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## The limits of aesthetic seeing

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## OS LIMITES DA VISÃO ESTÉTICA<sup>1</sup>

### *The Limits of Aesthetic Seeing*

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Pablo Fontoura<sup>2</sup>

#### RESUMO

Este artigo explora o conceito de percepção através da visão, a partir das perspectivas cognitiva e estética, examinando os limites da atenção visual. Neste texto, aborda-se como mecanismos conscientes e inconscientes podem influenciar o que as pessoas veem e experienciam esteticamente. Da mesma forma, apresenta-se uma pesquisa empírica que utiliza rastreamento ocular para analisar o comportamento visual de visitantes de uma exposição de arte que observaram uma pintura do artista japonês Isson Tanaka. (1908-1977). O estudo mostra que aspectos ocultos da visão interagem com mecanismos no limite da percepção, revelando novas imagens. Especificamente, o rastreamento ocular registra e revela os rastros invisíveis dos olhos das pessoas enquanto observam uma pintura, oferecendo oportunidades para uma poética visual baseada em estímulos sensoriais e movimentos oculares. No geral, essa abordagem interdisciplinar contribui para uma compreensão mais diversa das complexidades da percepção visual nas artes.

**Palavras-chave:** Experiência Estética. Movimentos Oculares. Atenção Visual. Poética Visual. Isson Tanaka. Fukami. Pinturas.

#### ABSTRACT

This article explores the concept of sight perception from both cognitive and aesthetic perspectives, by examining the limits of visual attention. It discusses how conscious and unconscious mechanisms can influence what individuals see and may experience aesthetically. It also presents empirical research employing eye-tracking to analyze the visual behavior of visitors of an art exhibition viewing a painting of Japanese artist Isson Tanaka (1908-1977). The study demonstrates that indiscernible aspects of vision interact on the limits of perception, which gives birth to new images. Specifically, the eye-tracking records and uncovers the invisible traces of people's eyes as they are observing the painting, providing opportunities for visual poetics based on sensory input and eye movements. Overall, this interdisciplinary approach contributes to a more thorough understanding of the complexities of visual perception in the arts.

**Key-words:** Aesthetic Experience. Eye-tracking. Visual attention. Visual Poetics. Isson Tanaka. Fukami. Paintings.

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A cognitive approach to aesthetics has gained significant theoretical relevance over the last decades (SHIMAMURA & PALMER, 2011; LOCHER et al., 2020). With the advancement of scientific methods, aesthetic studies have increasingly focused on understanding the brain mechanisms guiding our interactions with the world. One striking aspect of these studies is the tension between subjectivity and objectivity as well as the interplaying between exterior and interior elements of perception (ANSORGE et al., 2022). Due to its potential implications, attention has emerged as a core interest in aesthetics.

This article explores two primary concepts within cognitive studies and philosophy: attention and aesthetic experience. It tentatively aims to connect these two notions to oculomotor research for illustrating our visual relation to images. To achieve this objective, I more particularly draw on two experts: Marisa Carrasco, a cognitive psychologist and Jean-Marie Schaeffer, a philosopher. These two authors have been especially inspirational because their works provide comprehensive and significant insights into the cognitive approach to vision and aesthetic experience based on their research and their synthesizing contributions of a wide range of researchers. For instance, Carrasco offers a detailed review of scientific findings in vision spanning the last two decades, while Schaeffer provides an extensive compilation of scientific and philosophical research in aesthetics, based on a psychologically and phylogenetically grounded description of the mental resources on which aesthetic experience draws. Both authors are recognized as authoritative in their respective fields and present highly valuable syntheses, which are summarized in this article as well as complemented with other references. Let us note, however, that the perspectives presented by Carrasco and Schaeffer are not the only existing remarkable insights in this growing field of research. Nonetheless, they provide sufficient accurate information and theoretical background for a reflection on this paper's subject and for an introductory presentation of the key concepts addressed here on the topic of vision and aesthetics.

According to the scientific literature, attention is a cognitive process whereby we select specific information for further processing. In the context of vision, attention shifts from merely seeing to actively looking by selec-

ting what is relevant in the visual field. In other words, ignoring irrelevant information is a crucial aspect that enables us to focus on and interpret the essential parts of what we see. This process prompts us to consider, for instance, the role of forgetfulness in conscious processing. Nonetheless, the attentional process requires significant cognitive resources and energy, which implies that a considerable portion of our perceptual experience depends on the information we select and discard (CARRASCO, 2011). Therefore, exploring the concept of attention in the visual process is critical for comprehending how we perceive and experience the world.

In a broad sense, three primary types of visual attention have been identified in the scientific literature: spatial attention, feature-based attention, and object-based attention (CARRASCO, 2009; STAUGAARD et al., 2016). Spatial attention can be either overt or covert. Overt attention involves the movement of the eyes to a specific location of interest, whereas covert attention involves directing attention without the corresponding eye movements. Feature-based attention can be covertly directed toward specific attributes such as color, orientation, or motion direction. Object structures influence object-based attention; in this case, the attentional focus is determined by the entire object rather than its features. These three primary types of attention interplay and aim to improve visual task performance by overcoming the visual system's limited capacity by focusing on different types of information and enhancing the subjective appearance of the stimulus.

Research has evidenced that covert spatial attention precedes overt attention (CARRASCO, 2011). This process sheds light on the importance of covert attention in visual perception as it enables us to scan our environment and direct subsequent eye movements toward regions of the visual field that contain salient and relevant information. Covert spatial attention has also been shown to enhance perceptual performance, particularly in discrimination and localization tasks. It can even impact the appearance of objects in tasks mediated by early visual dimensions, such as contrast sensitivity and spatial resolution. Additionally, covert spatial attention is crucial in social situations, for it enables to unconsciously select relevant visual information based on prior knowledge or expectations (KIEFER et al., 2011).

A deeper understanding of covert attention can be achieved by categorizing it into two distinct types, as suggested by Carrasco (2011). The first type is endogenous/sustained attention, a voluntary system that enables us to intentionally focus on the information at a particular location (top-down processing). The second type is exogenous/transient attention, an involuntary system that triggers an automatic orienting response to an area where sudden stimulation occurs (bottom-up processing). In other words, knowledge of the world, the behavioral state of the body, and the appearance of likely relevant information in the environment facilitate the processing of sensory input. Specifically, top-down processes involve signals originating in the brain (top) that directs the eye movements (down). In contrast, bottom-up processes refer to visual stimuli initiating in the eyes (bottom) then sent to the brain (up). Both refer to the path and direction of the stimuli trajectory and may well coincide. Top-down processes are said to be culturally oriented and guide what people see based on what they know, whereas bottom-up processes are physically oriented and guide what people know based on what they see (THEEUWES & FAILLING, 2020).

Research shows that directing spatial attention to a specific location improves visual search performance, and attending to the target location enables observers to discriminate finer details. Covert spatial attention enhances perception by improving decision criteria, amplifying the signal, increasing sensitivity, reducing external noise, and decreasing spatial uncertainty (CARRASCO, 2009). Furthermore, attention increases the quality of the stimulus representation by enhancing the signal gain within the selected location. It also suppresses distractors that differ from the target along relevant dimensions by constraining the filter that processes stimuli. This mechanism reduces external noise and operates through a decision template shaped around the target attributes (CARRASCO, 2009; WOLFE, 1998).

The efficiency of our attentional mechanisms is critical to optimizing visual performance. The ability to filter out irrelevant information and focus on relevant stimuli is essential to make sense of the visual world surrounding us. By selecting and magnifying relevant information and suppressing irrelevant data, covert attention shapes our perceptual experience. I believe that understanding covert and overt attention mechanisms and their

impact on perception can lead to insights into how we experience the world aesthetically in various contexts.

Now I will, drawing on the work of Jean-Marie Schaeffer (2015a), explore the relationship between attentional processes and aesthetic experience. Schaeffer argues that the aesthetic experience is a cognitive event directly connected to a specific inflection of the attentional processes related to perception, cognitive fluency, and emotions. This experience is not circumscribed to particular objects or artworks but can be triggered by any perceptual input.

The cognitive notion of the aesthetic experience, as addressed since the 18<sup>th</sup> century by Kant in his 'Critique of Judgment,' has been challenged by authors such as Hans-Georg Gadamer (1900–2002) and George Dickie (1926–2020). Gadamer emphasized the importance of the hermeneutic process, suggesting that understanding an artwork involves a fusion of horizons between the viewer and the artwork's historical context. Meanwhile, Dickie focused on the institutional theory of art, challenging the traditional concept of aesthetic experience as purely cognitive. These scholars argued that Kant's notion of aesthetic experience would misrepresent the ontology and the relationship to an artwork. However, Schaeffer distinguishes himself from these authors in that he advocates that the aesthetic experience is not a function; it is a dynamic attentional process regulated by the attractiveness index of the attentional activity itself, activated within a typical cognitive structure. When attention operates in an aesthetic context, it acquires a specific profile. According to Schaeffer, the aesthetic experience involves active discrimination by the cognitive system and is emotionally charged, valued for the cognitive pleasure it is capable of eliciting, despite the energy costs that such an attentional mode requires. The aesthetic experience is by no means a passive attitude but rather an activation of our perceptual-cognitive resources, combined with a gradation-indexed satisfaction related to mental activity, and not the object. In this perspective, the aesthetic experience explores our standard attentional, emotional, and hedonic repertoires in a very particular manner (Schaeffer, 2015b).

According to Schaeffer, understanding the aesthetic experience's uniqueness requires examining the active practice of attention, which is the

principal source of cognitive pleasure or displeasure in an aesthetic event. It also entails comprehending the principles of hedonic calculation. The central aim of the aesthetic experience, according to the philosopher, is not to formulate an appreciative judgment, such as considering something beautiful or ugly. Instead, it is a cognitive activity regulated by its internal satisfaction index, broadly speaking, stimulated by curiosity and dampened by boredom. This interdependence between attention and hedonic calculation represents the core of the aesthetic experience, as Schaeffer envisions it, since it is grounded in a cognitive and affective interaction with the world, others, and ourselves.

I will now focus on my hypothesis of the visual attentional dynamics of aesthetically oriented attention, specifically on covert attention. Schaeffer argues that the aesthetic experience maximizes top-down endogenous attentional processes by actively exploring stimuli. Schaeffer does not make explicit reference to covert and overt attention in his writings, but it is assumed that actively exploring stimuli implies overt attention. The author also recognizes that looking at a picture in an aesthetic way doesn't neutralize the pre-attentional stages of visual organization because visual attention is commonly triggered exogenously and acts concomitantly with top-down processes. Even in places where people are supposedly expected to experience particular objects aesthetically, such as museums, our standard perceptual strategies continue to operate and influence the entire visual process. The aesthetic inflection of attention, according to the author, is not only attention-driven, but also has a peculiar auto-teleology built into it, with the attentional process itself being the source of an hedonic calculation.

The omnipresence of the pre-attentional process in daily-life situations raises the question of what role covert attention may play in the aesthetic experience in one's lived experiences. Carrasco's research suggests that covert attention plays a significant role in shaping visual discrimination by selecting and enhancing relevant information that will be processed further overtly. Therefore, the aesthetic experience appears to be somehow intertwined with covert standard perceptual mechanisms influenced by visual stimuli and their contextual surroundings, as covert attention is critical in perceiving the world, influencing, and enhancing overt attention. This covert

process, I argue, might contribute to aesthetically orienting sustained episodes of top-down attention suggested by Schaeffer, as we can assume from related findings in empirical studies of aesthetics in art, such as in this synthesis put forward by Paul Locher:

The aesthetic experience with visual art has been shown to occur in two stages. Upon initial exposure to a painting, a viewer spontaneously generates a global impression, or gist, of the work. One's first impression of a painting includes a sense of its pictorial content, overall structural organization and style, meaningfulness, and an affective reaction to it. When gist information in a painting is deemed to have sufficient interest to an observer, the second stage of aesthetic processing ensues. This consists of directed focal exploration of the image to expand knowledge concerning the work's compositional features and organization to satisfy cognitive curiosity and to develop aesthetic appreciation of a composition (LOCHER, 2015, p. 75).

Locher's research on empirical aesthetics upholds the idea of different visual stages preceding an aesthetic experience. The author accounts for this by referring to the "gist" in the visual inspection of art, which corresponds to a previous comprehensive, bottom-up visual scanning followed by a top-down attentional episode of the aesthetic kind.

Following my hypothesis, measuring the effects of covert attention on the gist and on the aesthetic experience would require highly specialized tools and methods that are less likely to be used in real-world environments, outside of a laboratory. However, some techniques have the potential of identifying overt attentional episodes that are, according to Carrasco, supposedly and usually preceded primarily by covert attention, which can thus contribute to our understanding of the alleged interplaying between visual attention and aesthetic experience. For instance, I will employ an eye-tracking method to examine the information gathered by the eyes to investigate how individuals view paintings in museums. Specifically, I will present the example of an eye-tracking study conducted at the exhibition *Fukami* in 2018: *Immersion in the Art and Aesthetics of Japan*. This exhibition, organized by the Japan Foundation in Paris at the Hôtel Salomon de Rothschild, commemorated the 160th anniversary of diplomatic relations between Japan and France. The word "Fukami" in Japanese means "depth," and the exhibi-

tion invited visitors to explore the intricacies of Japanese aesthetics, known for its ability to stimulate a reflective thinking process.

I will now focus on the eye-tracking method mobilized in this study. This method allows us to investigate individuals' eye movements by recording the gaze by means of infrared light reflected off their pupils that spots fixations and saccades. Fixations direct the fovea towards the elements being focused on (the fovea is the area of the ocular globe where a higher number of photosensitive cells responsible for accurate vision are located). Saccades, in turn, represent the shifts between two fixations. Other parameters not taken into consideration in this article are also used to better understand people's emotions through vision. For example, pupil size registered by eye-trackers, in association with electroencephalogram, is being recently employed to associate emotional mental states and eye movements (LIM et al., 2020).

Fixations and saccades have already been used in the analysis of paintings (ROSENBERG & KLEIN, 2015), for comprehending an artist's pictorial technique's aspects (FONTOURA & MENU, 2022), as well as for apprehending aspects of art relation according to different age groups, such as children visiting museums (FONTOURA, 2021). With the recording completed, eye movement information is mapped onto image scenes using specialized software (in this case, the Tobii ProLab software). This process evidences how observers' eyes behave while viewing an image, exposing elements of visual inspection. In total, fifteen individuals were recruited to wear a Tobii Pro Glasses 2 mobile eye-tracking system equipped with cameras, which monitored their gaze precisely as they viewed various artworks (Image 1).

Before presenting the eye-tracking results, it is essential to highlight that this study is not intended to provide definitive scientific proof of aesthetic experience episodes through eye movements, as achieving such a goal would require more advanced methods, if it is even possible. However, I argue that eye movements can serve as a starting point for identifying where, for how long, and how many times people precisely focus their attention on images, which may well contribute to disentangling the complexity of the aesthetic experience phenomenon originating from vision and artworks.



**Image 1:** A participant wearing mobile eye-tracking glasses looking at Funaki exhibition. Photography by Pablo Fontoura.

As Schaeffer suggests, one can inspect an image in different ways, but when attention is aesthetically inflected, it is believed to be self-reinforcing in a continuous attentional feedback, contributing to achieving a perceptual learning, that is, the lowering of the attentional threshold. I argue that identifying people's visual inspection patterns can give us starting clues of the probable content that might be linked to an invisible hedonic reinforcement of an aesthetic inflected attention episode. For instance, by observing how many times and for how long people focus and return to specific areas of an image, one can potentially access or at least visualize the likely traces of what psychologists call the "training" of a potential top-down attention-driven information retrieval (AHISSAR & HOCHSTEIN, 2004). In effect, this recurring process reduces the threshold for our attentional access, enabling us to delve deeper into the hierarchy of information seeking. According to Schaeffer, this "reverse hierarchy theory" favors a horizontal, distributed attentional dynamic in an aesthetic mode, as opposed to a standard

cognitive bottom-up process focused on achieving efficient beliefs and evaluations in a low-cost energy manner (SCHAEFFER, 2015b).

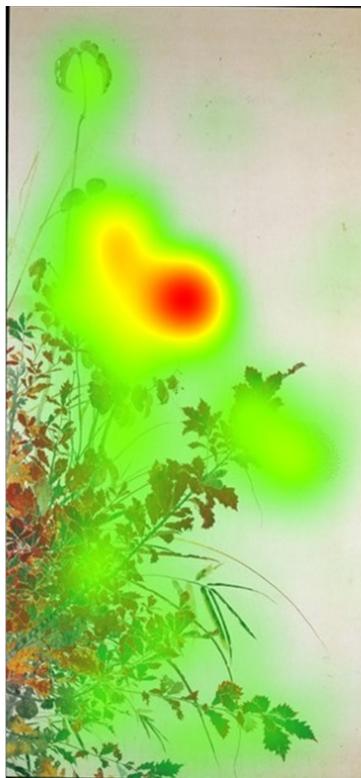
I will now present the eye-tracking study's results based on Japanese artist Isson Tanaka's painting *Autumn Hues* (Image 2). Tanaka's artwork is known for reflecting the concept of time and nature's life cycle in the Amami archipelago (FONDATION DU JAPON, 2019). The reason for selecting Tanaka's painting for this study is its ambiguous and subtle representation of both iconographic and abstract elements. This feature was one of the many motivating factors for selecting the artworks showcased at the Fukami exhibition as the subject of eye-tracking experiment, given that one of the aims was to investigate and hypothesize the potential relationship between vision and aesthetic experiences.



**Image 2:** *Autumn Hues*, Isson Tanaka (1908-1977), around 1945, color on silk, 155,2 x 73,6 cm, Tanaka Isson Museum.

The fixation heat maps obtained through eye-tracking reveal that beholders focus on the treeline in Tanaka's painting and pause at a specific point where a camouflaged butterfly is located (Image 3). This butterfly represents metamorphosis, which implies a profound, slow, and silent reinvention resulting from an eventual radical transformation. While fixating the

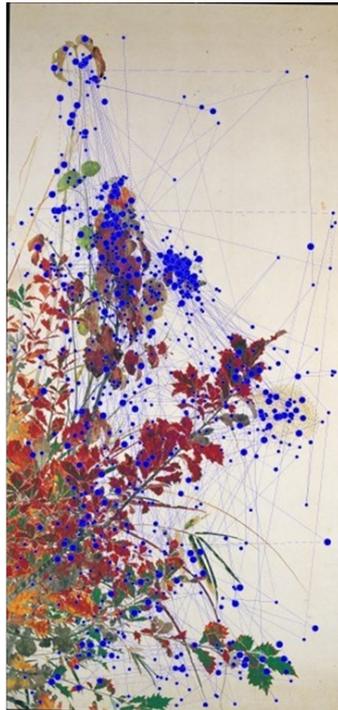
butterfly, viewers overlook the flowers in the image's upper, bottom, and middle parts. However, participants reported that they were paying attention to the subjective concept of "time" when looking at the leaves, which metaphorically echoes the notion attached to the butterfly. Yet while the butterfly represents a bodily performance acme, the autumn leaves represent a stage of decline, both being phases of a similar process associated with life-cycles. Hence, it could be surmised that observing the butterfly and leaves depicted in Tanaka's artwork would be tantamount to contemplating existence in its diverse forms and expressions.



**Image 3:** Heat maps of fixation count revealing the most focused areas on *Autumn Hues*, by Isson Tanaka.

Unlike the apparent similarities in visual interest around the abstract notion of temporality in Tanaka's *Autumn Hues*, the sparse fixations on the leaves contrast with the intensity of visual interest in the butterfly. This finding suggests that eye movements may unconsciously emulate the concept of "intensity" and "fading" represented by focusing more on the youthful butterfly and less on the allegedly waning leaves. Furthermore, the gaze plots demonstrate that visual attention is briefly drawn toward the details and the image's bare peripheral areas, indicating the presence of subtle attention triggers where no substantial elements are to be seen (Image 4). The

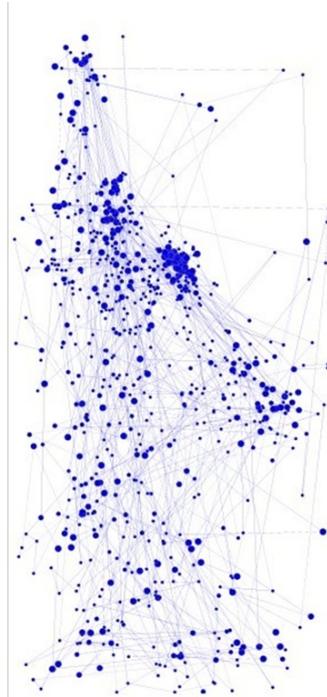
limited fixations on the marginal parts of the image may suggest that individuals tend to avoid contemplating the blank spots in Tanaka's painting, perhaps unconsciously interpreting them as symbolic representations of death, given the context of the artwork and the artist's pictorial strategies. Finally, the participants' eyes create a virtual triangulation between the butterfly, the leaves, and the surrounding void, which resonates with the notions of beginning and end.



**Image 4:** Gaze plots indicating the fixation trace of participants' eyes on *Autumn Hues*, by Isson Tanaka.

The gaze plotting also evidences that people's eyes follow an unconscious trajectory, producing a trace captured by the oculometry machine. This finding uncovers an intricate network of pathways creating a brand new image as such (Image 5). The eye movements of viewers gliding on the image generate a virtual representation of the artwork, exposing connections among its various elements that give birth to an invisible visual structure emerging from the conscious and unconscious interplaying between the object and the beholder. In addition, the eye-tracking data reveals a subtle yet consistent interconnection between the butterfly, leaves, and the translucent branches in the middle-left part of the image, the latter being the only elements that resemble a diaphanous structure in the painting. This interplay exposes a new relationship at an intermediate stage between the tangible and

the intangible, which both illustrate the levels of disappearance apprehended through the beholders' eyes' unconscious interaction with Tanaka's artwork.



**Image 5:** The visual trace of participants' eye movements looking at *Autumn Hues*, by Isson Tanaka.

The recordings of visual pathways, which consist of multiple fixations represented by dots whose size symbolizes the amount of time spent on the area, and saccades illustrated by lines connecting the gaze plots, render overt the covert and expose the initially imperceptible traces left by an individual's gaze. If it is true that covert attention not always translates into overt attention, fixation patterns alone cannot reveal episodes of aesthetic experiences either. However, the value of eye-movement data in aesthetic studies cannot be underestimated, because it reveals aspects of viewers' intimate experiences, such as curiosity and repetition patterns on specific images. Fixation plots make visible initially imperceptible phenomena, such as the sensory input sent to our brain through the eyes when an item is seen or, in the case of an aesthetic-inflected attentional episode, the specific content searched by our brain and captured by our eyes. In both cases, eye-tracking allows us to precisely identify which visual information is involved in the observation. Additionally, I argue that the eye-movement pathways and visual exploration of images may be seen as a prototype or a visual represen-

tation of the beholder's fluency dynamics. It is, therefore, crucial to consider what eye wandering reveals in terms of the content and visual trajectory of people's visual experiences because these pathways can be seen as a prelude to forming the images that make up the vast universe giving shape to our imagination and are believed to underlie aesthetic experiences. This approach opens up promising avenues for exploring the complex interplay between perception and subjectivity, based on empirical data.

In conclusion, this article has examined the concept of attention in the visual process and its limits in what may be a significant stage in shaping our aesthetic experiences. However, it is essential to acknowledge that other sensory modalities, i.e. auditory, tactile, olfactory, gustatory, vestibular, and proprioceptive, can also influence our imagination and memory of visual stimuli. Our experience of the world is multisensory and involves the integration of a variety of modalities' input.

However, understanding the mechanisms of visual attention and exploring their content provide valuable insights for creative practitioners and inspire new forms of expression, particularly in art. In the case of vision, covert attention plays a decisive role in optimizing visual performance by selecting and enhancing relevant information while suppressing irrelevant content. Therefore, events of the aesthetic type activating our perceptual, cognitive, and hedonic resources may be considered as being influenced by and arising from the conscious and unconscious visual processes described in this text. Hence, it is recommended that future studies incorporate both quantitative and qualitative perspectives further to investigate vision in a cognitive, aesthetic approach.

Simultaneously, since the aesthetic experience is a personal and individual mental state, eye-tracking alone may not completely unveil the emotional responses that viewers experience when observing images. Instead, it can only identify which visual information and image scanning patterns might be involved when and if this distinctive attentional process occurs. Therefore, the analysis derived from the eye movement data in Tanaka's painting can be seen as a plausible interpretation of the aesthetic possibilities that may arise from an outside perspective based on the observed visual behavior within its context.

By shedding light on the subtle and often unconscious movements of the eyes, scholars can gain a better understanding of how the visual world around us and the interplaying between various pieces of visual information impact our perception. For instance, the empirical analysis of gaze plots and fixation heat maps offers insights into salient zones and hidden visual connections within specific images, exposing the intricate relationship between the observer and the observed. Consequently, this approach offers starting opportunities for conducting research based on a nuanced understanding of the explicit and implicit limits of the aesthetic seeing.

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## REFERÊNCIAS

AHISSAR, Merav, HOCHSTEIN, Shaul. The reverse hierarchy theory of visual perceptual learning. *Trends in Cognitive Sciences*, v. 8, 10, 2004, pp. 457-464. Available on: <https://doi.org/10.1016/j.tics.2004.08.011>. Accessed on: June 25, 2023.

ANSORGE, Ulrich, PELOWSKI, Matthew, QUIGLEY, Cliodhna, PESCHL, Markus F., LEDER, Helmut. Art and Perception: Using Empirical Aesthetics in Research on Consciousness. *Frontiers in Psychology*, v. 13, 2022, pp. 895985. Available on: <https://doi.org/10.3389/fpsyg.2022.895985>. Accessed on: June 26, 2023.

CARRASCO, Marisa. "Visual attention: The past 25 years". *Vision Research*, v. 51(13), 2011, p. 1484-1525. Available on: <https://doi.org/10.1016/j.visres.2011.04.012>. Accessed on: Apr. 9, 2023.

CARRASCO, Marisa. "Covert attention increases contrast sensitivity: psychophysical, neurophysiological and neuroimaging studies". *Process in Brain Research*, v.154, 2009, p. 33-70. Available on: [https://doi.org/10.1016/S0079-6123\(06\)54003-8](https://doi.org/10.1016/S0079-6123(06)54003-8). Accessed on: June 26, 2023.

CARRASCO, Marisa, EVERT, Denise L., CHANG, Irene, & KATZ, Svetlana M. "The eccentricity effect: Target eccentricity affects performance on conjunction searches". *Perception & Psychophysics*, v. 57(8), 1995, p. 1241-1261. Available on: <https://doi.org/10.3758/BF03208380>. Accessed on: June 26, 2023.

FONDATION DU JAPON. *Fukami: Immersion in the art and aesthetics of Japan [exhibition, Paris, Hôtel Salomon, July 14-August 21, 2018]*. Paris: Editions Flammarion Japan foundation, 2019.

FONTOURA, Pablo; MENU, Michel. "Exploration visuelle des peintures d'Amedeo Modigliani : étude d'oculomotricité". In: GENTY-VINCENT, Anaïs, MENU, Michel. & SENOT, Marie-Amélie. (Eds.), *Les secrets de Modigliani: Techniques et pratiques artistiques d'Amedeo Modigliani*. Translated by Leroux K. Lille: LAM and Éditions Invenit, 2022, pp. 176-185.

FONTOURA, Pablo. "Les nuances du regard des enfants." *Communications*, vol. 109, 2021, pp. 169-189. Available on: <https://doi.org/10.3917/commu.109.0169>. Accessed on: June 26, 2023.

KIEFER, Markus, ANSORGE, Ulrich, HAYNES, John-Dylan, HAMKER, Fred, MATTLER, Uwe, VERLEGER, Rolf, & NIEDEGGEN, Michael. "Neuro-cognitive mechanisms of conscious and unconscious visual perception: From a plethora of phenomena to general principles". *Advances in Cognitive Psychology*, 7, 201, 55–67. Available on: <https://doi.org/10.2478/v10053-008-0090-4>. Accessed on: June 26, 2023.

LIM, Jia Zheng, MOUNTSTEPHENS, James & TEO, Jason. "Emotion Recognition Using Eye-Tracking: Taxonomy, Review and Current Challenges". *Sensors*, 20(8), 2384, 2020. Available on: <https://doi.org/10.3390/s20082384>. Accessed on: June 28, 2023.

LOCHER, Paul John. "The Aesthetic Experience with Visual Art “At First Glance”". In: BUNDGAARD, Peer, STJERNFELT, Frederik. (eds) *Investigations Into the Phenomenology and the Ontology of the Work of Art. Contributions To Phenomenology*, vol 81. Springer, Cham, 2015. Available on: [https://doi.org/10.1007/978-3-319-14090-2\\_5](https://doi.org/10.1007/978-3-319-14090-2_5). Accessed on: June 26, 2023.

LOCHER, Paul John. The Study of Eye Movements in Empirical Aesthetics. In NADAL, Marcoa & VARTANIAN, Oshin (Eds.), *The Oxford Handbook of Empirical Aesthetics*, pp 273-290. Oxford: Oxford University Press, 2020. Available on: <https://doi.org/10.1093/oxfordhb/9780198824350.013.12>. Accessed on: June 25, 2023.

ROSENBERG, Raphael & KLEIN, Christoph. *The moving eye of the beholder: Eye tracking and the perception of paintings*. Oxford : Oxford University Press, 2015.

SCHAEFFER, Jean-Marie. *L'Expérience Esthétique*. Paris: Gallimard, 2015a.

SCHAEFFER, Jean-Marie. "Aesthetic Relationship, Cognition, and the Pleasures of Art." In BUNDGAARD, Peer F. & STJERNFELT, Frederik (Eds.), *Investigations Into the Phenomenology and the Ontology of the Work of Art: What are Artworks and How Do We Experience Them?*, 81, 2015b, p.

145–165). Springer, Cham. Available on: [https://doi.org/10.1007/978-3-319-14090-2\\_9](https://doi.org/10.1007/978-3-319-14090-2_9). Accessed on: June 26, 2023.

SCHOLZ, Agnes, KLICHOWICZ, Anja, & KREMS, Joseph. F. "Covert shifts of attention can account for the functional role of “eye movements to nothing.”" *Memory & Cognition*, 46(2), 2018, 230–243. Available on: <https://doi.org/10.3758/s13421-017-0760-x>. Accessed on: June 26, 2023.

SHIMAMURA, Arthur P., PALMER, Stephen E. *Aesthetic science: connecting minds, brains, and experience*. New York, Oxford University Press, 2011.

STAUGAARD, Camilla Funch, PETERSEN, Anders, VANGKILDE, Signe. "Eccentricity effects in vision and attention". *Neuropsychologia*, v. 92, 2016, p. 69-78. Available on: <https://doi.org/10.1016/j.neuropsychologia.2016.06.020>. Accessed on: June 26, 2023.

THEEUWES, Jan, FAILLING, Michel. "Attentional Selection: Top-Down, Bottom-Up and History-Based Biases". *Elements in Perception*. Cambridge: Cambridge University Press, 2020. Available on: <https://doi.org/10.1017/9781108891288>. Accessed on: June 26, 2023.

WOLFE, Jeremy M., O'NEILL, Patricia, BENNET, Sara C. "Why are there eccentricity effects in visual search? Visual and attentional hypotheses". *Perception & Psychophysics*, v. 60, 1998, p. 140–156. Available on: <https://doi.org/10.3758/BF03211924>. Accessed on: June 26, 2023.



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