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The Influence Of Depth Of Field On The Perception Of Detail In Still-Life Photography

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Abstract- This article examines the influence of depth of field on the perception of detail in product photography of jewelry. The relevance of the study stems from the fact that in macro photography of jewelry, microscopic elements of facet cutting and polishing determine the value of the piece, while a shallow depth of field simultaneously represents a risk and a creative tool, since even a minimal focusing error can conceal important details; at the same time, the choice of an optimal focus zone directly affects viewer trust and the commercial success of the images. This work aims to establish a quantitative relationship between the width of the focus zone and the subjectively perceived level of detail, to determine the threshold depth of field at which an observer ceases to notice micro-surface defects, and to develop recommendations for optimal shooting settings for catalog, advertising, and artistic photography of jewelry. The novelty of the research lies in the synthesis of optical depth-of-field calculations with data from macro calculators and diffraction theory, in the integration of psychophysiological results from eye-tracking and the flicker paradigm with behavioral analyses of consumer perception, and in the formulation of practical recommendations based on consensus among focus-stacking, tilt-shift, and lighting experts in jewellery photography. The main findings indicate that stopping down from f/4 to f/8 doubles depth of field, although further aperture reduction is limited by diffraction at around f/11; at a 1:1 macro ratio with an f/8 aperture and a 100 mm focal length, the physical width of the focus zone is only 0.6 mm, necessitating a 15-frame focus-stacking sequence with 0.1 mm steps; a shallow depth of field significantly reduces likes and purchase intent (coefficients −0.23 and −0.94), a moderate setting constructs a clear visual hierarchy without losing context, while an extremely shallow depth of field intensifies emotional response but prolongs change detection time; optimal shooting regimes range from f/8 with focus stacking for catalogs to f/4 for advertising macro scenes and moderate apertures for social media. This article will be valuable to professional jewelry photographers, e-commerce specialists, marketers, and researchers in the field of visual perception.

Keywords: Depth of field, perceived detail, jewelry photography, focus stacking, microcontrast.

Introduction

Depth of field is the range between the nearest and furthest points of a scene that are rendered acceptably sharp in an image, its magnitude determined by the interplay of aperture, focal length, subject distance and the permissible circle of confusion; at a 1:1 macro ratio, depth of field may shrink to fractions of a millimeter, which demands rigorous control by the photographer. In product jewelry photography, microscopic facets of cutting and polishing define the value of the piece, hence a shallow depth of field represents both a risk and a creative instrument: a minimal focusing error can obscure the carat of a gemstone, whereas a correctly chosen focus zone emphasizes the geometry of the facets and removes distracting reflections from the background. Alongside technical considerations, the significance of this parameter is confirmed by studies on the quality of commercial images: a high level of sharpness increases the likelihood of sale and enhances viewer trust in the product (Wunderlich, 2025).

The objective of the present study is to establish a quantitative link between depth of field and subjectively perceived detail in jewelry images, to refine the threshold width of the sharp zone at which observers cease to notice micro-surface defects, and to propose optimal shooting regimes for catalog, advertising, and artistic photography.

Materials and Methodology

The article is based on the analysis of 15 key sources, including theoretical investigations of optical depth-of-field parameters, industry guides to macro photography, and studies of perceptual and behavioral effects. The theoretical component comprised descriptions of the relationships among aperture, focal length, subject distance, and the critical circle of confusion (Wunderlich, 2025; Hollows, 2024), results from the DOF macro calculator in Zerene Stacker (2024), and data on the impact of sensor size on the circle of confusion (Harmsen, 2018). Perceptual aspects were drawn from psychophysiological studies employing eye-tracking and the flicker paradigm (Leder et al., 2022; Zhang et al., 2019; Zhang et al., 2017), behavioral tests evaluating perception of geometry and emotion (Meng et al., 2022; Descours, 2017), and analyses of the local-contrast pop-effect (Chambers, 2025). Applied methods for focus stacking, tilt-shift, and lighting schemes were reviewed based on technical surveys in jewelry photography (Olkowicz et al., 2019; Ginsburgh, 2020; Lenton, 2023) and analyses of the effects of depth of field on consumer behavior on online platforms (Li et al., 2014).

Data synthesis was conducted through thematic grouping and qualitative comparison. Optical calculations were cross-validated with macro-calculator outputs and diffraction data. Perceptual findings were matched against behavioral consumer-perception models. Practical recommendations were derived from consensus on optimal shooting regimes for catalog, advertising, and artistic photography. This structured approach enabled the integration of diverse methodologies and the identification of universal thresholds and application scenarios for various depth-of-field values in jewellery photography.

Results and Discussion

By adjusting depth of field, the photographer selects the relative aperture, that is the f-number: the smaller the f-number, the larger the aperture diameter, and the narrower the zone of acceptable sharpness, since the limits of the range are calculated proportionally to the product of the f-number and the circle of confusion; practical tables demonstrate that stopping down from f/4 to f/8 doubles depth of field, yet for a constant composition sharpness outside this zone drops precipitously (Leder et al., 2022). Figure 1 illustrates how visual scene perception proceeds through a stage of pre-classification influenced by context and affect, followed by automatic processing of chromatic and luminance cues within 50–100 ms, intermediate analysis of symmetry, composition and focus at approximately 500 ms, subsequent evaluation of meaning, emotion and significance over 1000–6000+ ms, and culminates in two outcomes: a rapid selection based on low-level cues and a deep interpretive understanding shaped by cultural, task-related, social and personal factors.

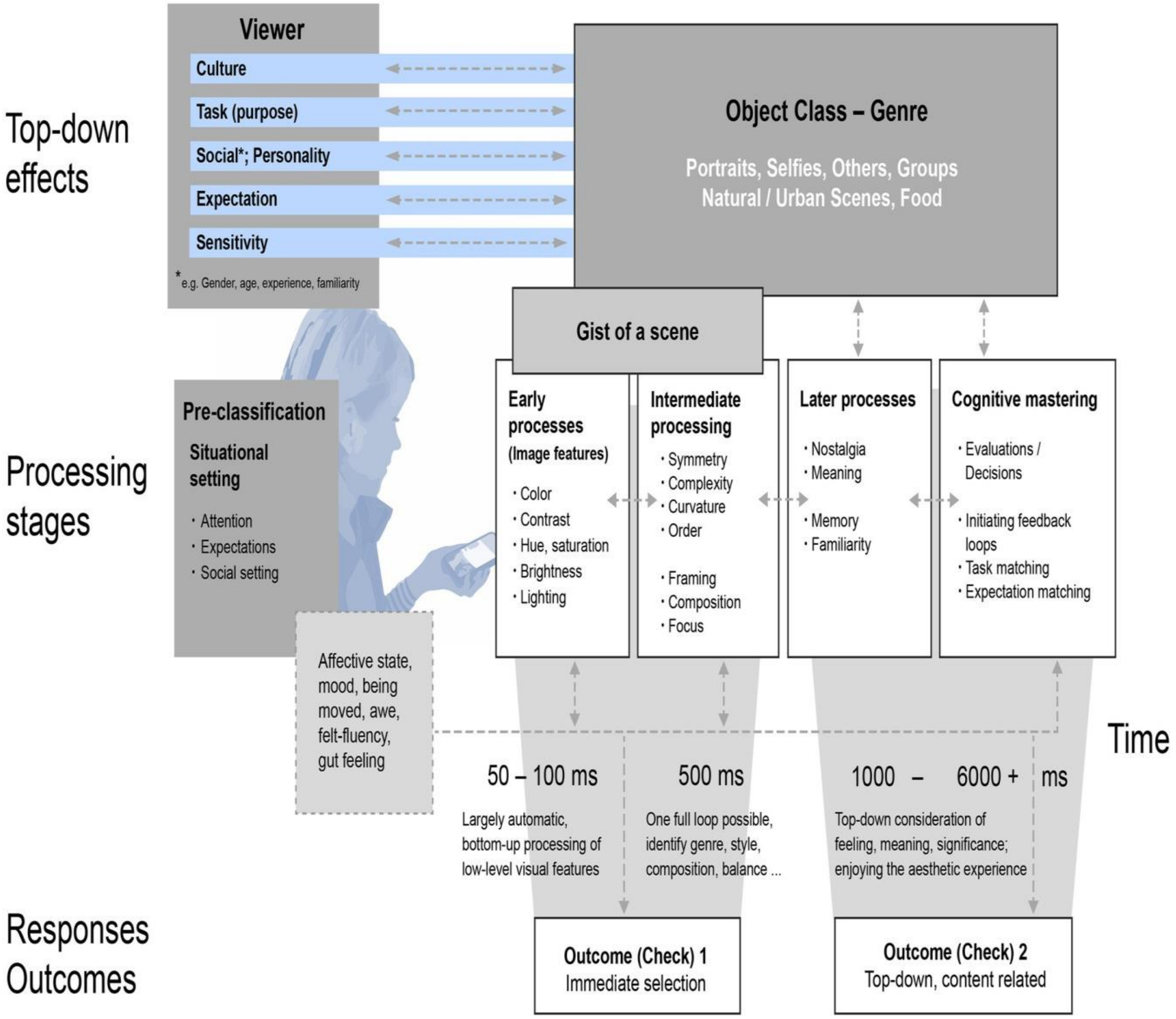

Fig. 1. Temporal Hierarchy of Visual Scene Processing (Leder et al., 2022)

Focal length and subject distance exert an equally strong effect: at a 1:1 macro ratio, depth of field reduces to fractions of a millimeter, for example for a full-frame camera with a 100 mm lens and an f/8 aperture it measures approximately 0.6 mm, while increasing the reproduction ratio to 2:1 further diminishes it threefold; these calculations are corroborated by macro calculators, which record depth-of-field growth proportional to the square of the inverse reproduction ratio and linearly relative to shooting distance (Zerene Stacker, 2024).

Sensor size directly determines the circle of confusion; therefore, to maintain the same angle of view, shooting on an APS-C sensor requires a shorter focal length and yields a visually 1.5–2 times greater depth of field than a full-frame system. However, suppose identical lenses are used at the same distance. In that case, the physical depth of field remains unchanged, and differences arise solely from the need to scale images differently for identical output formats, as illustrated in Figure 2 (Harmsen, 2018).

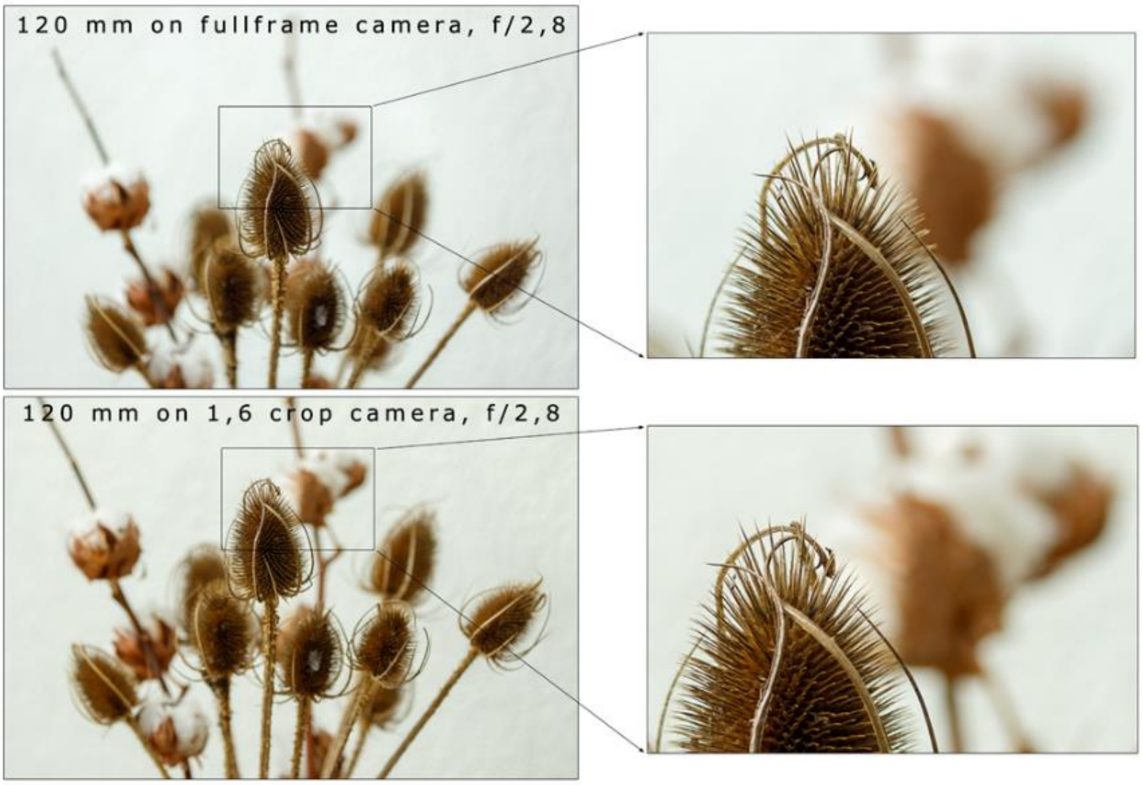

Fig. 2. Effect of Sensor Size on Depth of Field in Photography (Harmsen, 2018)

Finally, increasing depth of field by strongly stopping down the aperture encounters diffraction: beginning at approximately f/11 on a full-frame sensor, the Airy disk exceeds six micrometers, which is comparable to pixel size, and leads to loss of microcontrast; for sensors with denser pixel layouts, the critical value shifts to f/8, therefore in jewelry photography one typically works within f/8–f/13, and further expansion of the sharp zone is achieved by focus stacking to avoid diffraction losses (Hollows, 2024). This balance between the number of sharp details and the preservation of microcontrast defines the technical limit within which depth of field remains helpful in conveying the texture and brilliance of gemstones, and lays the groundwork for further analysis of perceptual effects.

The width of the depth of field is not only determined by optical parameters, but it also markedly alters viewer behavior; therefore, the evaluation of perceptual effects logically follows the physical premises described earlier. When the entire surface of a piece falls within the zone of sharp rendering, the viewer receives a complete set of microcontrast cues about the quality of cutting and polishing. A large-scale study of more than fifty thousand product images on a social commerce platform demonstrated that the variable LowDoF, interpreted as shallow depth of field, had a negative coefficient of –0.23 in a first-difference model and –0.94 in an extended regression, meaning that images with reduced depth of field lost likes. Decreased purchase intent in a statistically significant manner compared to frames where the object was entirely sharp (Li et al., 2014). This confirms that for catalog purposes, a wide depth of field is perceived as an indicator of accuracy and honest depiction of details.

It is not necessary to blur the background completely: a laboratory eye-tracking study showed that with a moderate reduction in depth of field, viewer fixations concentrate on the sharp zone, while attention across the remainder of the frame remains sufficiently uniform, preserving scene context and avoiding a sense of flat technicality (Zhang et al., 2019). An experiment employing the flicker paradigm further demonstrated that with this emphasis arrangement, changes in the sharp area are detected more rapidly and in the blurred area more slowly, but without a significant increase in errors, indicating the formation of a clear visual hierarchy without loss of information (Zhang et al., 2017). For jewelry images, this means that by placing the focus plane on the main gemstone and leaving the edges of the setting slightly soft, the photographer emphasizes the key compositional element while maintaining recognizability of the form.

When depth of field becomes extremely shallow, the psychological mechanism changes: a strong blur gradient creates an illusion of spatial separation of the object for the viewer and, according to the theory of emotional enhancement, increases the subjective intensity of feelings such as admiration or wonder toward the displayed gem (Descours, 2017). Nevertheless, the same change-detection study recorded that with a very narrow zone of sharpness, the probability of missing a change in the blurred areas increases, and response times lengthen, meaning that one pays for emotional emphasis with a partial loss of perceived informativeness (Zhang et al., 2017). In advertising, this trade-off is often acceptable, as the goal is to create an atmosphere of luxury rather than provide a purely technical description of the product.

Thus, the data indicate a graded scale: a large depth of field enhances trust in the technical perfection of the piece, a moderate depth of field helps to build a visual hierarchy, and an extremely shallow depth of field shifts perception into an emotional realm, highlighting the selected element at the expense of the background. This confirms that the choice of depth of field should be viewed not only as a technical technique but also as a controlled psychological tool that enables the jewelry photographer to influence viewer attention purposefully, accuracy of evaluation, and emotional response.

Control of depth of field affects the perception of detail because it redirects visual attention, alters local microcontrast, and creates optical contrast between sharp and blurred zones. When the focus zone is narrow, eye fixations concentrate within it, while the frequency of wandering saccades and the average dwell time on the sharp fragment increase. In the experiments of Meng et al., which included one eye-tracking experiment and three behavioral tests, a small depth of field caused a statistically significant redistribution of attention toward the object, even leading to an overestimation of its physical size (Meng et al., 2022). Similar findings on gaze shift to the focal area were confirmed in an engineering study, in which narrow sharpness guided initial fixations and reduced change-detection latency (Zhang et al., 2019).

Alongside attention, microcontrast proves decisive. In the sharp zone, high spatial frequencies are preserved, so even fine scratches and polishing haloes reflect light differently from an ideal facet. Zeiss notes that reducing diffraction at medium apertures increases microcontrast and enhances the so-called pop effect, making brightness-shadow transitions more expressive (Chambers, 2025). A multisensory imaging method applied to detect micro-defects in polished optics confirms that local contrast enhancement facilitates both automatic and visual detection of micron-level defects (Sun et al., 2022).

Contrast between the sharp object and the softly blurred surroundings further amplifies the subjective brightness of the gemstone. The alternation of light and dark reflections on the facets creates the impression of greater light return at a constant absolute brightness. The blurred background does not compete with these reflections, so the viewer perceives the gem as more sparkling and richly colored.

Collectively, these mechanisms explain why an extended depth of field is required in catalog photography for the objective presentation of quality, whereas in advertising, macro shots employ a shallow depth of field as a tool of directed attention and visual dramaturgy, enhancing the perception of sparkle without overly revealing microsurface defects.

Since perceived detail was found to be directly related to the width of the depth of field, the logical continuation is an examination of practical techniques that allow for the direct management of this parameter on the set, thereby establishing the desired level of visual information about the jewelry object. The most radical method for expanding the zone of sharpness is to shoot a series of frames at different focus planes sequentially, followed by digital composition. A study on submillimeter photogrammetry demonstrated that when merging a stack of dozens of frames, the average reconstruction error of the relief is reduced below the resolving limit of a medium-format sensor, making the method suitable for demonstrating the microfaceting of gemstones (Olkowicz et al., 2019). Practical publications on jewelry macro photography report that for a ring approximately 20 mm in diameter, 15 slices at 0.1 mm increments are sufficient to achieve full sharpness without diffraction losses and noticeable noise increase after stitching, as shown in Figure 3 (Ginsburgh, 2020).

Fig. 3. Ear Jewelry – Up Close Using a stack of 15 slices captured with a Canon 100mm f/2.8L Macro lens (Ginsburgh, 2020)

The optimal workflow is built around a motorized rail synchronized with batch-capture software, which simplifies layer alignment and eliminates micro-shifts of the frame.

If the goal is to align focus along a flat or gently curved surface, thus saving time in post-processing, it is more convenient to use a lens with a tilt function. A slight tilt of the front optical group rotates the plane of sharpness according to the Scheimpflug principle, allowing, for example, the entire circumference of a ring and its decorative gemstone to remain in focus at f/8 without noticeable loss of microcontrast. Tests cited in a survey of commercial product photography show that with a moderate tilt, the photographer can save up to one-third of working time compared to a full focus stack, and for large accessories, may even dispense with compositing altogether (Lenton, 2023).

When the aim is to convey volume without increasing depth of field, a directed light gradient is employed. A narrow light source placed to the side and softened by a diffuser produces a smooth transition from highlight to shadow, visually separating the object and significantly enhancing the sense of three-dimensionality. At the same time, the physical focus zone remains unchanged. Fine-tuning of reflections is achieved by using substrates and reflectors: white and silver cards return fill light into the shadows of the setting, whereas black flags block unwanted glare and emphasize the contours of facets. A polished acrylic plate additionally produces a soft mirror reflection, which visually doubles the number of discernible facets while remaining outside the focus plane and not distracting attention.

Thus, focus-stacking ensures complete objective sharpness, tilt-shift provides rapid geometric control, a light gradient creates the impression of volume with a minimal focus zone, and reflectors, together with substrates, enhance local contrast without altering the depth of field. By combining these methods, the jewelry photographer can precisely dose information about texture and brilliance, tailoring it to the technical or emotional purpose of the shot.

Practical work with depth of field is grounded in shooting objectives, as different tasks demand varying amounts of visible information. In a catalog, the buyer seeks objective confirmation of quality, so the sharp zone should encompass the entire object. This is achieved by using a medium aperture, systematic focus-stacking, and even diffused lighting that emphasizes form without harsh highlights. The camera is fixed on a tripod, and the shoot is controlled via software to ensure a consistent focus-step increment. In post-processing, the layers are merged, edge alignment is verified, and natural microcontrast is restored through gentle local-contrast adjustment, avoiding aggressive sharpening that can render metal artificial. If necessary, a slight tilt of the lens provides additional sharpness across the plane of the setting without extra compositing work.

An advertising macro scene requires a different approach, since the task is to create an emotional emphasis on the central gemstone, highlight the play of light, and conceal minor technical artefacts. An open aperture is employed, the light source is placed at a low angle to the facet, and a narrow backlight pulse is added to draw out the sparkle toward the viewer. Using a black card for fill produces dark edges that enhance the sense of volume. To ensure the gemstone's sparkle falls within the focus zone, the photographer focuses precisely on an enlarged live view and exposes so that highlights remain within the dynamic range. In post-production, the gemstone's color is enhanced with a soft tone curve while the metal is kept neutral, and the background saturation is slightly reduced to maintain attention hierarchy.

For social media images, the balance between informativeness and artistic bokeh is vital, as the image is viewed on a small screen and competes with numerous other visual elements in a feed. A moderately open aperture is retained, focus is aimed at the main accent of the piece, and the background is rendered into a soft blur. A simple, uniform background, such as a light-gray gradient, is chosen to avoid competing with the jewelry's details or triggering aggressive compression algorithms. A single-colored reflector or gelled flash adds a subtle, brand-specific tint without abrupt transitions. At the publishing stage, it is essential to preserve the original resolution and adjust sharpening for the platform, ensuring details remain legible even with reduced depth of field.

These scenarios demonstrate that the choice of depth of field becomes a tool for guiding perception: a wide zone confirms quality, a moderate zone builds hierarchy. An extremely narrow zone creates an emotional emphasis. By understanding the physical limits and perceptual effects, the photographer can adapt techniques to shooting objectives, ensuring the precise balance of informativeness and visual expressiveness.

Conclusion

The data obtained confirm that depth of field is a decisive parameter that simultaneously determines the technical quality of a jewelry image and guides viewer perception. Quantitative analysis showed that increasing the f-number from f/4 to f/8 doubles the depth of field; however, further expansion by strong stopping down is limited by diffraction, which begins to reduce microcontrast around f/11 on a full-frame sensor. At a 1:1 macro ratio, the measured physical width of the sharp zone at f / 8 with a 100 mm focal length is only 0.6 mm; thus, for complete surface depiction of an object, it is necessary to use focus-stacking of approximately fifteen frames with 0.1 mm steps, yielding an objectively sharp image without diffraction losses. A study examining the effect of sharp-zone width on consumer behavior found that a shallow depth of field statistically significantly reduces likes and purchase intent, with coefficients of −0.23 in a first-difference model and −0.94 in an extended regression. Conversely, a wide zone increases trust in the technical perfection of the jewelry.

Psychophysiological analysis confirmed a graded scale of perceptual effects: with full object sharpness the viewer more rapidly and accurately notices microdefects; with moderate reduction in depth of field fixations concentrate on the sharp region, forming a clear visual hierarchy without loss of context; with a highly narrow zone an emotional-enhancement mechanism is activated, amplifying the subjective value of the central gemstone but simultaneously increasing the likelihood of missing changes in the blurred background. Microcontrast preserved in the sharp area makes facets more expressive and facilitates the detection of micron-level defects, whereas contrast between the sharp object and its soft surroundings enhances the perceived brightness and color saturation of the gemstone.

Practical analysis of control methods revealed that full objective sharpness is reliably achieved by focus stacking, geometric alignment of the plane of focus is accelerated by moderate lens tilt according to the Scheimpflug principle, and a directed light gradient, combined with a system of reflectors, preserves the illusion of volume even with limited depth of field. These techniques enable the precise dosing of visual information and its alignment with shooting objectives. For catalogs an optimal depth of field that covers the entire item is achieved at f / 8 with focus-stacking and diffused light; for advertising macros an open aperture around f / 4, precise focusing on the central gemstone and backlit pulse lighting are recommended; for social media a balance between informativeness and bokeh is sought with a moderately open aperture and simple background.

Thus, in product jewelry photography, depth of field serves not only as a technical constraint but also as a controllable psychological instrument. An informed choice of its magnitude enables the photographer to direct attention, regulate the perception of quality, and create the desired emotional response, ensuring an exact balance between objective informativeness and the visual expressiveness of the image.

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