Research on Subtitle Forms in Stereoscopic Films

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Abstract: In film and television works, subtitles are generally understood as elements independent of pictures. However, with the emergence of a large number of stereoscopic films, subtitles become the space elements of "real existence" in the space of stereoscopic pictures. The form, spatial position and content design of subtitles and other attributes which were relatively independent of the picture in the past are brought back into the scope of the picture. Inappropriately designed subtitles can destroy the overall aesthetic feeling of the picture, or even increase the discomfort of watching the film, thus breaking the carefully constructed experience of the works. But at present, the industry and academic circles focus on the content of subtitles; there is a lack of in-depth discussion on the form of subtitles and their impact on the film-watching experience. It is urgent to rethink the design of subtitles from the perspective of the overall design of stereoscopic pictures.

1. Introduction

In the creation of film and television pictures, as text elements, such as dialogue subtitles, explanatory subtitles and screen key information subtitles are generally regarded as supplementary elements of the picture, which exist independently of the space and content of pictures. While subtitles play an indispensable role in audiences' understanding of the dialogue content and prompt key information. Under the background of internationalization of film and television industry, translated subtitles have become an important bridge for foreign film and television works to enter our country's market, and also an important way for our country's cultural products to go out. In recent years, stereoscopic films have become the main source of box office, and the feedback of audience on subtitles has gradually expanded from the aspect of simple content quality to the form of subtitles. Problems such as too many subtitles and too many out of the screen have become the objects that the audience "complains" after watching the film. In some stereoscopic films, subtitles even become the "weakness" of the whole film experience.

2. Problem: Poor Experience of Stereoscopic Image Subtitles

For example, after the film "Star Wars: The Force Awakens" was released, the audience had more negative comments on the subtitles which were too "protruding pictures". In addition to the poor viewing experience caused by the spatial position of stereo subtitles, another kind of negative evaluation of subtitles of stereoscopic films focuses on the frequency and content of subtitles. For example, there are audiences who reflect that the subtitles of the film "The Martian" make all the words appearing in the picture, whether the descriptive subtitles printed in the original picture or the words shot in the picture, they are all displayed in the form of dialogue subtitles, which distracts the audience's attention and interferes with the carefully created viewing experience of the creator.

On the other side of the plane image, the form of subtitles is relatively casual, the position can be freely chosen up and down the picture, and the density of subtitles can be very high, even on some "bullet screen" of internet video platforms has become an indispensable part of watching videos. The aspects of aesthetic psychology, appreciation habits, and content adaptability promote indispensable components, but the essence of it can tease out the basic differences between stereoscopic and plane image subtitle viewing at the physical and experiential levels.

2.1 Physiological Factors

When pictures and texts are presented in the field of view in the form of plane, the physiological basis for human eyes to watch is the Saccadic Movement up to 500 degrees per second. That is, there is no need to adjust the convergence for both eyes, and the whole picture (including subtitles) can be viewed by scanning or even jumping on the plane with the same spatial depth. In contrast, in the space of stereoscopic picture, the eye movement of the audience is not only plane saccade, but also needs to change the angle between the eyes through Vergence Movement, moving back and forth will gather points to see clearly the picture content at different spatial distances. The Vergence Movement speed of human eyes is only about 25 degrees per second, which is far below the plane saccade. At the same time, because Vergence Movement needs to affect more eye muscles, accompanied by the changes of lens curvature, the visual fatigue caused by synthesis is much higher than that of plane saccade.

Similar problems are common in many stereoscopic film pictures with relatively large stereoscopic depth. For example, the first scene of "Thor: Ragnarök" uses the depth composition of the imaginary foreground: The background is located in the depth of the positive-parallax space (deep into the screen) to provide a distant background environment. The protagonist's face is located just behind the zero-parallax plane (the screen), and the most comfortable space with the most three-dimensional expression is the main body of the picture. The blurred foreground cage is located in the negative parallax space (out of the screen). The subtitles are all in the depth of the negative parallax space which is more prominent than the imaginary objects in the foreground. This kind of space allocation is logically correct, but brings inconvenience to the audience: when the audience wants to move their attention from the protagonist's face to the subtitle, the eyes need to be nervous and gather to the center, so as to move the convergence point and focus to the subtitle position deep in the space of negative parallax. In "Spider-Man: Far From Home", the frequent jump of subtitles in depth position in stereoscopic space can also cause similar problems.

2.2 Experience Factors

In addition to pure physiological factors, the viewing experience of stereoscopic pictures is also significantly different from that of plane pictures. There is no actual parallax space in the plane picture itself, and its stereo sense is formed by non-parallax clues such as perspective, coverage, light and shadow. When watching plane pictures, the audience will divide the spatial levels of the pictures with these "clues" acquired from daily life. When the subtitle or even "bullet screen" covers the picture, the audience can distinguish its level differences quickly and understand the subtitle as a special element "In the picture and out of the content". Besides the non-parallax clues, stereoscopic film, VR and other stereoscopic image media add the key parallax space, and the elements in the picture form a relatively "real" image space with parallax as the main relation. Subtitle, as the element which occupies the actual level in the stereoscopic space, can have the relationship between front and back and even side-by-side with other elements in the picture. At this time, the subtitles have changed from the "assumed level" in the plane picture to the space element of "actual existence". Subtitles are integrated into the whole space of the picture by independent text space.

3. Current Situation: Standards and Tools for Subtitle Production

As an important component of image products, subtitles need a whole set of standards, tools and production process from production to show, so as to ensure their normalization, compatibility and consistency of presentation effect. The physiological and appreciation features of subtitles in the above stereo pictures also need corresponding technologies to realize. As the international standard of film distribution, Society of Motion Picture and Television Engineers (SMPTE) ST 428-7 standard "Digital Cinema Distribution Master: Subtitle" and China's "Technical Specification for Subtitle in Vetting Digital Cinema Master" (GY/T 288-2014) have made basic constraints on the "plane" composition of subtitles on the picture. However, the main purpose of the subtitle range

specified in the standard is to ensure the visibility and readability of the subtitle in the plane image space, and try not to affect the overall effect of the picture. However, there is no standard for reference for the space problem of subtitles in stereoscopic pictures such as stereoscopic films. In order to technically guarantee the safety and comfort of subtitles in the stereoscopic space, the space depth and depth movement of the stereoscopic subtitles should also be included in the standard.

In terms of tools, subtitle rendering technology has made great progress in the context of the improvement of timed text rendering technology at the show. For example, the 2014 edition of the ST 428-7 standard adds support for IMF format multimedia files. The subtitle design part is based on the W3C TTML grammar, which can provide quite rich subtitle control and realize the complex picture effect similar to "ASS external subtitle" in Internet videos. On August 2018, the World Wide Web Consortium (W3C) released the third edition of TTML (TTML, Timed Text Marker Language), TTML2, and TTML-IMSC1 three official recommendation standards. Three relevant parameters of "Zposition, VariableZ and LoadVariableZ" are added to control the depth position of subtitles in the stereoscopic space. Through these parameters, stereoscopic subtitles can appear at any specified position in the space of stereoscopic pictures. At present, the mainstream digital master production tools all provide the production function of 3D subtitles, many of which provide automatic parallax analysis function, which can avoid the deep contradiction between subtitles and pictures. In response to the difficulty of controlling the font size and position of videos in multiple resolution modes, the "tts: fontSize" parameter is added to the above standard to specify the subtitle size by percentage of the screen instead of the specific number of pixels.

4. Expectation: Subtitles Return to the Picture Space to Optimize the Viewing Experience

After clarifying the physiological and appreciation characteristics of subtitles in stereoscopic pictures and sorting out the current situation of subtitle standards, tools and production process, the future development direction of subtitles in stereoscopic films can be analyzed from the perspective of design technology and the expectation from the perspective of industrial process.

Firstly, reduce the frequency of subtitles and avoid frequent subtitle replacement. In plane pictures, audiences can accept subtitles with shorter length and higher replacement frequency, while in stereo pictures, due to the physiological characteristics of watching stereo subtitles, high-frequency subtitle switching can easily lead to more frequent Vergence Movement of the audience, quickly accumulating eye fatigue and interfering with the immersive viewing experience.

Secondly, design the subtitle form oriented by picture elements. Different from the text elements and independent of the picture in the plane image, the subtitles in the space of stereoscopic image and the picture are in a continuous three-dimensional space, so they should be designed as the elements in the picture. For example, in stereoscopic films, especially huge screen, Fonts with wider strokes and sans serif (such as Bold and Regular in Chinese, and Arial for Latin letter) are more suitable for the formation of subtitle space entity sense. In addition, the font size is restricted by the relative size of the screen rather than the number of pixels, it can avoid the problems that the subtitles designed for ordinary screens are too large to disturb the picture under the huge screen show environment, and the font size played on small screens such as mobile phones is too small to read.

Thirdly, reasonably arrange the two-dimensional position and three-dimensional depth of subtitles to match the space of the picture and improve the viewing experience of subtitles. Although the current standard does not specify the three-dimensional depth of subtitles in detail, the position arrangement of subtitles can refer to the requirements of three levels: visibility, logical order correct and comfort. The visibility of subtitles in stereo pictures is similar to the form in plane pictures, and the logical sequence is basically determined as "subtitles in the front", but the relationship between comfort level and form remains to be explored and summarized. The comfortable area of stereo image is near the zero parallax. Because people's vision is particularly alert to objects moving towards their direction, if not required by the design, try to avoid quick movement of subtitles to reduce excessive attention caused by subtitle leaving the screen.

In addition, with the internationalization of the film market, subtitles will continue to play an

important role as a bridge. And its production process should also be updated according to the characteristics of stereoscopic image itself and the demand of international distribution. It is mainly considered that subtitles have become the organic entity of the picture space, and their designs should reflect more about the creator's overall design of the picture, instead of being completely set freely by the translation part. For example, the basic form of time series subtitles of "real-time rendering" should be designed by the film creator, and the basic subtitles of the film's native language should be made through TTML grammar, and packaged in the international release master. During localization process, distributors could simply replace the asset file related to the subtitle content with the target language, fine-tune the subtitle timing according to the language conventions, and eventually repackage it.

In a word, in the stereo image space, subtitles have inevitably become the organic components of the picture and the entity in the image space. The audience's requirements for subtitles have added "comfort, harmony and beauty" of the picture from the literal "faithfulness, expressiveness and elegance ". The content and form of the screen should be highly examined in the overall design of the screen so as to improve the beauty of the subtitle and the harmony with the stereo screen. Relevant standards, tools and workflow have provided a preliminary basis. With the development of technology and the update of concept, the production of stereoscopic subtitles of stereoscopic films will be more convenient and unified in the future, the design concept of the picture can also be completely run through under the international distribution mode. Subtitles will eventually get rid of the bad reputation of weakness of film watching experience, and together with other picture elements, constructing a harmonious and unified stereoscopic image space and creating a perfect and coherent film watching experience.

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