicians [14]. When listening to well-practiced piano music, professional pianists exhibit involuntary motor activity and engage the primary motor cortex [24]. In a theoretical vein, the philosopher, Alva Noë, contends that our perceptual experience is dependent upon the use of our sensorimotor knowledge and that we make use of our bodily skills to take advantage of the intrinsic relations between our bodies and our brains [50]. In a similar fashion, the philosopher, Derek Melser avers that mental concepts are nothing more than actional concepts, that is, thinking is learned, voluntary action [47].

Dance and cognition

In the case of dance, an aesthetic response would not principally arise from some aesthetic sense or derive inexorably from some particular sensory modality but originate in mental events or higher cognitive functions. Four cognitive abilities are central to aesthetic movement: Motor logic and organization, kinesthetic memory, and kinesthetic awareness [61]. Motor logic and organization comprise the dancer's neuromuscular skill with regard to the assembling, articulation, and ordering of movement. This comprises the syntax and organization of movement. Kinesthetic memory enables the dancer to think in terms of movement by mentally reconstructing muscular effort, movement, and position in space and time. Kinesthetic awareness or the kinesthetic sense proper, an amalgam of vision, proprioception, and the vestibular sense, provides the dancer with online information about the extent, direction, and weight of movement. All four comprise the cognitive basis of an aesthetic sense. This aesthetic sense would include the ability to use one's body to convey an idea or emotion, create a spatial design, or fashion a more extended choreographic product in time and space.

Collective memory and intelligence

Collectively, [46] proposes that keeping together in time executed through human group movement had important historical consequences because, among other things, it facilitated human solidarity and social cohesion through such enactive vehicles as community dancing, marching, and singing; religious rituals; courtship; close-order military drill and battle; calisthenics; martial arts; sports; demonstrations; parades; choral singing; as well as some forms of factory labor. But, it also enhanced and expanded the storage and retrieval of information, or what I'm going to call collective memory, through group participation in large informational networks. Similarly, these group interactions augmented collective intelligence and emphasized collaborative movement's cognitive function by encouraging participatory democracy—participation in collective decision-making—and the facilitation of an individual's unique social identity.

The aesthetic impulse in dance

Let's consider how an aesthetic impulse might arise in an individual dancer or choreographer. First, a dancer would match body parts of self and other and then generate movements mapped onto his or her own body configurations. Not surprisingly, human

infants readily map their mental experiences to bodily acts as well as note equivalences between perceived and executed actions. They also assume that others have the same mental experiences and map mental properties onto behavioral states of others. While the right inferior parietal lobe picks out and detects the actions of others and maps them onto bodily aspects of self, the left inferior parietal lobe computes the obligatory sensorimotor relationships for imitation. Most dances—whether ballet or modern dances—are choreographed directly from observing others or by observing digitized videos of dances. Martha Graham's great modern dance works of the 1930s, *Lamentation* and *Primitive Mysteries*, were reconstituted from watching the steps on film as recounted to me by dancers in the company [60]. I have directly observed modern and ballet dancers learn completely new choreographic works by watching it on a laptop computer screen positioned obliquely to their bodies, so they were literally on stage with the other dancers. Frankly, when a modern dancer trained in ballet first demonstrated it to me, I couldn't believe my eyes. They pickup movement seemingly instantaneously because they are already deeply embedded in the grammar of movement of the particular style of dance they are engaged; Graham technique or French or Russian ballet method, for instance. Even when dances are recreated from dance notation, the actual movements are worked out among dancers in the studio as I observed and participated in at the Laban Institute in New York City. Labanotation (1928), as it is called, was one of the first dance notations

Second, these equivalence relations among mapped body parts create kinetic signatures of self and other that a dancer capitalizes on in movement [48]. Kinetic signatures are correspondences across sensory modalities or intermodal mappings that are stored in the brain and commingled with sensory-specific information such as touch, vision, and proprioception from the body [71]. They are thus analog representations, body analogies if you will, for complex movement sequences. Third, these intermodal mappings are drawn from diverse sensory modalities as in something seen, heard or felt and fused with self-generated action because dance conveys aesthetic meaning through conceptual and sensory interplay.

Aesthetic mechanisms in dance

There are six aesthetic mechanisms in movement: Imitation, style, visual resemblance, metaphor, metonymy, and statuses and roles [12]. For example, a very young dancer might imitate an airplane or a bird in flight by flapping her arms. Likewise, when a dancer moves or behaves in a feline manner she is demonstrating the capacity for visual resemblance or the outward form of movement. The illusion of overcoming gravity, however, through ballet pointe technique—as opposed to the use of heaviness of the lower body to convey pathos in modern dance—is an example of style in dance or the conventionalization of gestures and whole-body movements. The two tropes, metaphor and metonym, convey aesthetic meaning by substituting one movement for another as in placing the hands on each side of the head to express anxiety or using a part of a movement as a metonym to express a larger whole as in a war dance to convey the notion of impending battle. Lastly, statuses (a king) and roles (a romantic lover) are

conveyed through, respectively, a courtly or coquettish dance [67]. These aesthetic responses constitute embodied analogies to physical qualities, to the senses, and to the emotions [65,71]. Rather than expressing actual sensory, physical or emotional experience, dance reveals aspects of reality, such as relationships among individuals, through embodied or gestic form [39].

Dance as virtual objects and forces

Dance creates gestic form in two primary ways. Through virtual self-expression the dancer's concrete gestures capture the forms of feeling as in a hand outstretched to convey romantic desire. Through logical expression the dancer symbolizes concepts with the body as in the hands pressed together to one side of the head to suggest sleep. Both self-expression and logical expression are enacted through the interaction of bodily-gestural forms, the kinesthetic and projected space around the dancers' bodies, lighting, scenery, props, music, and audience reactions. For that reason, dance might be best understood as a field of virtual objects and forces including dancers, dance elements, space, time, and gravity [67]. This is so because dance is governed by physical laws of motion [42]. These include the physical laws of velocity, acceleration, position, and time as well as the relationship between these physical laws of motion and the forces that operate on things in motion. These physical laws create the illusion of virtual forces. For example, an arabesque in ballet where the dancer turns on one leg while the other is extended outward horizontally on pointe creates the illusion of the body suspended in space.

Embodied analogies

These embodied analogies occur both in the immediate present in a body loop in which occurrent physical, sensory, and emotional experiences assist physical movement and in an as if loop based on previous experiences stored in kinesthetic or long-term memory [8]. A similar embodied process has been argued to underlie musical composition and improvisation [66]. That is, the ability to integrate information across different sensory modalities enables individuals to perceive intensity, melody, spatial location, tempo, and rhythmic structure in music in an amodal manner; that is, to encounter it as one integrated experience [62,70,71].

Was dance the first aesthetic impulse? Was dance the first art form originating in early H. sapiens as some scientists propose, or was there coval emergence of dance, music, and visual art? Genetic polymorphisms on genes AVPR1a and SLC6A4 are associated with aesthetic movement in professional dancers but not elite athletes, nonathletes or nondancers. Differences in common genetic polymorphisms (phenotypes reflecting specific genetic causes from two or more alleles at the same gene locus) reflect variation in preferences, aptitude, and the need for expression through dance in diverse individuals. The serotonin transporter gene (SLC6A4) not only regulates serotonin but contributes to serotonin's effect in creating spiritual experience as suggested by dance's association with sacred rituals and ceremonies. The arginine vasopressin receptor 1a gene (AVPR1a) appears to modulate affiliative behaviors (who you hang out with) as well

as social communication (how, when, where, and with who you communicate). The results suggest that the association between aesthetic movement in professional dancers and genetic factors is modulated by aspects of personality including one's spirituality, capacity for empathy, need for social contact and varieties of courtship, as well as qualities of social communication [2].

Is There an Aesthetic Sense Underlying Music?

Like dance, discrimination and taste in music are, to a degree, faculties of the higher cognitive functions. One manner in which an aesthetic sense might function in music is through equivalencies to human movement. In his original contour theory [35], a philosopher of music, argued that the sonic shape of a musical piece was analogous to human emotional expression indicating a close association among music, the body, and human speech. This association is borne out by studies of contemporary English and French speakers and late 19c and early 20c English and French composers. Measures of durational variability based on sampling of vowels and musical tones occur in the same general direction for both musical compositions and linguistic utterances taken from the same culture [51]. Durational variability is the difference in duration between pairs of vowels or musical notes relative to the average length of the pair in a speech or musical sample. Vocal prosody or intonation of a composer's native language thus appears to influence the form or structure of a musical piece. This is so because composers most likely internalize rhythmic patterns of their native language very early in life and incorporate rhythms of folk and popular songs acquired in childhood in their mature compositions [70].

In a similar fashion, [9], a music philosopher, contends that human emotions are presented directly in a musical work through analogy to human movement, behavior, physiognomy, the human voice, gait, and the like. According to Davis, music doesn't symbolize, describe or represent anything on its own, but like human movement, musical motion is inherent in the temporal dimension of music and turns on musical tension and relaxation. It is thus experienced as felt emotions in the listener.

Musical cognition

Yet, aesthetic appreciation in music, as in dance, is not solely a mental activity but a form of cognition embodied [65,70]. Empirical studies have demonstrated that when human infants are bounced on their parent's lap on either the second or third beat, they subsequently prefer the rhythmic pattern that matched their earlier experience [52]. Thus, the experience of the infant's own body, but not the infant's self-initiated movement, is critical to the development of human musical understanding. This indicates that the effect is largely tied to the proprioceptive system rather than the vestibular system or vestibular-auditory interaction. Pedagogical practices in music including the Dalcroze, Kodaly, Orff, and Suzuki methods capitalize on the fact that basic elements of music such as rhythm and musical dynamics, intervallic relationships such as pitch and melody, and sonority can be most effectively taught through physical motion using such devices as rhythm, sight-singing or rhythmic solfege, and improvisation [29,70].

Is audition necessary for an aesthetic sense in music? [20], a deaf percussionist, is able to play music through her ability to feel and adjust to the nuances of vibrations of musical instruments, the floorscape, and cognate materials. There is additional evidence that the postlingually deaf or individuals with acquired hearing loss retain some musical imagery and appear to respond to musical sound [59]. And there are anecdotal observations that composers who have lost some or all of their hearing are still able to compose, a few to astonishing heights, as in Ludwig von Beethoven in the last decade of his life. If not in music, might there be an aesthetic sense in the visual arts?

Is There an Aesthetic Sense Underlying the Visual Arts?

Is image-making informed by an aesthetic sense? The history and evolution of image-making suggests that there is no aesthetic sense if one means by that a particular sensory modality necessary and sufficient for aesthetic enjoyment within a particular visual artistic genre. If the purpose of image making is to represent the sensible essence of objects as some artistic observers have asserted, then the form of the image is far removed from its actual appearance or any of its sensory properties or qualia [56]. Rather, aesthetic appreciation and production emerge from the intellectual imposition of meaning or semanticity on a set of marks or forms.

Early exploitation of aesthetic form

In human evolution, early hominins appear to have exploited three kinds of forms or marks: Color symbolism, decorative stylization, and direct marking [10]. Meaning was initially impressed on shapes and forms preexisting in nature or from one's own body [21,76], although some have proposed that the origins of image-making may have been early hominins' own mental activity. These mental phenomena may have included entopic phenomena or sensations that seemingly arise from within the eyeball, such as afterimages and hallucinations, but actually emerge from physiological processes in the brain [43,78]. In either case, Ernest Gombrich, the notable art historian, claims that the human mind originally imposed a few central narrative or classificatory schemes over the most recent ten millennia or so. For example, loss and renewal, and victory and defeat. These central schemes, he hypothesizes, arose from cultural developments in early human history rather than from punctuated biological changes in the human brain [36,43,78]. Such early image making may have served the storage and transfer of cultural knowledge [15,77], myth creation [76], social identity [77], food procurement, control of reproduction and fertility [78], as well as early forms of spirit worship [43]. Indeed, of the 300 or so prehistoric caves that exist in Europe, anthropologists and other scientists have found evidence of many important aspects of modern visual art including perspective drawing, interlocking figures, surface preparation to control light and contrast, pointillism, false relief, the apparent capacity to switch easily from 2-dimensional to 3-dimensional imagery, and evidence of a social system of apprenticeship and training [71,78]. Importantly, the most frequent subjects represented such as horses, bovines, and

mammoths were dietarily the least important. Recent evidence, using uranium-thorium dating, indicates that an early hominin, *H. neandertalensis*, used perforated marine shells as ornaments and drew abstract images consisting of long lines, dot patterns, and the outline of the human hand on the walls of caves dating back as much as 120,000 years ago long before modern humans, *H. sapiens*, had settled in areas of eastern Spain [25]. This represents the centrality of advanced cognitive capacities in early hominins in aesthetic production.

Infra-human primates and young children

On the other hand, while infra-human primates (Great Apes) may partake of visual and kinesthetic delight in applying paint to paper and create balanced and symmetrical designs, the marks appear to have no representational meaning [11]. Yet, in young children, one can discern an incipient aesthetics in their ability to comprehend, for instance, simple stylistic differences in groups of paintings from different historical eras, a noteworthy cognitive ability given little or no prior experience [18].

Modularity in the brain

The empirical and scientific evidence indicates that aesthetic perception in the visual arts is modular with perceptual systems in the brain functionally specialized for the recognition of color, form, motion, direction and orientation, faces and facial expression, and body language [44,79]. Color vision itself, however, is far removed from actual appearance in the real world, because for one thing, the human visual system only perceives light within a very narrow range of the electromagnetic spectrum (400-780 nm). Color consistency and color unity across an object's surface—color and form are inextricably linked because object borders are instrumental in the creation of shape and form—are computed by visual areas of the brain based on a simultaneous comparison of a color patch on the surface of an object and its immediate visual surround. Both are significantly influenced by judgment, learning, and memory since there are both natural and unnatural colors [79]. Individuals missing the genes for red, green or blue color perception, are either red-green or blue-yellow colorblind or both and the red and green color genes are sex-linked and more common in males. There is some evidence that certain females may compute color with an additional cone—cells on the back of the retina that sense color—in the red range of the electromagnetic spectrum potentially heightening their aesthetic appreciation [34]. Conversely, individuals who have lost visual sensation rely on other sensory systems as the following excerpts from a blind Professor of Religious Studies attest.

“A blind person is simply someone in whom the specialist function of sight is now devolved upon the whole body, and no longer specialized in a particular organ. For instance, rain has a way of bringing out the contours of everything; it throws a colored blanket over previously invisible things; instead of an intermittent and thus fragmented world, the steadily falling rain creates continuity of acoustic experience. Facial vision [my emphasis] is the sense of pressure on the skin of the face rather than or upon the ears” [26].

Certainly, the sensory impressions of temperature and pressure on the face and bodily surfaces and sound pressure upon the tympanic membranes of the inner ear as well as the analysis and discrimination of sound have always assisted the sensorium of the blind. Their investigation, in fact, originally commenced with the French philosopher, Denis Diderot's early studies and prognostications on the subject in the 1700s [73].

Luminosity

Besides color, luminosity or perceived brightness is an important aesthetic value because luminance of color differs depending on ambient light and influences the perception and shape of objects. Rembrandt exploited this aesthetic feature extensively in his artistic work by manipulating the luminance contrast between the background and subject of his paintings, a technique called countershading. He used it to great effect in his 1632 work, “Meditating Philosopher,” predominantly through the use of chiaroscuro or tonal contrast between light and dark that create 3-dimensional form, stereopsis, and abet color mixing. The striking result that Jean-Auguste Dominique Ingres achieved two centuries later in his portrait of “Princess Alabert de Broglie” foreshadowed the realism of early photography [44].

Familiarity, context, and typicality

Familiarity, context, and typicality are also important aesthetic values and along with color and luminosity play a significant role in aesthetic visual perception even though immediate perception itself (color, luminosity) is informationally encapsulated and less porous to conscious knowledge and past experience [58], which these three incorporate. Familiarity, of course, refers to acquaintance with an aesthetic object or event in a painting or print such as an apple or pear or an event like war or the gathering of citizens in a town square. Related to familiarity is typicality or whether these objects or events are conventional in pictorial depiction or not. Context alludes to the relationship of the objects and events to each other and the overall scene denoted in the depiction. Nonetheless, discrepancies among vision, touch, and proprioception—what's been called the unity of the senses—are re-calibrated by central cognitive systems when there is conflicting information among these various sensory modalities. But conflicts between visual memories and conscious, objective knowledge are typically resolved in favor of the former even though this stored knowledge is continuously compared to ongoing perception with all of its inherent conflicts [58].

Visual ambiguity

The same is true of visual ambiguity. If the visual stimulus remains constant but the percept changes—as in ambiguous figures such as a line drawing switching back and forth between a young and old woman—higher brain centers, the fronto-parietal cortices, kick in as we become aware of the discrepancy and try to voluntarily switch visually between alternative visual percepts. It is this ability to experience multiple perceptual viewpoints from a work of art not just in patently ambiguous figures but in all visual art that renders aesthetic pleasure according to one of its most prominent proponents, the neuroscientist [80].

Beauty

As it turns out the experience of beauty in art also has significant neurological components. A network of brain regions including the medial orbito-frontal cortex, anterior cingulate, left parietal cortex, and motor cortex appear to underlie the perception of beauty. The medial orbito-frontal cortex along with important linkages to the corpus striatum, a subcortical structure, is involved in the perception of rewarding stimuli and is activated by novelty and salience and thus makes objects and things appear vivid to the senses. This cortical-subcortical network contains neurons that respond to food and drink, sexual arousal, psychoactive drugs such as nicotine, and monetary reward [3]. The anterior cingulate cortex is a deep cortical structure central to attention as well as emotional arousal and perception. The ventral part of the anterior cingulate cortex is activated by the emotions of anxiety and sadness and appears to be involved with empathic awareness and the appreciation of music. The dorsal part is linked to social communication areas in the brain such as theory of mind regions and is activated by, among other things, romantic love. The left parietal cortex undergirds spatial awareness, undoubtedly a prominent feature of visual aesthetics. The motor cortex is involved in approach and withdrawal from aversive and rewarding stimuli along with areas in the right hemisphere and the amygdala that play a role in the perception of negative emotions. It appears that there is not a separate area in the brain for the perception of beauty and its opposite as both appear to be mediated by the same underlying neural network [33,80].

Taste and discrimination

This brings us to the issue of taste and discrimination. [27] believed that taste was a human propensity that cut across various forms of aesthetic pleasure whereas Immanuel Kant elevated aesthetic enjoyment to a separate realm supervenient upon bodily ones [38]. Others have also proposed that aesthetic appreciation is a universal human property [13] as supported by the aforementioned neurological evidence [5]. Indeed, Kant acknowledged that aesthetic experience and the experience of beauty were universal because they were undergirded by mental processes that were themselves ubiquitous and present in all modern humans.

The Aesthetic Sense in Other Sensory Modalities

Aesthetic elements of wine tasting. When discussing the aesthetic enjoyment of wine, for instance, master sommeliers and viticulturists emphasize the acquisition of the ability to discriminate such aesthetic elements as the body of the wine (light, medium or full body); dryness or the lack of sweetness in a wine; acidity or crispness; as well as oakiness or the addition of certain flavors within the barrel in which the wine is aged [4]. Additionally, there are such aesthetic components as the wine's structure or the combination of body and tannin in a wine, and the floral or fruit quality of a wine such as its butteriness (due to a trace component called diacetyl), herbaceousness or the prominence of a grassy taste, spiciness (sweet as in cinnamon, ginger, cloves, anise, licorice, nutmeg, and allspice or savory as

in black pepper, white pepper, cumin, coriander, and mustard powder), as well as floral scents such as orange blossom, honeysuckle, lilac, lavender, lily, hyacinth, jasmine, and hibiscus, to name a few [57]. These abilities, moreover, do not just rely on taste receptors on the surface of the glossa or tongue but may be superseded by olfactory receptors in the nasal cavities (the wine's nose), visual appearance (the wine's color and clarity) as well as the haptic sensation of the wine on the interior surfaces of the mouth as in assessing the wine's concentration of tannins. Aesthetic enjoyment is most likely further compounded by vestibular and proprioceptive feedback in the holding as well as the initial design of the various wine glasses and decanters that shape and modify the aesthetic pleasure conveyed by the external sensory apparatus. The olfactory system, moreover, is importantly connected to multimodal areas in the orbitofrontal cortex that integrate information from the gustatory, olfactory, affective, and intellectual areas of the brain, thus providing a holistic experience of food and drink (Purves et al., 2004).

Pairing food and drink

The cognitive complexity of acquiring such an aesthetic ability is compounded by learning which foods and which wines go best together. Classic pairings—known to whet the appetites of gastronomes, at least in Western cultures—include such delicacies as steak and full-bodied reds (Cabernet, Merlot), champagne and caviar, goat cheese and Sancerre (a dry, herbaceous white wine), chips and salsa combined with a sweet Riesling, and so on. The justification for such pairings is that they are acquired higher-order cognitive abilities. Such abilities, of course, categorize and classify things in the world based on the sensory attributes of objects and such aesthetic pleasures are probably universal across human cultures although neither obviously nor specific cultural objects nor the pairings themselves.

Summary

Is there an aesthetic sense? Not if what is meant by an aesthetic sense is some property of sensation that situates aesthetic appreciation and understanding in a particular form of sensory perception or some truncated collection of sensory modalities. Rather, aesthetic appreciation and understanding are the operation of the higher cognitive functions in close communion with the body. These higher cognitive functions are reliant on the senses as well as the body and importantly shaped by culture, experience, and informal and formal education [79]. From the standpoint of neuroscience, beauty is the brain's response to rewarding stimuli that activate areas of the brain that respond to novelty and salience. These rewarding stimuli cut across classes of social and nonsocial objects (people and things) and include not just the perception of persons and bodies, but food and drink, music, the visual arts, aesthetic movement, and similar areas. As a consequence, what we know about the properties of brains and the properties of bodies suggests that an aesthetic sense is universal in human experience. That is, all individuals in all cultures can potentially appreciate the beauty of a sunrise or sunset or the beauty of music or dance or visual art because they are undergirded by minds, brains, and bodies that are ubiquitous and universal features of human understanding.

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