Costume Design In Three Spectral Areas

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Abstract

This paper presents the innovative possibilities of graphic technology for use in visual scenic activities. The individual values of costumes and scenography in the ultraviolet, visible and infrared spectrum are reproduced with new graphic technologies.

Each element of the costumes becomes visible when illuminated with different values of wavelengths of light observed through modified cameras.

With the addition of black light in the lighting design, the viewer sees only the ultraviolet element. In the absence of black light the costumes reveal only the design created in the area visible to the bare eye. The set-design elements created in infrared values, invisible to the bare eye are shown with a projection, simultaneously.

The presented technique represents a new means of expression in all forms of visual art.

Keywords: ultra-violet, infrared, video twins, parallel imaging

1. Introduction

Up until now, the creation of costume design elements in visual activities has been designed exclusively for the visible area. A new InfrareDesign method (CMYKIR method) of active information management has been proposed, respecting the properties of matter in the near infrared spectrum [1]. In print, hidden information in the near infrared spectrum has been found to be applied for security reasons in various printing techniques. [2]

By defining CMYKIR separation (InfrareDesign technique), a door is opened to the diverse and creative protection of all graphic products, packaging, textiles, leather, artwork [3,4].

Dual art paintings that conquer a new visual space are demonstrated, intriguing and provoking the viewer with a double message, but also uniquely and impenetrably, protecting the original. [5]

Measurements and analyses of the development of protection of documents printed with ultraviolet (UV) protective coatings were carried out in systems: CMYK, CIELab, RGB and HSB [6].

Designing inscriptions in the UV range (280 - 350 nm) created a field of expanded information invisible to the naked eye. This area of electromagnetic radiation is visible to the spectator only when illuminated with special lighting fixtures [7]. Special cameras were designed to examine the information imprinted in the costumes within the near infrared area

[8]. Former cameras recorded images as video in a single spectrum. Due to the technical characteristics of the CCD chip inside the video camera it is possible to construct special cameras for recording information invisible to the bare eye [8]. A dual camera (ZRGB camera) was constructed, consisting of two separate cameras, one of which captures the visual spectrum (RGB: 400 to 750 nm), and the other that captures the absorption of the near infrared spectrum of matter (channel Z at 1000 nm) [9]. The ZRGB camera simultaneously captures the RGB and Z video of the environment being recorded. The camera uses daylight without a separate built-in infrared light source that allows shooting objects in the immediate vicinity as well as at a great distance [8,9,10]. In parallel shooting, a sync slate was used to synchronize the two images taken in the same space and time in two different spectra [11]. When shooting people and their garments, differences in responsiveness within the infrared spectrum were noticed, depending on the materials of which they are made up of, and textile dyes used on them.

2. Settings and results of experimental work

This paper presents costume printing with elements in three separate spectra. The observed area occupies the space of 360 nm - 1200 nm (Figure 1) of the electromagnetic spectrum. Individual values for each spectrum are visible due to different lighting design for each area separately. Every observed area is visible under a certain type of lighting. Ultraviolet and visual values are visible to the naked eye, with the addition of a special kind of light (black light). The infrared values become visible only by using electronic devices. Hidden values are printed in the created costimography using the InfrareDesign graphic technology. In order to see the infrared values, a hand-held ZRGB-M camera was used for parallel recording of the visual and infrared spectrum. The information imprinted into the costumes is shown only in a certain spectrum, while the other values of the matter are invisible to the eye.

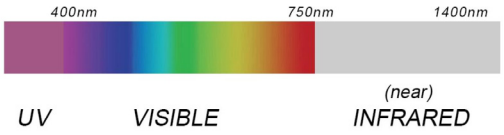


Figure 1. electromagnetic spectrum of the observed area

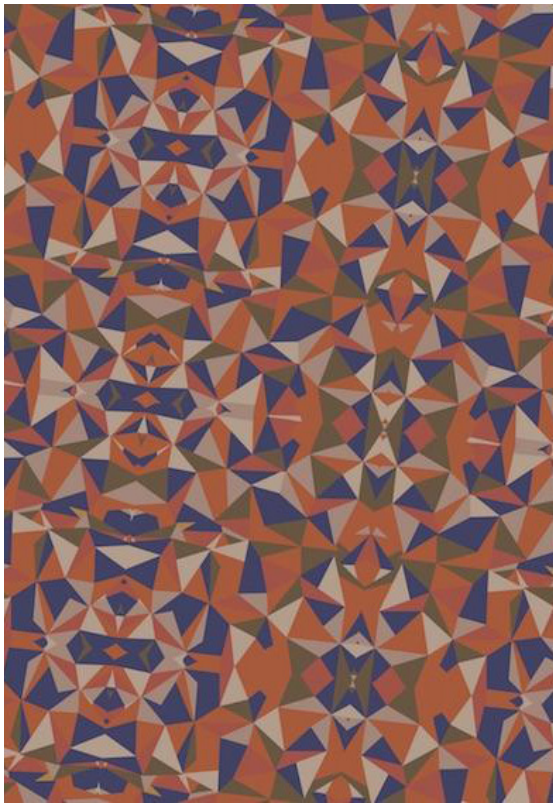
Options of observation of all three spectra simultaneously were explored (Figure 2). Costumes with information in the ultraviolet, visual and infrared area were designed. By using black light, ultraviolet values are visible simultaneously with the projection of infrared information. The visible values of the costimography are visible along with the infrared values at the same time.

	UV	VISUAL	INFRARED
UV			X
VISUAL			X
INFRARED	X	X	

Figure 2. The possibilities of simultaneous observation in all three spectrum.

3. Creating hidden images in the near infrared area

The technique of double images with information in the infrared spectrum is a kind of illusion that makes it possible to design a costume element with a hidden message. A canvas with a double message was created using the CMY-KIR method. The first is in the visual part of the spectrum, visible to the bare eye of the observer. The second message is embedded in the near-infrared and is visible using the constructed ZRGB-M video camera (Figure 3). One camera (RGB) captures the visual spectrum while the other (Z) camera shoots the same object but in the infrared area. The infrared light is of high intensity and is not dangerous to the human body. In order to view the infrared values, major adjustments to lighting solutions are not required. In the making of this kind of costume design, new forms of communication are used between the screenwriter, graphic and costume designer.



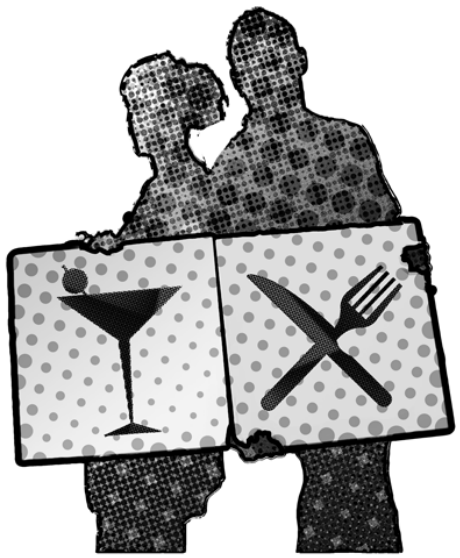


Figure 3. costume elements in V and NIR spectra

With the introduction of dual video images, parallel recordings of the visible and invisible spectrum with the ZRGB-M video cameras, storyboards are enhanced by a new column that displays infrared information. In this method of graphic technology and dual reproduction of the visual and infrared spectrum, the use of a clapper board for synchronizing video twins was upgraded. By creating a production process of double spectrum workflow, a new infrared film technology is carried out.

4. Creating hidden images in the ultraviolet range

The printed graphics with dual values in the near infrared and in the visual spectrum are enhanced with information in the ultraviolet range. A special UV color is used, and the design is hand-painted on with a brush (Figure 4). It was necessary to apply the paint very lightly, because of the specific residue that remains visible when viewing the costume with the bare eye. The embedded element itself is not visible in the visual spectrum until it is observed under special lights. A special black light allowed the viewing of the ultraviolet element. Ultraviolet information is introduced as the third element and an upgrade to the existing ZRGB video twins recording technique, and a new dimension of creative expression is opened. A three-spectrum display of the same scene setting has the ability to extend the visual information the viewer observes.

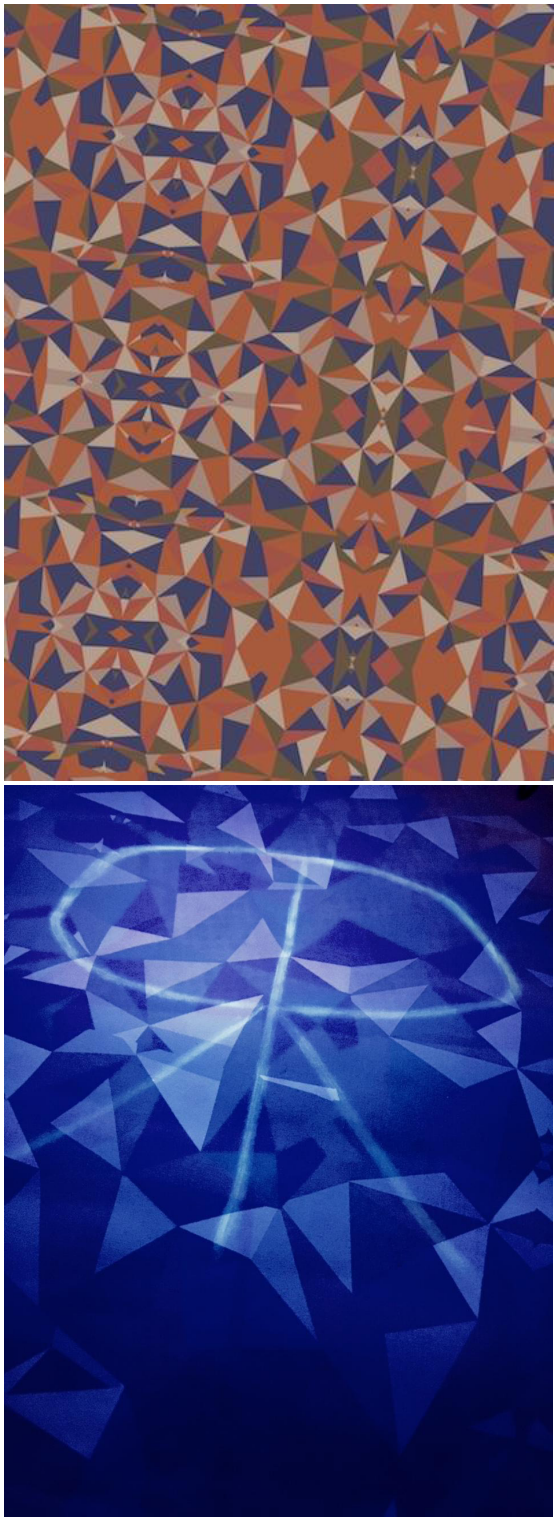


Figure 4. costume elements in the ultraviolet (UV) and visual spectrum (V)

By creating extended, three-spectral information on a single costume element, a space is opened up for the creation of new visual works. Information visible to the bare eye is visible under standard lighting, while the ultraviolet information becomes visible under black light. While the viewer observes the UV element there is not enough illumination to see the visual elements. Unlike the ZRGB technique, the ultraviolet element is only visible under black light, and in this case, there is no possibility of simultaneous viewing of the scene in the visible part of the spectrum and the ultraviolet. Black light is used as the ultraviolet light values (from 400nm downwards) are hazardous for the human body. (Figure 5.). In the storyboard, an additional column for ultraviolet values is created, which opens up a new area for additional expansion of script writing material.

UV	VISIBLE	INFRARED
black light	white light	infrared light
harmful	unharmful	unharmful
visible with bare eye	visible with bare eye	invisible (without use of electronic devices)

Figure 5. characteris tics of particular spectra

5. Conclusion

By shaping scenographic and costimographic elements in the visible, and to the eye-invisible spectrum, expanded information of the same material is created.

By introducing a three-spectra display of the ultraviolet, visual and infrared area, a new workflow is formed in film production in which all of the collaborators of the project take part in. Such an expression allows authors a new kind of communication when designing artistic creations. Conclusions are drawn about the processes of creating different values on the same matter in each spectrum separately. To view the near infrared values, ZRGB-M cameras were used, which simultaneously capture the moving image elements in the visual and infrared area. Ultraviolet values are seen with the bare eye in custom light conditions. In this case study, the user is not able to simultaneously observe all three spectrum with the naked eye. The infrared area is displayed through electronic devices (custom cameras and projections) and can be parallelly observed with the visual and ultraviolet, separately. A problem was detected with the parallel observation of the visual and ultraviolet area without the use of black light. Construction of a custom "UV camera" is proposed - one that captures the values of the ultraviolet state by using white light

with more pronounced values in the near ultraviolet region, as to make the UV elements visible with the naked eye by a projection. Given that "pure" UV light is hazardous to the human health, additional research and further study of safe methods of using such lighting is required. In this case, costume elements, which would also be used to protect the scene participants (protective suits and eyeglasses) are recommended. Presumptions were made for the possibility of parallel observation of ultraviolet values and the visible elements of costume and set design. The spectator would then see all three spectra simultaneously. A new form of communication between authors and users in three spectra is proposed to artists in creating their scenarios.

Creation of storyboards and production workflows are upgraded for the visual display of information in the ultraviolet, visual and near infrared spectrum. By defining the production processes of the expanded three-spectral presentation, a new method of graphic technology and communication design was created. This paper proposes experimentation with an extended form of information to all visual professionals.

6. References

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