

Performance Exploration of the Light and Shadow Trajectory in Experimental Characters

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ABSTRACT

Chinese characters are the crystallization of Chinese civilization, and the trajectory and composition of Chinese character strokes give Chinese character culture great vitality and cultural deposits. Light and shadow are the sources that shape space, and various light and shadow trajectories present a dynamic visual change with different expressive characteristics. This article combines static Chinese character strokes with dynamic light and shadow trajectories for design experiments, exploring the more visual effects of Chinese character font structure in the dynamic space of light and shadow trajectories; Through repeated assumptions and experiments on text design using experimental methods, this article will explore the clever combination of various light and shadow trajectories with Chinese character stroke structures.

Keywords: *Chinese character strokes, Light and shadow trajectory, Experimental characters.*

1. INTRODUCTION

“Experimental font design” emerged after the text design movement in the 20th century, and the design that subverts font readability in font design can be called “experimental font design”.¹ Experimental fonts are more advanced compared to font design in commercial applications, while attempting to use more new technologies for character innovation. The process of experimental font design is similar to a research experiment, with many elements having variables in between. Experimental font design is also a conceptual design. Experimental font design is an endless experiment that involves proposing hypotheses, repeatedly experimenting, and further adjusting the process. In this process, scientific methods are used to repeatedly hypothesize and experiment with font design.

This experimental character design combines the visual characteristics of various dynamic light and shadow trajectories, proposes a design hypothesis that combines light and shadow

trajectories with character stroke trajectories, and records the light and shadow trajectories of natural and artificial light in a “time-lapse photography” manner. During the experiment, the authors recorded the different manifestations of various light and shadow trajectories in different situations and media, and analyzed the characteristics of light and shadow trajectories. Finally, they extracted the design factors of light and shadow trajectories and combined the factors with the strokes and shapes of the characters for design experiments.

2. CHARACTERISTICS OF EXPERIMENTAL CHARACTERS AND LIGHT AND SHADOW TRAJECTORY

2.1 *The Relationship Between Character Structure and Trajectory*

The structure of Chinese characters is the content presented in a two-dimensional space, and the structure of Chinese characters is composed of various stroke combinations. The writing of strokes visually presents a trajectory change, and the final presentation of the writing trajectory is the external

1. Zhu Yongping, The Form and Meaning of Chinese Characters and the Development of Function Words with a Discussion of the Chinese Character Teaching to Speakers of Other Languages [J]. International Chinese Language Education, 2018(3).

structure of the entire font.² The writing trajectory of character is dynamic, corresponding to the dynamic changes in light and shadow; The external structure of character is static, corresponding to a static photographic image.

This exploration is conducted from the aspects of light intensity, illumination distance, color, speed, etc. of light and shadow, analyzing the visual expression characteristics of light and shadow trajectories under different situations, and combining light and shadow trajectories with character trajectories for design.

2.2 The Relationship Between Experimental Characters and Light and Shadow Trajectory

Chinese characters present a two-dimensional form in visual space, while light and shadow trajectories are composed of different shapes in visual space, forming different virtual real relationships, perspective relationships, color changes, and so on. In the carrier of experimental character design, various experiments are conducted to combine light and shadow trajectories with Chinese character writing trajectories for design. After extensive literature review, there is a lack of integration design between light and shadow trajectories and characters in experimental character design. So this experimental character design research on light and shadow trajectories has a certain degree of innovation. By using time-lapse photography to capture light and shadow trajectories, various visual effects are presented. The changes in natural light are important natural substances in people's daily lives, and the visual effects that can be represented by their light and shadow trajectories are very rich. With the upgrading of lighting tools, there are more and more ways in which various artificial luminescent objects are presented, and their application fields are gradually expanding. By incorporating the technique of "time-lapse photography" before designing experiments, the visual characteristics of natural and artificial light and shadow trajectories can be captured, exploring the visual connection between text and light and shadow. In the relationship between light and characters, the stronger the illumination, the stronger the contrast between character form and visual perception, which better reflects the importance of text content.

2. Xie Zhixian, Exploring the Visual Representation of Light and Shadow in Exhibition Space Design [J]. Popular Literature, 2017(17).

The contrast between light and shadow corresponds to the visual presentation of text in the corresponding layout. Characters undergo continuous evolution in the long river of time, and on this basis, the introduction of light and shadow trajectories representing the passage of time highlights the uniqueness of the long process of Chinese character creation.³

3. EXPERIMENTAL PRINCIPLES FOR REPRESENTING LIGHT AND SHADOW TRAJECTORY THROUGH TIME-LAPSE PHOTOGRAPHY

Time-lapse photography, also known as time-lapse photography, is a photography technique that records the exciting process of changes in things or objects over a certain period of time through photos or videos.⁴ This experimental font design utilizes time-lapse photography to capture the visual changes of artificial and natural light and shadow over a certain period of time, and analyze their light and shadow characteristics.

3.1 Principle of Interestingness

The principle of interestingness is mainly manifested in the experimental process of time-lapse photography, where the images in the photographic images are highly interesting and dynamic, providing viewers with a strong visual experience. The changes in light and shadow trajectories over a certain period of time are clearly visible in the photographic images. Experimental fonts are explored and designed based on the theory of time-lapse photography, which has unique vitality. With the development of science and technology, innovative forms of writing are utilized to add storytelling and varied fun to experimental font design, providing new ideas and references for the future development of experimental fonts. Combining different light and shadow trajectory characteristics with character handwriting to create different effects can also provide the author with unique enjoyment and fun in conveying information. In experimental character design, various design experiments emerge one after another, but capturing the characteristics of light

3. Wang Huixun, The Exploration of the Chinese Character Font Structure in Visual Space [D]. Southwest Jiaotong University, 2013.

4. Song Lu, The Aesthetic Application Expression of Time-lapse Photography in Images [D]. Qingdao University, 2018.

and shadow changes through time-lapse photography and combining them with Chinese characters for redesign, unleashes the unique charm of Chinese characters, breaks the traditional single form of Chinese characters, and implants the charm of photography and light and shadow into Chinese characters.

3.2 Principle of Continuity

Continuity is manifested in the visual characteristics presented by light and shadow trajectories, and its properties are not only present in natural light and shadow trajectories, but also in artificial light and shadow trajectories. The change of light and shadow is the contrast of strength and weakness that occurs over time, producing stunning visual effects. The continuity of time determines the continuity of light and shadow changes, and the changes in light and shadow trajectories have the characteristic of continuity within a certain time period and space. The light and shadow trajectory flow also has strong continuity, forming a highly dynamic and variable light and shadow trajectory. From the perspective of Chinese character writing, whether it is cursive or regular script, it is composed of each linear and continuous stroke, so Chinese character strokes and light and shadow trajectories have strong continuity. The writing trajectory of strokes also forms a set of trajectory changes in the entire font in two-dimensional vision, with characteristics such as direction, jerkiness, neatness, lightness, virtuality, and thickness.⁵ Combining the trajectory of light and shadow with the stroke trajectory of Chinese characters, that is, combining the agile and casual trajectory with the regular and rhythmic trajectory, can form a special artistic effect.

3.3 Principle of Exploration

The combination of light and shadow trajectories with the structure of Chinese characters creates a unique light and shadow space in the font, which is different from the common two-dimensional plane space of character. This combination not only combines the visual characteristics of light and shadow in the font, but also implants a three-dimensional experience of light and shadow in the font.⁶ Therefore, the original strokes of Chinese characters are regarded

as a basic set of two-dimensional graphics and are designated as the initial information in the design.⁷ On this basis, different visual characteristics of light and shadow trajectories are added to the structure and strokes of Chinese characters, and the parameters of light and shadow are adjusted to change the original initial information. The Chinese character graphics fused with light and shadow trajectories are designated as the final information.

Comparing the original strokes of Chinese characters as initial information with the embedded light and shadow trajectory features of Chinese characters as final information, there are three relationships between the initial Chinese character shape and experimental text designed with light and shadow trajectory features in visual space. Firstly, it is the visual spatial relationship between virtuality and reality. After combining the structure of Chinese characters with the trajectory of light and shadow, it will change with the strength of the illumination light. The stronger the light, the firmer and more pronounced the strokes of Chinese characters, and the weaker the opposite. Secondly, there is a continuous spatial relationship between motion and stillness. If there is no light involved, the font can be regarded as a static geometric shape; And when there is a combination of light and shadow design, by adjusting the lighting angle and intensity, the strokes of Chinese characters will generate motion trajectories accordingly, adding a temporal dimension of light and shadow to the static font space, thus attracting the attention of viewers.⁸ Thirdly, for the visual spatial relationship between two-dimensional and three-dimensional, the appearance of Chinese characters in the viewer's vision is a two-dimensional space. When the three-dimensional visual effect of light and shadow is integrated, it adds a new visual effect to the two-dimensional Chinese characters, and the contrast of color brightness and darkness further enhances the light and shadow effect of the font.

5. Wang Guiyuan, Process and Mechanism of Chinese Character Stroke System [J]. Linguistic Sciences, 2014().

6. Sun Ke, The Spatial Variation of Font Form [J]. Art Science and Technology, 2016(4).

7. Su Peicheng, Outline of Modern Chinese Characters [M]. Peking University Press, 2001.

8. Yu Rongjie, Chinese Characters Font Design Modelling and Affective Image Analysis [D]. Wuhan University of Technology, 2012.

4. VISUAL CHARACTERISTICS OF LIGHT AND SHADOW TRAJECTORIES BASED ON TIME-LAPSE PHOTOGRAPHY EXPERIMENTS

4.1 Visual Characteristics of Natural Light and Shadow Trajectory in Time-lapse Photography

Capturing the changes of natural light and shadow through time-lapse photography, the visual characteristics of natural light and shadow trajectories gradually change over time. For example, at noon, the color contrast of light and shadow is strong, and the subject of the light receiving part appears white and has obvious highlights, which also causes the subject to produce clear and distinct black shadows. In the evening, as the sun sets in the west, the light in the atmosphere weakens. The hard light and blue light at noon is absorbed by the atmosphere, and the light and shadow produce softer light through scattering and diffusion. The emitted light will present gradient warm tones such as red yellow, pink purple, blue orange, etc.⁹ In addition to the natural light and shadow of the sky, there are also lightning, starlight, moonlight, and other elements in the natural climate. In addition to the well-known firefly light in the animal kingdom, there are also a large number of light and shadow emitted by marine organisms that are worth carefully exploring their trajectory characteristics.

4.2 Visual Characteristics of Artificial Light and Shadow Trajectory in Time-lapse Photography

In this experiment, artificial lighting is the main research object, and in time-lapse photography, the properties, colors, and speed of light are studied. There are many types of artificial lighting, and the color temperature of car lights, streetlights, indoor lights, etc. will vary. And under the same lighting conditions, the quality of the lighting fixtures may vary, and the color temperature of similar light sources may also differ. However, moving lights, mainly headlights, have differences in the speed of light. Slow moving headlights have large fluctuations and uneven light quality. The fast-moving headlights have a relatively uniform light

quality and color. So even the same artificial light in different scenes will have completely different light color effects.

5. EXPERIMENTAL FONT DESIGN PRACTICE FOR EXTRACTING LIGHT AND SHADOW TRAJECTORY ELEMENTS

Through time-lapse photography experiments, the light and shadow trajectories of natural and artificial light are extracted, with a focus on observing changes in light effects, light position, color, and speed of light. Different visual effects are produced by observing the trajectory changes of different light sources, including their trajectory shapes, changes in light and shadow reality, color characteristics, and dynamic light and shadow space.¹⁰ The characteristics of light and shadow trajectories are summarized, and design factors are extracted. Finally, the running characteristics of different light and shadow trajectories are combined with font design. This design experiment uses the words "trajectory" as the carrier for font design. This demonstrates the experimental design effect of combining light and shadow trajectories with fonts.

5.1 Combining Light and Shadow Trajectory with Character Stroke Trajectory

5.1.1 Combining Natural Light with Character Stroke Trajectory

The hour after sunrise or before sunset is often referred to as the "magical moment", and its light and shadow effects are the most dynamic state. So in this experiment, the authors first conducted time-lapse photography on the "sunset glow" to capture the light and shadow trajectory of the sunset glow. At 17:25 on October 31, 2023, the sunset glow filled the sky. After half an hour of filming, the light and shadow trajectory of the sunset flow during this time period was captured (as shown in "Figure 1").

9. Jiang Xin, Visual Representation of Light and Shadow in Display Design [J]. North Literature, 2015(02).

10. (U.S.) Jason Tselertis, Type Font & Function [M]. China Youth Publishing House, 2012: 166.



Figure 1 Sunset light and shadow trajectory.

a Taken by the authors.

After shooting, the authors extract the characteristics of the flow of light and shadow trajectories in the sunset. Because the wind is light and the clouds are light on that day, the trajectory changes of clouds being gently blown by the wind can be clearly seen in the sunset. The trajectory shape is block shaped, and the overall state is relatively light. The closer the trajectory is to the sunset, the more saturated the color. The farther away from the sunset, the closer the trajectory color is to the deep blue of the sky, and the overall color is in a gradient state. After analyzing the characteristics of the sunset trajectory, light and shadow design factors were extracted (as shown in "Figure 2") and combined with the "trajectory" character for design (as shown in "Figure 3").

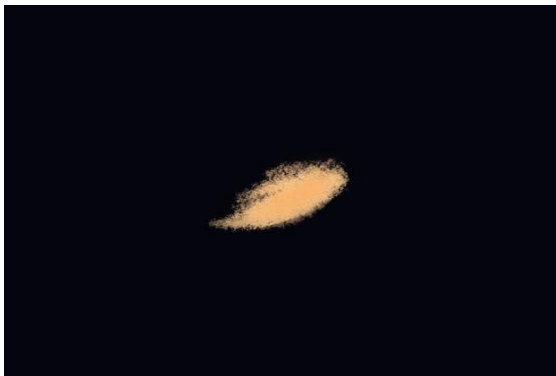


Figure 2 Design factors for sunset light and shadow trajectory.



Figure 3 Font design for sunset light and shadow trajectory.

5.1.2 Combination of Artificial Light and Character Stroke Trajectory

Artificial light and shadow trajectory refers to the changes in the light trajectory of motor vehicles driving on the road. The scene of bustling streets in the city is best presented through time-lapse photography. The scene captured this time is the state of the vehicle driving rapidly. The authors have extracted the characteristics of the flow of light and shadow trajectories of high-speed car lights after shooting. The trajectory displayed by its headlights is linear and has a strong sense of speed. Each light and shadow trajectory has a strong halo, and its color is mainly yellow white (as shown in "Figure 4"). After analyzing the characteristics of the light and shadow trajectory of high-speed driving vehicles, design factors were extracted (as shown in "Figure 5") and combined with the "trajectory" character (as shown in "Figure 6").



Figure 4 Light and shadow trajectory of high-speed car lights.

a Taken by the authors.

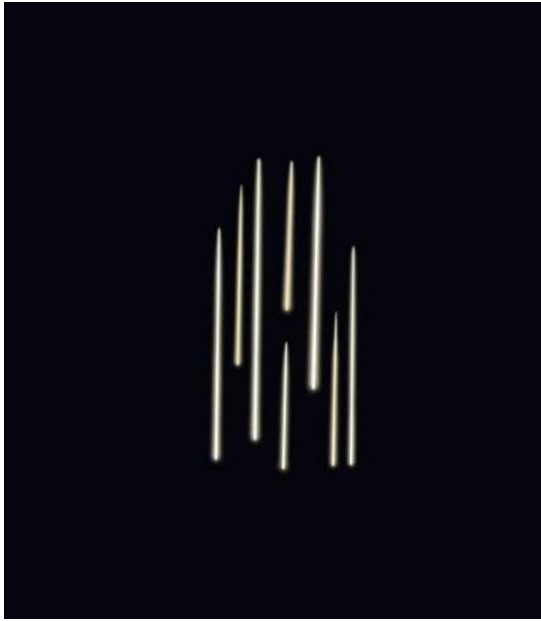


Figure 5 Design factors for light and shadow trajectory of high-speed car lights.



Figure 6 Font design for light and shadow trajectory of high-speed car lights.

5.2 Combining Light and Shadow Trajectory with Character Shape

5.2.1 Combining Natural Light with Character Shape

The most stunning natural light and shadow, apart from the variations of the sun's light and shadow, is the lightning's light and shadow, which flashes through the dark night, creating a highly visual effect through the combination of light and electricity. ("Figure 7") Due to the absence of lightning weather during the experiment, the light and shadow trajectories of lightning were searched in the network to analyze their characteristics. Its trajectory shape is wavy, with strong randomness in

the overall state. There is a main line in the middle, which is more intense in color and form. The auxiliary line disperses downwards according to the attached main line. Its trajectory also has a strong halo, and the overall color is mainly white. After analyzing the characteristics of lightning trajectories, design factors are extracted (as shown in "Figure 8") and combined with the "trajectory" text (as shown in "Figure 9").



Figure 7 Lightning light and shadow trajectory.

a Source: network.

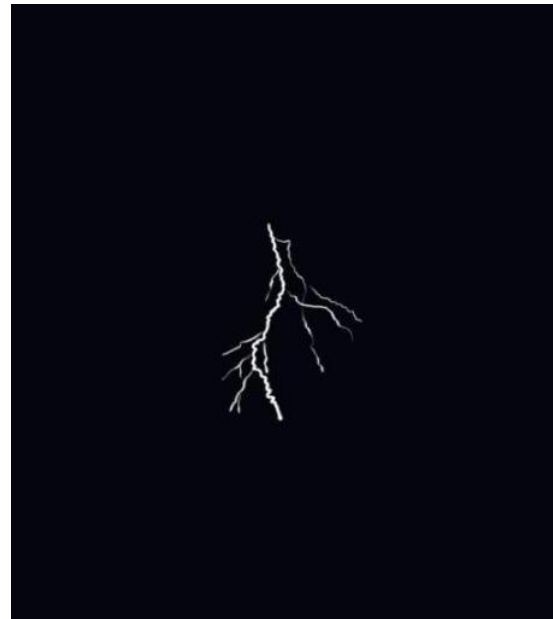


Figure 8 Design factors for lightning light and shadow trajectory.



Figure 9 Font design for light and shadow trajectory of lightening.

5.2.2 Combining Artificial Light with Character Shapes

The previous section analyzed and designed the high-speed light and shadow of car driving. Based on the design practice of high-speed light and shadow trajectories of car lights in the previous section, the light and shadow trajectories of car lights driving at low speeds were time-lapse photographed and analyzed. The shooting location for this photography is a highway near a certain

campus. Due to its proximity to the school, there are certain speed restrictions on driving, and the light and shadow trajectory is significantly different from the high-speed driving headlight trajectory mentioned earlier. The speed of light and shadow movement is relatively low, and its trajectory changes are significantly different from those of high-speed vehicles.

After shooting, the authors extracted the flow characteristics of the light and shadow trajectories of vehicles driving at low speeds. ("Figure 10") Due to the slower speed, compared to vehicles driving at high speeds, the trajectory displayed by the vehicle lights shows more obvious changes in reality and virtuality, with a noticeable shaking sensation. The trajectory is also linear, but its linearity has a certain wave shape, and its color is mainly yellow white. After analyzing the characteristics of the light and shadow trajectory of low-speed driving vehicles, design factors are extracted (as shown in "Figure 11") and combined with the "trajectory" character (as shown in "Figure 12").

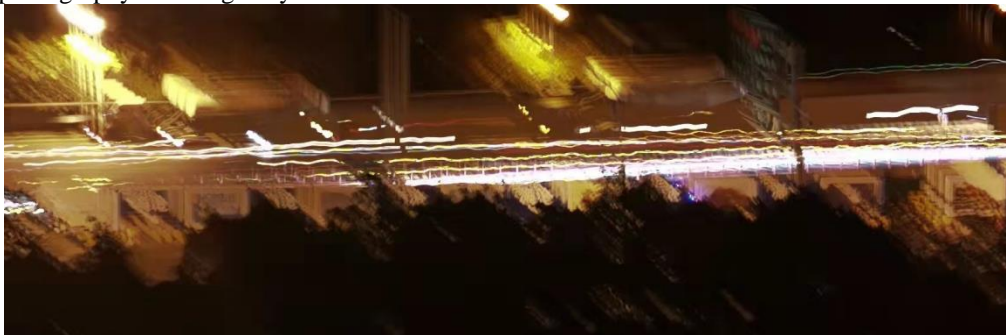


Figure 10 Light and shadow trajectory of low-speed car lights.

a Taken by the authors.

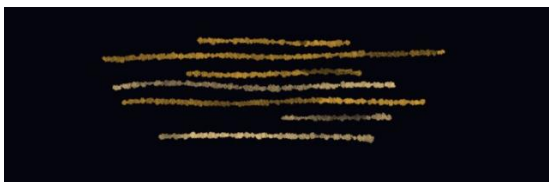


Figure 11 Design factors for low-speed headlight light and shadow trajectory.

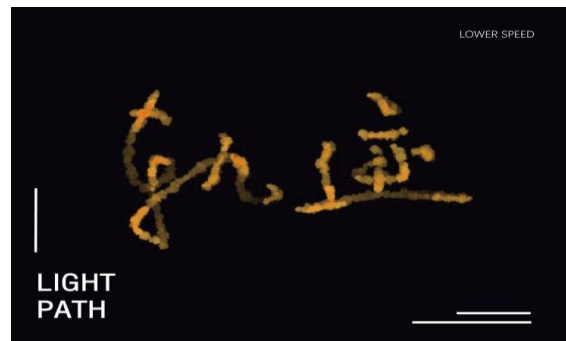


Figure 12 Font design for light and shadow trajectory of low-speed car lights.

6. CONCLUSION

By using time-lapse photography technology to analyze the characteristics of changes in the trajectory of light and shadow over time, and combining these characteristics with the trajectory of Chinese character strokes in experimental fonts, the authors continuously explore more possibilities in font vision, which can help to inspire viewers to pay attention to the relationship between two things. In the design exploration of experimental innovative characters, new technologies can also be used to better inherit Chinese character culture. After extracting the visual characteristics of various light and shadow trajectories and combining them with Chinese character fonts, designing new fonts can enhance visual rhythm and recognition effects, and enhance viewers' perception of font recognition. The two-dimensional visual space of the Chinese character font extends to the three-dimensional light and shadow space in the light and shadow trajectory, embedding the changing trend of light and shadow trajectory in the font over time to enrich the visual experience of the viewers. It also helps inspire designers to combine creativity with new technologies to create new design works for common but easily overlooked things in life.

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