

Original Research Article

Aesthetics of Modern Art from the Perspective of Cognitive Neuroscience

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Abstract

Problem statement: Why do some casual art audiences question the aesthetics of some abstract works? What are the aesthetic criteria and indicators in modern art? Basically, the *raison d'être* and aesthetics of modern art are considered noteworthy topics in the philosophy of art. The growing body of research in cognitive neuroscience has provided a deeper insight into the neurological basis of visual perception and decision-making processes in the brain. This insight can lead to extensive applications in various theoretical and practical fields ranging from explaining the formation of aesthetic experiences to cognitive design.

Research objectives: This paper focuses analytically on the aesthetic criteria of modern art based on neuroscience, interprets the most important and relevant empirical studies, and explains their relations to modern art. It also presents an aesthetic analysis of modern art based on the principles of neuroaesthetics.

Research method: A descriptive-analytical approach was employed in this qualitative study. The discussion, findings, and results are based on the analysis and interpretation of results from empirical studies on neuroaesthetics.

Conclusion: This analysis of research findings indicated the effects of certain neuroaesthetic laws on the aesthetic experience of modern art. Based on the visual processing mechanism in the brain, these laws are in closer links with the gene-based route of aesthetic perception. Apparently, the aesthetic experiences of abstract artworks are mostly the results of concepts constructed by the syntactic reasoning brain system akin to a semantic label on modern artwork. The intertwined two routes of instinctive gene-based aesthetics and the syntactic reasoning brain system have a two-sided dialectic interaction in the process of aesthetic perception. The analytic results indicated that the second route, which is mostly affected by culture and education, had a greater impact on the aesthetic judgment of modern art.

Keywords: *Aesthetics, Modern art, Cognitive neuroscience, Neuroaesthetics, Syntactic reasoning system.*

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Introduction

Art critics and historians have different perspectives on the chronological origin of modern art. Some think that modern art emerged with impressionism in the second half of the 19th century and with post-impressionism in the late 19th century, whereas others reckon that the two related styles facilitated the emergence of modern art in the early 20th century. In any case, the mid-18th century generally marks the ascendancy of classical art peaking in the transcendental Renaissance. However, the early 20th century marks the beginning of the publication and development of various modern art styles. Evidently, modern art—in its conceptual whole—no longer observes one of the most important missions of classical art, namely the faithful and accurate representation of the object and the natural world. In fact, it emphasizes art as an instrument of sensual expression by “defamiliarization of form.” This emphasis on sensual expression is seen in many works of modern art styles such as Fauvist and Expressionist works as well as more abstract and even surrealist styles, placing a content emphasis on modern art formed in style and form on defamiliarization of visual form. The challenging origin of modern art is not separate from the challenging origin of the definition of art. Since aesthetic judgment depends on the recognition of stylistic indicators and features as well as the relatively-comprehensive definitions of the origin of art, always throughout history, art philosophers and critics have tried to define art and its stylistic formation. The difficulty in presenting a comprehensive definition of art could have led philosophers such as George Dickie to accept the institutional theory, according to which the origin of art—and therefore aesthetic criteria for artwork—is a construct of the dignity that the art universe including artists, critics, historians, masters, professional audiences, and gallery owners will bestow upon the object (Dickie, 1974). In other words, what raises an object to an artwork is the relative consensus of the art universe. In fact, the origin of art and aesthetic criteria are socially constructed and therefore are

dependent on time and place. This perspective can adequately explain most definitions and criteria for art and aesthetic perception in various historical periods. At the same time, the growing body of research on cognitive neuroscience has provided a deeper insight into the neurological basis of visual perception and decision-making in the brain, which can provide accurate, interesting, and documented information about the mechanism and, in some cases, the reason for the aesthetic judgment of artwork. Cognitive activities refer to high-level mental processes such as thinking, perception, imagination, speaking, acting, and planning. Hence, cognitive neuroscience seeks to explain cognitive processes based on the brain’s functional mechanisms (Ward, 2015, 2). In other words, cognitive neuroscience addresses how the brain perceives the environment and phenomena and how it responds to environmental stimuli. This relatively modern science analyzes how the brain is employed to think, plan, remember, perceive, see, hear, focus, create and control emotions, solve problems, and move in the environment. It also addresses the set of actions and reactions known as cognition in general (Jaaskelainen, 2012,10). In this framework, scientific explanations of art and aesthetics avoid reductive approaches—epistemologically—to complement and verify some of the most important philosophical and social perspectives in art and aesthetics and to even provide neurological equivalents for some of those perspectives including institutional theory.

Research Background

There are numerous local and foreign studies and books on aesthetic analysis and criticism of modern art; however, there has been no local analysis of modern art with a cognitive neuroscience approach. There are case studies in neuroscience research regarding art in general with mentions and examples of modern art. This study cites some of the most important papers from the past two decades. However, most studies on art and neuroscience have focused on art as a conceptual whole and not modern art in particular. Moreover, none of these papers have explored this subject from the

perspective of neuroaesthetic laws. In fact, a credible scientific-artistic analysis according to these laws can only be found in parts of the famous article and book by Ramachandran, the Indian-American neuroscientist and prominent scientist in neuroaesthetics. However, it is brief because it mentions only the examples that mostly concern the classical concept of art. In addition to its analytical focus on modern art according to neuroscience, this study will examine and interpret the most important experimental tests in this field and provide an analytical explanation of modern art based on neuroaesthetic laws.

Theoretical Background

• Routes of Aesthetic Judgment in the Brain

The brain has dual routes to aesthetic judgment. The first route includes parts of the reward and punishment system, such as the amygdala and the orbitofrontal cortex that evaluate the reward or punishment of input stimuli (T. Rolls, 2017). This evaluation is based on gene-based objectives or the cost/benefit of stimuli for human survival perceived as pleasant/unpleasant sensations. The pleasant nature of initial rewards, such as nutrients, is rooted in their importance and benefit to survival. Therefore, we avoid dangerous stimuli for survival due to their unpleasant sensation. Created by the brain's reward system releasing dopamine neurotransmitters, this pleasant feeling is the neurobiological aesthetic basis of some artworks with examples including the pleasantness and attraction of symmetric patterns in artworks such as paintings, statues, and architecture. As symmetry recognition is important for survival, dedicated regions have evolved in the occipital lobe for processing inputs from the visual system and recognizing symmetry. The resultant benefit of this biological advantage can be seen in the attractiveness of the symmetrical patterns in many artworks. The second route of the brain's syntactic reasoning system includes the prefrontal cortex and the language cortex (T. Rolls, 2019). Since the prefrontal cortex generates high-level cognitive abilities and social cognition, this route generally includes multistage and long-term calculations,

planning, and decision-making through syntactic reasoning for a reward, which could be the delaying of a primary reward for a greater future reward, although the processing results may not necessarily be aligned with gene-based goals and be in favor of memes, i.e., the elements of cultural information. In the first route, the values of rewards and the creation of a pleasant emotion are measured based on the benefit of stimuli for survival, whereas in the second route, the sense of pleasure can result from problem-solving in the brain's reasoning system, the output of which could be breaking down complexities and finding simple yet beneficial solutions. In the following, the role of neuroaesthetic laws will be reviewed (the description and analytical application of these laws will be presented in the findings), and different areas of the prefrontal cortex will be explored in the formation of aesthetic experiences (including any immediate aesthetic emotions and pleasure-perception resulting from aesthetic judgment), especially regarding modern works.

Research Method

In this qualitative study, a descriptive-analytical approach was employed to explain the aesthetics of modern art by analyzing and interpreting the results of empirical studies in neuroaesthetics. In general, this explanation takes shape as two routes of aesthetic judgment in the brain. Proposed in 2017 and 2019 by British neuroscientist Edmund T. Rolls, these two routes were explained in the theoretical background. The methodological characteristic of this study is the combination of aesthetic perception routes with previous studies on art, neuroscience, and neuroaesthetic laws.

Discussion and Analysis of Findings

• The role of neuroaesthetic laws in aesthetic perception of modern art

In his book, the Tell-Tale Brain, on the human brain's visual processing mechanisms, Ramachandran, an Indian-American neuroscientist, and leading scientist in neuroaesthetics, proposes a set of nine

laws to explain the reasons for aesthetic judgment of many artworks. Some of these general laws, which he referred to as universal laws, were the generalized forms of specific Gestalt laws in visual experience proposed by experimental scientists in the early 20th century. They were developed in Ramachandran's version with evolutionary explanations and neurobiological mechanisms of visual perception. Relying on these laws to explain aesthetic perception is mainly based on the first route explained earlier and a pre-fabricated network of neurological mechanisms of visual processing and sensory reactions. This section analyzes the effects of these laws on the aesthetic perception of various styles of modern art.

The brain's limited attention capacity is a so-called bottleneck, meaning that it can only focus on one aspect of an image or an object at any given moment. In neuroaesthetics, this is called Isolation (Ramachandran, 2011). Evidently, the cells in the primary visual cortex (i.e., the first stage of visual processing) only react to the outlines of an object as well as why the outlines of a subject draw more attention than its details. Therefore, industrial designers, fashion designers, architects, and others sketch up their initial ideas or simple line drawings such as the sketches of cows or pigeons by Pablo Picasso (Fig. 1) draw more attention than the natural-colored drawing of the object in its natural scale and with all details. This initial attraction is based on cognitive principles and concepts related to the roots of modern art, i.e., the importance of sensual expression in modern art that elevates artworks such as Picasso's sketches. Thus, without any knowledge of this cognitive notion, many artists represent subjects in their works by instinctively dulling certain visual aspects (e.g., form, line, color, and motion) of a subject to emphasize specific aspects. Since certain models of neurological activity and networks in the brain overlap, they are constantly competing for limited attention resources. Therefore, an artist emphasizing an aspect while eliminating or dulling other visual elements can focus most of

the brain's attention capacity on that aspect (ibid.). This is similar to Raffaello's works in classical European painting or Reza Abbasi's works in Iranian painting—Safavid School of Esfahan—which highlight the originality of the line by highlighting the boundaries or edges against European Rubenist and impressionist works and Sultan Muhammad's works—Safavid Painting School of Tabriz—which draws attention to the color space by eliminating or dulling boundary lines. Considering the brain's energy consumption, this limited and optimized information processing can bring a pleasant visual experience. Therefore, some of the attraction in the originality of the line in certain abstracts of art styles such as cubism—in the style of Picasso—or the originality of color in impressionist works (Fig. 2)—an important and early style of modern art—is rooted in this general neuroaesthetic law.

Considered another neuroaesthetic law, Contrast (as a specific concept) can play a prominent role in the aesthetic judgment of abstract art. Essentially, contrast is any significant distinction between degrees of clarity in formal elements of two adjacent or overlapping objects. The contrast could be found in degrees of color clarity, depth, texture, or shape and distinguish two adjacent or overlapping forms, e.g., the shape from the background. This is a specific and more abstract aspect of contrast known as conceptual contrast (ibid.). Some works in conceptual art can surprise the audience with

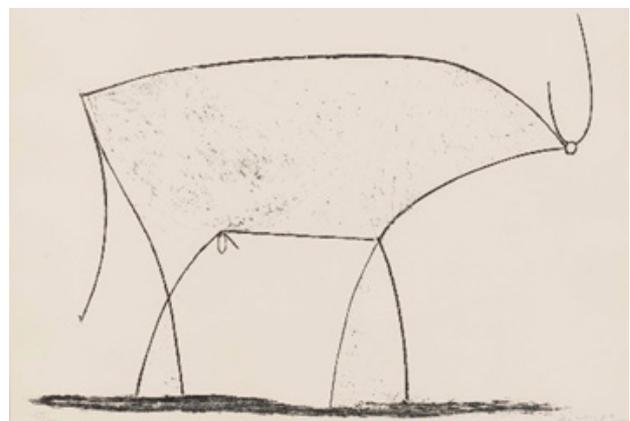


Fig. 1 . The Bull by Pablo Picasso (1946). Source: <https://www.wikiart.org/en/pablo-picasso/bull-plate-xi-1946>.

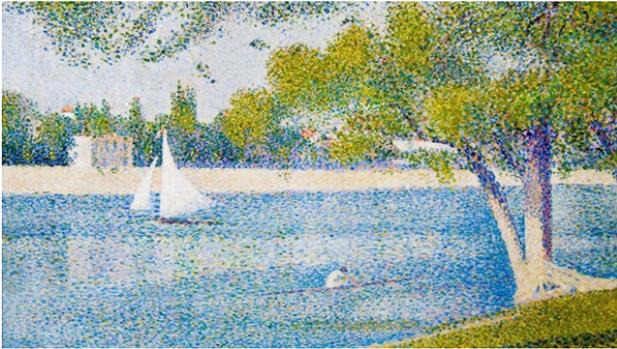


Fig. 2. The River Seine by Georges Seurat (1888). Source: <https://www.wikiart.org/en/georges-seurat/the-river-seine-at-la-grande-jatte-1888>.

specific and tangible formal features. In Fig. 3, as the audience encounters the ambiguous and unknown formal whole of the work that is inconsistent with their previous formal expectations and experiences of their surrounding routine objects, the contrast combined with formal features such as depth and texture and the significant contrast of the formal whole with its background of normal and familiar space—form-wise—in an art gallery can establish a significant conceptual contrast and attract the attention of the audience. However, the aesthetic experience of the audience while encountering this work is only partially affected by this attraction arising from conceptual contrast.

Another neuroaesthetic law called Perceptual Problem Solving (*ibid.*) stipulates that covering a larger part of a visual object can make it more attractive. The experience of such an attraction can arise from, for example, the photogenicity of portraits in which the hair has covered parts of the face or angles that make the face ambiguous by penumbra or a specific pose as opposed to the images where the face is fully visible. This law is also very important to dress designers, for the creation of open and covered spaces with clothing can experientially make that design visually attractive. Essentially, human perception is a problem-solving process. The human brain constantly tries to recognize the environment to identify opportunities or threats to human survival. Therefore, according to gene-based algorithms, solving perceptual problems and even the problem-solving process can lead to pleasure in

the brain. Hence, there are ambiguous encounters with visual stimuli in some conditions, decoding which can be as pleasant as solving a mystery. An example of this attraction is found in impressionism where the artist employs a “reduced clarity” to create a somewhat familiar visual landscape of an ambiguous visual space—both as a whole and in visual details—and stimulate the human visual system (Fig. 4). Moreover, defamiliarization of a form in some modern artwork, e.g., cubism, can create visual ambiguity in the audience’s encounter with the content (e.g., representation of cubist faces). In such cases, the visual system relies on pre-existing assumptions and patterns and previously-learned information to try to resolve the ambiguity from the ambiguous visual whole.

Another feature of the human brain is the attraction resulting from the brain’s response to exaggerated visual stimuli known as the Peak Shift law (*ibid.*). This feature is partially related to the neurological mechanisms of vision in face detection that can explain successful portraits by artists and the allure of caricatures. It is partially related to the mirror neurons and the brain’s strong response to motion and changes in body and facial expressions. However, this study focuses on another aspect of this law that Ramachandran refers to as “ultranormal”. He believes that in abstract art, an artist employs trial and error as well as intuition and ingenuity based on initial patterns/shapes perceived by the brain from the initial stimuli to produce ultra normal stimuli that can stimulate parts of the brain’s visual neurons with more intensity than the initial stimulus (*ibid.*). Now, it is worth noting that despite being derived from an initial form the ultra normal stimulus has an abnormal formal whole as opposed to the initial stimulus that can even dull the iconic similarity to the original form. For example, as seen in one of the works by Wassily Kandinsky (Fig. 5), the artist has considered three original shapes (i.e., square, triangle, and circle) as the basis to produce an abstract work considered an ultra normal stimulus in its formal whole as opposed to the original shapes.



Fig. 3. Untitled by Mick Vincenz (2013). Source: http://markmcleod.org/wp_mtsufoundations/tag/installations/



Fig. 4. Sunset by Claude Monet (1872). Source: <https://www.wikiart.org/en/claude-monet/impression-sunrise>.

Another abstract work by Piet Mondrian (Fig. 6) creates an abstract whole as the ultra normal visual stimulus based on the original square shape.

The next law is the use of Metaphors in visual art. According to Ramachandran, metaphorical art can sometimes establish a relationship between the so-called intuitive function of the right hemisphere and the literal/syntactic function of the left hemisphere and create a rich domain of cognitive concepts and experiences (*ibid.*). Since modern art does not accept accurate representations of the natural world as its mission and is based on the use of formal elements for sensual expression, it is inherently semantic. Therefore, visual metaphors in various styles of modern art can create various semantic layers to evoke a wide range of interpretations by the audience. Interpretations with semantic decoding of the visual aspects of the work are combined with a deeper connection to the functions of both

hemispheres to create pleasant mental experiences while observing the work.

It is worth noting that these factors are only some of the parameters involved in the formation of an abstract experience in seeing modern artworks. Apparently, the aesthetic perception of various styles of modern art depends mostly on contextual factors such as education, specialized knowledge, and the cultural/social context that significantly affect the brain's logical/syntactic system. In this regard, the role of certain parts of the prefrontal cortex, i.e., an important area of the brain's logical system, in the formation of aesthetic experiences related to modern art will be explained.

The Role of the Brain's Syntactic Reasoning System in Aesthetic Judgment of Modern Art

As mentioned earlier, the brain's syntactic reasoning (rational) system is considered the second route of aesthetic judgment in the brain (T. Rolls, 2017). This system includes cognitive regions such as the prefrontal cortex and the associated memory (short-term memory) and the language cortex (T. Rolls, 2019). Generally, this system, especially the prefrontal cortex, is involved in high-level cognitive abilities, social cognition, and decision-making. This route includes multistage and long-term calculations and planning and decisions based on syntactic reasoning for a reward, one resulting from this system engaging problem-solving solutions, decoding complexities and ambiguities, and finding simple and efficient solutions. Compared with casual audiences, scientific observations, and findings show that art specialists tend to be further satisfied with artwork characterized by greater formal complexity, abstraction, and non-representative (Hekkert & van Wieringen, 1996), but why? Countless times we could be asked the common question, what actually leads someone to become so fond of an abstract work of art or a minimalist work? Do these works have specific visual elements that remain hidden from casual audiences? Or are there transcendental



Fig. 5. Blue Painting by Wassily Kandinsky (1924). Source: https://commons.wikimedia.org/wiki/File:Vassily_Kandinsky,_1924_-Blue_Painting.jpg

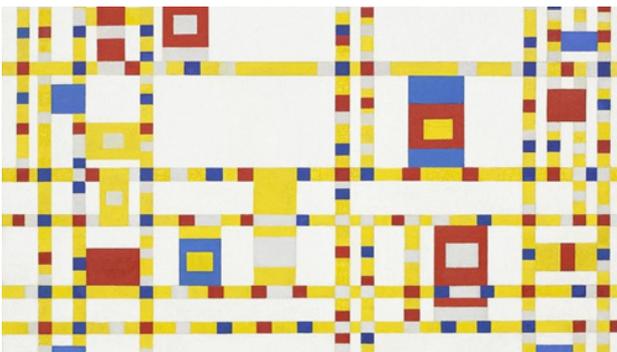


Fig. 6. Boogie Woogie Broadway by Piet Mondrian (1943). Source: <https://www.wikiart.org/en/piet-mondrian/broadway-boogie-woogie-1943>.

concepts embedded in these works that only critics, artists, and specifically those interested in art can decode?

Empirical observations suggest that in all people, the initial and middle areas of the visual cortex become more active when encountering artwork and aesthetic judgment. These studies also indicate that functions such as color processing—that are among initial visual processes—have structural neurological differences between art specialists and artists and casual audiences. Observations from functional magnetic resonance imaging (fMRI) have confirmed the greater concentration of grey matter in regions associated with color processing in the brains of artists (Long et al., 2011). Moreover, various eye-tracking studies have shown that when encountering

artwork, art specialists tend to focus on stylistic and conceptual features whereas casual audiences regard artwork in the routine and normal way they perceive their surrounding objects (Leder, Gerger, & Brieber, 2015). These findings illustrate that artists and art specialists view artwork as differently from casual audiences. However, do they also have a different understanding of the conceptual content of artwork? Before answering this question, the role of context and background of presenting the work in the creation of an aesthetic experience should be mentioned (ibid.). A secure platform, e.g., an art gallery with proper decoration, lighting, and even silence, is a very suitable context for aesthetic judgment as it allows the brain's attentive mechanisms to focus on the work's formal and content aspects. Obviously, such a context cannot be created in, for example, a busy sidewalk in the middle of the city. We also know that some of the attraction of tragedies in plays and cinema is attributed to the safe distance between the audience and the events portrayed by the work. Evidently, the same events happening in the real world before the audience would not lead to an aesthetic experience. This is related to the contradictory effect of the mid-orbitofrontal cortex, meaning that the combination of a pleasant stimulus with a mildly unpleasant stimulus can increase the pleasantness of the resultant mixture (T. Rolls, 2017). In these examples, an unpleasant stimulus including a tragic narrative is combined with a set of pleasant stimuli, e.g., the work's major technical, structural, and conceptual stimuli, absence of real-world anecdotes, sympathy, and helpful cognitive experiences for the viewer's personal and social life that creates an aesthetic experience even from seemingly tragic and unpleasant works.

Another important facet of the subject of context and background is the role of textual/contextual information, or the role of specialized knowledge, in aesthetic judgment. Studies have shown that specialized information in art can create high-level cognitive processes such as solving problems and ambiguities and can lead to a deep perception of

the content. For abstract art in particular, textual/contextual information can create fresh interpretive perspectives and a different understanding of the work and influence the aesthetic judgment of even casual audiences (Leder, Gerger & Brieber, 2015). This is incredibly important in the aesthetics of various styles of modern art. Familiarity with the history of art, the prelude to impressionism, Cézanne's effect on modern artists such as Picasso, the role of defamiliarization of form in sensual expression of abstract art, and so on alongside recognition of the stylistic features of modern art forms can indeed lead to deeper interpretations and perceptions of modern art and affect the audience's aesthetic judgment. Therefore, the aesthetic interpretations and ranking of artists and art critics, especially concerning abstract works, are inherently different from casual audiences. As discussed previously, professional art audiences view artwork differently from casual audiences and interpret their content differently or recognize if differences in interpretation, perspective, and understanding of works also extend to neurological equivalents. Numerous studies confirm this. Essentially, word labels can affect the aesthetic judgment of the audience. Some studies have also shown that titles affect both the perception and the aesthetic evaluation of works (*ibid.*). With a contextual and information background, meaningful titles can provide upper-lower solutions in the brain for ambiguous visual inputs (Pepperell & Ishai, 2015). All the evidence confirms the role of specialized knowledge, education, and generally, a prominent role for the socio-cultural context in the aesthetics of modern art. A closer examination of the mentioned neurological equivalencies will be presented below.

The Effects of the Ventromedial Prefrontal Cortex and the Dorsolateral Prefrontal Cortex on Aesthetic Judgment

Several studies confirm the effect of semantics on receiving pleasure from olfactory stimuli. In one study, the participants evaluated an olfactory stimulus as much more pleasant when combined

with pleasant vocal descriptions than unpleasant vocal descriptions, which was also attributed to the increased activity of the ventromedial PFC (De Araujo, et al., 2005). Observations have shown that high-level cognitive inputs such as lexical labels clearly affect the activities of the ventromedial PFC, something which is important to creating mental pleasure (Kirk & Feedberg, 2015). In a study employing fMRI, versions of paintings from the Museum of contemporary arts in Copenhagen were placed on display for casual participants without familiarity or specialized knowledge of the art. Half of the works had the gallery label and the other half had computer-generated tags. Observations showed that participants associated a greater aesthetic value to works with the gallery label due to greater ventromedial PFC activity while viewing gallery-labeled works than otherwise (Kirk, et al., 2009). Another interesting study analyzed the effects of bias on aesthetic judgment. Involving art experts and casual audiences, this experiment exposed the participants to somewhat amateur works. Some of the works carried the label of a sponsor that had allocated a cash payment to all viewers as a reward, whereas others carried the label of a company with no sponsorship. The results showed that casual audiences associated greater aesthetic value with works carrying the label of the sponsor company, which did not affect the judgment of art experts. In fact, fMRI observations showed increased VMPFC activity (Fig. 7) in casual audiences while viewing works carrying the sponsor's label, which was absent in the same area of the brain in art experts when viewing both groups of works. However, there was increasing DLPFC activity (Fig. 7) in art experts while viewing artwork, which was inactive in casual viewers. Further observations showed "right DLPFC turned out to be functionally connected to the VMPFC, and the coupling of these two regions was stronger during the presentation of sponsored paintings than during presentation of non-sponsored paintings", a finding which suggests that the DLPFC controls the activity of the VLPFC when

encountering biases and in a way protects the person's judgment from biases, prejudices, and marginal reward factors (Kirk & Feedberg, 2015). With a neurological approach, this study explains why artists and art specialists make aesthetic judgments with less prejudice and bias than casual audiences and are less affected by such biases.

All the neurological evidence properly illustrates the profound effects of contextual and specialized information on aesthetic judgment. In addition to specialized personal knowledge, it seems the mere title of galleries or the name of renowned artists with special social and cultural stature among the cultural and artistic class and their stances can also affect the audience's appraisal of artwork while their brain imaging confirms neurological similarities in these cases.

Conclusion

The analysis and explorations suggested that isolation, contrast, perceptual problem-solving, ultra normal stimulus, and metaphor from Ramachandran's nine neuroaesthetic laws had tangible roles in forming aesthetic experiences of modern art. These laws function based on the brain's visual processing mechanisms and in a close connection with the first route of aesthetic perception in the brain (i.e., the intrinsic and gene-based route). Moreover, the

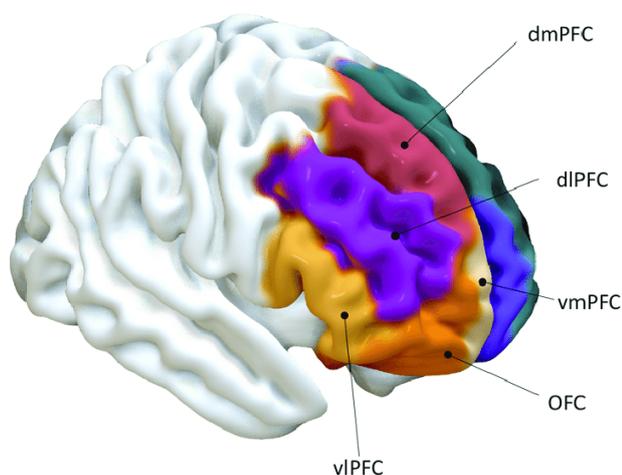


Fig. 7. VMPFC and DLPFC Areas, Exp. Neurobiology (2022). Source: Exp Neurobiology 2022; 31:97-104 <https://doi.org/10.5607/en22008>.

analysis and interpretation of findings and scientific experimental tests indicated that most of what constitutes the aesthetic experience of viewing abstract artwork resulted from the concepts constructed in the brain's syntactic reasoning system (rational system-second route), a semantic label that is attributed to the artwork. The neurological evidence also properly illustrated the profound effects of contextual and specialized information on aesthetic judgment. Not only specialized knowledge, but it seems even the artists, critics, and art galleries of social and cultural stature among the cultural and artistic class in society and their stances can affect the audience's valuation of artwork. Meanwhile, brain imaging also indicates neurological equivalents in these cases, confirming the institutional theory based on the role of the art universe in raising the artistic object, especially modern and abstract artwork. Clearly, there is a need for more research on the consistency or inconsistency of these findings with other valid theories on aesthetics, arts, and its relationship with the challenging subject of the definition of art. Findings concerning the role of lexical labels and the effect of specialized knowledge in the form of contextual information can also indicate an interesting and deep link between linguistics and aesthetics. To conclude, it is worth mentioning that the isolation of these two routes would not mean the presence of two separate and independent routes of aesthetic perception in the brain. In practice, these two routes are intertwined and related—in a dialectic interaction—in cognitive processes such as decision-making and aesthetic perception. However, based on the stylistic and formal features of artwork, each has a different weight (role or effect) on aesthetic judgment. According to empirical observations and analyses, it seems that the second route—mostly affected by culture and education—has a more significant role than the first route in the aesthetic judgment of modern art.

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