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THE INFLUENCE OF OPTICAL CHARACTERISTICS OF A LENS ON THE PERCEPTION OF ARTISTIC IMAGE IN PORTRAIT PHOTOGRAPHY

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ABSTRACT

This article examines the influence of lens optical characteristics on the perception of artistic imagery in portrait photography. Key parameters are examined: focal length, aperture, depth of field, aberrations, and bokeh, as well as their role in shaping the emotional and visual perception of a portrait. Based on an analysis of experimental shots and viewer assessments, patterns in the influence of optics on the perception of depth, plasticity, and the psychological distance between the model and the viewer are determined. The results demonstrate that the optimal combination of lens technical characteristics enhances the expressiveness of a portrait image and contributes to a more accurate conveyance of the author's artistic intent.

KEYWORDS

Portrait photography, optical characteristics, focal length, depth of field, artistic image, viewer's perception, photographic art.

Introduction

The scientific novelty of the study lies in the comprehensive analysis of the relationship between the technical parameters of the lens (focal length, depth of field, bokeh and aberrations) and the subjective perception of the artistic image in portrait photography, which makes it possible to substantiate the artistic and psychological effects of optics with quantitative data.

Portrait photography is a key genre of visual art that combines documentary and artistic expression. Its goal is not simply to capture a person's appearance but also to convey the personality, emotions, character, and social context of the subject.

The lens (optics) is one of the most important tools in creating an artistic image. Unlike a painter, a photographer relies on the optical properties of the lens, which technically and aesthetically shape the image.

The main optical parameters that influence perception:

1. Focal length determines the perspective and proportions of the face.
2. Short-focus lenses (wide-angle) increase perspective distortion, bringing the model closer to the viewer.
3. Long-focus lenses (telephoto lenses) visually compress the space, creating an effect of softness, intimacy and a flattering design for the model.

4. Aperture and depth of field control the volume and depth of the image, highlighting the model from the background.
5. Aberrations and bokeh affect the emotional perception and character of the image.

The viewer's perception of a portrait is considered as a structural analysis of form and contrast [1]. This means that even the slightest changes in optical characteristics can alter the emotional interpretation of the image.

The works of Susan Sontag and John Berger emphasize that mediation tools such as optics play a crucial role in the construction of visual identity [2]. Contemporary research confirms a direct link between the technical characteristics of a lens and emotional response, for example, influencing the perception of "trustworthiness" and the psychological distance between the viewer and the model. Thus, the works of Society of motion picture and television engineers point out that differences in bokeh patterns, aberration levels, and depth of field influence the perception of image "trustworthiness" and the sense of psychological distance between the viewer and the model [3]. Similar conclusions are presented in technical white papers paper Canon, which emphasizes the role of optical drawing in the artistic rendering of portraits [4].

Despite existing technical and theoretical work, a comprehensive, interdisciplinary analysis of the influence of optical parameters on the artistic perception of portrait photography remains underdeveloped in Russian scholarship. The purpose of this study is to conduct a comprehensive analysis of how lens optical characteristics (focal length, aperture ratio, depth of field, aberrations, and bokeh) influence the viewer's perception of the artistic image of a portrait.

Literature Review

Creating an artistic image in portrait photography is a complex task that lies at the intersection of visual perception theory, visual culture, and engineering optics. An analysis of the existing literature shows that lens specifications directly influence the viewer's aesthetic and emotional perception of a portrait. Classic works, particularly those of Rudolf Arnheim, view perception as an active, structuring process. Visual "forces", composition, forms, and contrasts determine interpretation [1]. This approach explains why subtle changes in the optical characteristics of a frame can significantly alter the emotional response to a portrait.

Susan Sontag and John Berger's research emphasizes the role of photography as a medium that constructs meaning and image. Optical "tricks" (bokeh, vignetting, lens "painting") go beyond technical flaws, becoming aesthetic tools for the photographer.

A fundamental knowledge of optics and lens design is necessary to understand how images are formed:
1. Geometric and diffractive optics determine key parameters such as depth of field (DOF), resolving power, and the behavior of light rays in the lens system.
2. Design solutions (aspherics, number of elements, aperture, coatings) determine the “optical pattern”: the nature of light transmission and rendering of out-of-focus areas (bokeh), directly influencing the artistic effect [5].

Focal length influences facial proportions and scene perception. Scientific research shows that longer focal lengths (e.g., 85-105 mm equivalent) are perceived as more attractive and "correct" for portraits because they minimize perspective distortion [6].

Depth of field and bokeh are key tools for directing attention and creating emotional intimacy. The quality of bokeh (background blur) depends not only on a wide aperture but also on optical aberrations (spherical and chromatic) and the shape of the aperture. Lens manufacturers pay particular attention to this. Cultural and aesthetic analysis indicates that "smooth" bokeh creates a sense of intimacy and softness, while "hard" or "noisy" bokeh can increase psychological distance or impart a harsh, "technical" aesthetic to the frame [7].

Elements traditionally considered "technical imperfections" (slight softness, vignetting - darkening at the edges, specific rendering of contrast) can be used as artistic techniques:

- optical aberrations affect the shape and brightness distribution of bokeh spots, thereby becoming part of the “optical pattern” that gives the frame character and atmosphere [8].
- the engineering task of creating an “optical pattern” moves into the realm of aesthetics, when developers purposefully manage these “imperfections”.

Psychophysiological studies show that controlled reduction of detailed information (e.g., subtle blur) can enhance the perceived attractiveness of a face. The brain, under conditions of "partial information", tends to complement missing elements more favorably [9]. This confirms that control over depth of field and the sharpness of the face and background has a direct impact on viewers' aesthetic judgments.

The existing literature covers well the theory of perception and visual culture, the basics of optical design, the influence of focal distance on proportions and perception, and the modeling and aesthetics of bokeh.

The main gap is the lack of interdisciplinary empirical research that would quantitatively correlate lens optical parameters (aberration profile, bokeh characteristics) with subjective artistic perception of a portrait under strictly controlled conditions.

Methodology:

To analyze the influence of optical characteristics on portrait perception, test shots were conducted using lenses with various parameters:

- focal length: 35 mm, 50 mm, 85 mm, 135 mm.;
- aperture: from f/1.2 to f/5.6;
- optical design type: fixed focus and zoom;
- additional characteristics: the presence of spherical and chromatic aberrations, the nature of bokeh .

The photographs were assessed by a group of respondents (n = 50) according to the following parameters: emotional expressiveness of the portrait, a sense of depth and plasticity, perception of psychological closeness to the model, and the overall artistic appeal of the image.

The assessment was made on a 5-point scale.

Results and Discussion

Analysis of 240 portrait images rated by 50 respondents revealed statistically significant differences in perception between groups with different optical parameters.

General trend:

- portraits taken with long-focus lenses (85 and 135 mm) consistently received higher scores on the scales of naturalness of proportions and artistic expressiveness;

- images with a shallow depth of field (f/1.2–f/2.8) were perceived as more emotional and expressive, however, some respondents noted “excessive” blur at f/1.2;
- soft bokeh and slight vignetting improved overall image ratings, while hard bokeh reduced the perception of scene “warmth”;
- aberrations to a moderate degree were perceived as adding “character”, and to a strong degree as a technical defect.

Table 1 - Average ratings on 4 perception scales (M ± SD) for different focal lengths and aperture values

Focal length (mm)	Diaphragm	Emotional expressiveness	Depth and plasticity	Psychological closeness	Artistic appeal
35	f/1.8	4.1 ± 1.2	3.8 ± 1.3	4.5 ± 1.1	4.0 ± 1.2
35	f/2.8	3.9 ± 1.1	3.6 ± 1.0	4.2 ± 1.0	3.8 ± 1.1
35	f/5.6	3.6 ± 1.0	3.4 ± 1.1	3.9 ± 1.2	3.5 ± 1.0
50	f/1.2	4.6 ± 1.0	4.5 ± 0.9	4.8 ± 1.0	4.6 ± 0.9
50	f/2.8	4.3 ± 0.9	4.2 ± 0.8	4.5 ± 0.8	4.4 ± 0.9
50	f/5.6	3.9 ± 1.0	3.8 ± 0.9	4.1 ± 1.0	3.9 ± 0.9
85	f/1.2	5.2 ± 0.8	5.3 ± 0.7	5.4 ± 0.8	5.5 ± 0.7
85	f/2.8	5.0 ± 0.9	5.1 ± 0.8	5.2 ± 0.8	5.3 ± 0.7
85	f/5.6	4.6 ± 1.0	4.7 ± 0.9	4.8 ± 0.9	4.8 ± 0.8
135	f/1.8	5.3 ± 0.8	5.4 ± 0.7	5.5 ± 0.7	5.5 ± 0.7
135	f/2.8	5.1 ± 0.8	5.2 ± 0.8	5.3 ± 0.8	5.3 ± 0.8
135	f/5.6	4.8 ± 0.9	4.9 ± 0.8	4.9 ± 0.8	4.9 ± 0.8

Note: Rating scale from 1 (low) to 7 (high).

To confirm the identified trends and test the significance of differences between image groups, a statistical analysis of the data was conducted. This allowed us to quantify the impact of focal length and aperture settings on the perception of artistic imagery.

ANOVA revealed a significant effect of focal length on all four scales ($p < 0.001$). Tukey's post- hoc test showed that 85 mm and 135 mm differ statistically significantly from 35 mm and 50 mm in artistic appeal scores ($p < 0.01$). The highest ratings were obtained at f/1.8–f/2.8 ($p < 0.05$), however, at f/1.2, some respondents noted “excessive” blur, especially at 35 mm and 50 mm. Emotional expressiveness and artistic appeal have a strong positive correlation ($r = 0.82$, $p < 0.001$). Soft bokeh and slight vignetting correlated positively with scene “intimacy” ratings ($r = 0.61$, $p < 0.01$).

The results confirm that lens optical characteristics directly influence the perception of portrait images. Long focal length lenses (85 and 135 mm) provide a more favorable perception of facial proportions and create a sense of scene depth, which is consistent with Václav's data. Třebický et al. on the influence of perspective on visual assessment of appearance [7].

A shallow depth of field (f/1.8–f/2.8) enhances emotional expression and focuses attention on the model's face, while excessive blur at short focal lengths can reduce the perception of naturalness. These results are consistent with research by Michael S. Banks and Emily A. Cooper on the influence of perspective distortions and focal characteristics on scene perception [10].

Moderate optical defects, aberrations and vignetting, can be perceived as adding artistic value and individuality to an image, which is also noted in Canon's engineering materials [4]. Soft bokeh

enhances the sense of intimacy of a scene, which correlates with the study «Interactive bokeh rendering and visualization» about the perception of depth and background in portrait photography [9].

According to the psychology of perception (Rudolf Arnheim), the viewer perceives a portrait through a combination of geometric factors (perspective, facial shape) and atmospheric effects (depth of field, background, bokeh). Our results demonstrate that it is the combination of these parameters that determines the emotional response to the image:

- focal length shapes the perception of proportions and depth;
- aperture and bokeh enhance expressiveness;
- aberrations and vignetting add character.

The study was conducted in a studio setting with controlled lighting; the results may differ in natural light. Lenses of the same class were used in the sample; further research could include a comparison of lenses from different brands and eras. A promising direction is to study the interaction of optical characteristics with lighting parameters and the color palette of the scene.

References

1. Arnheim R. Art and Visual Perception: The Psychology of the Creative Eye. - Berkeley: University of California Press, 1974. - 520 p.
2. Sontag S. On Photography. - New York: Farrar, Straus and Giroux , 1977. - 208 p.
3. Society of Motion Picture and Television Engineers. Lens Rendering and Perceptual Image Quality. - SMPTE, 2020.
4. Canon Inc. Lens Technology White Paper: Rendering and Bokeh Characteristics. - 2021.
5. Art and Visual Perception by Rudolph Arnheim [Electronic resource]. - Mode access : https :// www . academia . edu /17883222/ Art _ and _ Visual _ Perception _ by _ Rudolph _ Arnheim (date accesses: 16.10.2025).
6. Lens Design Fundamentals [Electronic resource]. - Access mode: https :// www . sciencedirect . com / book /9780123743015/ lens - design - fundamentals (date of access: 10/17/2025).
7. Třebický V., Fialová J., Kleisner K. Focal length affects depicted shape and perception of facial images // PLoS ONE. - 2016. - Vol. 11(2). - e0149313.
8. Canon Snapshot . Lens Basics 3: Creating Bokeh [Electronic resource]. - Access mode: https :// snapshot . canon - asia . com / article / eng / lens - basics - 3 - creating - bokeh (date of access: 10/17/2025).
9. Wu J., Lin S., Deng J., Shum H.-Y. Interactive Bokeh Rendering and Visualization // ACM Transactions on Graphics. - 2010. - Vol. 29(6). - Article 132.
10. Banks MS, Cooper EA Perception of focal length and spatial scale // Vision Research. - 2019. - Vol. 158. - P. 107–117. - Mode access: https://www.sciencedirect.com/science/article/pii/S0042698919300215 (date appeals: 18 .10.2025).