COLOR FINGERPRINTS OF DIRECTORS

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ABSTRACT

COLOR FINGERPRINTS OF DIRECTORS

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This thesis presents a new analysis and determination method and its example application for the presence of the Kolorit (color use characteristics) specific for a director in his/her films. This characteristic if present forms a color finger print, a signature for that director. Worldwide well known directors are known to have this property. This study aims to introduce a material evidence for the presence of Kolorit for 3 Turkish directors. Example cases are selected to be Turkish directors Fatih Akın, Nuri Bilge Ceylan and Zeki Demirkubuz. It is shown that all three directors have characteristic color use in their films., We have found that the strongest color identity displayed by Fatih Akın.

Keywords: Color Fingerprint, Kolorit

ÖZET

YÖNETMENLERİN RENK PARMAK İZLERİ

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Tez Yöneticisi: Asst. Prof. Andreas Treske

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Bu tez, bir yönetmenin filmlerinde renk kimliği varlığının analizi ve tespiti için yeni bir metod ve bunun örnek bir uygulaması sunmaktadır. Bu kimlik var olduğu durumda, söz konusun yönetmen için bir renk parmak izi, bir imza niteliği oluşturmaktadır. Dünyaca ünlü yönetmenlerin bu özelliğe sahip olduğu bilinmektedir. Bu çalışma 3 Türk yönetmen için renk kimliğinin varlığına somut delil yaratmak amaçlıdır. Örnek durum olarak Türk yönetmenler Fatih Akın,,Nuri Bilge Ceylan ve Zeki Demirkubuz seçilmiştir. Her üç yönetmende de renk kullanımının karakteristik olduğu gösterilmiştir. Faith Akın en belirgin renk kimliği sergileyen yönetmen olarak belirlenmiştir.

Anahtar Kelimeler: Renk Kimliği, Renk Parmakizi

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CHAPTER 1

INTRODUCTION

In any film a certain number of frames are displayed one after the other to give an illusion of motion. In order a motion to be perceived, the frames must have different compositions either in shape or position coupled with change in hue and/or value. In color films the series of frames containing different colors and/or values (darkness or lightness) constitute a string of changes in the average perceived color of the film. As the human vision is based on the light sensing property of the specialized cells on the retina in the eyes, the structure and properties of these cells are of utmost importance in defining a colour scheme and colour space for any visual that is to be perceived..

Sequence of frames in a film can be scaled down to a single string of dominant colours which changes through the film. These consecutive colours, can be mapped onto a color space which is based on three main colours (depending on the main colours used) will form a series of collection of dots, thus a visual form. The starting question of this study is; “Are these forms representative of the style of the director of the a given film?

We hypothesize in this thesis that; “As colour perception is totally based on human biology, thus related to genetics and environmental effects (Human Vision and Color Perception), and the director is assumed to be the sole autheur of the film according to “Autheur Theory”. (Cook, 1999:235) these forms are representative of the director’s style. In which case, the visual form will represent the identity of the director as well if he/she has a definitive style. As for identity determination, finger prints have been used for many decades, we will name these characteristic forms as Color Finger Print of the director.

In order to evaluate the validity of this hypothesis and to find a verifiable answer to the main question, we have selected three well known directors from Turkey. The selected directors are Fatih Akın, Nuri Bilge Ceylan and Zeki Demirkubuz.

The main argument of this work is the quest for an answer for the question; Does the colour use in films display a revealing pattern for the identity of the director?

As the films are a stack of frames each of which can be represented as photographs, any property that can be derived from photographs can be mapped into a higher dimensioned space due to the sequence of frames appearing in time dimension. Thus, if brightness of the frames change, this can be defined as a function of time, or hue change in time dimension can be defined as a function.

Although the start of the thesis subject was the above defined problem, with the understanding that any property of a frame can be followed and defined by a function with the independent variable time, it must also be made precise what is meant with colour. Actually colour has many sub properties like hue, saturation, value, vibrance etc. (Color Theory) Thus, all of these sub elements of colour can be examined in the above defined understanding.

So the revised question could be:

Do the time dependent variations of hue, saturation, vibrance or any other colour sub-element display a characteristic property that can be related to the identity of the director?

As the first approximation for a colour, hue can be taken as it defines the place of colour in the spectrum (Color Theory).

The colour space selection is another important element in the analysis as the results will be displayed in that space. Selection of the appropriate color space should be such that, diffeerences of use of hue, saturation and brightness (value) among different directors can be inspected easily, both visually and numerically.. Mathematical and physical definitions of colours provide us with a very high number of colour schemes such as RGB, CMYK and numerous others (Color Theory).

However, the colour is a perceived entity through human vision. This can be best observed in the definition of magenta which is just an artifact of human brain. Because of this, the human visual system must be used as the main reference. The result of choice is the use of RGB colour scheme as human eye works on this basis (Human Vision and Color Perception, 2015).

Also, the availability of films on internet and their format forms provide a rich resource for monitors and projectors. It must not be forgotten that, the examination of films should use a consistent and comparable method to be valid for a range of films and directors. The most widely available format is AVI (Church, 2015) and the availability of analysis tools like ImageJ (National Institute of Health, 2016) for this format makes this format suitable for the analysis performed in this thesis.

The software ImageJ which is available on the internet as an open project, has the versatility of having many plug-ins that can be used for performing many analysis of visual elements including videos, films and photographs (ImageJ). It must be noted that, the analysis of films are based on a two step procedure in which the first one being the seperating the films into its frames that will be analyzed by the second step in sequence.

The first step can be done by plug-ins which breaks down the films into their frames in terms of stacks of photographs or by specialized software developed for image processing. We have selected the ffmpeg program as it is capable of handling all visual data formats and it is very powerful in terms of processing large amount of data (ffmpeg).

An important plugin of ImageJ is the Color Inspector 3D (ImageJ). Developed by Kai Uwe Barthel, this plugin visualizes the numerical values of digital pictures in various formats and color spaces (Barthel).

A fundamentally important notion that forms the main motivation of this thesis study is the equivalent color in digital imaging which is a result of the pixel form of the color units in computer images. An example of this notion can be found in "The Mona Lisa" by Ed Manning, which is a blocpix image in which the photo of the Mona Lisa painting by Leonardo da Vinci is given in 8 different forms including the direct un manipulated photo of the painting itself besides 7 representations of it in different resolutions. As the number of pixels decrease, an average, equivalent colored pixel covers the corresponding area of the painting (cited in Zelansky, 1989:82).

In digital images; digital photography, video, the image is consisted of pixels each in turn is composed of three elements of three basic colors; namely: red, green and blue. By changing the amount of light released from each color element, a pixel may get different colors. The total number of colors that can be obtained through this process is 255X255X255. Also the saturation (pureness) and balance of colors can be adjusted on the display unit by the spectator (Zelansky:77-79).

Psychological effects of colors are an important result of color perception as they are related to moods associated by colors and physiological end effects created by the psychological effects, such as increase of blood pressure in red environments (Zelansky, 1989:29-30). Directly related to psychology, color preferences are also depended on the person and thus can be accepted as a personal preference (Zelansky, 1989:33). This view plays a major role in this study, as the director's personal preferences might be reflected to his work.

It is known that approximately 80% of the knowledge acquired by a person is through visual medium (Küppers, 1986:7). This amount is too high to ignore and the importance of color is clear.

However, color is a result of the human visual perception. Colors only exist in our senses (Küppers, 1986:22-23). Thus, color perception is directly related to the vision of the individual. And as color is perceived because of ambient light, the color temperature of the ambient light (Color Theory) determines the perceived colors. By definition, "The color temperature of a light source is the temperature of an ideal black-body radiator that radiates light of comparable hue to that light source. The temperature is conventionally stated in units of absolute temperature, known as Kelvin (K)" (Westinghouse).

Also we have to take into account that, human eye does not have a homogenous field of vision, thus only a certain part of the visual field can be seen clearly and in detail. This is true for both colors and details (Küppers, 1986:17). Also additional difficulty arises as; human vision has a property that perception of the colors differes when the colors that are being seen interact, i.e. same color can be perceived differently in the presence of other colors (Küppers, 1986:18-19).

Human vision has several complex properties (Human Vision and Color Perception) and one of them is the color sensing structures in the eye. There exist three main colors due to the structure of the human eye. The sensory cells have three different types in the case of color vision and these cells are sensitive to three different colors, namely; violet-blue, green and orange-red (Küppers, 1986:26).

These sensory cells are located in a small area on the retina of the human eye and are sensitive to different wavelengths. The three wavelength groups are, long, medium and short. Violet-blue has the shortest wavelength among these, green constitutes the medium and orange-red the longest wavelength (Küppers, 1986:26-27)

Certain problems in human vison system can cause defective perceptions. These include the different perception of colors due to absence or weakness of the types off sensory cells (Küppers, 1986:28-30).

It is also possible to think of human vision as a computer system as claimed by Küppers (Küppers, 1986:24-25) and seeing is a very important step in self-awareness. Especially seeing oneself in the mirror is key to self-perception and awareness. What if the mirror is false colored exactly as in the movies (Glöde, 2014:37) This brings us to the point where, the perception of others and self can be questioned by a different space where the environment painted differently than the everyday life.

Culture dependency of color perception is a well-known fact (De Bortoli, Maroto, 2001) and language plays a key role in culture. However, the relation between language and image which includes color is highly complex, not just because of the human vision's complexity but also because of the incompatibility of them as stated by Foucault; image and language are incompatible in the sense that their relation and interactions are not linear and they are complex in nature (Foucault, 1970:9). It must be noted that he is not refusing any interaction between image and language, instead he claims that if one wishes to keep the relation of language to vision open, if one wishes to treat their incompatibility as a starting-point for speech instead of as an obstacle to be avoided, so as to stay as close as possible to both, then one must erase those proper names and preserve the infinity of the task (Foucault, 1970:9-10).

This complex interaction is where the cinema stands. Directors are trying to convey concepts, senses, feelings, situations through an image dominated medium to a language dominated receiver; the human. This makes them special in the sense that, their perceptions, ways of conveying notions through images need as much depth as possible. As mentioned by Glöde, "color constituted for one physical dimension" (Glöde, 2014:31) so the color provides additional dimensions to the visual language of cinema which by definition was crippled by the removal of physical space's depth dimension. Therefore, the directors color identity becomes a determining factor what and how he/she will convey his/her messages.

CHAPTER 2

AVAILABLE STUDIES IN THE FIELD

There are many studies and works available on internet that are investigating the differences among films due to their color content and differences among directors due to their color use. However, only few of them have original idea and approach, whereas the rest are consisted of application of those few core examples. In the field of color of films analysis, there exist two main color related approaches.

One is based on the main color palette used in the films and the other is the flow of the average or equivalent colors of the films through the film. Average color or by its name we will be using in this thesis; equivalent color, is based on the notion “The Gestalt Law of Similarity” in color (O’Connor, 2015:89). The overall effect of the vision frame (the area that is seen) in terms of color will be a single overall color. This color can be computed by taking the average of the all of the colors in the scene by taking into account their multiplicity and area of coverage. This is achieved by use of image processing tools available on internet (i.e. ImageJ, Icy). The process is dependent on the frames (stills) selected from the film. Thus this line of approach is somewhat limited in displaying the directors choice, due to the selection of frames is a user action interfering with the will of the director. In order to overcome this problem, all palette based approaches uses the frames that became the trade mark of the film in question. Thus the director choice is preserved and emphasized.

2.1 COLOR PALETTE BASED APROACHES

For the examples based on color pallet determination, the process is mainly done by the use of image processing software that is widely used and very user friendly; Photoshop (Adobe, 2016) or online services (i.e. DeGraeve, 2016). The actual mechanism is to convert the image to indexed color mode of Photoshop in which all the colors available in the image are tabulated and narrowed down to the number specified by the user. Thus the result of this process selects the most effective colors in the image. The color palette can be arranged according to several further notions like cool or warm colors. Another method that can be used to create the palettes is based on Adobe Color CC (Adobe, 2016), which is also available as an application on mobile devices. However this product gives 5 color palettes at a time according to the mood specified by the user thus can only be used to present the most dominant colors in a film. The selection of the mood by the user interferes with the authorship of the director and the result is biased towards the user choice other than the actual choice of the director.

One of the original examples is given by Lackey (Lackey, 2015). He gives the five color schemes that are used in films by submitting the color palettes. In doing so, he determines first, into which color scheme the film fits and then determines the color palette. The color schemes he examined are; complementary, analogous, triadic, split complementary and tetradic color schemes (Lackey, 2015).

Complementary color scheme uses the two colors placed opposite to each other on the color wheel. Analogous color scheme on the other hand, uses adjacent three colors on the color wheel (Lackey, 2015).

Among the other color schemes tetradic uses four colors such that, the color chosen form a rectangle on the color wheel. Triadic one forms an equilateral triangle and split complementary forms an isosceles triangle such that the base of the triangle is formed by the two neighboring colors of the complement of the third one (Lackey, 2015). His efforts in classifying the color schemes available in the films is unique among the other color palette based works.

In another work Miller gives 15 films as examples of effective color palette selection (Miller, 2014) in which he presents the color palette data of 15 selected films. His work is noteworthy because it gives the differences and shows the similarities among those 15 films that he has selected.

An important contribution of color palette use by directors is given by Present & Correct in their tumbler account. They examine the films of Wes Anderson. The color palettes they give show a very strong characteristics of use chromatic grays and prismatic colors in a balanced manner. The importance of the distinction between prismatic colors and chromatic grays and their uses were mentioned on several occasions by Marek Brzozowski (personal communications, fall and spring semesters of 2011, 2012, 2013, 2014). Through this color palette Anderson emphasize the depth of the scene very effectively almost like a painter. Thus there is a very definite and characteristic color use in his films. In Goethe's terminology (Goethe, 1804), which was later revived by Marc Glöde (Glöde, 2014), it is clear that Wes Anderson has a very striking and definite Kolorit (Havlin), (Present & Correct).

Lynch gives another example of color palette scheme (Lynch, 2013) in which he processed the frames he captured from famous films and resulting color palettes of the films.

Another online resource for the color palettes of stills from famous films can be found in (digitalsynopsis). The technique is based on the palette extraction utility of Photoshop software (Photoshop) by Adobe. The palettes extracted are from the famous scenes of the films, rather than the overall film.

The most widely known example of the color palette approach is due to Radulescu, who extracted the color palettes of the films using Photoshop and displays the results in her blog (Radulecu, 2016). Her work is even mentioned by others as being a trend setter (Czeck, 2013).

The color palette based approach is important as the color palettes help to see the color space that the director was trying to create. However, the color palette gives about the static setting of the film, ignoring the dynamism and flowing nature of movies. This limits their power in determining the director characteristics.

2.2 EQUIVALENT COLOR BASED APPROACHES

Equivalent or average color based schemes are stemming from the fact that film is a dynamic entity and the importance of time and flow of the frames throughout it, are important. In this approach frames are taken from the film at certain intervals and the resulting collection of scenes are then reduced to one pixel with a color equivalent to that of the frame. Thus, in this process the first product is a string of pixels with different colors. This process is mainly done by dedicated software or modified java scripts that the authors wrote.

One of the first examples of this approach can be seen in the work of Charlie Clark and he presented his work in a site designed and developed by himself (Clark), where he explores the use of color in movies. The method used by Clark is partly adapted and used in this thesis. His method of employing the equivalent colors for frames is one of the basic ideas that made this thesis possible. In his website Clark extracts the equivalent colors of the frames of films and display them as a strip of colors following each other (Clark).

Besides using equivalent color notion, another option is the use of long exposure photography to get a visual from the whole of a film. This approach is used by Jason Shulman (as cited in AnOther, 2016) to obtain a series of visuals for some well-known films, which AnOther called them as “cinematic masterpieces” (Another, 2016). The analytical merit of this approach is debatable as human vision is not an additive process as Foucault stated (Foucault, 1970:9), similar to the non-linearity of color formation as stated by Zelansky (Zelansky, 1989:55-56).

Similar approach was employed by Kevin Ferguson in analyzing Western films, by adding frames digitally to obtain a single frame (Ferguson). In Ferguson's work the result is a frame of abstract color composition.

In another equivalent color approach, using the average colors of the frames, Brodbeck obtains visual respresentations of the colors in the movies by using custom made software (Brodbeck). He uses the "fingerprint" terminology that we adapted in this thesis also.

Dillon Baker uses custom made software to analyze the movies to get average colors for each frame of the films. Displaying them in a strip form, allows him to show how the color changed throughout the film (Baker).

In all of these equivalent color schemes, the flow and change of the color along the film can be seen in a horizontal or vertical strip format. The main issue in this method is the interval that the frames are extracted from the film. Most authors specify 1 second interval for convenience. However, as human vision is a complex mechanism, the frequencey of the frame extraction should also be determined on scientific evidence. Due to this fact, in this thesis, we adapted the perception speed research of Holcombe (Holcombe, 2009) due to which, the perception speed of shape-color combinations are limited to 3-4 Hz. Which means, 3 frames per second is an acceptable level.

CHAPTER 3

COLOR THEORY

Humans take color as granted and a reality of life. However, detailed analysis and research have shown that “Color is first and foremost an experience” (Kuehni, 1983:1) and almost contrary to common belief; “there is no such thing as colour, at least in optical physics. Colour is a biological, or even sociological construct” (Rhodes, 2015). Color is not a characteristic property of material to be seen colored (Küppers, 1986:12). Depending on the interferences caused by filters, the light waves can result in produced colors that has no connection to the material (Küppers, 1986:14). The non-existence of color outside human perception is stated by Kuehni as; “Colors “are not real, and the world in front of us is not colored. Our brain creates the sensations of colors, most often from certain quantities and qualities of electromagnetic radiation which strike our sensory organ”, namely the human retina (Kuehni, 1983:7).

Color is directly related to light. Küppers claims that, material color is relative and color perceived from a material depends on the lighting conditions and the light available (Küppers, 1986:15). The amount of light is related to luminance and "‘Pure’ luminance variations tend to arise from illumination" (Biggam, 2011:3). Also we have to remember that, the definition of brightness is given as; “perceived intensity of light is called brightness” (Briggs). The lighting conditions will change the color perceived and a numerical simulation of this can be experienced by using the applets given by Briggs (Briggs).

Color theories have existed since the ancient times. These include, “Hindu Upanishads, early Greek philosophers and physicians and the Arab physicist Alhazen” (Zelansky, 1989:46). Later during Antiquity Aristotle proposed that all colors are the results of mixtures of dark and light (Zelansky, 1989:46). His ideas followed his procedure; “Verifications from experience and observation of similarities are necessary” (Zelansky, 1989:46).

During Renaissance Leonardo da Vinci, and after Newton, Moses Harris, Goethe, Runge, Chevreul, Rood, Munselland Ostwald contributed to the color theory (Zelansky, 1989:47-56). Newton’s contribution to color theory is considerable. "Through his experiments Isaac Newton discovered that you could combine all the colors light together to create white light" (The History and Science of Color Film). Newton showed that white color is the combination of the colors in the spectrum (“spectrum”) and formed a logical understanding of the structure for the colors (Zelansky, 1989:47). Also he gave the first color wheel representation of the colors (Fig.1) showing the order of colors with respect to each other.

Figure 1. Newton's Colour Circle (http://rsta.royalsocietypublishing.org)

As color can be created by pigments besides lights, Moses Harris worked with pigments instead of lights and gave color wheel representations of the pigment equivalents of the Newton's color wheel (Zelansky, 1989:48).

Newton’s scientific approach to color theory was opposed by Goethe his book “Zur Farbenlehre, (Theory of Colors)” in 1810 strongly criticizing the approach of Newton and returning to the tradition set by Aristotle and Leonardo who followed a similar approach as of Aristotle (Zelansky, 1989:49). He also gave a color wheel displaying the relation of colors among themselves (Fig.2). Goethe's book “Zur Farbenlehre” was one of the milestones of color studies although his views presented in his book were criticized by the scientists. In his book Goethe mentioned about the physical, physiological and sense related properties of colors in detail and associated colors with moods and psychological states including the color perception related illnesses. In his work several notions were described like; the colored shadows, chromatic aberrations and refraction besides the notion of kolorit (Goethe, 1812).

Figure 2. Goethe’s Color Wheel
(http://fineartamerica.com/featured/goethes-color-wheel-science-source.html)

At the same time of Goethe's book, German painter Philip Otto Runge published a book named “Die Farbenkugel, The color sphere” and gave the first three dimensional representation of color space (Zelansky, 1989:51).

Later in 19th century, Michel Eugene Chevreul wrote the book “The principles of Harmony and Contrast of Colors. He gave a detailed and finely graded version of the color wheel which was another two dimensional representation as of Newton and Harris (Zelansky, 1989:52).

Being a scientist, besides an artist, American Ogden Rood, defined the terms of saturation (purity), lumosity (value) and hue (the place of the color on the color wheel) (Zelansky, 1989:52). Although he put great effort to scientific approach, Rood was unable to form a consistent and mathematically logical structured of color. In other words, his efforts of establishing a scientific color system did not finalize (Zelansky, 1989:53). Later in 1905, Albert Munsell used a three dimensional structure to unify all of Rood's concepts and formed the color notation for pigments that is still used in U.S. (Zelansky, 1989:55).

And finally, German color theorist Wilhelm Ostwald formed the scientific system of colors during early twentieth century, by using geometric progression instead of arithmetic, which means that color formations are not based on addition but on multiplication (Zelansky, 1989:55-56).

The basis of color spaces being defined in 3 colors goes back to Thomas Young. "Trichromatic theory was first put forward by Thomas Young in 1802 and refined by and Herman von Helmholtz in the 1850s" (The History and Science of Color Film). "The Young-Helmholtz theory postulated that human retina was made of cones that were responsive to only three colors of light – red, yellow and blue" (The History and Science of Color Film). This was the first version of today’s RGB color space. Later in the middle of 19th century he wrote a paper on the subject. "In his 1855 paper, Experiments on Color, Maxwell used spinning tops to demonstrate that validity of the Young Helmholtz theory, refining the primary colors to Red, Green and Blue" (The History and Science of Color Film). Today three colors are used in creating all the other colors. "It turns out you only need three primary colors to create white or any perceivable color" (The History and Science of Color Film).

3.1 COLOR PERCEPTION

Color is a result of the human visual perception. Colors only exist in our senses (Küppers, 1986:22-23). Thus, color perception is directly related to the vision of the individual. Color is usually perceived though vision. However, exceptions of this can also be seen. Color perception through touching has been noted by and people with synesthesia, associate smell and sounds with color (Zelansky, 1989:27). Psychological effects of colors are an important result of color perception as they are related to moods associated by colors and physiological end effects created by the psychological effects, such as increase of blood pressure in red environments (Zelansky, 1989:29-30). It must also be noted that cultural references affect the color meaning and interpretation. An example of this is the use of color red as a warning in west. However, in China such an association with red is not present (Zelansky, 1989:31). Color preferences are also depended on the person and thus can be accepted as a personal preference (Zelansky, 1989:33). Besides its importance, differences in the perception of color among people make it an area to be investigated by the psychologists besides others (Zelansky, 1989:9).

Human eye is the first element in human vision before nerves transmit electrochemical inputs to brain parts responsible for vision, where the incoming signals are processed and visual perception occurs (Zelansky, 1989:19). In human eye, incoming light is focused onto retina where specialized light sensitive receptor cells sense the light. The receptor cells are of two types. The ones with rod shape are sensitive only to the value of the light, which means the darkness or lightness of the incoming light are measured. Thus these receptor cells can only sense the range from black to white in a gray scale. However, the second type of cells in the retina are sensitive to one of the three wave lengths and are called cone cells. These cells are of three types which each can sense only one range of the wavelength spectrum ("spectrum"), long, medium, short. The long wavelength corresponds approximately to red color, whereas, medium corresponds to green and short corresponds to blue (Zelansky, 1989:19-21).

Additive synthesis is the formation of color through light. In this form of color production, the main colors red, green and blue are reflected at different amounts by different surfaces. The resulting combination of the reflected parts of the main three colors form the final color associated with the reflecting surface through an additive synthesis (Parramon, 1989:16). The three primary colors of additive synthesis when combined in pairs form the secondary colors which in turn are the primary colors of subtractive synthesis of colors that result in use of pigments as is the case in paintings (Parramon, 1989:20).

The perception of different colors is the result of the stimulation of the cone cells in human eye. As the cone cells are of three types, the combined stimulation of these cells result in different color sensations. Although there isn't a specialized cell sensitive to yellow color, stimulation of short wavelength and medium wavelength sensitive cone cells result in the yellow sensation. The number of possible color sensations can be maximized by selecting the triple color combination of red, green and blue lights. Thus any color can be represented by these three colors. As a result of this, any color can be described in a 3D space where the main axes are red, green and blue (Kuehni, 1983:71). Indeed, this is the basis of the color representations in "Color Inspector 3D" plug in used in ImageJ (Color Inspector 3D).

The dependency of color on culture can be seen through the analysis of visuals coming from different cultures. Examples of this can be seen by analysis of the color use of ancient Greek civilization, eastern civilizations, i.e. (Gage, 1993:11-27, 39-64). The use of colors as symbols can be seen in the colors of heraldry (Gage, 1993:81-82) and use of colors related to religion and related subjects (Gage, 1993:82-90). Another connection between color and symbolism is through the spiritual metaphors in metallurgy as indicated in the book Color and Culture (Gage, 1993:149-152).

Levoy (Levoy, 2012) gives a brief explanation to human vision and the tri-chromaticity (based on three colors) of human vision mechanism. The applets given in the web page display the various differences in perception of colors due to several medical conditions (Levoy, 2012). The important factor of the image capture mechanism in color capture can be seen by the different sensitivities of human eye color receptors compared to electronic sensors found in cameras (Levoy, 2012). Thus, even the capturing of the scene by a camera creates a difference in colors depending on the make and model. As the editing of films is also a part of the creation of the film, selection of the captured scenes is another step in which the end color scheme will be determined. As by autheur theory, all the decisions and results of the film are assumed to be determined by the director, the color schemes in the final product should display the choice of the director.

Essentially color is based on physical phenomena and the different colors people perceive are due to the differences in the wave length of the light caught by the color sensitive cells found in the retina of the eye (Zelansky, 1989:18-19).

Color preferences and perception show differences, depending on language, climate (De Bortoli, Maroto, 2001:4), gender and age (De Bortoli, 2001:5). There is also association between culture and color (De Bortoli, 2001:8). The color symbolism may change from country to country and De Bortoli gives the symbolic meanings of colors in various countries over the globe and the differences are striking (De Bortoli, 2001:15-26).

Besides the differences in perception, differences in color also cause different perceptions. “Differences in color are in most instances results of differences in material, whereas differences in luminance that are unaccompanied by differences in color are in most instances a result of variations in local illumination, e.g. shadows or shading” (Biggam, 2011:8). The depth and color relation is stated by Biggam as; "chromatic variations are a driving force for form and depth perception." (Biggam, 2011:8). However, language is an important element in color perception and understanding as Biggam mentiones by saying; "color discrimination is modulated by language even at a perceptual level" (Biggam, 2011:347). The language connection is also investigated by Foucault; “It is perhaps through the medium of this grey, anonymous language, always over-meticulous and repetitive because too broad, the painting may, little by little, release its illuminations" (Foucault, 1970:10).

There exist three main colors due to the structure of the human eye. The sensory cells have three different types in the case of color vision and these cells are sensitive to three different colors, namely; violet-blue, green and orange-red (Küppers, 1986:26). These sensory cells are located in a small area on the retina of the human eye and are sensitive to different wavelengths. The three wavelength groups are, long, medium and short. Violet-blue has the shortest wavelength among these, green constitutes the medium and orange-red the longest wavelength (Küppers, 1986:26-27)

Yet, human eye does not have a homogenous field of vision, thus only a certain part of the visual field can be seen clearly and in detail. This is true for both colors and details (Küppers, 1986:17). Also, human vision has a property that perception of the colors differes when the colors that are being seen interact, ie. same color can be perceived differently in the presence of other colors (Küppers, 1986:18-19). "Many of the benefits of color vision only emerge when studying the interactions between color and luminance rather than color vision in isolation." (Biggam, 2011:3)

We must also remember that, "visual sense operates on several levels like all other senses and functions of human body" (Kuehni, 1983:3). The first level is anatomical in which; "the sensory, the eye with its anatomical components, and the strands of nerve fibers connecting the eye in a complex pattern with what is called the primary visual cortex in the back of the brain" (Kuehni, 1983:3).

The second level is physiological one in which, "the organic processes of the visual system, the absorption of light energy in the eye, and the transformation of this energy into nerve signals that are passed along to their final destination in the brain" (Kuehni, 1983:3).

The third level is the chemical level which is consisted of the chemical interactions in the brain and nerves as a result of visual stimuli (Kuehni, 1983:3).

The physical level is formed as a result of the energy interacting with objects, its description and arrival at the light sensitive specialized cells in the human retina in the eye (Kuehni, 1983:3).

The following level is the psychological level which is related to the perception of the environment through light energy received through eye. This is the level that is responsible for the perception of colors, red, blue and green (Kuehni, 1983:3).

The final level is the esthetic/ ethical level in which certain energies that are absorbed result in certain moods and feelings (Kuehni, 1983:3).

The perception of light can be broken into, pereption of hue and perception of brightness or illumination. "We perceive variations in light intensity either as variations in the lightness (or shade-of-grey) of surfaces, or as variations in illumination such as shadows and shading." (Biggam, 2011:3)

However, certain problems in human vison system can cause defective perceptions. These include the different perception of colors due to absence or weakness of the types off sensory cells (Küppers, 1986:28-30).

"some researchers in visual perception have argued that the main role of color vision is to 'fill in' the blank areas that are left once the structure of the image has been encoded using luminance information" (Biggam, 2011:3). Kuehni also stated on the same subject as;" Lightness is the judgement of the brightness of a related color in relation to the average brightness of the surrounding colors" (Kuehni, 1983:41). Connecting this light perception of colors he said that, "Achromatic (or hueless) color with maximum lightness (no darkness) is called white" (Kuehni, 1983:41). A color with maximum darkness (no lightness) is called black" (Kuehni, 1983:41).

However, there are other ways to perceive colors without light reaching the sensory cells. These can be due to certain illnesses, physical effects on certain parts of the body or even by dreaming. (Kuehni, 1983:6). Yet, for healthy normal people, it can be said that; "Persons with a normally functioning visual system obtain perhaps the largest amount of information about their surroundings from the visual sense and color plays a most important part in this flow of communication" (Kuehni, 1983:1).

Color perception is a complex behavior in which association with other variables can affect. Goldstone gives the example of shape categories interfering with the color perception for objects (Goldstone, 1995). Thus the use of colors and color preferences are not linear and has a complex nature (Goldstone, 1995). This complex nature is solved by the perception on a larger scale. That is called gestalt and Spelke et. al mentions the age dependency of perception and the place of gestalt in the process (Spelke, 1993).

The first law of gestalt is; "The Law of 'Good Figure' (Pragnanz)"; "Under this Gestalt law, Pragnanz or 'good figure' is considered to be one that is easy to perceive as a whole" (O'Connor, 2015:88). The second law is related to being close; "The Gestalt Law of Proximity"; "This law suggests that shapes, objects or design elements located in close proximity tend to be perceived as a group" (O'Connor, 2015:88). The logic behind this law is that the human eye makes quick scanning movements on an ongoing basis when viewing a scene or performing any activity. Referred to as saccades, it is estimated that the eye makes about three scanning movements per second and that these tend to occur unhindered during both focal and distributed attention" (O'Connor, 2015:86). Also "contrast was a key predictor variable for visual detection and it can be surmised that contrast attracts saccades and draws focal attention" (O'Connor, 2015:86). The brightness is an important element in perception. Thus, "the human eye tends to notice and focus on objects that are bright or feature movement" (O'Connor, 2015:86). The color and contrast is an important part of perception and also an important basis of this thesis. "In visual communications design, strong contrasts in hue, saturation and/or tonal value can create fixational reflex within a design project and is often used to draw attention to significant areas of text or imagery or create some significant level of differentiation" (O'Connor, 2015:86). And the next law of gestalt is; "The Gestalt Law of Similarity; This law suggests that we tend to group together shapes, objects or design elements that share some level of similarity in terms of color, tone, texture, shape, orientation or size" (O'Connor, 2015:89).

The last one is, "The Gestalt Law of Good Continuation" O'Connor, 2015:89) and possibly the most important for our work in this thesis. Color changes through the films are to be such that. Continuation will make the spectator perceive more than visible. This is achieved by the color space selection and editing during the production of film. And according to autheur theory, director is the sole responsible one for this.

3.2 COLOR SPACES

The difference of material and color spaces is stated by Giggam as; "One way that color vision informs us about scene structure is by helping decompose the scene into its material and illumination layers." (Biggam, 2011:3)

Color space was first defined in three dimensional form by Philipp Otto Runge and later improved and developed into the latest 3D form by Albert Munsell, who used spherical form with identical sizes for colors to create equidistant placement for the colors in space. (Gerstner, 1986:12-25)

Color spaces can be visualized as three dimensional spaces with the main axes being red, green and blue in the case of additive color mixing, as in the case of light (Briggs). Other variables can also be used instead of three basic colors. Examples of variables that can be used in constructing color spaces are, hue (place of the color in the spectrum), saturation (pureness of color) and lumosity (lightness) or brightness. Although the last three terms are measuring the same quantity, the lightness, they are not exactly one to one equivalent. However, all those can be converted to others through well-defined formulas. Especially between RGB (red green and blue) space and HSB (hue, saturation and brightness) space, there is one to one correspondence.

As the human vision works in RGB mode, RGB color space has a privileged position over others. Originally RGB color space is a rectangular system. However RGB color space can be visualized in cylindrical spaces as well as discussed by Hanbury (Hanbury). “representation of the color coordinates of images in cylindrical coordinates (hue, saturation/chroma, lightness), is widely used in the image analysis and computer vision community" (Hanbury:1). However there are problems associated with each of the possible representations. Transforming values from standard RGB space to these cylindrical representations results in some problems in the applicability of them to certain cases as the saturation values are normalized by the lightness value (Hanbury, 2007:1). The most widely used two cylindrical color spaces are HSL and HSB, in which HSB gives a full cylindrical form whereas, HSL gives a double cone shaped volume (Canon).

The importance and usefulness of the concept of color space can be seen in the definition (Color Spaces)

> A "color space" is a useful conceptual tool for understanding the color capabilities of a particular device or digital file. When trying to reproduce color on another device, color spaces can show whether you will be able to retain shadow/highlight detail, color saturation, and by how much either will be compromised.

CHAPTER 4

COLOR IN CINEMA

Assuming director as an artist, we can claim that color in cinema is another tool available to the director. The importance of the color is emphasized by Zelansky as; “Color is perhaps the most powerful tool at the artsist's disposal” (Zelansky, 1989:9). Comparing film making to painting, it is possible to claim that film making is a way of painting with light as the brush as; in his book On the Road to Awareness, Bilal Zubedi states that (Zubedi, 2009:116),

> When talking about art, various art forms must also be considered, one that cannot prevent from coming to our mind is cinema. Cinema is painting with light (as it the name of John Alton's book) or it could be defined as the movement of images or as sculpting with time.

Besides light, other instruments that can change light can also be resembled to tools of painting exactly as Alton said; “In the hands of an artist the filter is just another brush, another instrument used in the painting of pictures” (Alton, 1995:130). Alton used the analogy of painting with light in the case of sun reflectors (Alton, 1995:127).

Botkin further emphasizes the importance of color use in cinema and the necessity to control it by saying that; "Color is such a powerful part of cinema storytelling that we should never neglect it. And despite the power of modern color correction tools, we can never leave it to chance" (Botkin, 2009)

Film making is creation of a volume which the projection of it onto the film will be taken. As this volume takes shape, more than one space are created; namely, physical space that we see as forms from the angle of the camera (which the director determines) and the color space that gives depth to the physical space and adds additional dimensions to it. In a way compensating the 2D limitation of the screen onto which film will be projected.

When talking about color space, not only light is important. The lack of light is also an element and youngblood stated that the intention of the directors to create both the physical and color spaces as; “We could tint the space any color we wanted to. Just being able to control the darkness was very important” (as cited in Glöde, 2014:238). The importance of darkness is also emphasized by Rhodes; “Even colourlessness is not straightforward” (Rhodes, 2015).

However, we must not forget that the actual human perception of a physical space under equivalent lighting conditions and what the camera records are completely two different things. Rhodes, mentions about this problem by saying that, “Given that we're taking a spectrum of effectively infinite colour and recording it as a proportion of three red, green and blue primaries, we probably shouldn't be surprised that things sometimes go awry” (Rhodes, 2015).

The use of colors is also related to trends that are the results of the fashion and thus are manipulated by the commercial concerns (Zelansky, 1989:125). The institutions that have a commanding position on the color trends exist and these play an important role in the color selection for designs for the products ranging from apparels to architecture (Zelansky, 1989: 125), thus the films captured using those elements. As anything in our world, trends are also bound to the power of economy, thus market place. So, economic situation and social events also effect the selection of colors and thus intervene with the determination of color trends (Zelansky, 1989: 126). Continuing in on the subject of relation between economy and color design, which use of color in cinema can also be included, Zelansky claims that “In applied design fields, color choices are strongly influenced by the demand of the market-place” (Zelansky, 1989:125).

For a design to be successful, it must be marketable, thus the product must affect the decision of the customers. This process is directly related to human psychology and the connection of economic concerns and psychology was given by Zelansky, by saying that; the effects of different colors on the psychological state of people was known and it had been utilized by the artists for different purposes ranging from, creating a certain mood to increase the marketability of the produts (Zelansky, 1989: 127-128). The mood creation is mentioned by Canini, Benini, Migliorati and Leonardi (2009) by saying, there are associated emotional identities for the films.

Affecting human perception is one side of the equation. On the other end, the perception of the director takes place and his/her perception of the scenes, forms and colors interact in different ways to allow them to design the film. Thus, interacting colors become an important element in the process of film making. Color interactions are also the result of the use of color and different color combinations may result in the different perceptions of same color (Zelansky, 1989:95-106). A property of color interactions is that; they “are most apparent to those who know to look for them”. This property is important in visual design as the director of film might have a tendency of using certain color interactions in their films almost like a trademark and spectators of his films would be more likely to perceive that (Zelansky, 1989:95).

4.1 EARLY WORK

In cinema, color has a long but a troubled history. Mazzanti mentiones about the color use in cinema and its cyclic importance in time by saying that (Mazzanti, 2010:325),

> Apparently, ‘color’ as a subject in film studies behaves very much like a quiet underground river: first it is in plain sight with essays and debates, then suddenly . . . gone it is!-only to resurface again a few years later, in full force.

About the subject there are important resources such as; an overall introduction to color in films can be found in (The History and Science of Color Film) or the detailed information and analysis given by Flueckiger, about the use of color in films, starting from the first color photographs presented by Maxwell in 1861, to contemporary techniques and methods of color in films (Flueckiger).

Another important research became available recently by the work of Marc Glöde (Glöde, 2014) in which he gives detailed and extensive information about the early times of color in cinema.

According to Glöde, the first attempt to colorize the cinema was actually attempts to colorize the films physically. Like the concept of painting by light (Zubedi, 2009:116), first attempts were by painting the celluloid films (Glöde, 2014: 165). Later, Arnaldo Ginna & Bruno Corra introduced the colors on the film with a well-planned manner taking the context and content of the film to enhance the transmission of message of the film (Glöde, 2014:167-168).

Glöde mentions about the connection of color use of Leopold Survage and Relativistic mechanisms of Einstein by pointing at the parallelism of question of space. His questioning of the depth and value of space in visual arts is in accordance with the meaning of volume and depth in relativistic mechanics (Glöde, 2014:168-169). He continues by saying that; Survage experimented with picture field (Glöde, 2014:169).

The fact that picture and color spaces are not a single entity was revealed during this time. In an analysis, Schawelka stated the picture space and color space were two completely different notions and should not be mixed (Glöde, 2014:170).

Walter Ruttmann, used colors and forms in abstract settings. His understanding is important as his notion of "Malerie mit Zeit" (Paintings with time) is actually paves way to change of colors used throughout the film (Glöde, 2014:175) and forms the basis of this thesis study as the equivalent color strips which will be introduced later in this thesis (Chapter 5) are actually color timelines of the films.

Whereas, Ruttmann used a dark frame around the central composition to keep the spectator ware of the fact that projection is just a vehicle (as cited in Glöde, 2014:176) Oskar Fishinger’s concern was about movement. For this purpose he experimented with fluid flow and mixing. He also experimented with a device named “Waschmachine” (washing machine) which sliced thin layers and result being taken by a camera (Glöde, 2014:179). In another experiment he had used a flexible sheet that will be lighted by colored lights when deformed into a chamber where lights are (Lumigraph) (Glöde, 2014:185).

On the other hand, Bela Balasz was one of the first to note that color has a potential to create a separate space on its own which is in interaction with the picture space (Glöde, 2014:189). His views are developed by Rudolf Arnheim, by claiming, by use of color the picture space can be enlarged (Glöde, 2014:190).

Whereas according to Sergei Eisenstein there are two facets for using color. One is the addressed scene and the other is the color scheme based on main concept, thus positions the film into the context of the director's aim (Glöde:194-197).

On the other hand, Len Lye was cautious about the color separation methods, which he employed to define a space which was peculiar to him. By doing so he made use of rhythmic presence of colors which in turn create a motion in depth of the movements of objects in the scene (Glöde, 2014:198).

The attitude of Mary Ellen Bute can be summarized as the need of a new art form which is both visual and in movement, also integrates audiovisual elements with physical forms. Her insight about the possibility of mathematically formulating a synchronous harmony among the sound and colors is also augmented by the possibility of using sound and visual elements in contrast, creating a form similar to counterpoint technique of western music (Glöde, 2014:202).

By using live music Hy Hirsh used an approach to the display of his films to re-edit the film for each occasion, thus creating a choreographer from the director of cinema, which in turn prevented his films to have a final version (Glöde, 2014:210) which made the cinema an experience itself..

Harry Smith used a direct physical intervention on the film material itself, which in turn allowed him to add a new layer mask in the contemporary sense (Photoshop layer mask) (Glöde, 2014:213). Smith's work can be visualized as a form of an excursion from the style of Kandinsky to abstraction. Through these what he achieved was the continuity of the depth of space (Glöde, 2014:216).

Stan Brakhage's position became a conflicting one as he was criticized by obeying the rules of the dominant ideology in art, although his starting point was to break the limitations of the understanding of art which was stemming from Renaissance (Glöde, 2014:223).

Jordan Belson use of colors was such that, they created an outer space where the color and light expressions define the space and were indescribable (Glöde, 2014:231). This creation of a new space of higher dimension was the reason of the difficulty in describing the spaces he created.

Youngblood also stated that freeing the images from the frames creates an uncanny effect as the frame of reference is lost. According to him, this effect was created through the use of color space. This procedure not only removed the frame dependency but also space dependency is also removed. (Glöde, 2014:238) This breaking the frame is similar to the removing the narration concept of Franscis Bacon "Narration Unterbrachen" in which color constituted for one physical dimension (Glöde, 2014:31) to compensate the deficiency caused by the removal of the traditional element. Thus, the colors became a power for achieving multi dimensionality as claimed by Glöde; by saying that, color space expands the image space by introducing additional dimensions to it (Glöde, 2014:17)

4.2 COLOR IDENTITY; KOLORIT

Color films contain color in two ways. The first one is the color of the images explicitly visible on the screen. The second one is the equivalent color that the images and color space create in the frames of the film as a result of the interactions of colors, shapes and overall effect they create that is known as *gestalt* which is the

German word for whole shape. The second one, i.e. the implicit one can be extracted from the film frames through image analysis and this process is defined and an application of it is given in this thesis.

Studying the psychoanalytic theory (Glöde, 2014:37), theories of image (Glöde, 2014:38-42) and theories of perception (Glöde, 2014: 42-46) he formed a basis for a new understanding of color space. He used the notion of “kolorit” for which he gave the definition due to Ernst Strauss as; Kolorit is the super notion embodying the colorized image structure (Glöde, 2014:47). His use of this term is such that kolorit becomes a personality trait of a director that is visible in his films. In other words; kolorit is the color identity of the director.

Beside the kolorit which is the color identity of the director, there is another notion that needs to be defined and that is the sign, evidence left in the film due to the color identity of the director. As this mark, evidence can be extracted from the film by image analysis through computational and technical means in an algorithmic way, it is similar to finger prints of people left on the objects they touch. Therefore, it is proposed that the mark, evidence left in the film due to director's color character could be called “Color Finger Print”. Hence the name of the thesis. Same terminology was previously used by Brodbeck (Brodbeck) in his thesis.

Glöde starting from the space, color and picture space concepts, questioned the relative positioning and interactions in between these elements in films (Glöde, 2014). He defined film as a complex structure of light and space construction and noted that color and image spaces are completely different entities, although they are interacting heavily in a complex way (Glöde, 2014:13,15,30).

Color temperature in a space determines the perceived colors (Glöde, 2014:78). This gives the director to paint the scenes with the colors using lights of different color temperatures that she/she wants, without being enslaved by the colors available at the scene caused by the naturally occurring color temperatures. This ability and its use are basic to the motivation of this thesis and it also supports the Autheur Theory. Changing color space is also similar to the lighting conditions in Cathedrals. Colored glasses of cathedrals create a unique color temperature distribution so the color space is unique and un-earthly. (Glöde, 2014:80)

There are studies that are trying to connect physical sciences, especially thermodynamics and cinema, as cinema could also be seen as a system. As the laws pertaining the systems in thermodynamics are very well structured and proved over time, such an analogy could give us the tools for analyzing the cinema from a different perspective (Youngblood, 1970:59:65). Youngblood also states that entropy notion in communication theory in his book and elaborates on the similarities of thermodynamic systems and cinema (Youngblood, 1970:62).

The color issue in cinema changed during the technological developments. At the start films were produced by chemical pigments on them. Later with the advent of the digital cinema, electronic sensors and light took the place of film and chemicals as stated by Johnson; “Ever since the modem alchemists learned how to transmute different wavelengths of light into a film image composed of equivalent dyes, there has been wide disagreement about the role of color on the screen” (Johnson, 1966:2).

We must note that, kolorit or the color identity is valid only when the authorship of the director is valid. Regarding the authorship of the director, as Cook said, “Debates about authorship in the cinema have occupied a privileged position in film studies since the 1950s – when the French journal Cashiers du Cinéma formulated the politique des auteurs” (Cook, 1999:235). He continued by saying that, “the politique proposed that, in spite of the industrial nature of film production, the director, like any other artist, was the sole author of the finished product” (Cook, 1999:235).

Although the final product, the film is the result of a cooperative efforts of many people and institutions, the authorship is a debated concept. However, as stated in the “The Cinema Book” “It would be wrong to suggest that authorship as a category has ended or is irretrievably problematized” (Cook, 1999:314). To prove his stance, Cook gives many examples of well-known directors as examples of the validity of the autheur theory, including Ingmar Bergman, Federico Fellini, Fritz Lang and many others (Cook, 1999:237-253).

CHAPTER 5

METHOD OF ANALYSIS

In this chapter, we will present the analysis methods and techniques used through the application of the available software. Using the database of digital forms of the films (Gürata), three Turkish directors are chosen. The criteria used in the selection are; the films should be in color (not monochrome), the director must be currently active and number of films available in the database should be higher than the rest. The application of these criteria resulted in the selection of;

- Fatih Akın
- Nuri Bilge Ceylan
- Zeki Demirkubuz

In order to keep the analysis manageable number of directors is limited to three, as the total number of films available for the above selected directors is 20 and numerical processing of the films requires very high computational power.

The software used in this thesis is consisted of the following:

- FFmpeg (FFmpeg, 2016)
- ImageMagic (ImageMagic, 2016)
- Adobe Photoshop (Adobe, 2016)
- ImageJ (NIH, 2016)

We used FFmpeg for capturing stills from the videos of the films and capturing certain screen sections. It is a command line based software and not as user friendly as everyday programs. Yet, its being very fast and powerful, combined with its ability to process all known image formats besides converting them to others without restrictions, resulted in our decision to choose it for this thesis study.

ImageMagic is an image processing software that has very quick response time for a wide range of actions on image files. Adding image files vertically or horizontally to others to create bigger image files with simple command line actions was the main reason of our selecting it for use in creating the strings of color pixels that in turn used for creating the color stripes of the films.

Adobe Photoshop is a versatile program for many purposes. However, in this study its use was just limited to resizing the final visuals for the print and obtaining the color palettes.

The second most important software that we have used in this thesis is ImageJ which has a long history of scientific use (NIH, 2016). Its ability to process visuals to produce numerical data and visually re-interprete them in different color spaces was very important, and made ImageJ the only reasonable choice.

The process for each film starts with the use of FFmpeg to capture frames at a certain rate, which was 3 per seconds in our case. We determined this rate according to the criteria given by Holcombe (Holcombe, 2009).

5.1 THE EQUIVALENT COLOR STRINGS OF FRAMES

After obtaining the frames of the film, each frame (picture) is resized to 1X1 pixel with the color being the average (equivalent) color of the frame. These 1 pixel visuals are then added to each other in the same order of the frames of film which results in a horizontal string of colored pixels. The length of the resulting visual is being the length of the film in seconds multiplied by the rate of frame capture (3 in our case). This string is then resized in vertical direction to allow us to see the color changes in horizontal direction easily. The result of a sample can be seen in Fig.3.

Figure 3. Sample Equivalent Color Sequence

5.2 COLOR PALETTES OF FILMS

The string of pixels is then analyzed by Photoshop in indexed color mode to get a palette of 16 main colors found in the string corresponding to equivalent colors of the frames of the film. The resulting color for a sample case is given in Fig.4.

Figure 4. Sample Color Palette

The 16 vertical stripes will be used in the visual analysis of color preference of the directors. This type of palette representation is useful in determining the color preference of the director in terms of chromatic gray, prismatic colors and contrast. In the analysis it was found that certain directors are trying to eliminate vibrant colors on purpose and show a shift towards achromatic grays, which are by definition colorless grays.

In the following sections following abbreviations will be used:
NCG = Number of Chromatic Grays, NAG = Number of Achromatic grays.
NPC = Number of prismatic colors.

5.3 OVERALL COLOR OF FRAMES AND SUB-FRAMES

Instead of just analyzing the film only in its whole frame, we divided the frames into equal parts as shown in Fig.5. Through this process we obtained 5 sub-frames for each frame. As the centers of these sub-frames coincide with the one-thirds of the main frame, it becomes possible to examine which part of the frame the director places emphasis. The color sequences (similar to Fig.3) are obtained for each sub-frame for every frame. Thus we obtain 6 color sequences for each frame; one main, 5 sub-frames. In this part again, we used FFmpeg and ImageMagic softwares.

The reason of dividing into 3 in each direction is the rule of thirds (http://digital-photography-school.com/rule-of-thirds/). Through this process the color sequences obtained are compared to each other and the differences among directors in selecting the area of emphasis are determined.

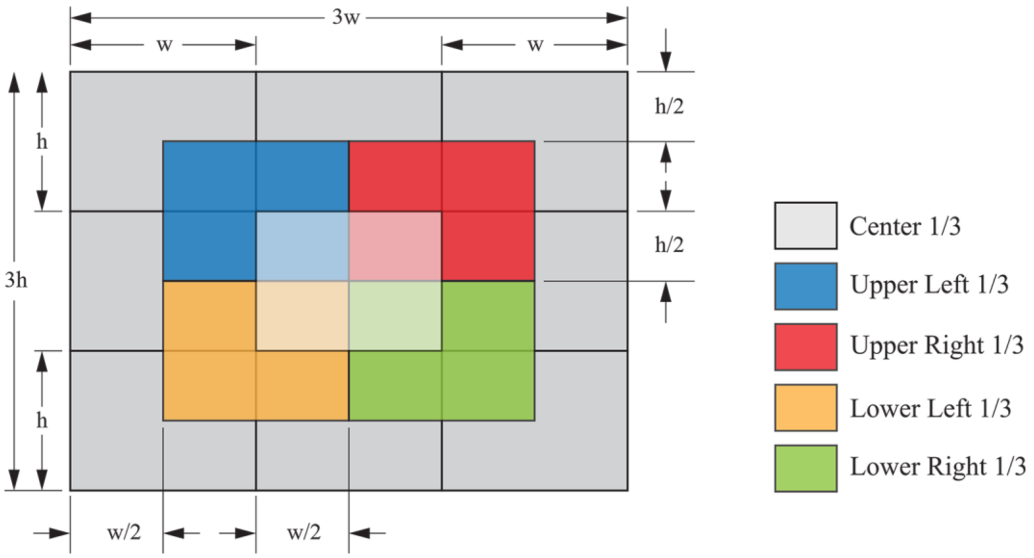


Figure 5. Definition of Sub-Frames

In the following sections following abbreviations will be used:
UL=Upper Left, UR=Upper Right, LL=Lower left, CC=Center, WF=Whole Frame

5.4 EQUIVALENT COLOR STRIPS OF FRAMES AND SUB-FRAMES

We combined the resulting color sequences using Photoshop like Fig.6.

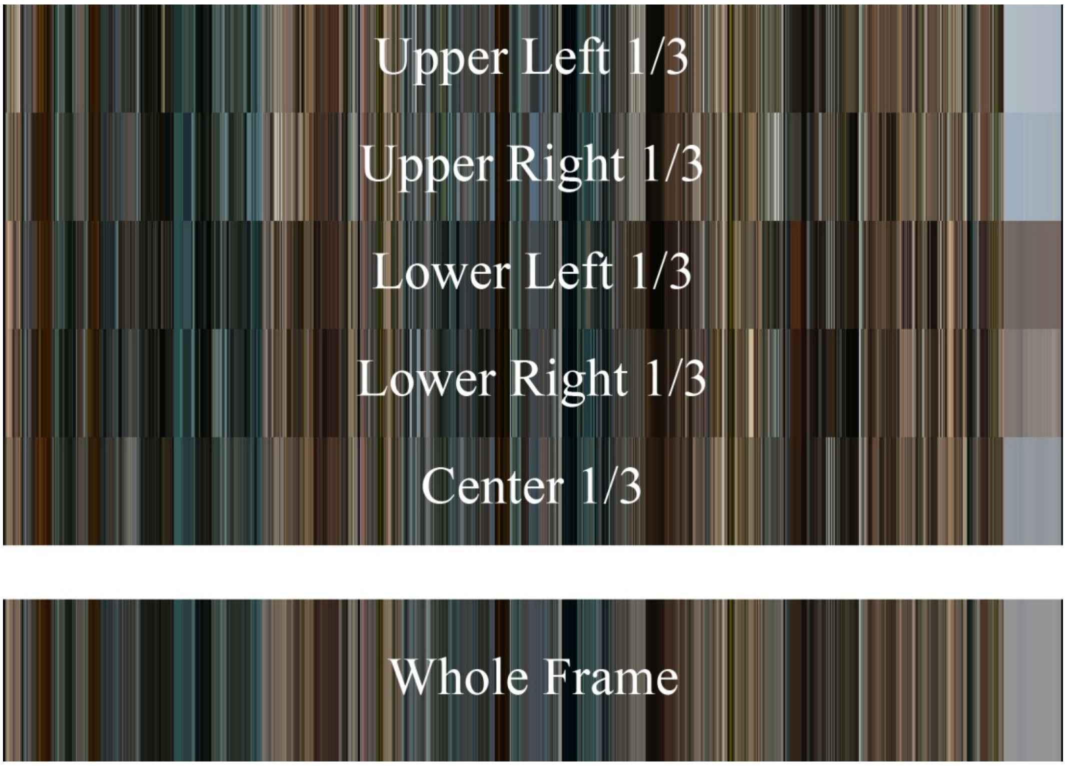


Figure 6. Sample Equivalent Color Sequences of Sub-Frames

By examining this visual the area of emphasis at each instant of film can be determined besides the sub-areas of the scene where more action takes place. The color use in different sub-frames can be different throughout the film and these can be tracted by examining the visual, thus revealing directors scene, composition perception, color preferences and preferred focal point to where he/she wants to draw the spectators attention.

A further step is the determination of the difference of each sub frame with respect to the main one. This can be done by using Photoshop blending modes (Adobe, 2016). By placing the color squences into different layers, the main frame sequence can be subtracted from the sub-frame sequence to give a difference pattern.

5.5 DIFFERENCE PATTERNS OF SUB-FRAMES

Difference patterns are obtained through the use of Photoshop. These difference patters can be used to find out the most contrasting areas of the frame in terms of color which in turn will be a better indicator of area of emphasis for that frame.

Figure 7. Sample Difference Pattern for Color Sequences

5.6 RGB COLOR SPACE REPRESENTATION OF FILMS

For color space, we used Color Inspector 3D (NIH) to get result like Fig.8.

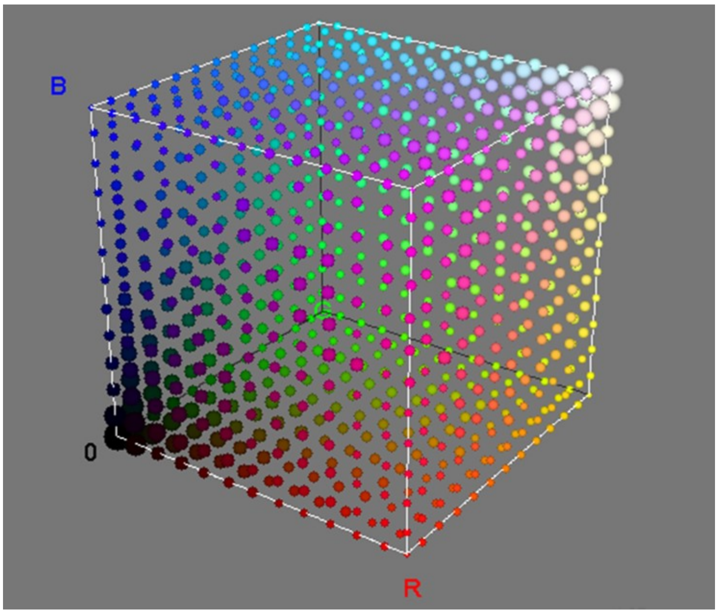


Figure 8. RGB-Space Color Distribution

Besides giving the color space pixel distributions of a given visual, Color Inspector 3D can also give the histogram (NIH) values inserted into the visual respresentaion as in Fig.8 which is a RGB color space (Canon, 2016) representation of all colors possible.

Image histogram (http://www.illustratedphotography.net/basic-photography/zone-system-histograms) is the distribution of areas of a certain color with respect to other colors in that visual. In case of digital images it corresponds to number of pixels.

5.7 HSB COLOR SPACE REPRESENTATION OF FILMS

Another color space that we used is HSB color space (Canon, 2016). As the saturation (pureness) and lightness (brightness) are the variables, the vertical axis represents the achromatic (colorless, with zero saturation) gray colors. Thus, this representation can be used, to find out whether the director prefers vivid colors of chromatic grays or achromatic grays, even without watching the film.

HSB color space example can be seen in Fig.9. for the same visual used in Fig.8.

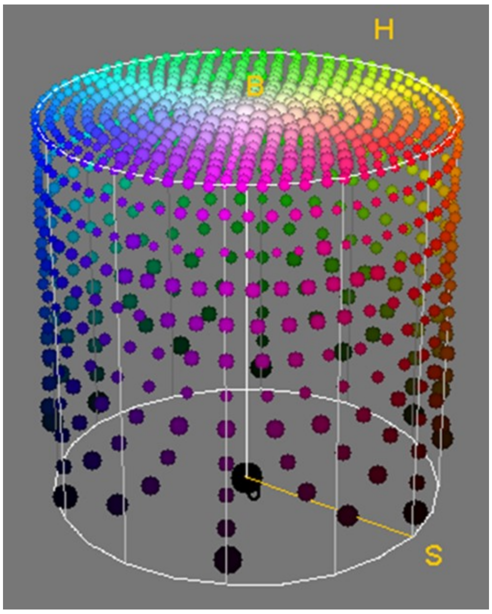


Figure 9. HSB-Space Color Distribution

The number of colors are reduced to a range between 32-48 in order to increase readability as with all the graphic is covered with pixels, some areas cannot be seen properly. By reducing the number of colors in the histogram, the space is divided into discrete volumes so that the color corresponding to the center of the volume will be the color of the sphere in the visual the size of the sphere representing the number of other pixels in that volume.

In HSB space color distribution the location of the colors along the vertical axis (brightness) determines whether shades (darker, lower along the axis, lower Brightness value) or tints (lighter, higher along the vertical axis, higher Brightness value) are dominant

5.8 HISTOGRAMS OF FILMS

Another possibility is to obtain the histograms of the horizontal color pixel strings as they represent the equivalent colors throughout the film. The histograms can be obtained by Color Inspector 3D (NIH) and they can be of 4 types.

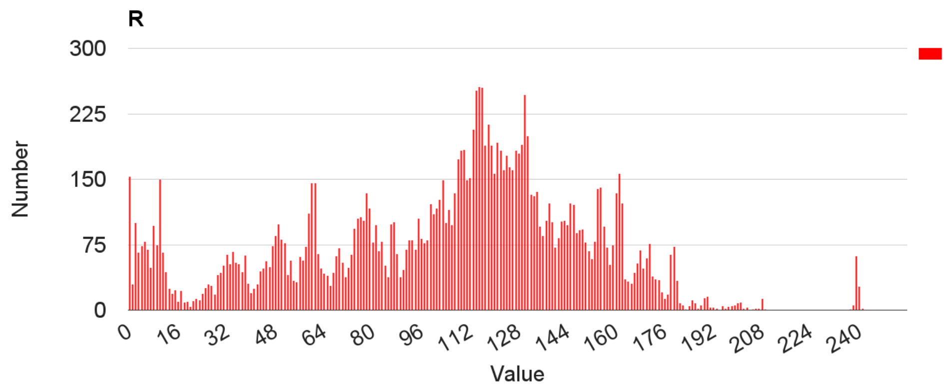


Figure 10. Sample Histogram Single Color Channel

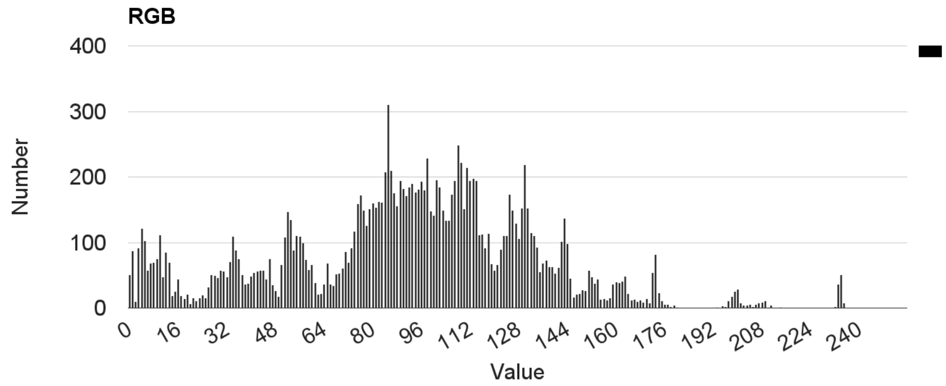


Figure 11. Sample Histogram RGB

These four types being Red channel (Fig.10), green channel, blue channel and RGB combined brightness value (Fig.11).

5.9 COMPARATIVE GRAPHS

Besides visual analysis, the numerical values corresponding to visuals are obtained from ImageJ (NIH). and plotted using Google Drive (http://drive.google.com/drive) to give graphs like Fig.12.

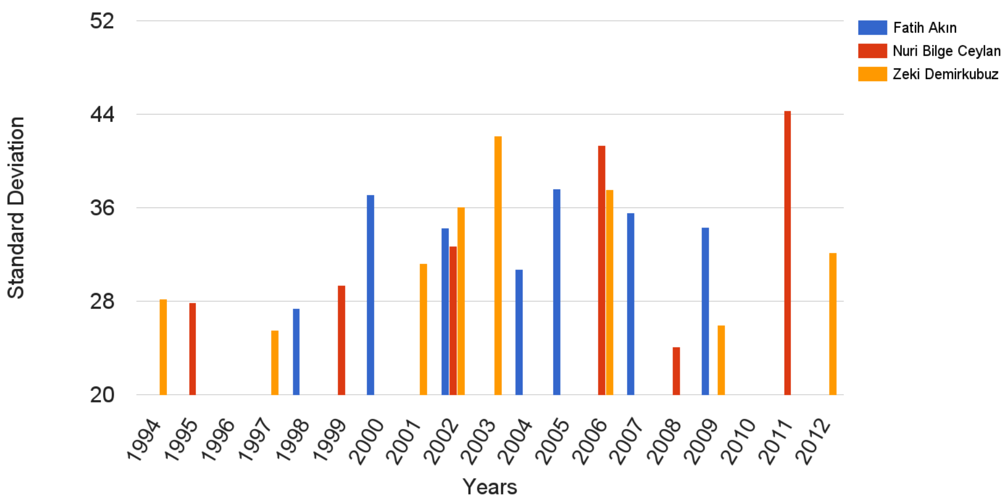


Figure 12. Sample Graph

CHAPTER 6

VISUAL ANALYSIS OF DIRECTORS

In this chapter, application of the procedures described in the previous chapter to the films of 3 Turkish directors are used for analyzing them in terms of color use and color characteristics is presented.

Using the database of digital forms of the films from Ahmet Gürata (personal communication, December, 2014), three Turkish directors are chosen. The criteria used in the selection are; the films should be in color (not monochrome), the director must be currently active and number of films available in the database should be higher than the rest. The application of these criteria resulted in the selection of;

- Fatih Akın
- Nuri Bilge Ceylan
- Zeki Demirkubuz

In order to keep the analysis manageable number of directors is limited to three, as the total number of films available for the above selected directors is 20 and numerical processing of the films requires very high computational power.

6.1 FATİH AKIN

Fatih Akın is one of the best known among the new generation of directors in Turkish cinema and has received many international prizes. Biography of Fatih Akın is given by IMDB as;

> Fatih Akın was born in 1973 in Hamburg of Turkish parentage. He began studying Visual Communications at Hamburg's College of Fine Arts in 1994. His collaboration with Wueste Film also dates from this time. In 1995, he wrote and directed his first short feature, "Sensin - You're The One!" ("Sensin - Du Bist Es!"), which received the Audience Award at the Hamburg International Short Film Festival. His second short film, "Weed" ("Getuerkt", 1996), received several national and international festival prizes. His first full length feature film, "Short Sharp Shock" ("Kurz Und Schmerzlos", 1998) won the Bronze Leopard at Locarno and the Bavarian Film Award (Best Young Director) in 1998. His other films include: "In July" ("Im Juli", 2000), "Wir Haben Vergessen Zurueckzukehren" (2001), "Solino" (2002), the Berlinale Golden Bear-winner and winner of the German and European Film Awards "Head-On" ("Gegen Die Wand", 2003), and "Crossing the Bridge - The Sound of Istanbul" (2005).

We analyzed seven films of Fatih Akın by the methods described in Chapter 4. The details of the films; date of production, digital format used, resolution of the videos are as follows:

Table 1. Film Data of Fatih Akın

Name	Year	Format	height(px)	width(px)	frames/s
Kurz und Schmerzlos	1998	AVI	512	384	25
Im Juli	2000	AVI	656	352	24
Solino	2002	AVI	560	304	25
Gegen die Wand	2004	AVI	640	352	25
Crossing the Bridge	2005	AVI	592	320	25
Auf der anderen Seite	2007	AVI	608	336	25
Soul Kitchen	2009	AVI	576	304	25

6.1.1 *Kurz und Schmerzlos*

Ordering of frames from darkest to lightest in Fig.21 : UR,CC,UL,LL,LR,MF

Figure 13. Overall Equivalent Colors of Main and Sub-Frames
- *Kurz und Schmerzlos*

Color distribution in Fig.14 : NPC=2, NCG=14, NAG=0

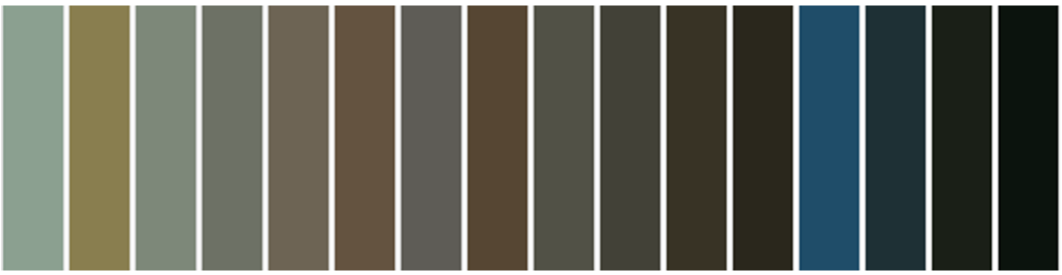


Figure 14. Color Palette
- *Kurz und Schmerzlos*

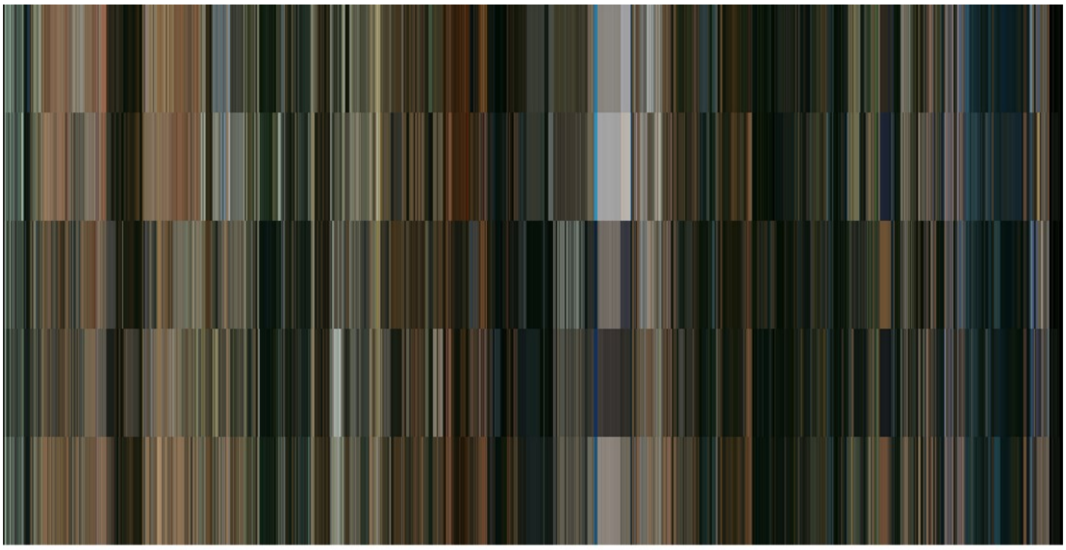


Figure 15. Equivalent Color Sequences of Main and Sub-Frames
- *Kurz und Schmerzlos*

Figure 16. Difference Pattern for Color Sequences
- *Kurz und Schmerzlos*

Ordering of the areas of emphasis (3 sub-frames) : UR,LR,CC

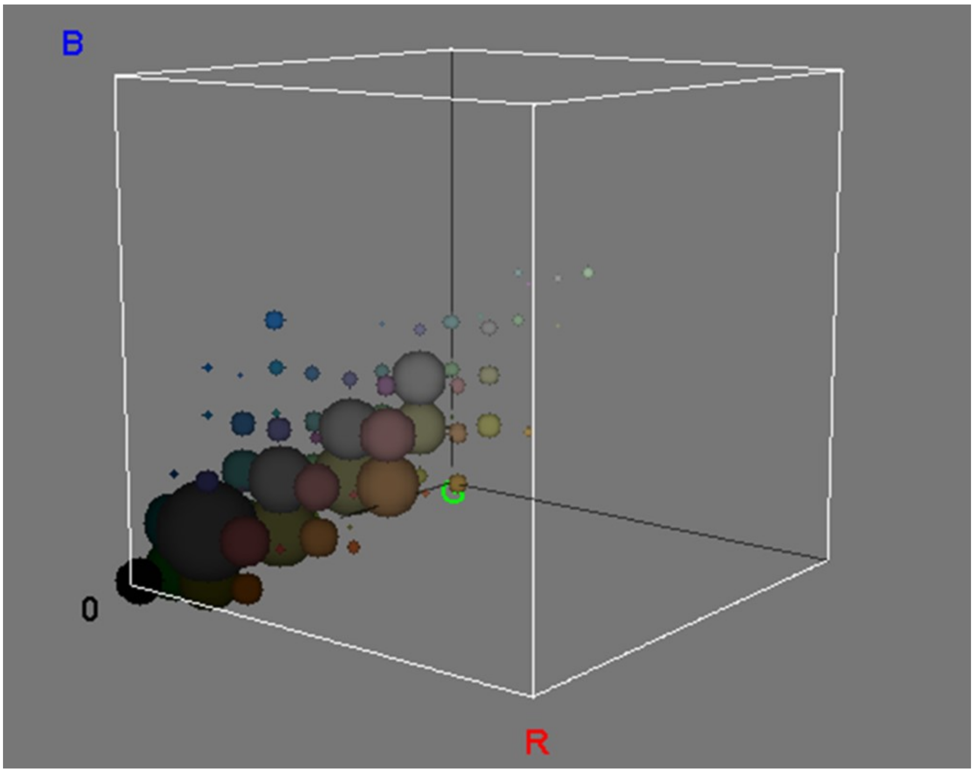


Figure 17. RGB-Space Color Distribution (view-1) - *Kurz und Schmerzlos*

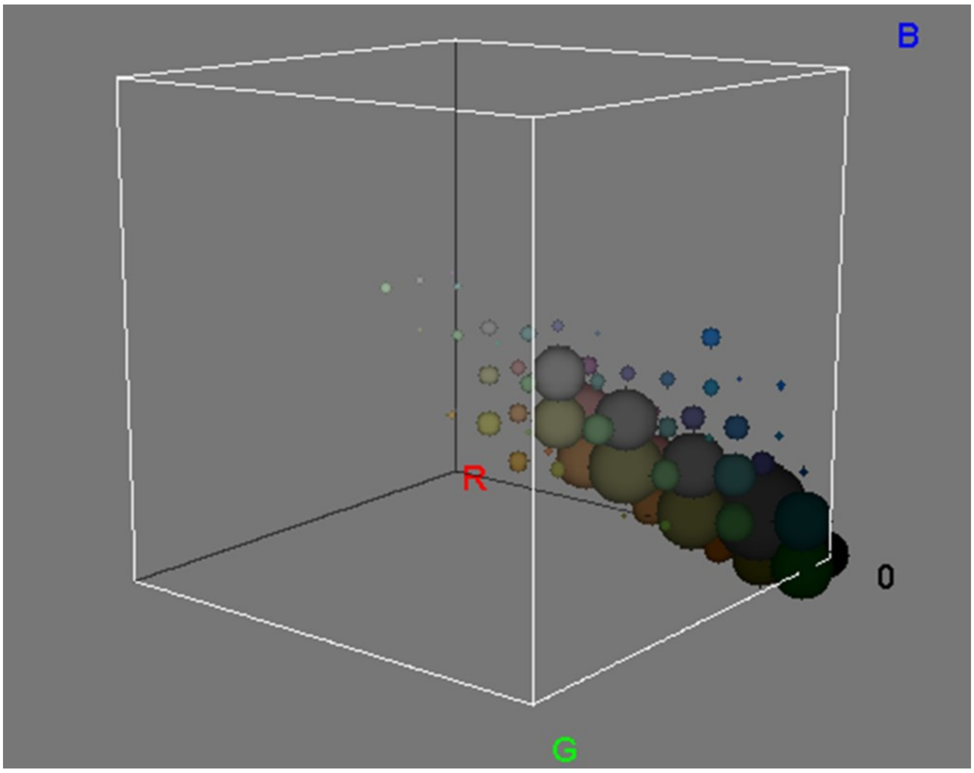


Figure 18. RGB-Space Color Distribution (view-2) - *Kurz und Schmerzlos*

Compact around black

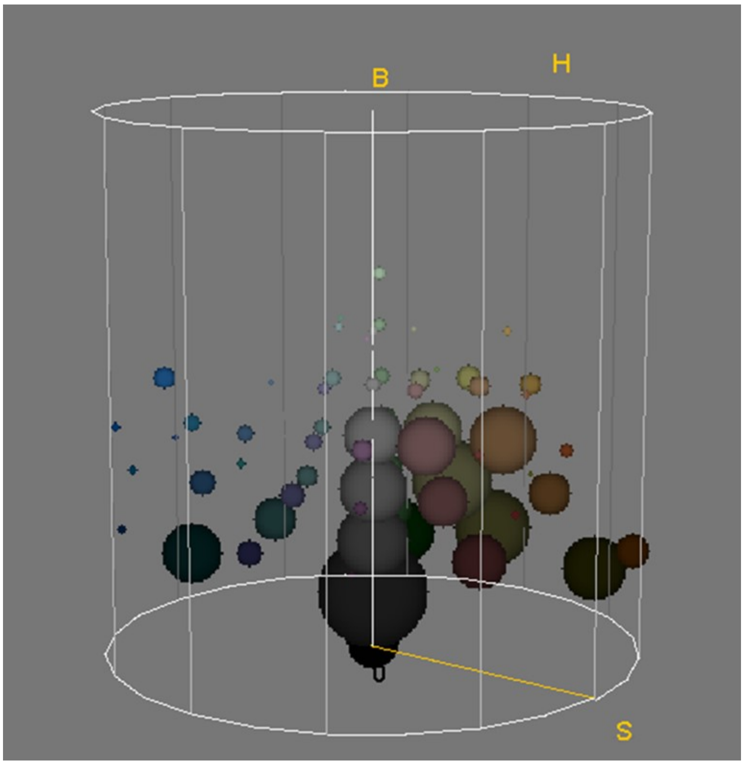


Figure 19. HSB-Space Color Distribution (view-1) - *Kurz und Schmerzlos*

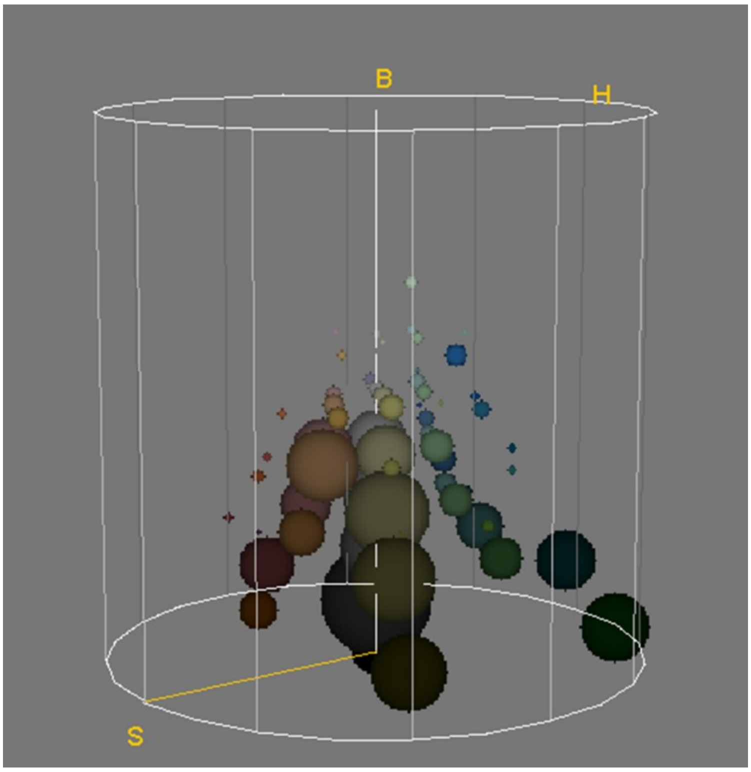


Figure 20. HSB-Space Color Distribution (view-2) - *Kurz und Schmerzlos*

Mainly Shades

6.1.2 *Im Juli*

Ordering of frames from darkest to lightest in Fig.21 : CC,UL,UR,LR,LL,MF

Figure 21. Overall Equivalent Colors of Main and Sub-Frames
- *Im Juli*

Color distribution in Fig.22 : NPC=3, NCG=13, NAG=0

Figure 22. Color Palette
- *Im Juli*

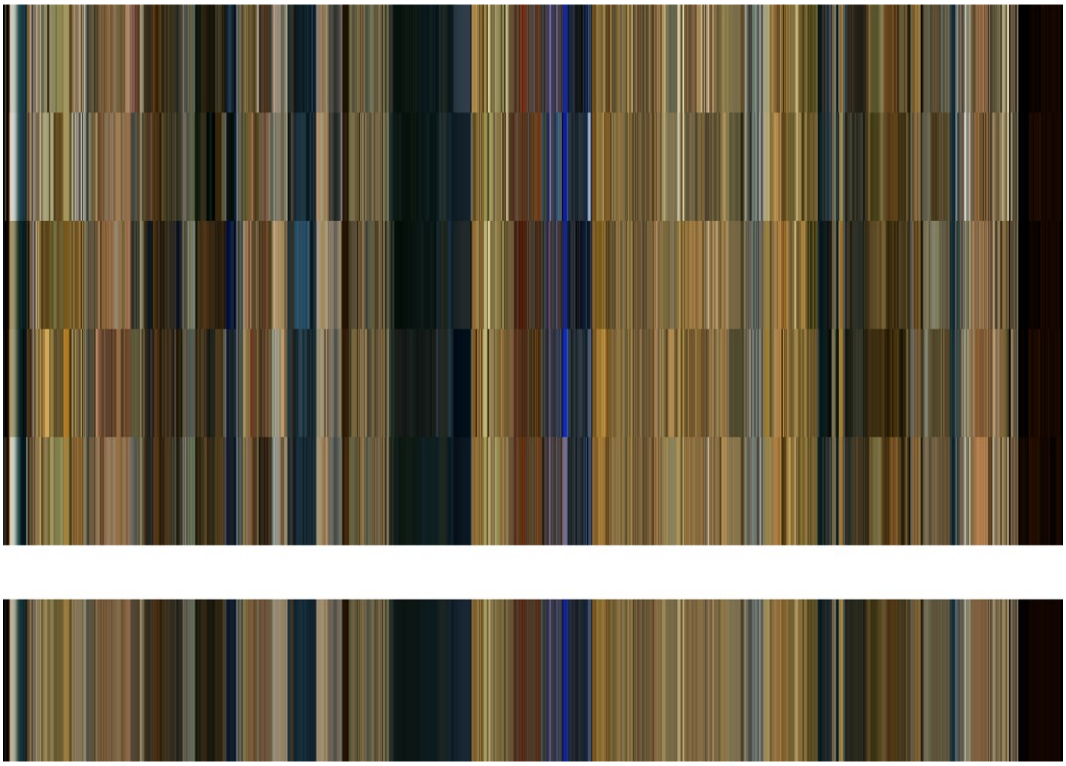


Figure 23. Equivalent Color Sequences of Main and Sub-Frames
- *Im Juli*

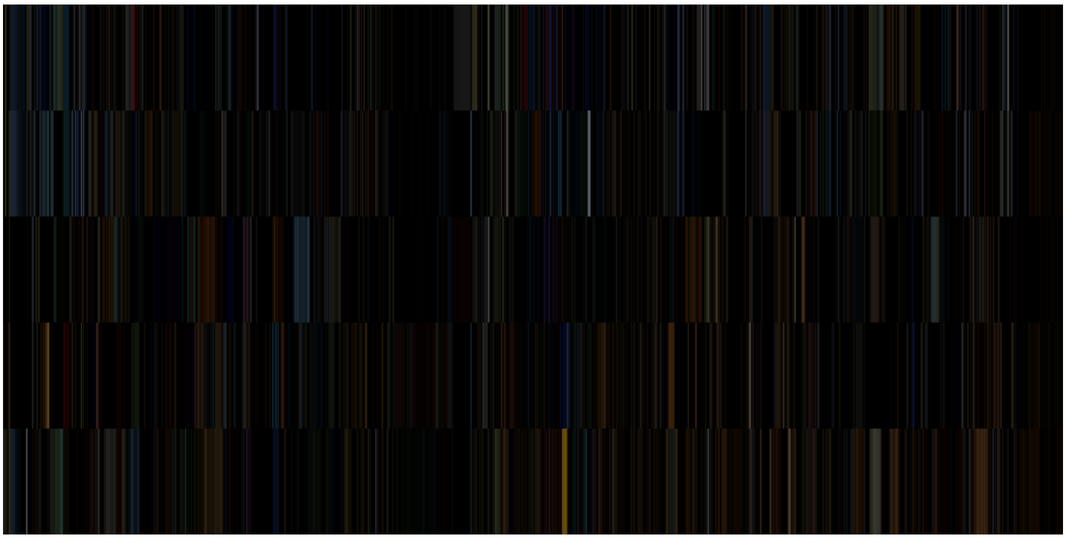


Figure 24. Difference Pattern for Color Sequences
- *Im Juli*

Ordering of the areas of emphasis (3 sub-frames) : CC,UR,LL

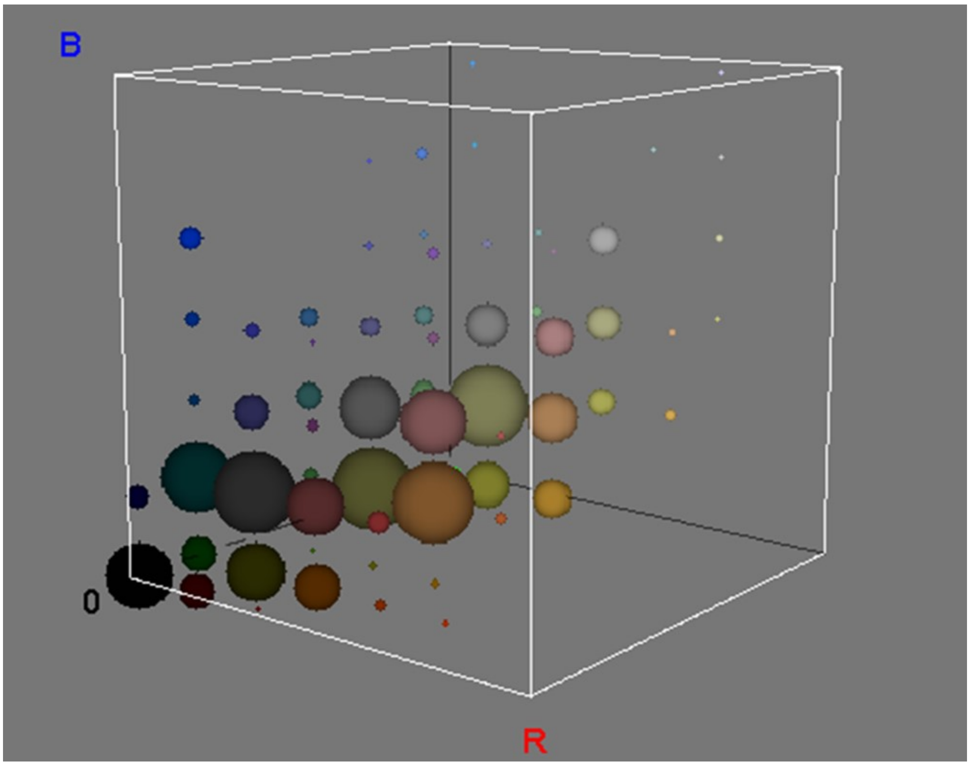


Figure 25. RGB-Space Color Distribution (view-1) - *Im Juli*

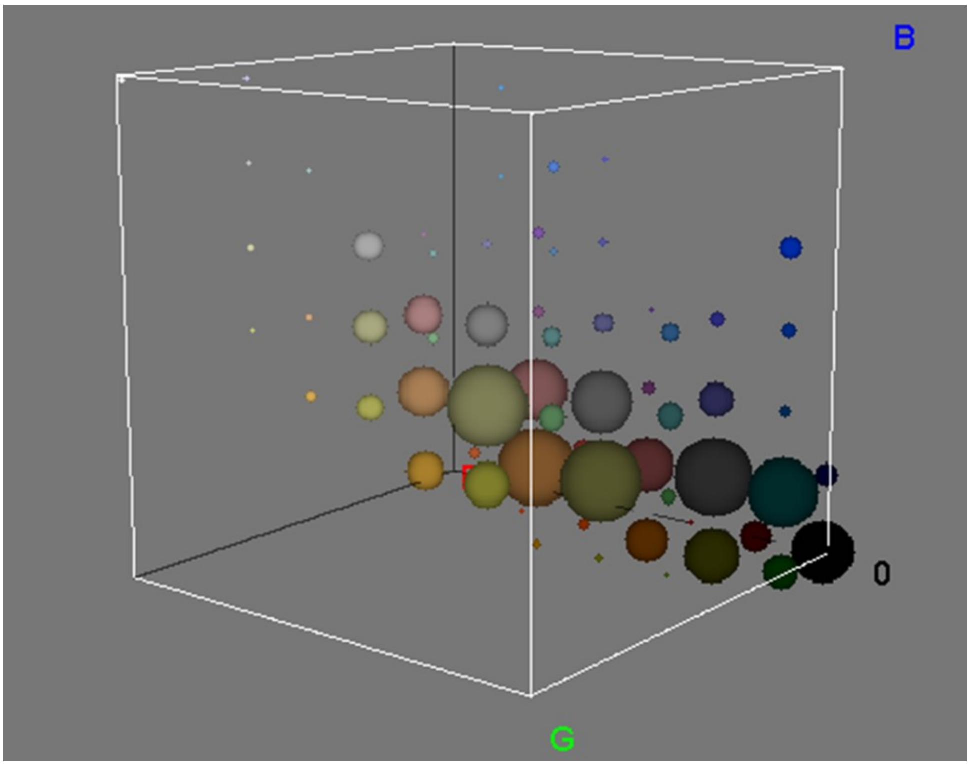


Figure 26. RGB-Space Color Distribution (view-2) - *Im Juli*

Well distributed

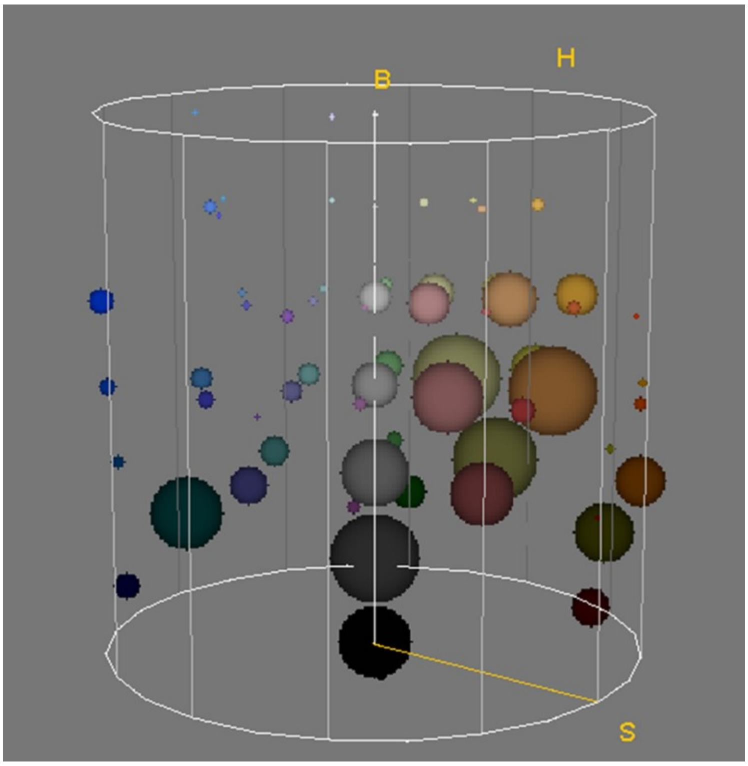


Figure 27. HSB-Space Color Distribution (view-1) - *Im Juli*

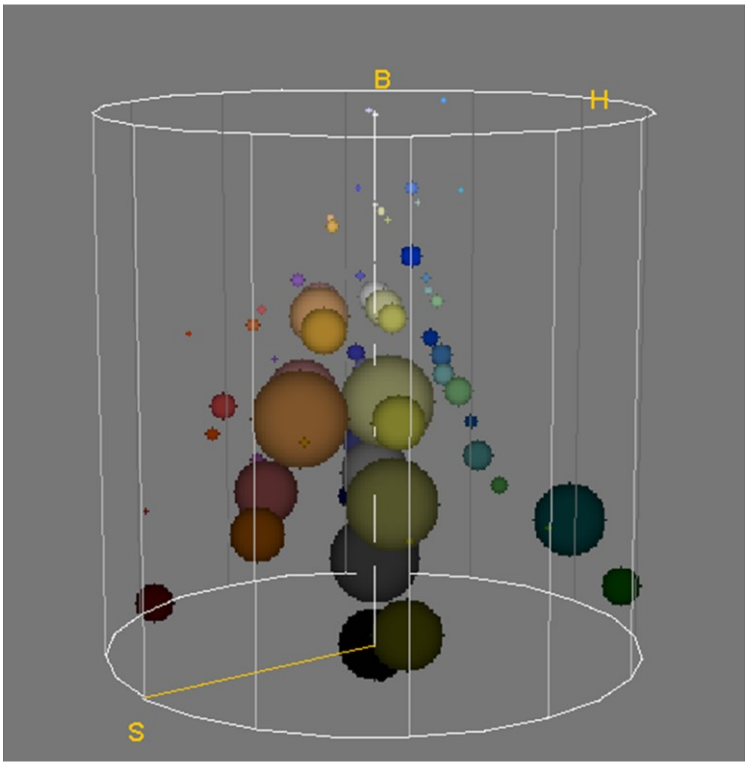


Figure 28. HSB-Space Color Distribution (view-2) - *Im Juli*

Equal tints and shades

6.1.3 *Solino*

Ordering of frames from darkest to lightest in Fig.29 : UR,UL,CC,MF,LR,LL

Figure 29 Overall Equivalent Colors of Main and Sub-Frames
- *Solino*

Color distribution in Fig.30 : NPC=3, NCG=12, NAG=1

Figure 30. Color Palette
- *Solino*

Figure 31. Equivalent Color Sequences of Main and Sub-Frames
- *Solino*

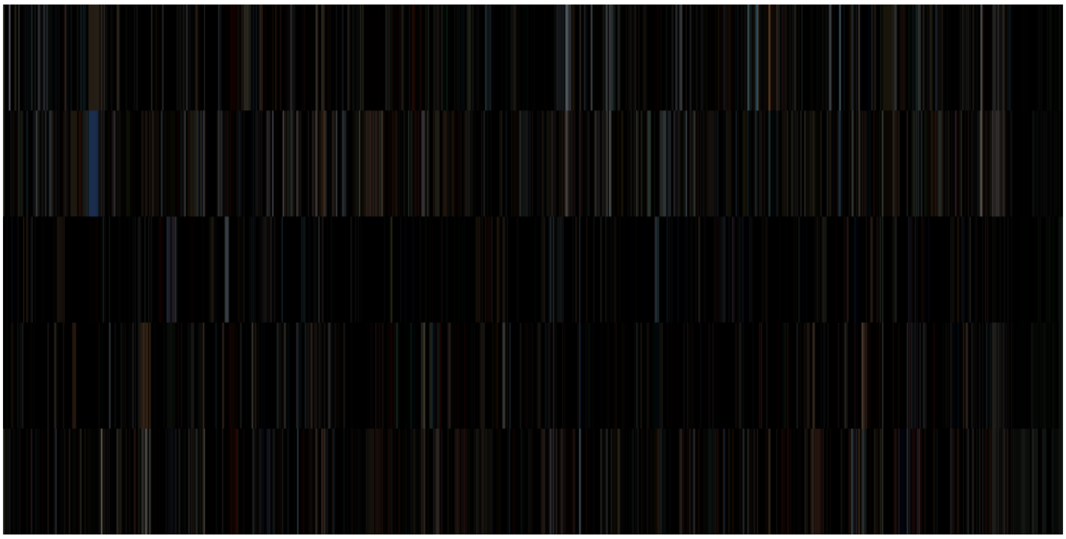


Figure 32. Difference Pattern for Color Sequences
- *Solino*

Ordering of the areas of emphasis (3 sub-frames) : UR,UL,CC

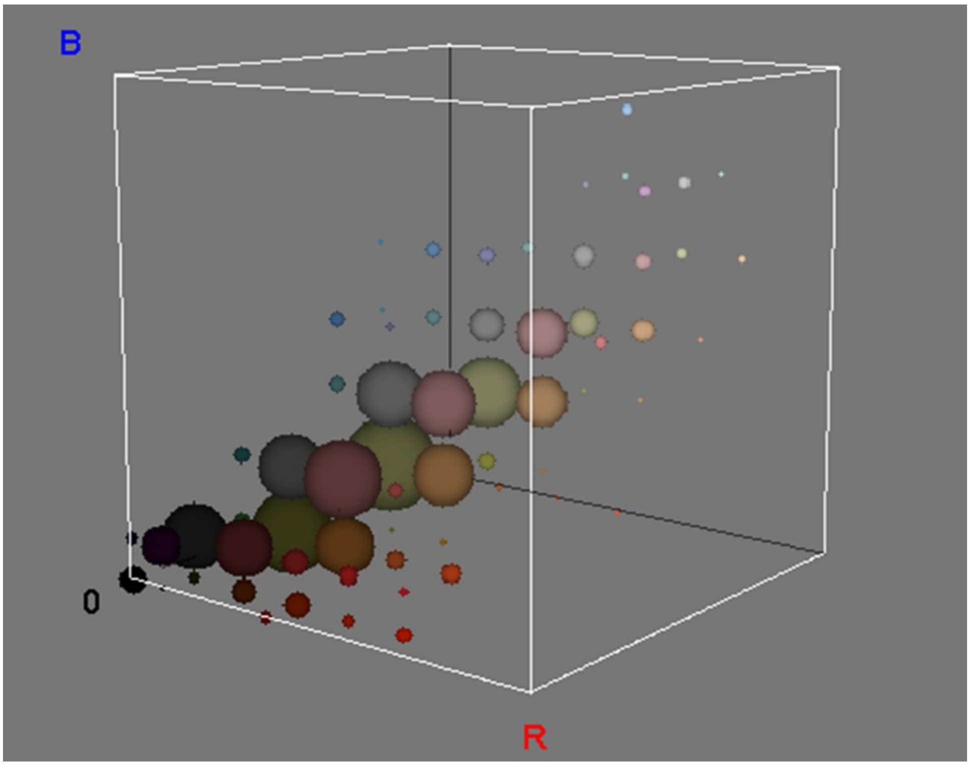


Figure 33. RGB-Space Color Distribution (view-1) - *Solino*

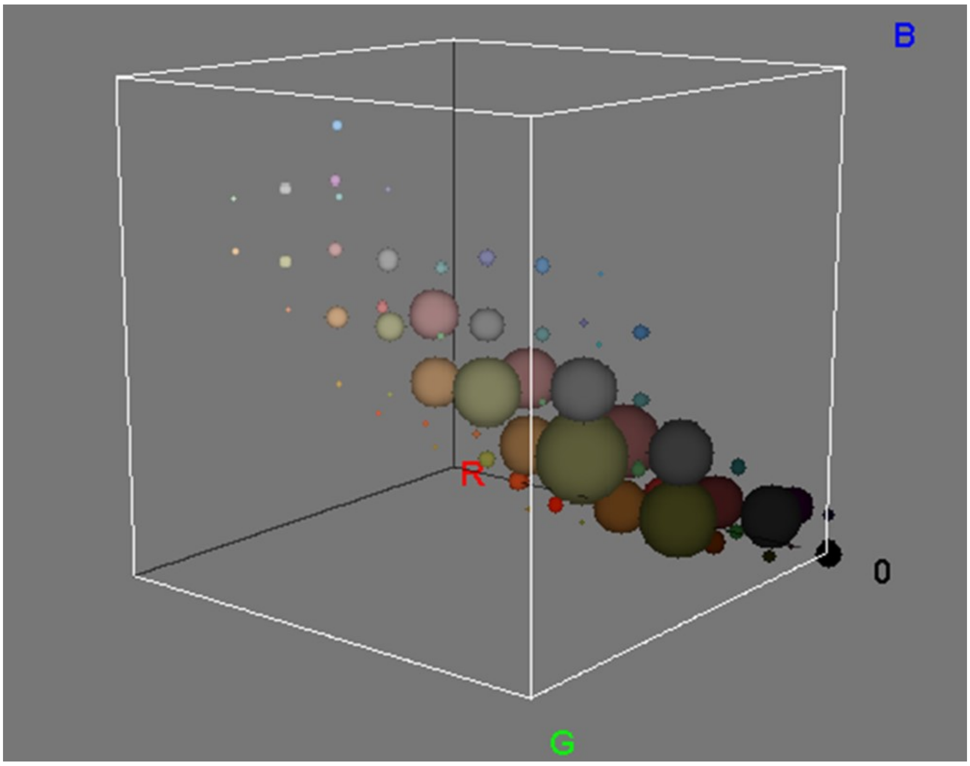


Figure 34. RGB-Space Color Distribution (view-2) - *Solino*

Well distributed along zero saturation axis

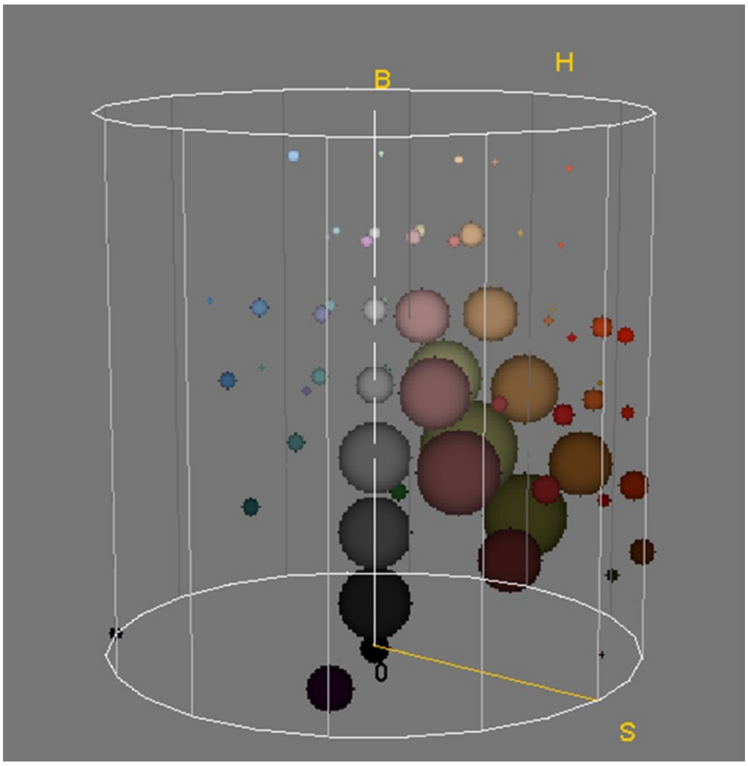


Figure 35. HSB-Space Color Distribution (view-1) - *Solino*

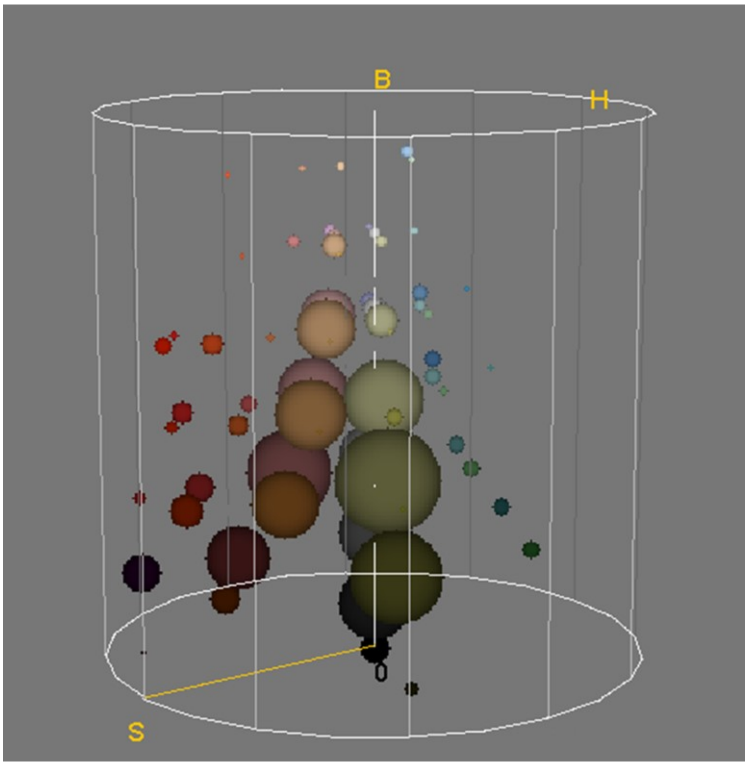


Figure 36. HSB-Space Color Distribution (view-2) - *Solino*

Equal tints and shades

6.1.4 *Gegen die Wand*

Ordering of frames from darkest to lightest in Fig.37 : UR,UL,CC,MF,LR,LL

Figure 37. Overall Equivalent Colors of Main and Sub-Frames
- *Gegen die Wand*

Color distribution in Fig.38 : NPC=3, NCG=12, NAG=1

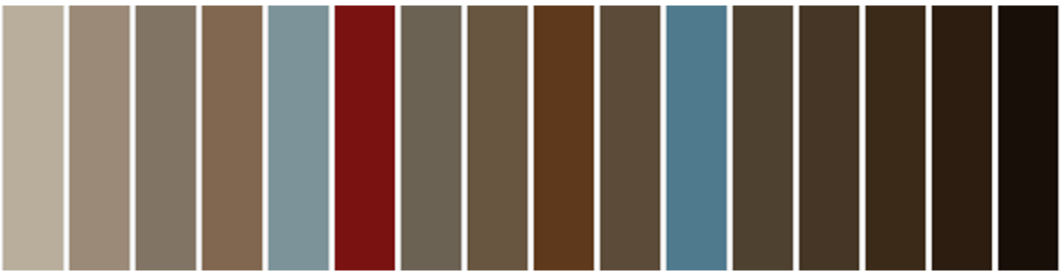


Figure 38. Color Palette
- *Gegen die Wand*

Figure 39. Equivalent Color Sequences of Main and Sub-Frames
- *Gegen die Wand*

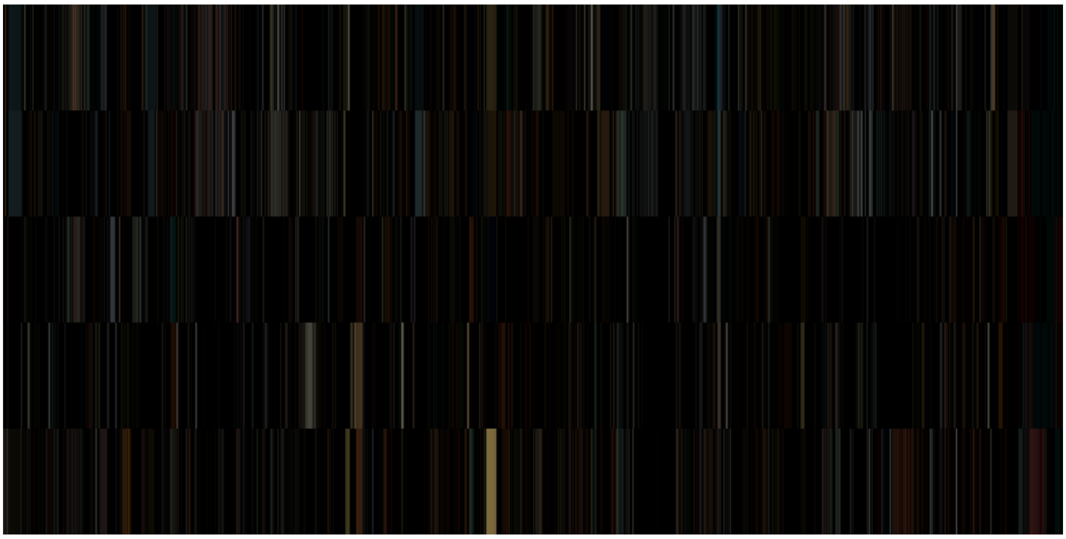


Figure 40. Difference Pattern for Color Sequences
- *Gegen die Wand*

Ordering of the areas of emphasis (3 sub-frames) : CC,LR,UR

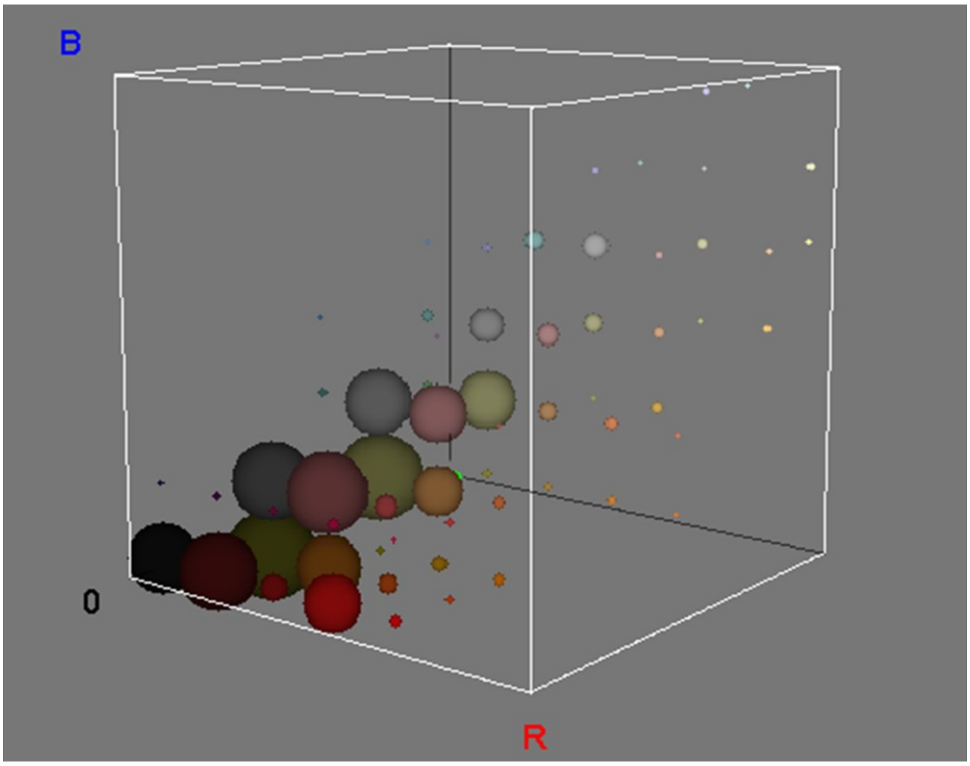


Figure 41. RGB-Space Color Distribution (view-1) - *Gegen die Wand*

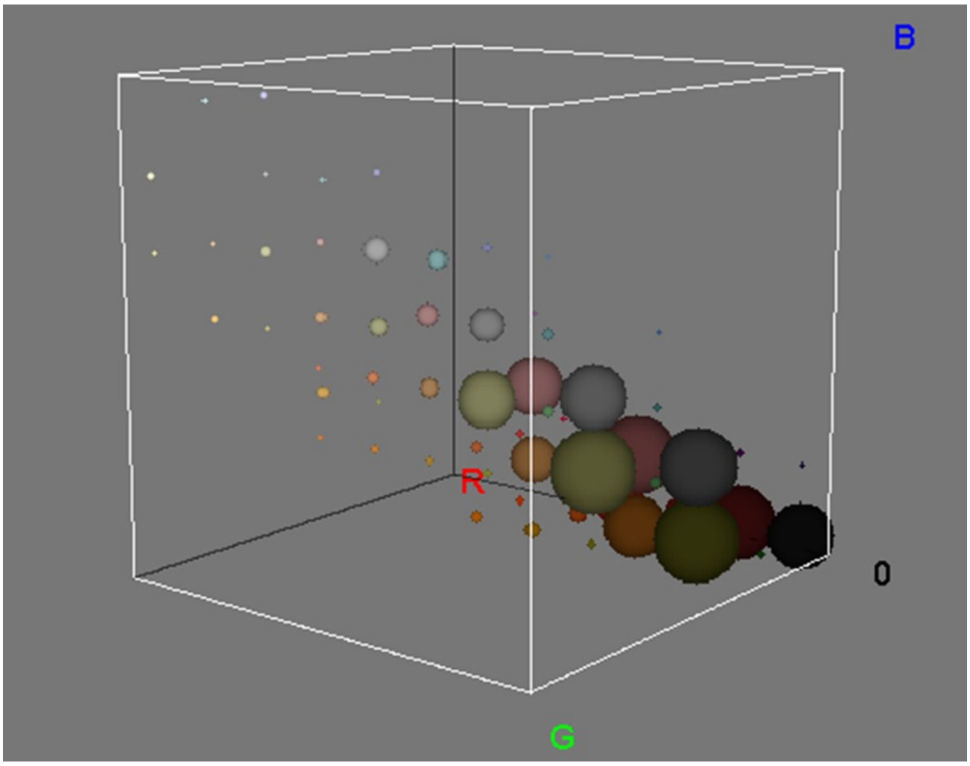


Figure 42. RGB-Space Color Distribution (view-2) - *Gegen die Wand*

Compact around black, with sparse colors near white.

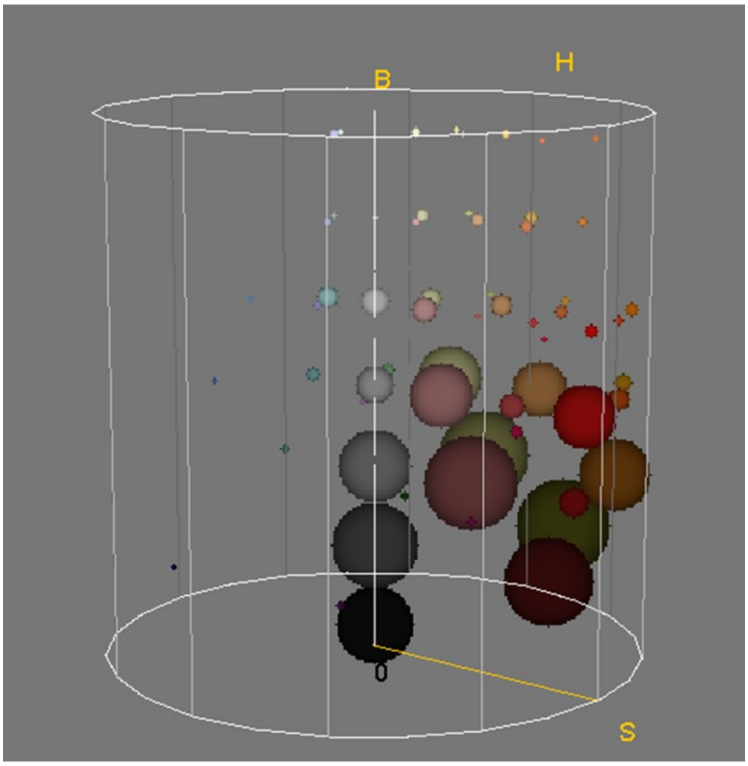


Figure 43. HSB-Space Color Distribution (view-1) - *Gegen die Wand*

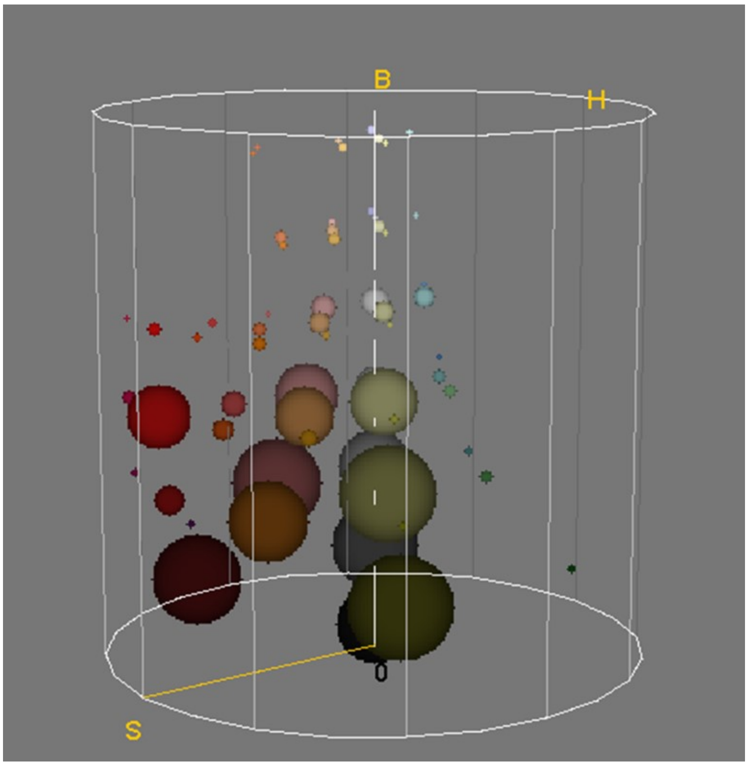


Figure 44. HSB-Space Color Distribution (view-2) - *Gegen die Wand*

Shades, with sparse tints

6.1.5 *Crossing the Bridge*

Ordering of frames from darkest to lightest in Fig.45 : UL,UR,CC,MF,LR,LL

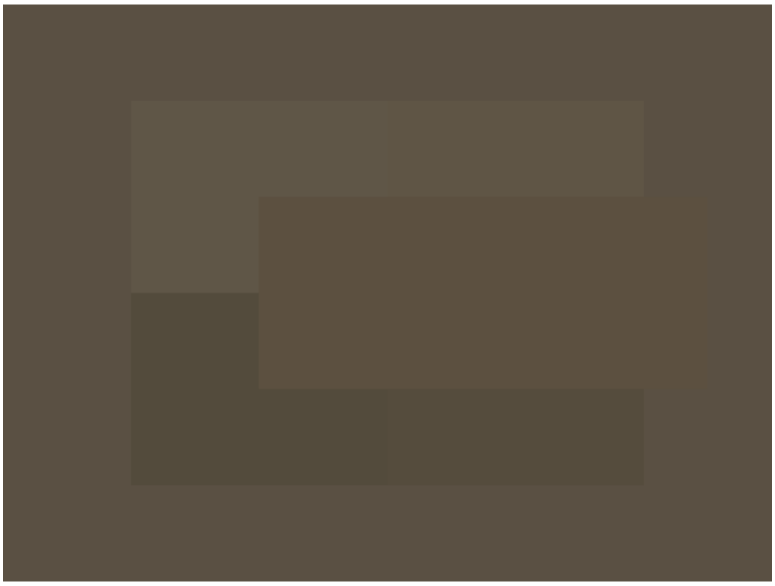


Figure 45. Overall Equivalent Colors of Main and Sub-Frames
- *Crossing the Bridge*

Color distribution in Fig.46 : NPC=4, NCG=10, NAG=2

Figure 46. Color Palette
- *Crossing the Bridge*

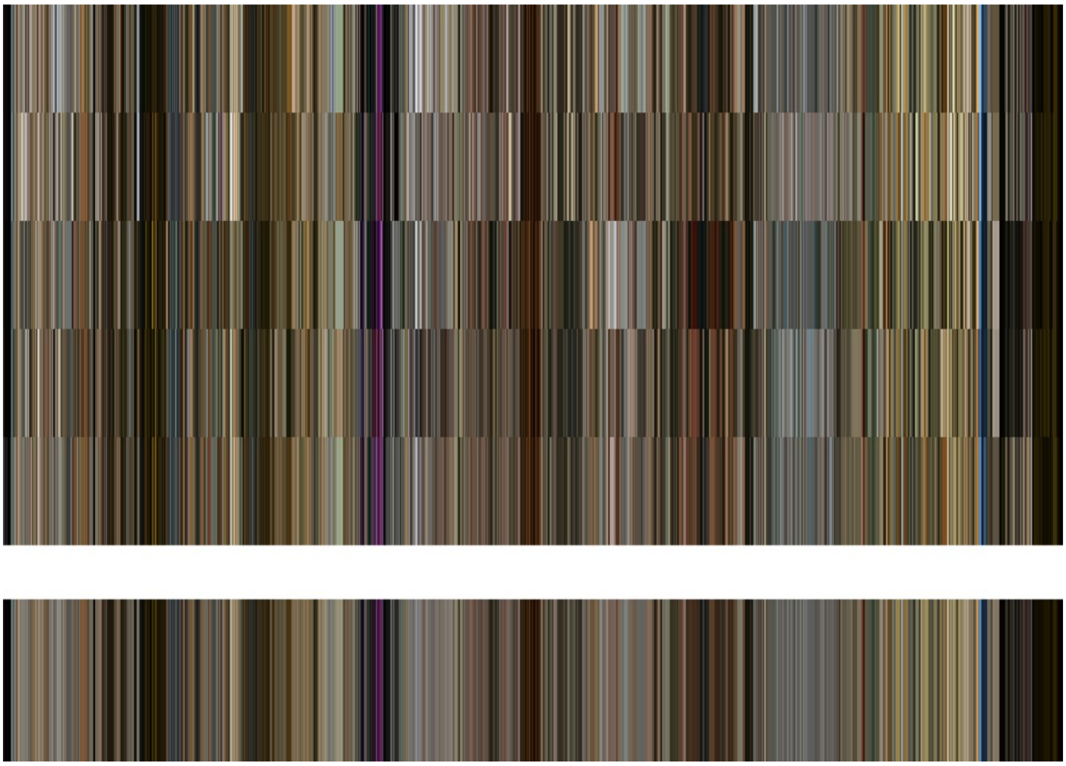


Figure 47. Equivalent Color Sequences of Main and Sub-Frames
- *Crossing the Bridge*

Figure 48. Difference Pattern for Color Sequences
- *Crossing the Bridge*

Ordering of the areas of emphasis (3 sub-frames) : LR,UR,LL

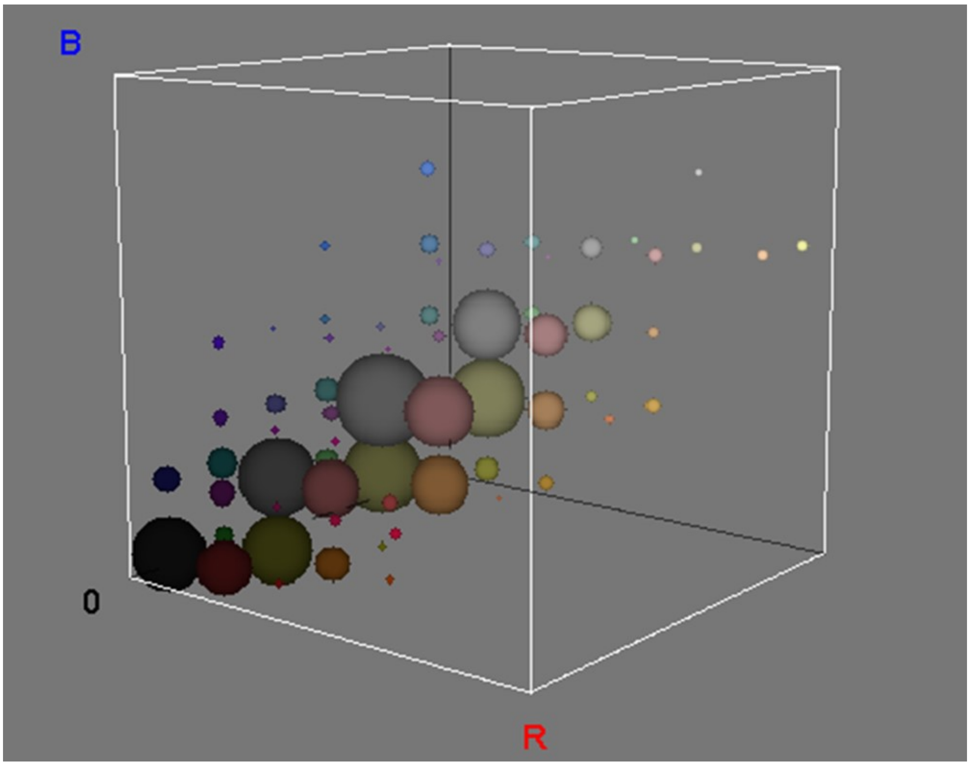


Figure 49. RGB-Space Color Distribution (view-1) - *Crossing the Bridge*

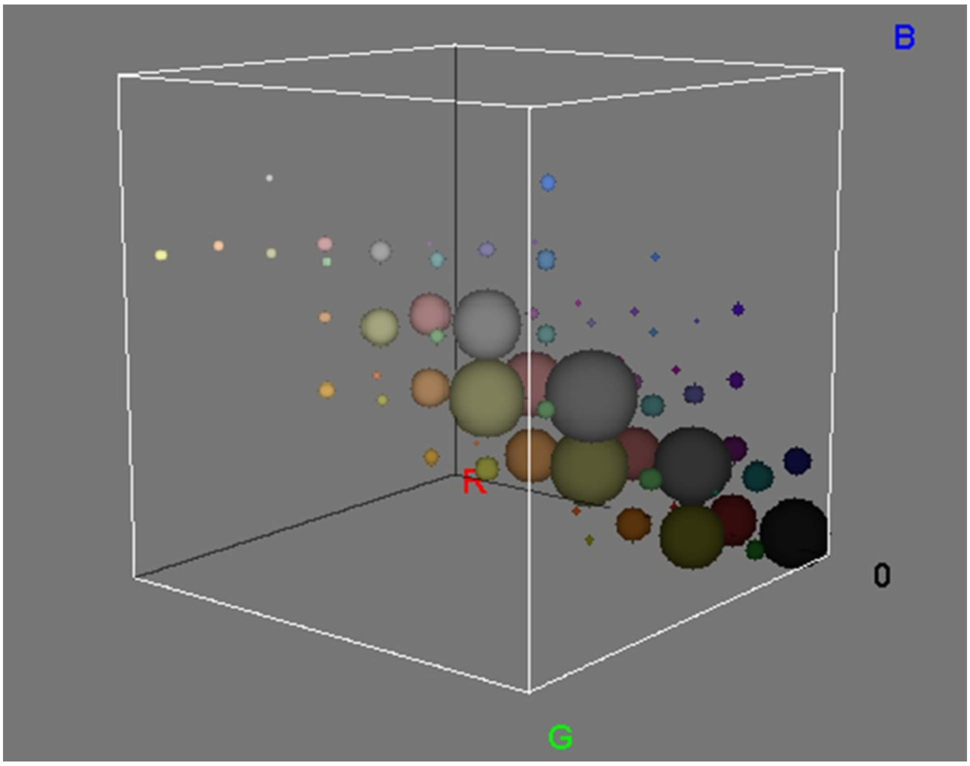


Figure 50. RGB-Space Color Distribution (view-2) - *Crossing the Bridge*

Slightly compact near black, some sparse distribution of colors

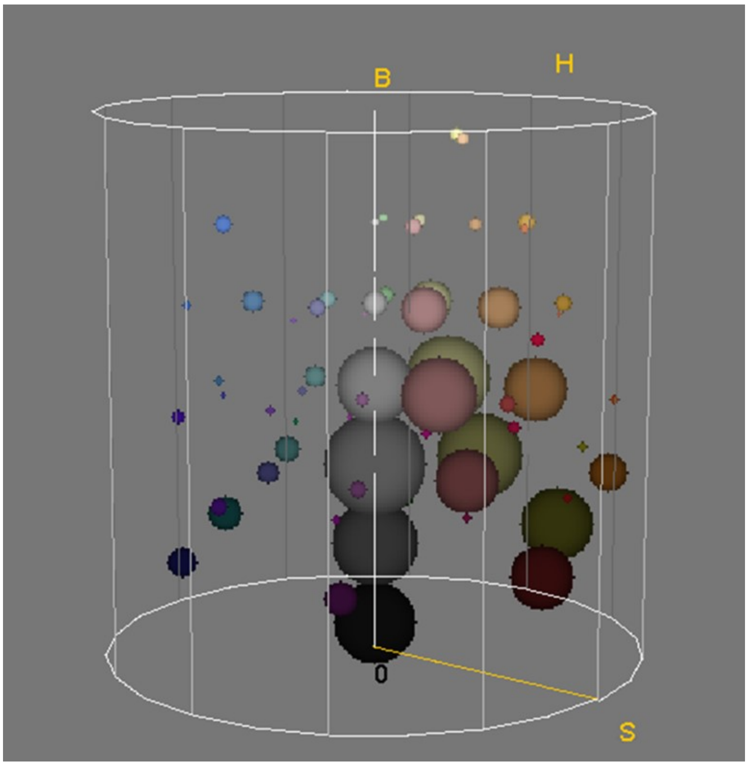


Figure 51. HSB-Space Color Distribution (view-1) - *Crossing the Bridge*

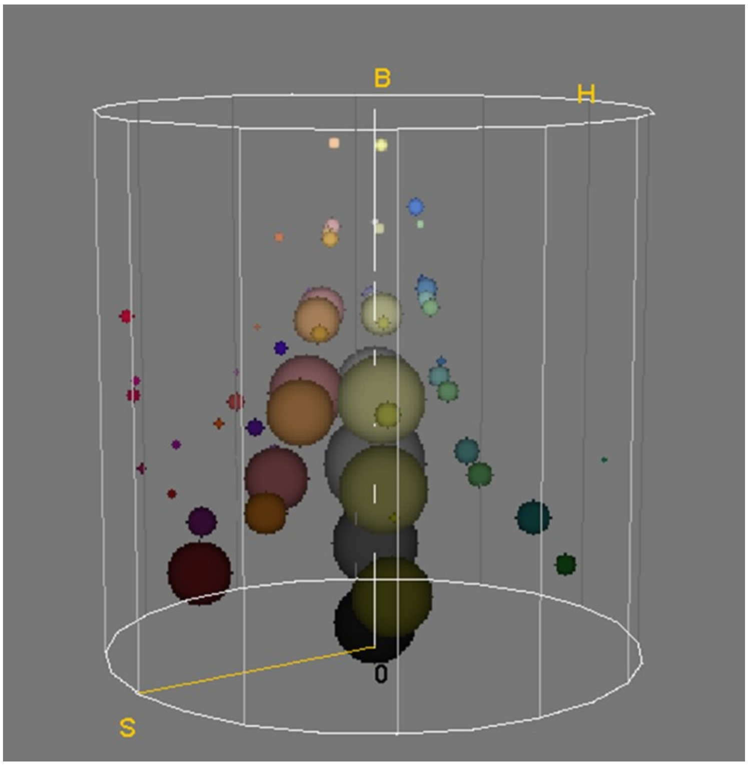


Figure 52. HSB-Space Color Distribution (view-2) - *Crossing the Bridge*

Equal tints and shades

6.3.6 *Auf der Anderen Seite*

Ordering of frames from darkest to lightest in Fig.53 : UL,UR,CC,MF,LR,LL

Figure 53. Overall Equivalent Colors of Main and Sub-Frames
- *Auf der Anderen Seite*

Color distribution in Fig.54 : NPC=0, NCG=14, NAG=2

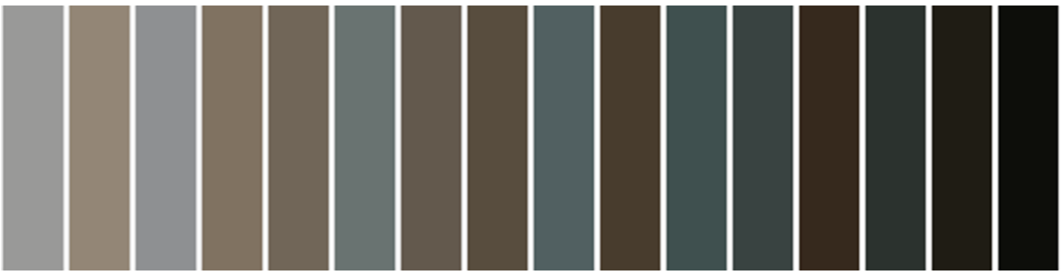


Figure 54. Color Palette
- *Auf der Anderen Seite*

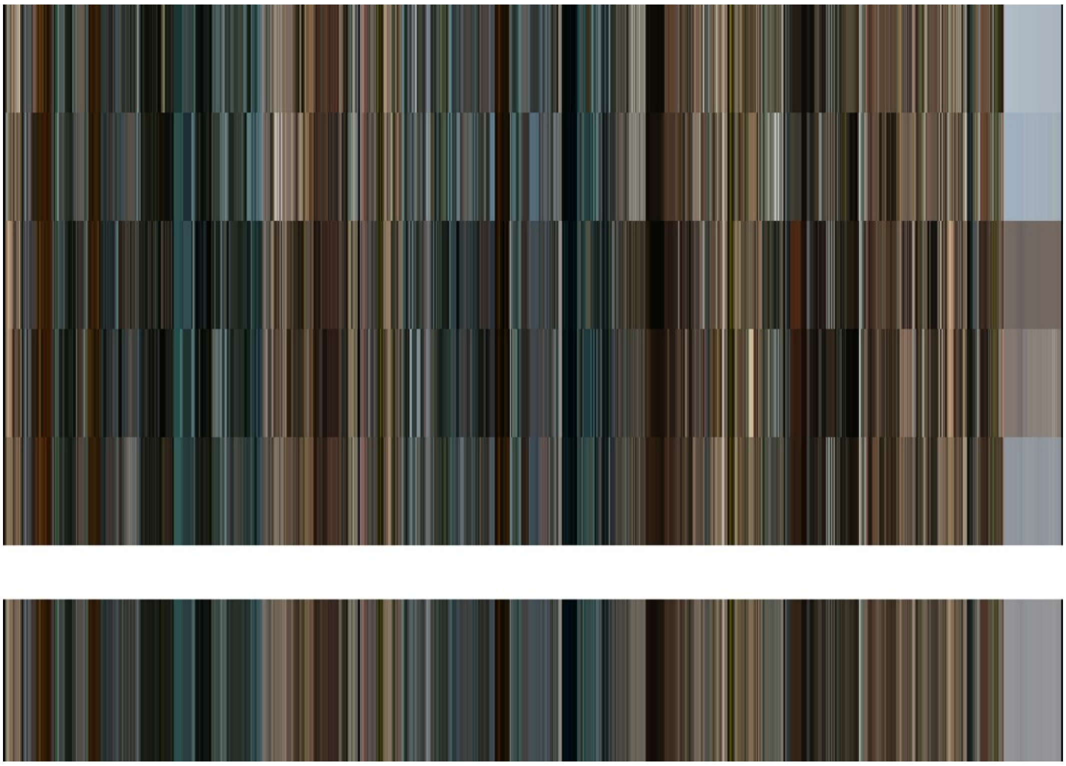


Figure 55. Equivalent Color Sequences of Main and Sub-Frames
- *Auf der Anderen Seite*

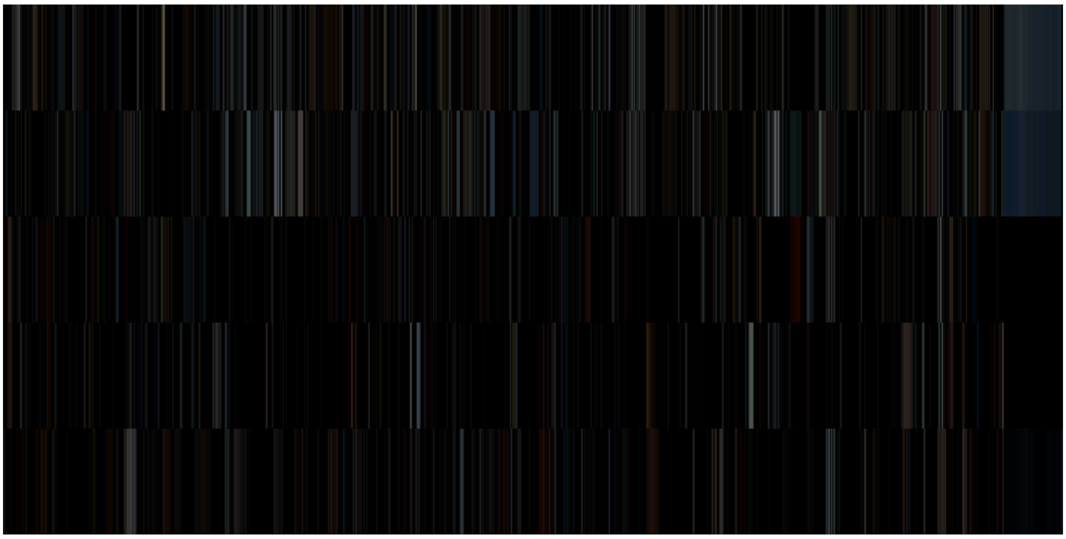


Figure 56. Difference Pattern for Color Sequences
- *Auf der Anderen Seite*

Ordering of the areas of emphasis (3 sub-frames) : UR,UL,LR

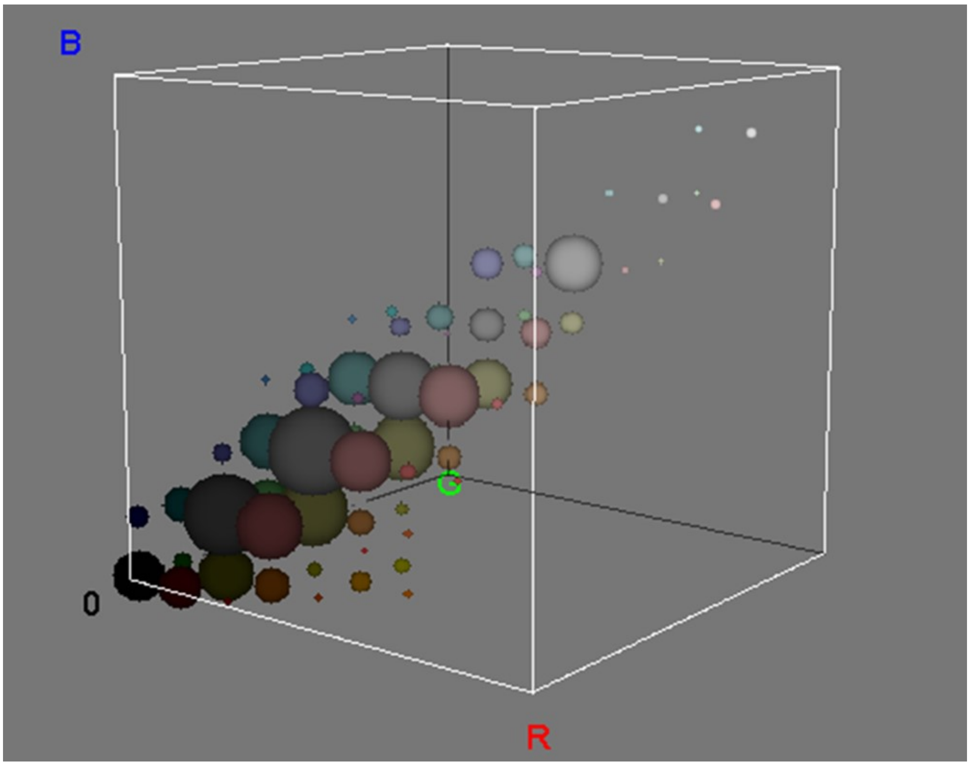


Figure 57. RGB-Space Color Distribution (view-1) - *Auf der Anderen Seite*

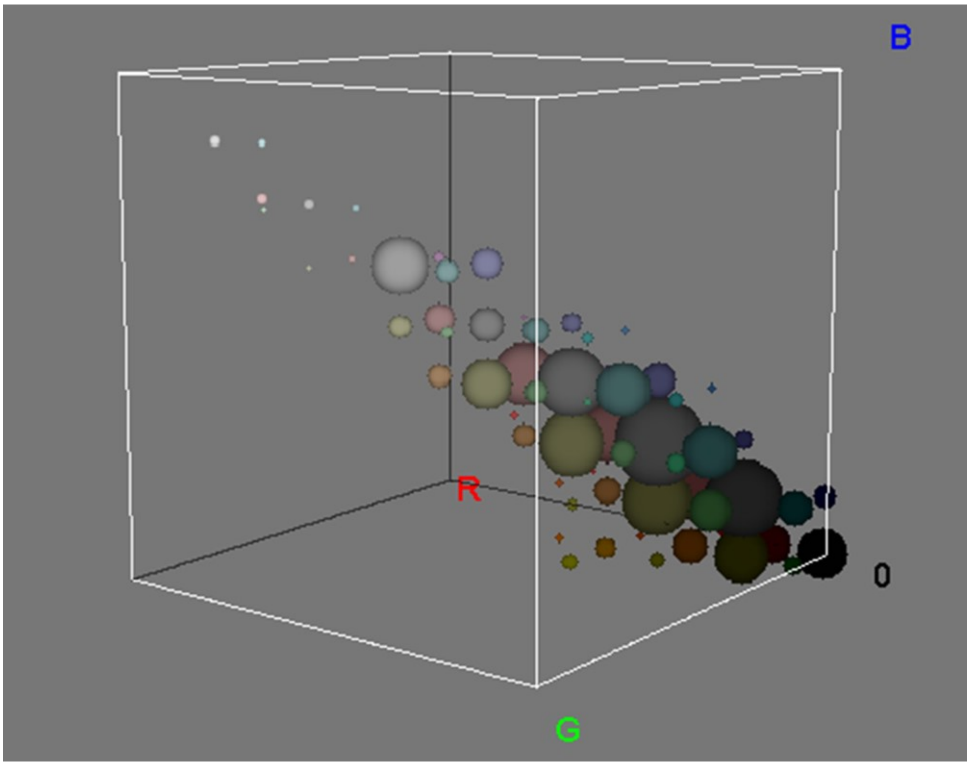


Figure 58. RGB-Space Color Distribution (view-2) - *Auf der Anderen Seite*

Compact around black, Concentration along zero saturation axis

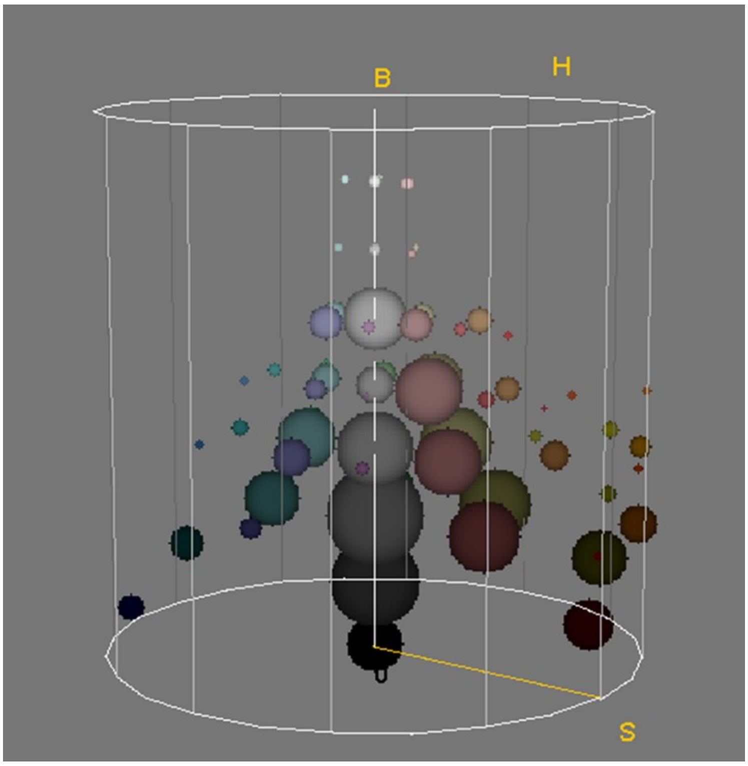


Figure 59. HSB-Space Color Distribution (view-1) - *Auf der Anderen Seite*

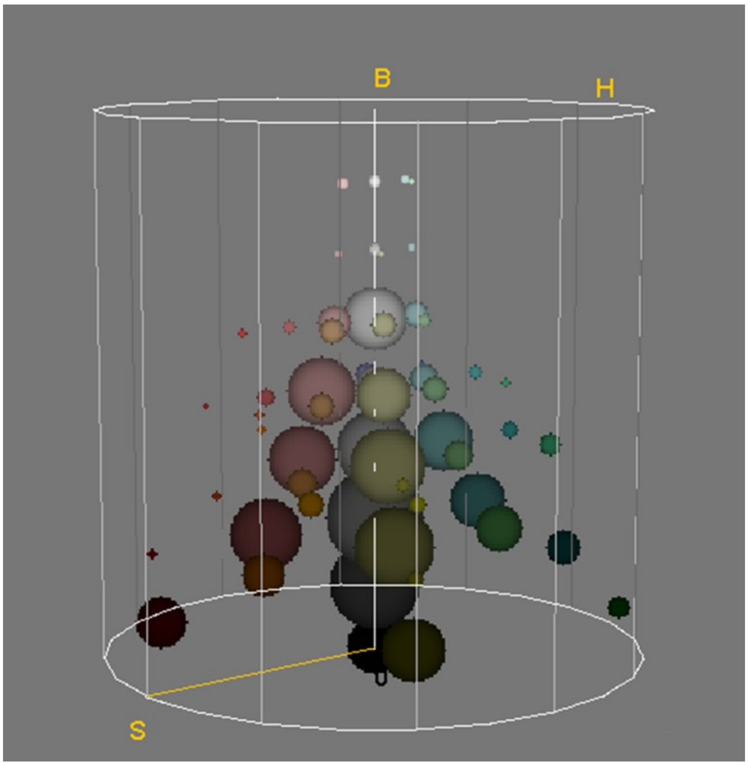


Figure 60. HSB-Space Color Distribution (view-2) - *Auf der Anderen Seite*

Slightly towards shades

6.1.7 *Soul Kitchen*

Ordering of frames from darkest to lightest in Fig.61 : UR,UL,MF,CC,LR,LL

Figure 61. Overall Equivalent Colors of Main and Sub-Frames
- *Soul Kitchen*

Color distribution in Fig.62 : NPC=1, NCG=14, NAG=1

Figure 62. Color Palette
- *Soul Kitchen*

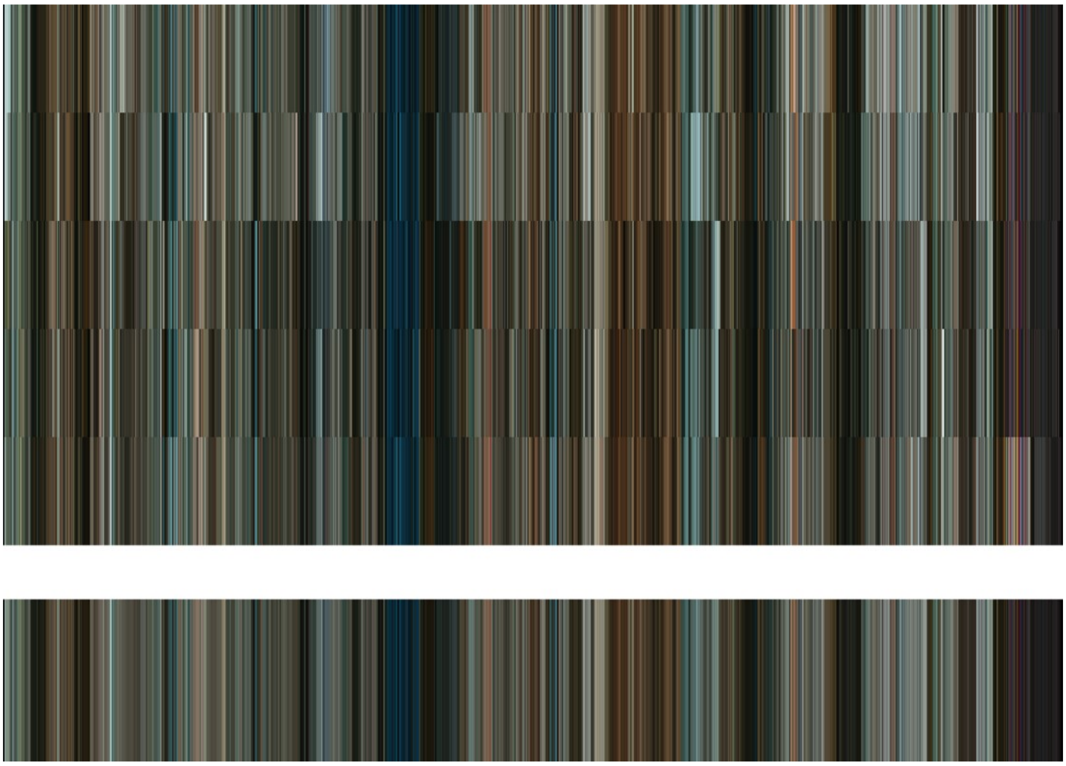


Figure 63. Equivalent Color Sequences of Main and Sub-Frames
- *Soul Kitchen*

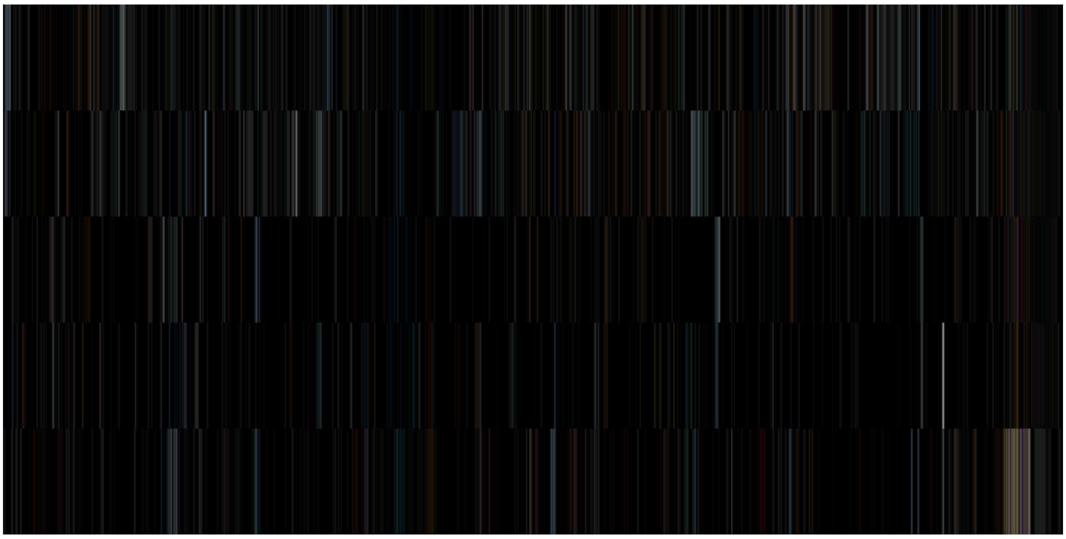


Figure 64. Difference Pattern for Color Sequences
- *Soul Kitchen*

Ordering of the areas of emphasis (3 sub-frames) : UR,CC,LR

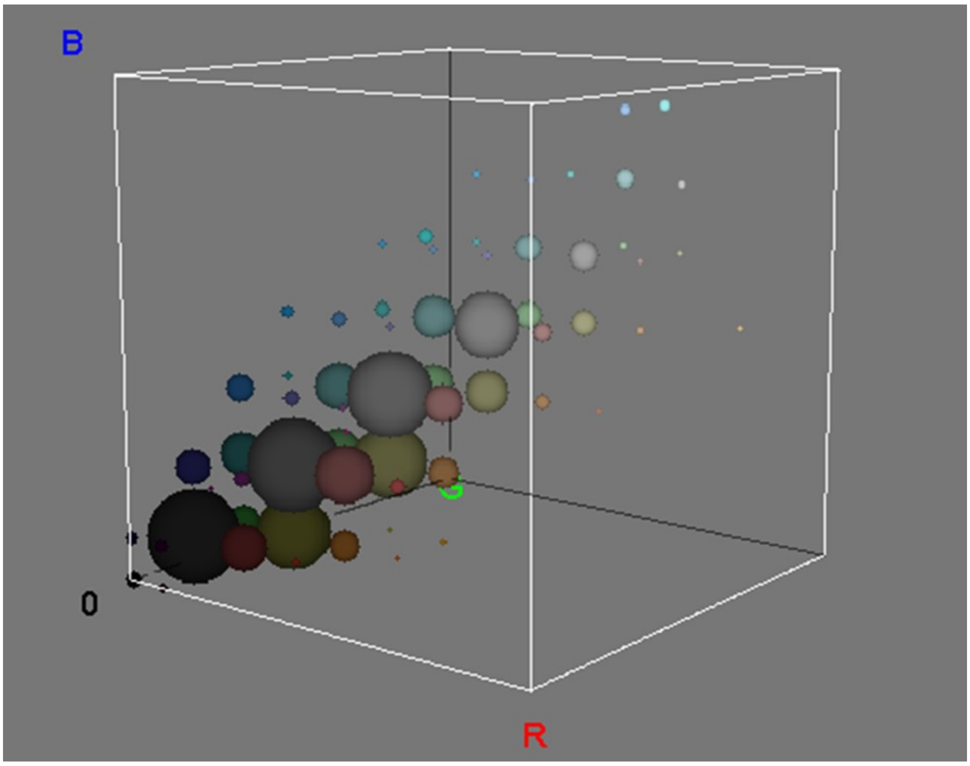


Figure 65. RGB-Space Color Distribution (view-1) - *Soul Kitchen*

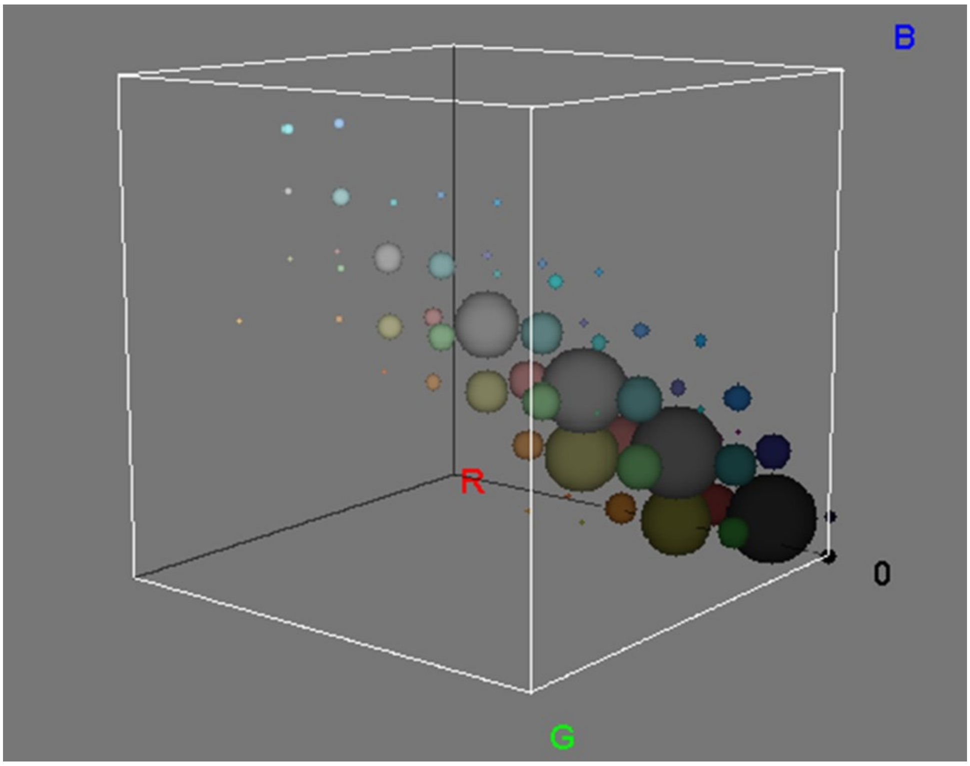


Figure 66. RGB-Space Color Distribution (view-2) - *Soul Kitchen*

Well distributed around zero saturation axis

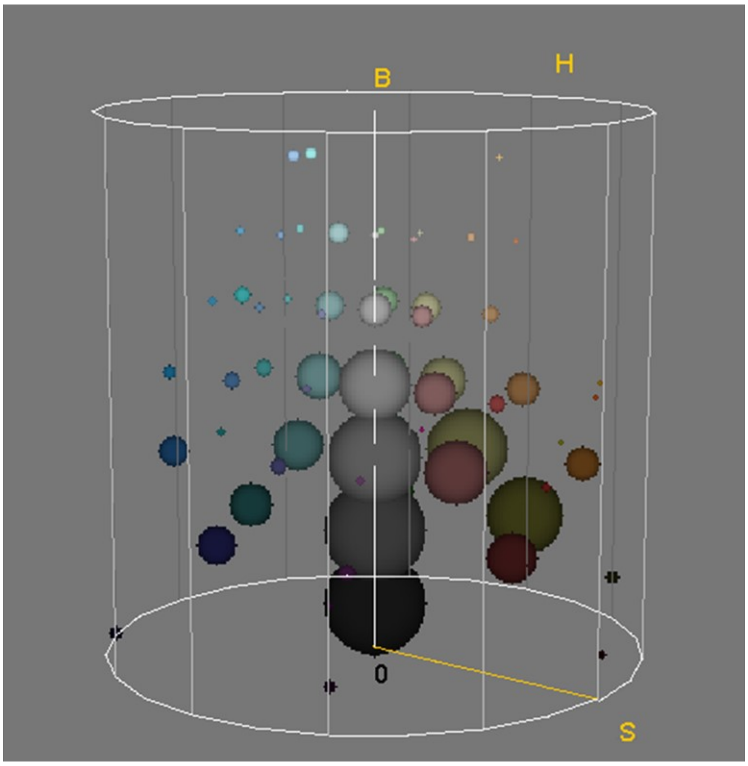


Figure 67. HSB-Space Color Distribution (view-1) - *Soul Kitchen*

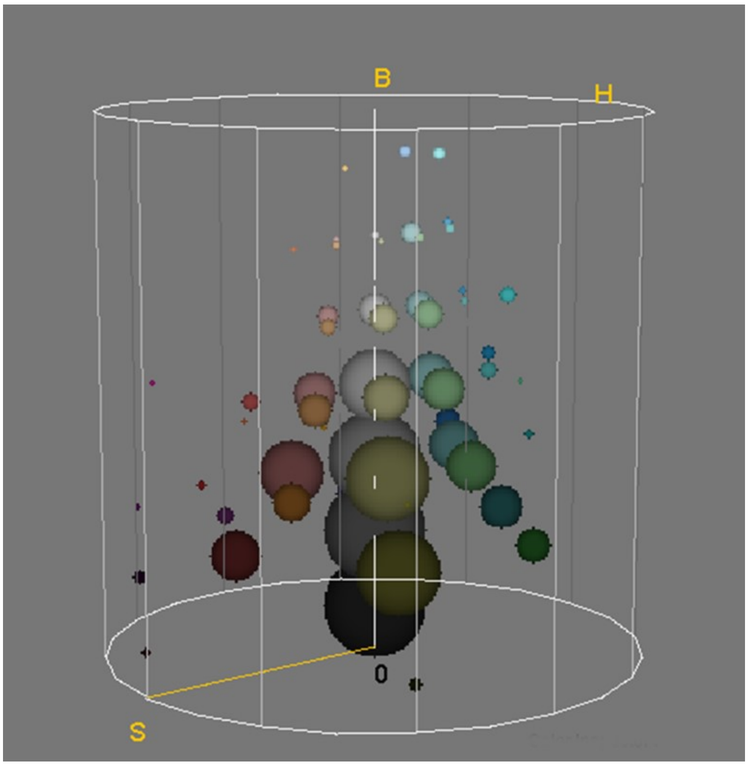


Figure 68. HSB-Space Color Distribution (view-2) - *Soul Kitchen*

Equal tints and shades

6.2 NURİ BİLGE CEYLAN

Nuri Bilge Ceylan is another Turkish director who has achieved international success. Biography of Nuri Bilge Ceylan is given by IMDB as;

> Nuri Bilge Ceylan was born on January 26, 1959 in Istanbul, Turkey. Studied electrical and electronics engineering at the Bogazici (Bosphorus) University. He is a director and writer, known for Bir Zamanlar Anadolu'da (2011), Uzak (2002) and Kis Uykusu (2014). He is married to Ebru Ceylan.
>
> His approach to the cinema can be seen in his following quote:
>
> “The literature always has an advantage over cinema. Because, you know, everybody knows that, that literature also uses the imagination of the reader. We can make the same thing to a certain amount by with ambiguity in cinema. So you can take the imagination of the audience into account and without using it and making the audience active you cannot go deep enough in cinema, I believe” (IMDB, Nuri Bilge Ceylan).

Five films of Nuri Bilge Ceylan were analyzed by the methods described in Chapters 4. The details of the films; date of production, digital format used, resolution of the videos are as follows:

Table 2. Film Data of Nuri Bilge Ceylan

Name	Year	Format	height(px)	width(px)	frames/s
Mayıs Sıkıntısı	1999	FLV	640	336	25
Uzak	2002	AVI	688	368	25
İklimler	2006	AVI	720	368	25
Üç Maymun	2008	AVI	704	304	25
Bir Zamanlar Anadolu'da	2011	AVI	720	304	25

6.2.1 *Mayıs Sıkıntısı*

Ordering of frames from darkest to lightest in Fig.69 : UR,UL,CC,MF,LR,LL

Figure 69. Overall Equivalent Colors of Main and Sub-Frames
- *Mayıs Sıkıntısı*

Color distribution in Fig.70 : NPC=3, NCG=13, NAG=0

Figure 70. Color Palette
- *Mayıs Sıkıntısı*

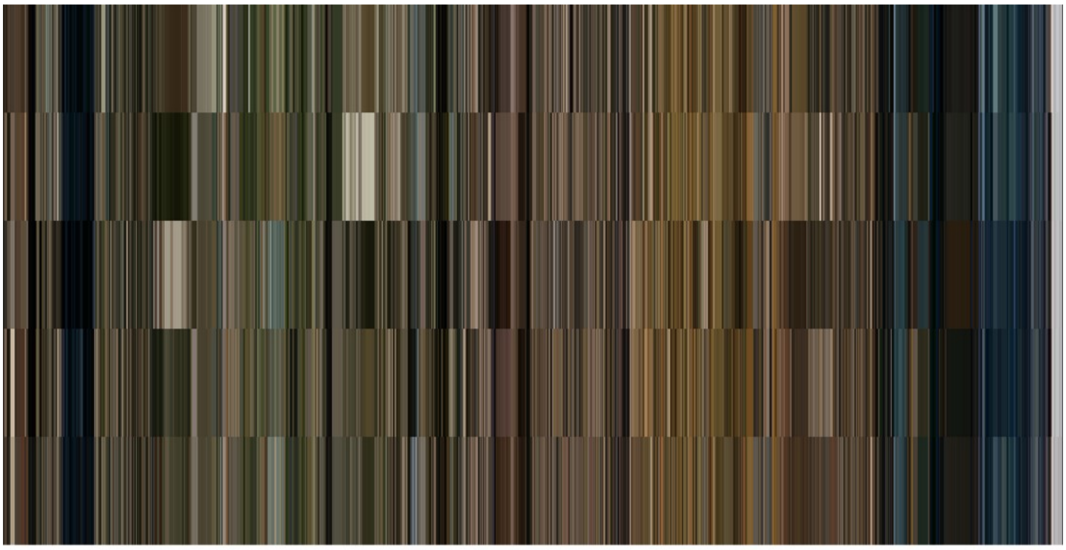


Figure 71. Equivalent Color Sequences of Main and Sub-Frames
- *Mayıs Sıkıntısı*

Figure 72. Difference Pattern for Color Sequences
- *Mayıs Sıkıntısı*

Ordering of the areas of emphasis (3 sub-frames) : LL,UR,LR

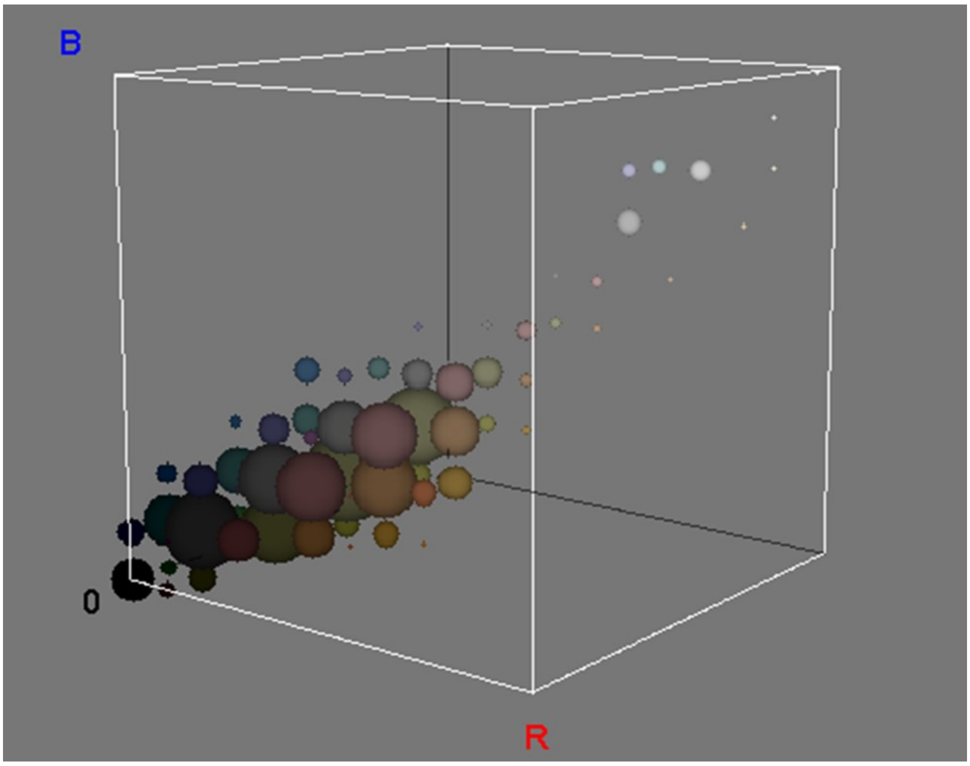


Figure 73. RGB-Space Color Distribution (view-1) - *Mayıs Sıkıntısı*

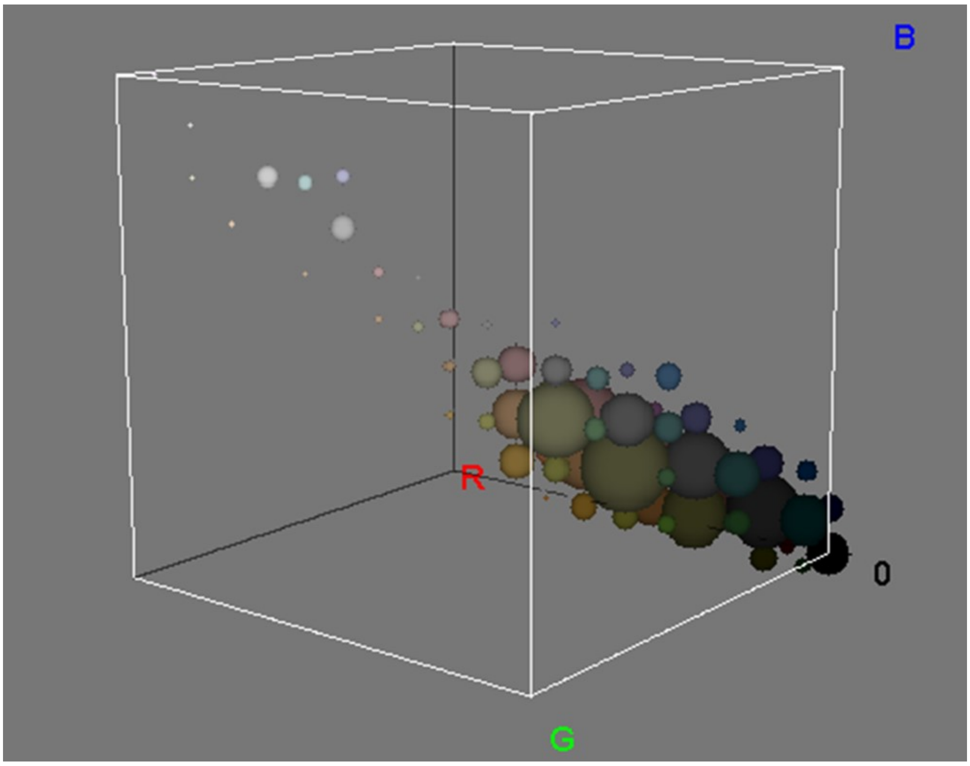


Figure 74. RGB-Space Color Distribution (view-2) - *Mayıs Sıkıntısı*

Compact around black, with detached group towards white

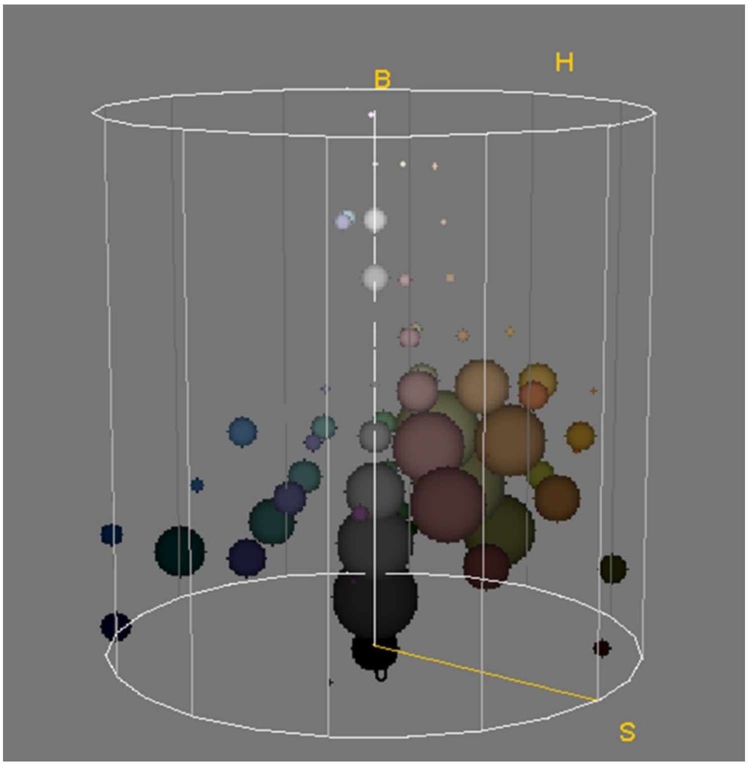


Figure 75. HSB-Space Color Distribution (view-1) - *Mayıs Sıkıntısı*

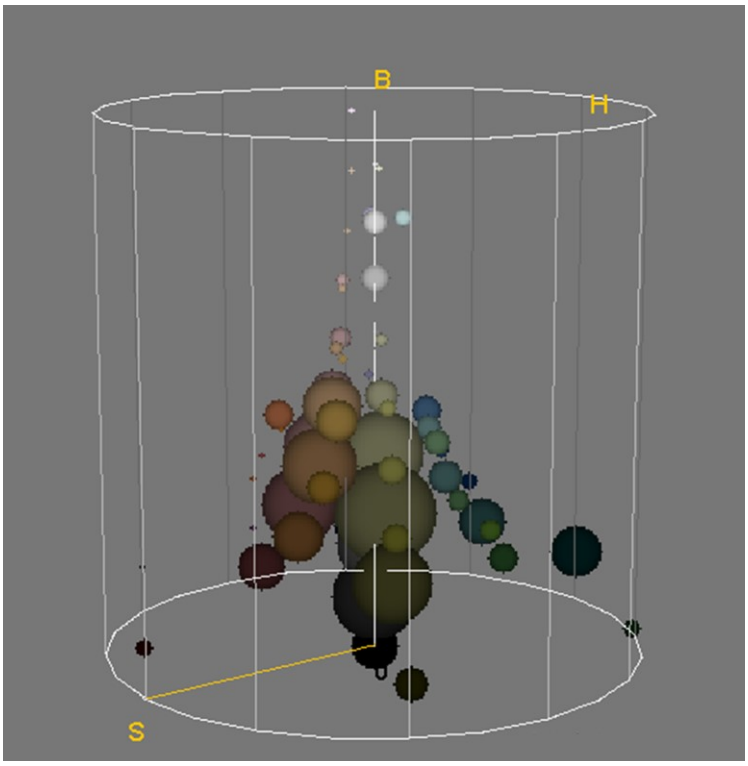


Figure 76. HSB-Space Color Distribution (view-2) - *Mayıs Sıkıntısı*

Shade heavy with tints

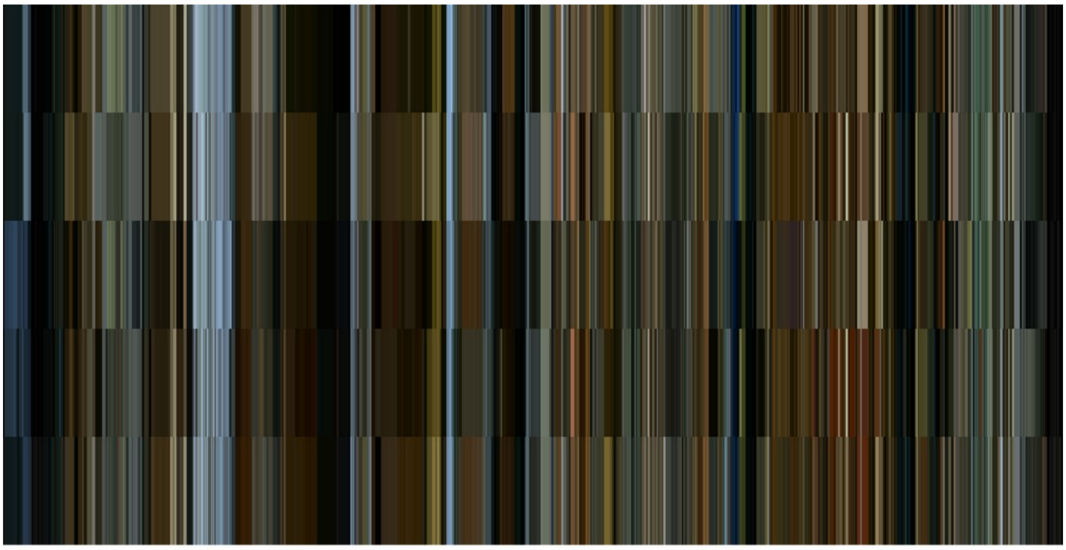
6.2.2 *Uzak*

Ordering of frames from darkest to lightest in Fig.77 : UR,UL,CC,MF,LR,LL

Figure 77. Overall Equivalent Colors of Main and Sub-Frames
- *Uzak*

Color distribution in Fig.78 : NPC=2, NCG=13, NAG=1

Figure 78. Color Palette
- *Uzak*



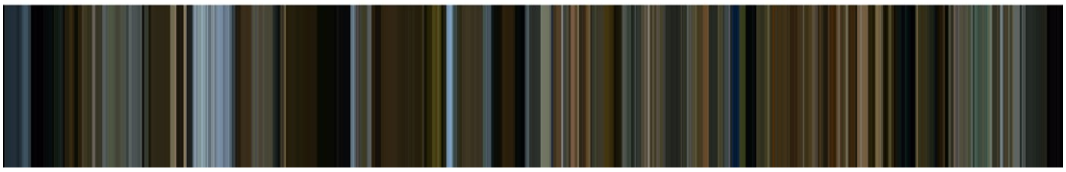


Figure 79. Equivalent Color Sequences of Main and Sub-Frames
- *Uzak*

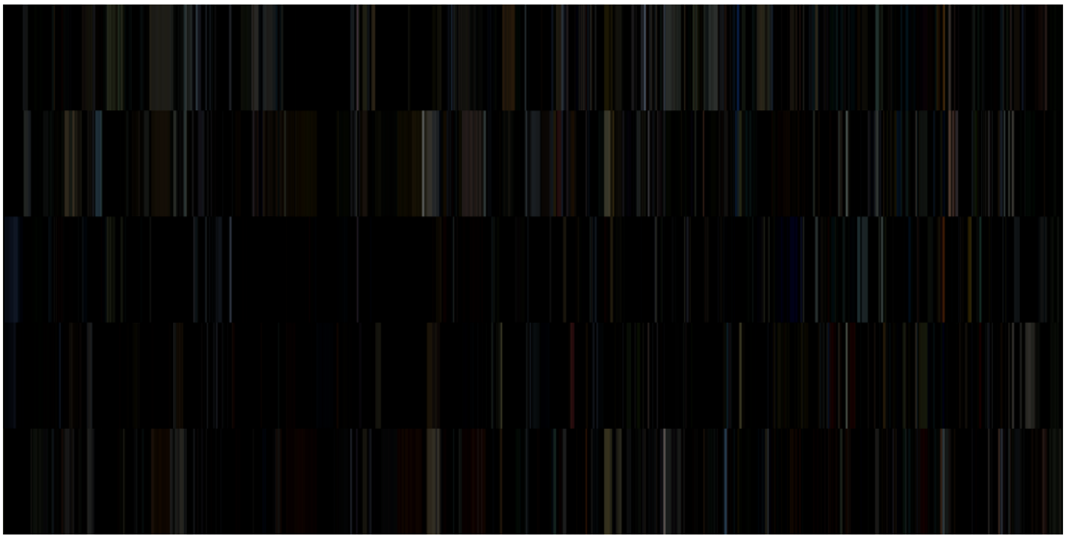


Figure 80. Difference Pattern for Color Sequences
- *Uzak*

Ordering of the areas of emphasis (3 sub-frames) : UR,CC,UL

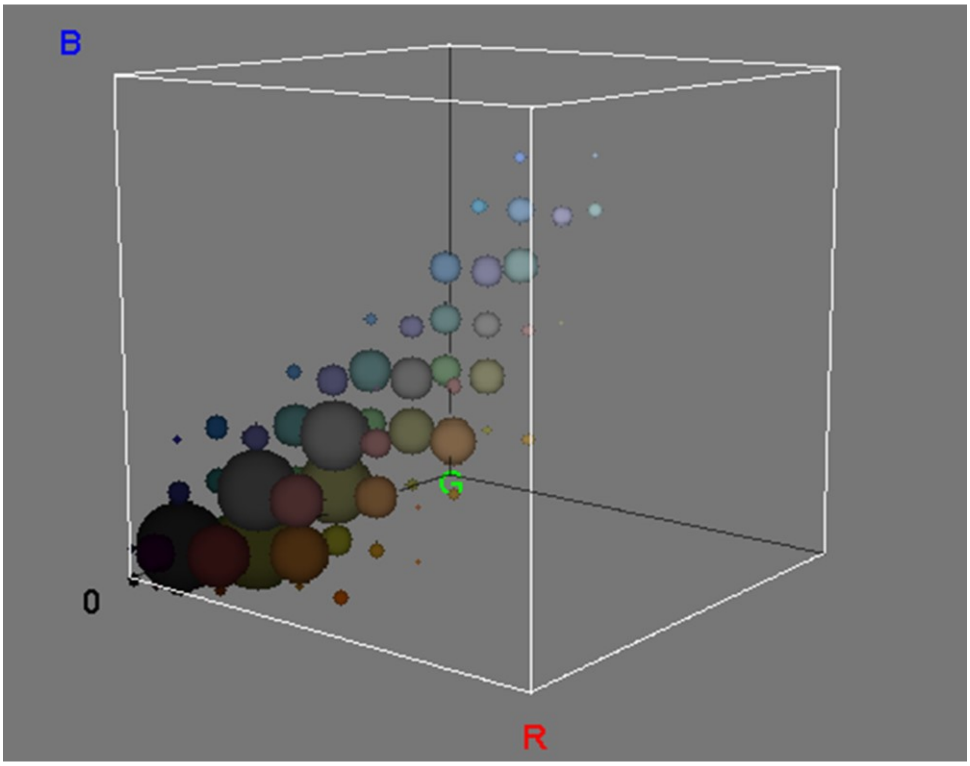


Figure 81. RGB-Space Color Distribution (view-1) - *Uzak*

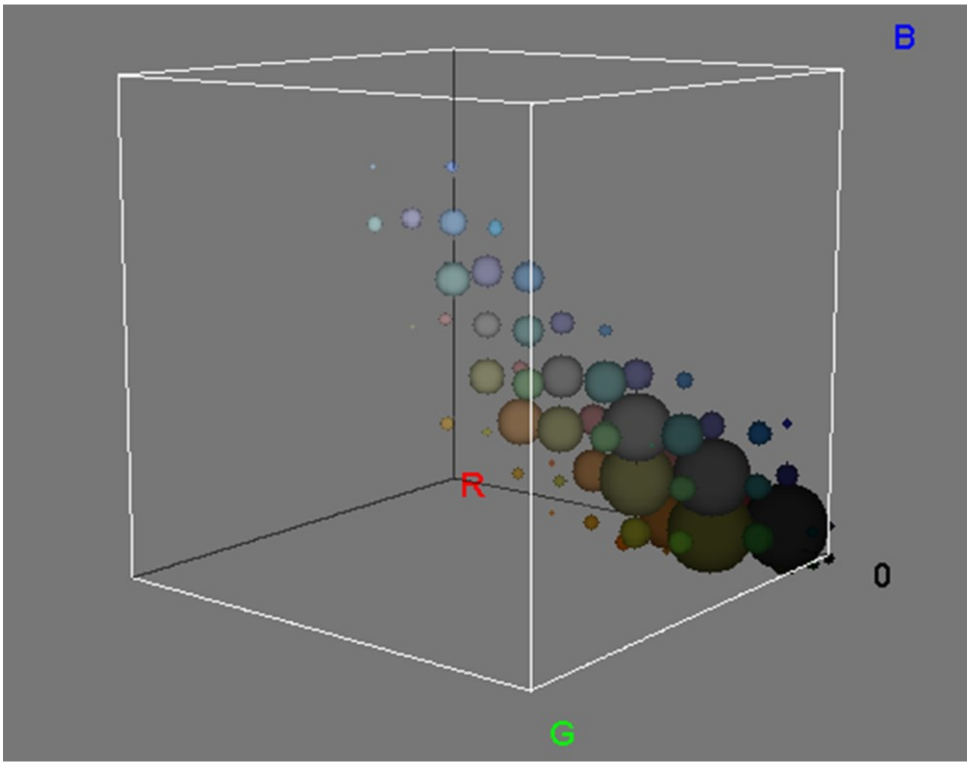


Figure 82. RGB-Space Color Distribution (view-2) - *Uzak*

Very compact near black with sparse colors around zero saturation axis

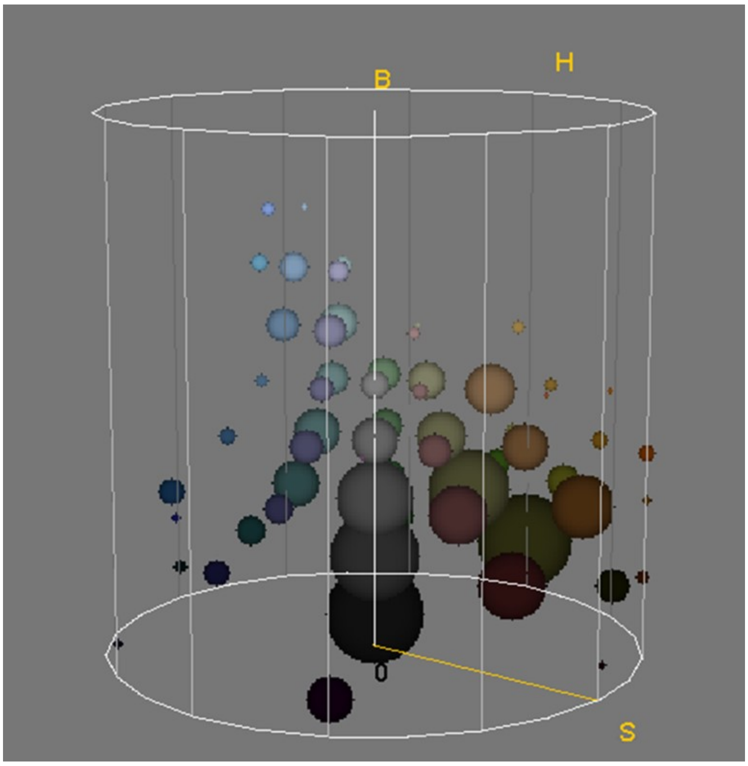


Figure 83. HSB-Space Color Distribution (view-1) - *Uzak*

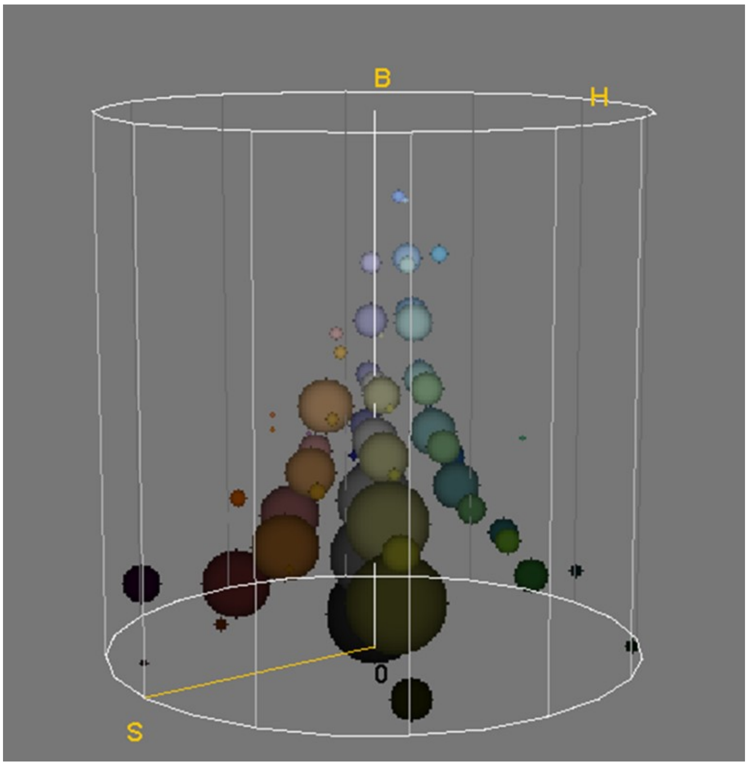


Figure 84. HSB-Space Color Distribution (view-2) - *Uzak*

Equal tints and shades

6.2.3 *İklimler*

Ordering of frames from darkest to lightest in Fig.85 : UL,UR,MF,CC,LL,LR

Figure 85. Overall Equivalent Colors of Main and Sub-Frames
- *İklimler*

Color distribution in Fig.86 : NPC=0, NCG=15, NAG=1

Figure 86. Color Palette
- *İklimler*

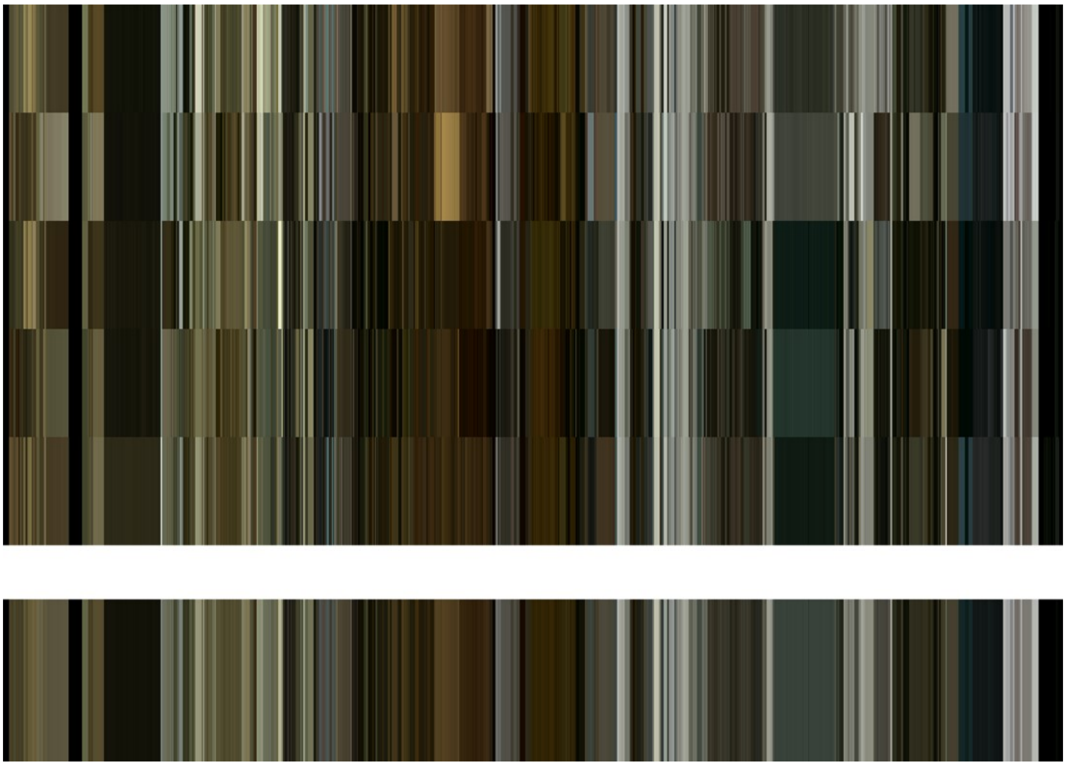


Figure 87. Equivalent Color Sequences of Main and Sub-Frames
- *İklimler*

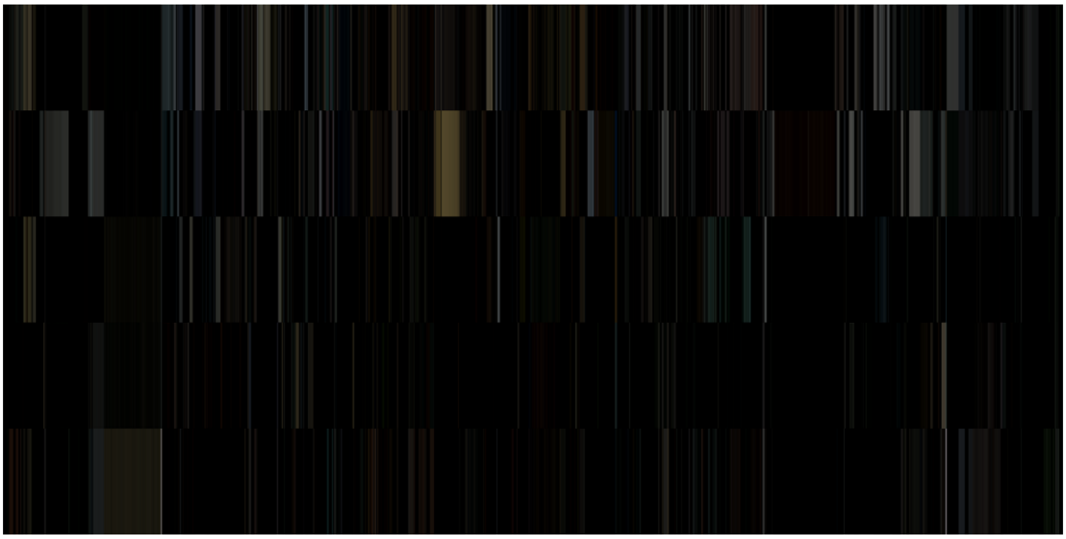


Figure 88. Difference Pattern for Color Sequences
- *İklimler*

Ordering of the areas of emphasis (3 sub-frames) : UR,UL,LL

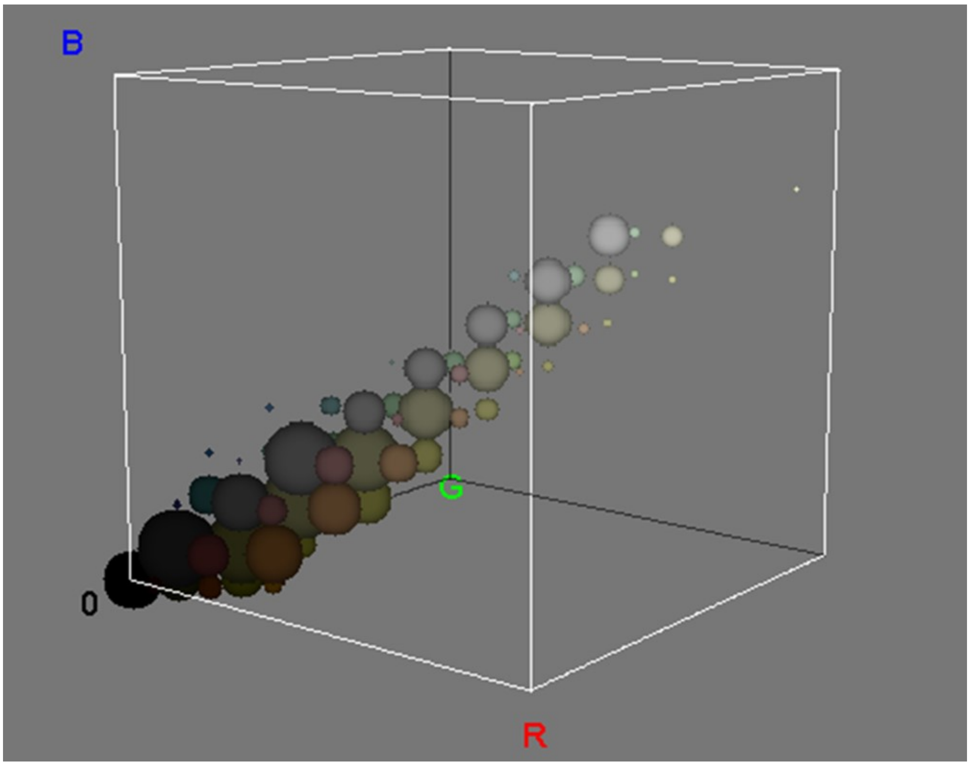


Figure 89. RGB-Space Color Distribution (view-1) - *İklimler*

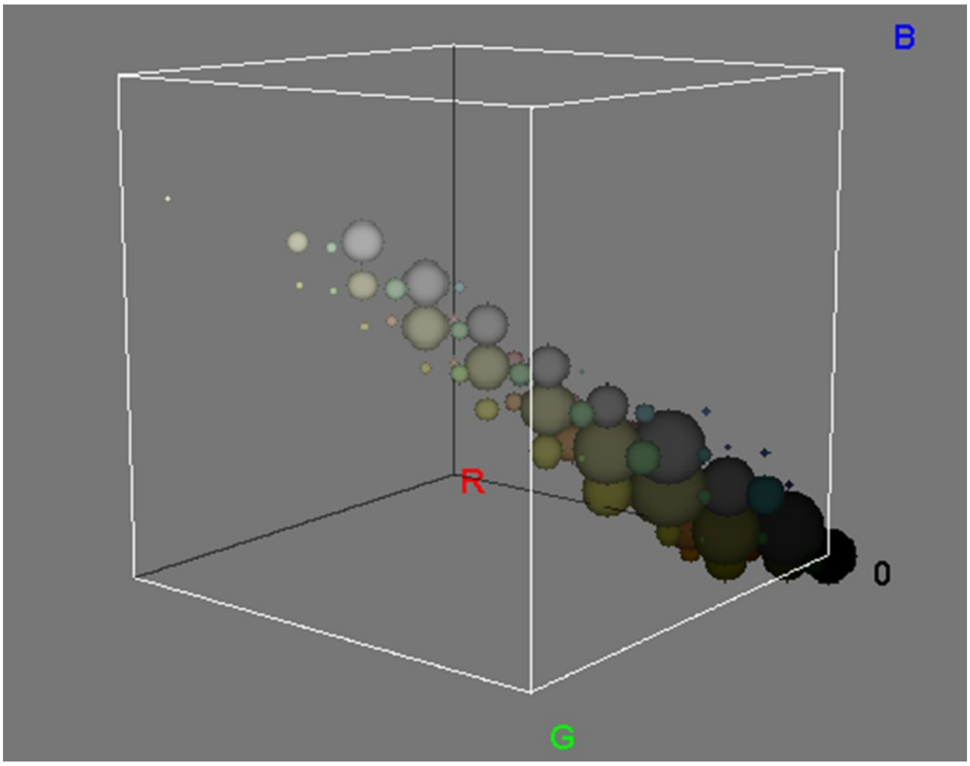


Figure 90. RGB-Space Color Distribution (view-2) - *İklimler*

Narrow concentration alon zero saturation axis.

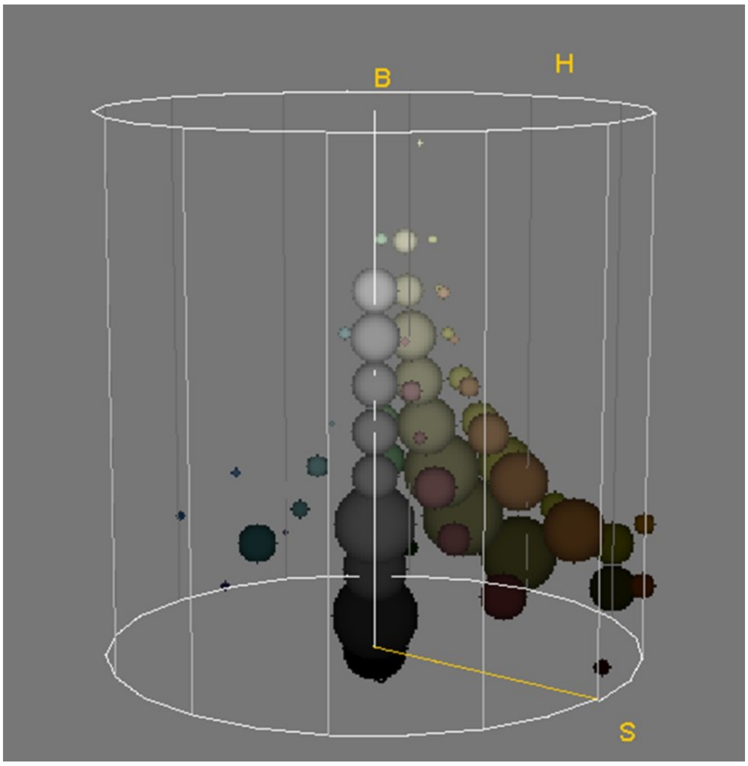


Figure 91. HSB-Space Color Distribution (view-1) - *İklimler*

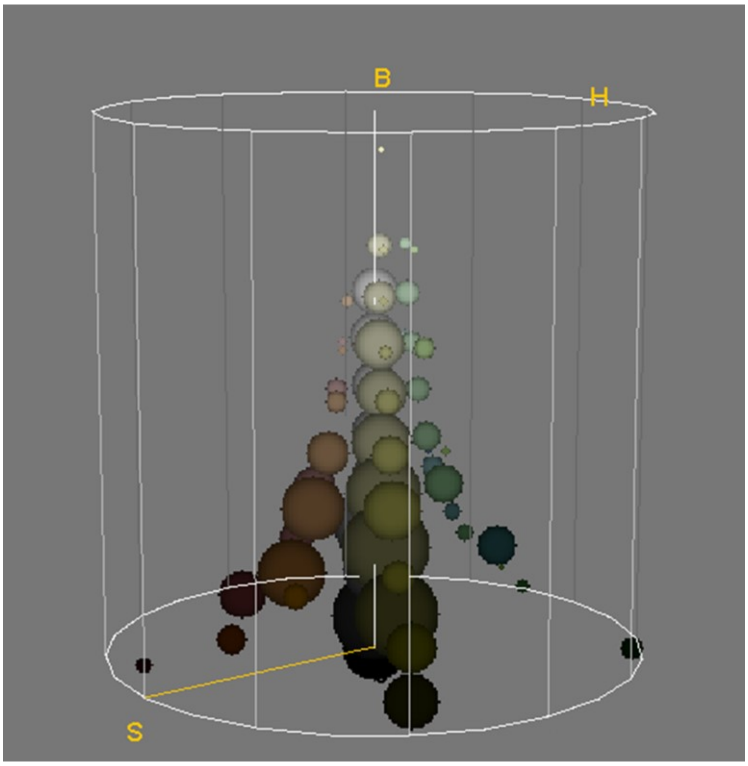


Figure 92. HSB-Space Color Distribution (view-2) - *İklimler*

Shade heavy with few tints

6.2.4 *Üç Maymun*

Ordering of frames from darkest to lightest in Fig.93 : UL,UR,CC,MF,LR,LL

Figure 93. Overall Equivalent Colors of Main and Sub-Frames
- *Üç Maymun*

Color distribution in Fig.94 : NPC=0, NCG=13, NAG=3

Figure 94. Color Palette
- *Üç Maymun*

Figure 95. Equivalent Color Sequences of Main and Sub-Frames
- *Üç Maymun*

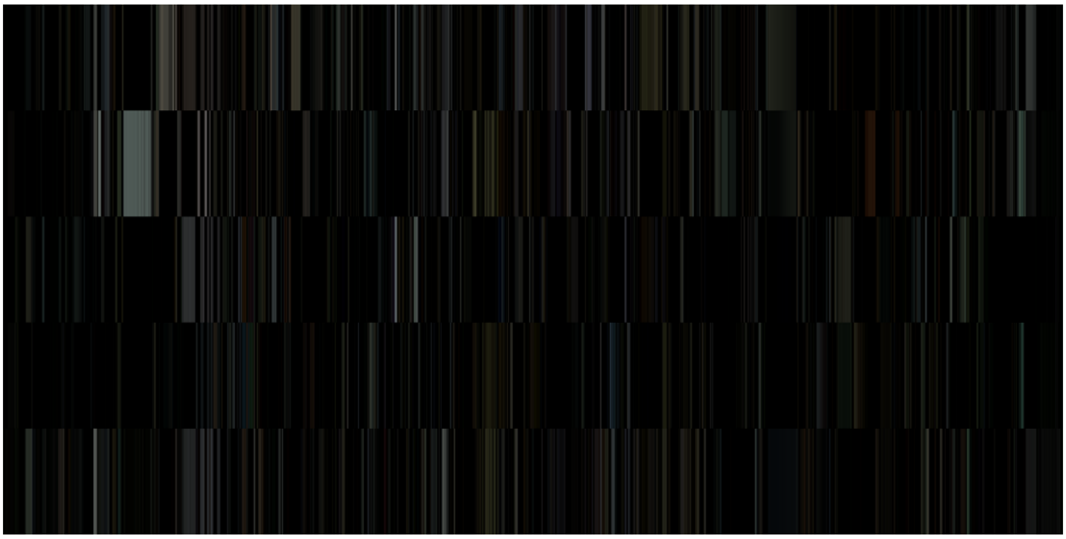


Figure 96. Difference Pattern for Color Sequences
- *Üç Maymun*

Ordering of the areas of emphasis (3 sub-frames) : UR,LL,UL

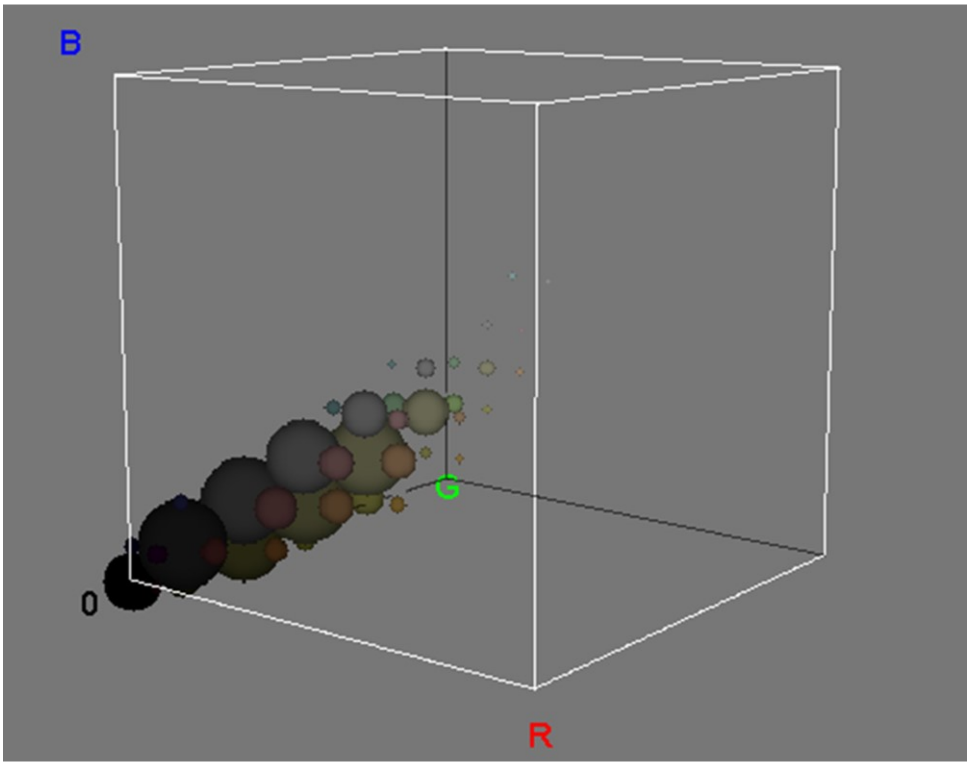


Figure 97. RGB-Space Color Distribution (view-1) - *Üç Maymun*

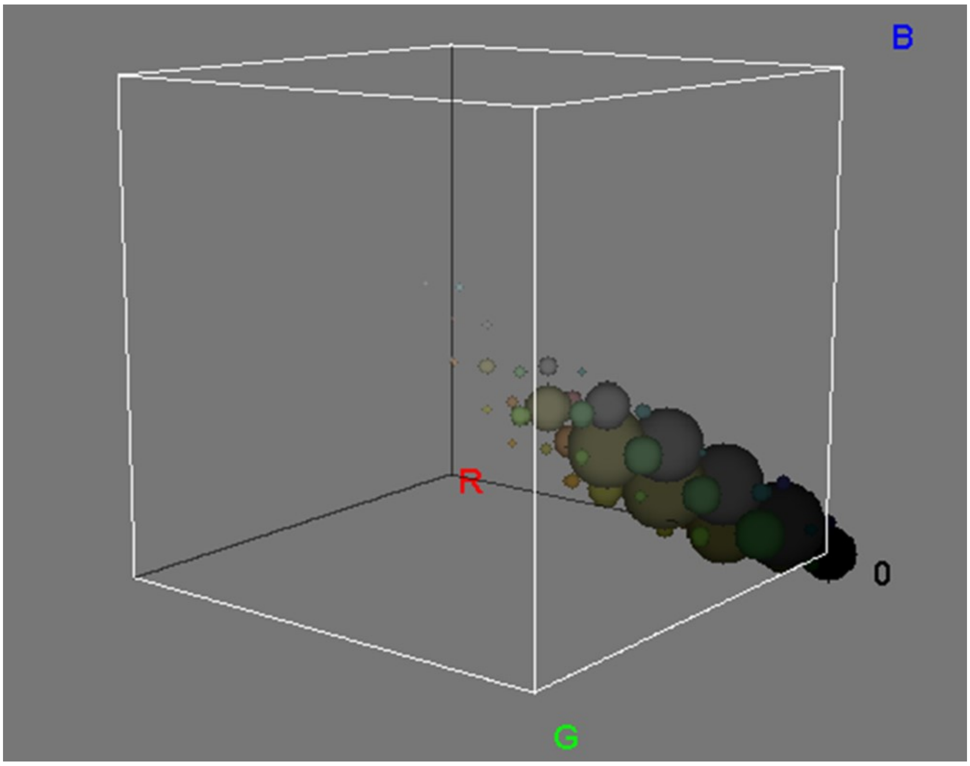


Figure 98. RGB-Space Color Distribution (view-2) - *Üç Maymun*

Extremely compact around black

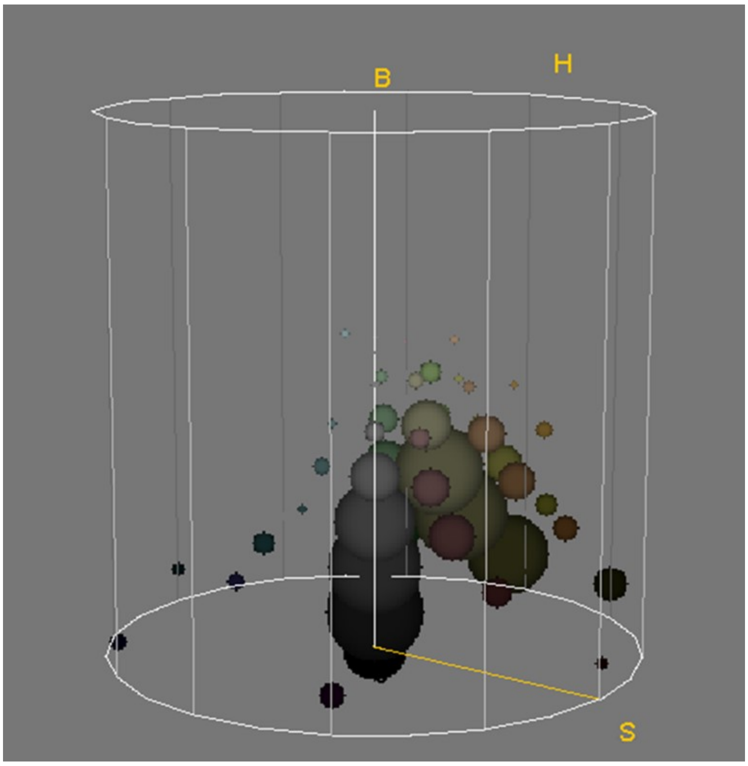


Figure 99. HSB-Space Color Distribution (view-1) - *Üç Maymun*

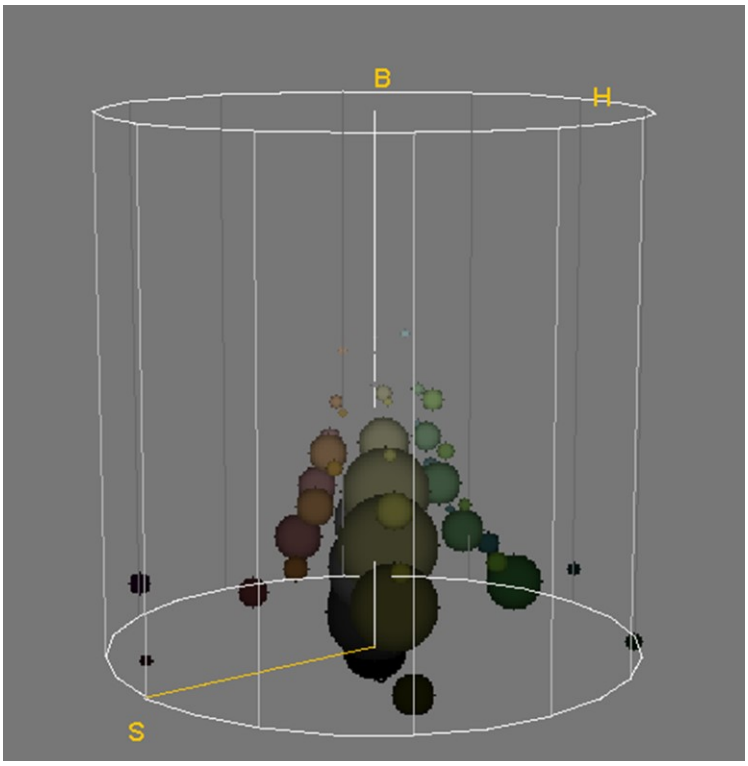


Figure 100. HSB-Space Color Distribution (view-2) - *Üç Maymun*

Totally shades

6.2.5 *Bir Zamanlar Anadolu'da*

Ordering of frames from darkest to lightest in Fig.101 : UR,UL,CC,MF,LR,LL

Figure 101. Overall Equivalent Colors of Main and Sub-Frames
- *Bir Zamanlar Anadolu'da*

Color distribution in Fig.102 : NPC=0, NCG=15, NAG=1

Figure 102. Color Palette
- *Bir Zamanlar Anadolu'da*

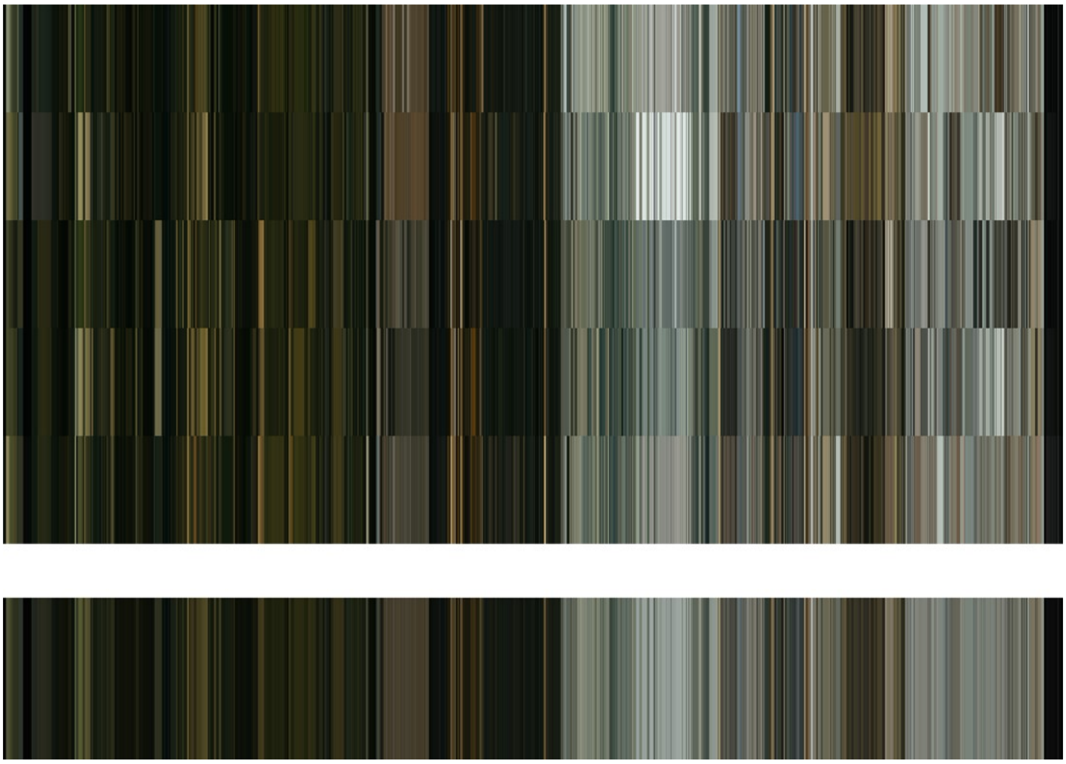


Figure 103. Equivalent Color Sequences of Main and Sub-Frames
- *Bir Zamanlar Anadolu'da*

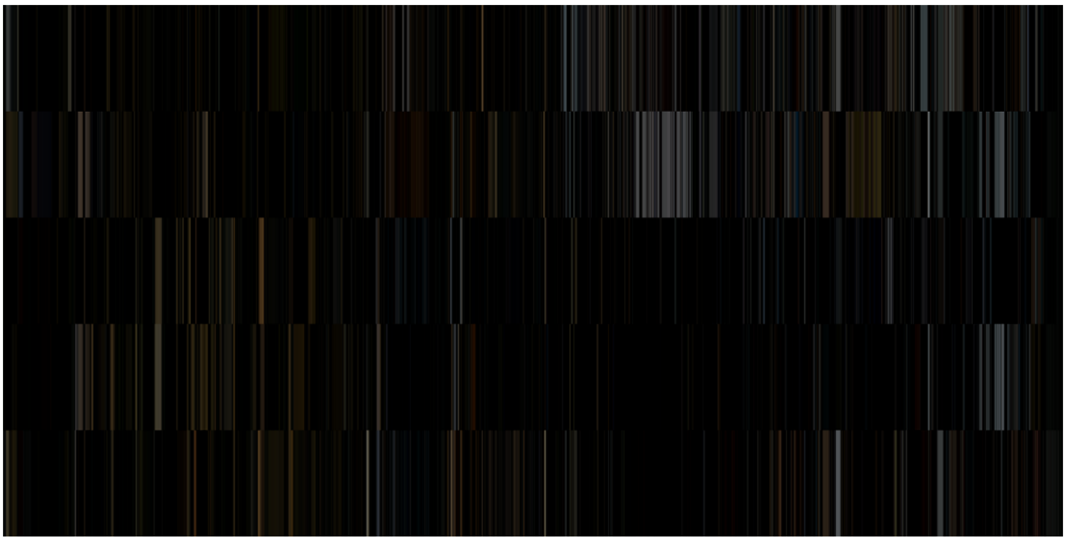


Figure 104. Difference Pattern for Color Sequences
- *Bir Zamanlar Anadolu'da*

Ordering of the areas of emphasis (3 sub-frames) : UR,UL,LR

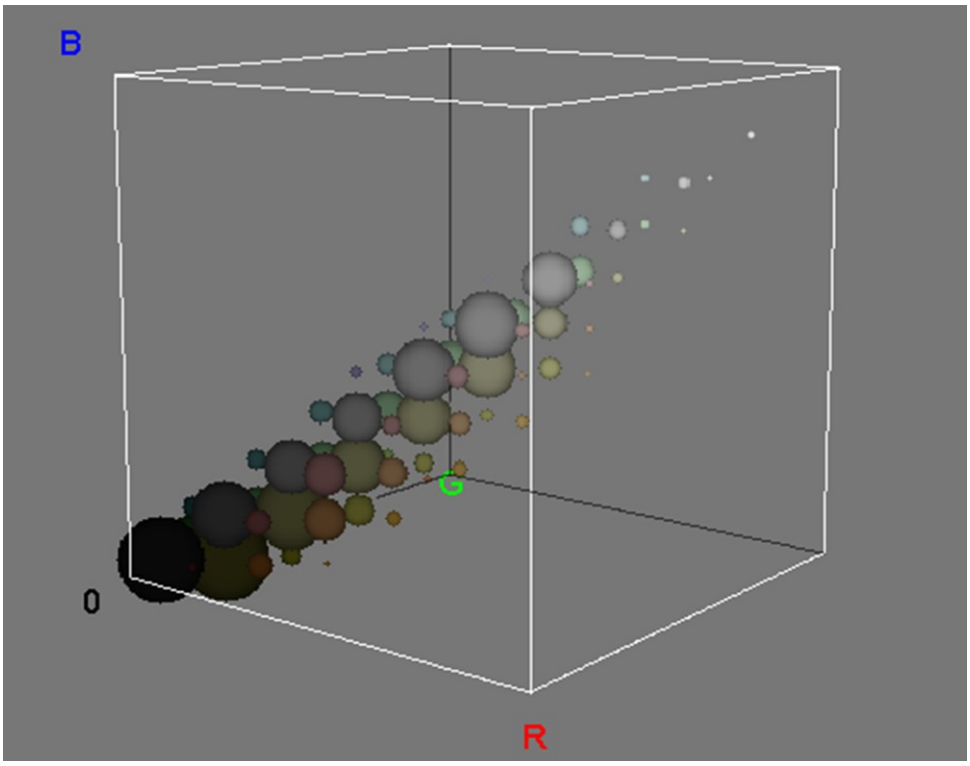


Figure 105. RGB-Space Color Distribution (view-1) - *Bir Zamanlar Anadolu'da*

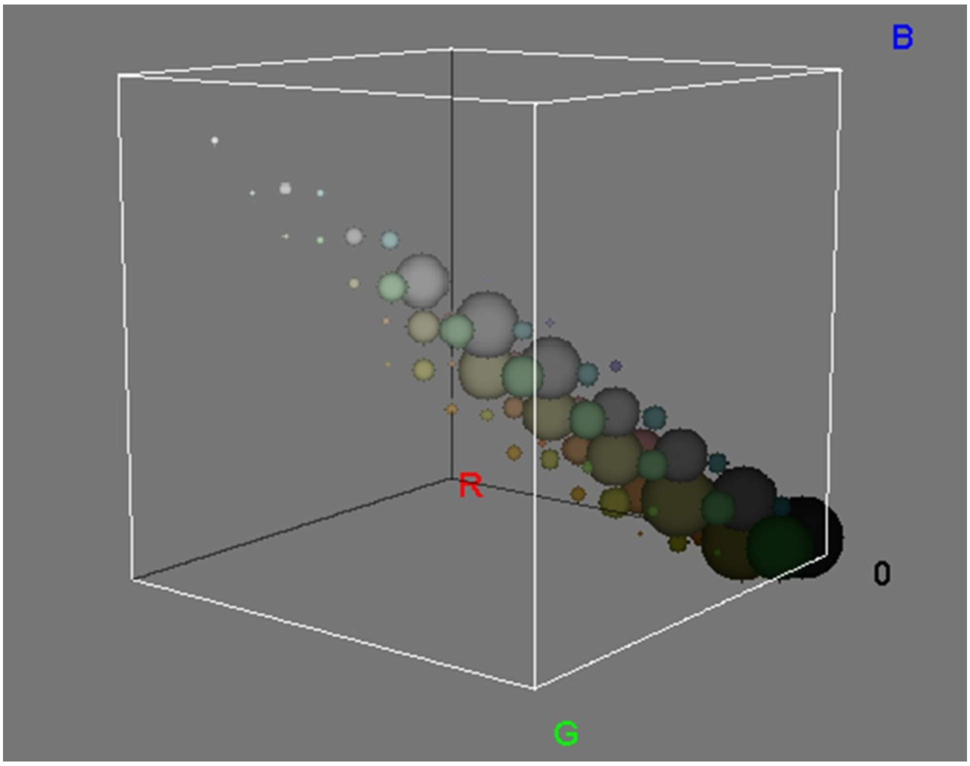


Figure 106. RGB-Space Color Distribution (view-2) - *Bir Zamanlar Anadolu'da*

Concentrated all along zero saturation axis.

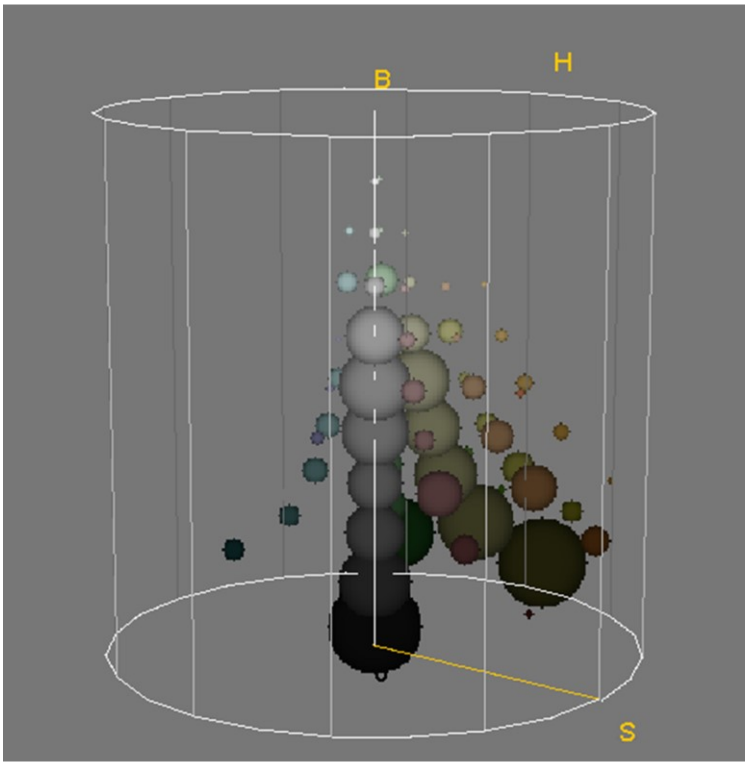


Figure 107. HSB-Space Color Distribution (view-1) - *Bir Zamanlar Anadolu'da*

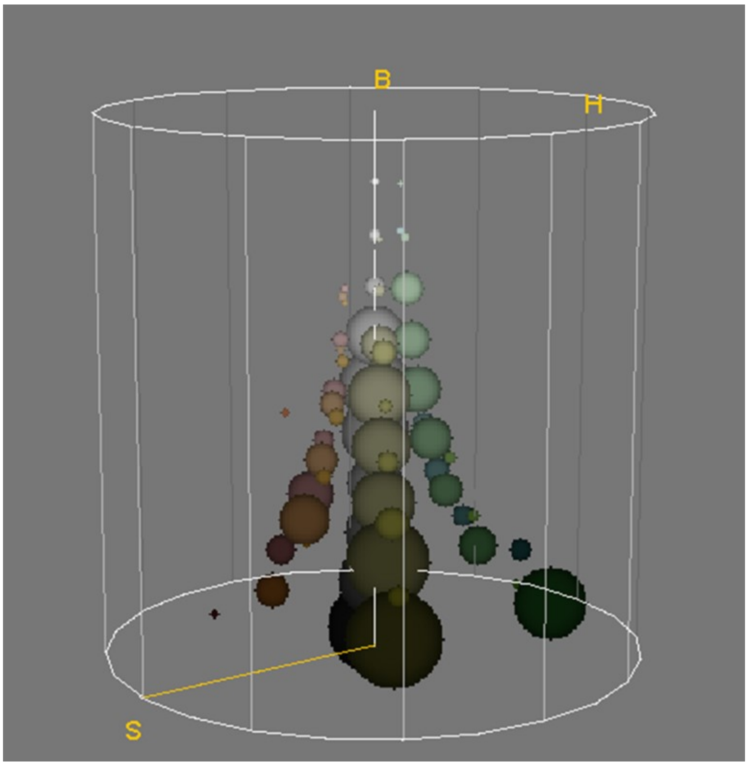


Figure 108. HSB-Space Color Distribution (view-2) - *Bir Zamanlar Anadolu'da*

Shades with few tints

6.3 ZEKİ DEMİRKUBUZ

Zeki Demirkubuz is a well known director in Turkey. His attitude towards the cinema is mostly related to sorrow and pain. Biography of Zeki Demirkubuz is given by IMDB as;

> Zeki Demirkubuz was born on October 1, 1964 in Isparta, Turkey. Graduated from the Department of Communications at Istanbul University. Was jailed without trial at age 17 after revolt by students and activists..He is a director and writer, known for Masumiyet (1997), Kader (2006) and Yeralti (2012). He is married to Nurhayat Kavrak. They have one child.

His perception and interpretation of cinema was shaped by the events that he lived through.as can be seen in own sentences; “...pain was the one thing that united us. Pain is everywhere, we must all face it. All my films are about it” (IMDB, Zeki Demirkubuz)

Eight films of Zeki Demirkubuz were analyzed by the methods described in Chapters 4. The details of the films; date of production, digital format used, resolution of the videos are as follows:

Table 3. Film Data of Zeki Demirkubuz

Name	Year	Format	height(px)	width(px)	frames/s
C Blok	1994	AVI	712	392	25
Masumiyet	1997	AVI	712	392	25
Yazgı	2001	AVI	608	368	25
İtiraf	2002	AVI	640	368	25
Bekleme Odası	2003	AVI	640	384	25
Kader	2006	AVI	640	368	25
Kıskanmak	2009	AVI	720	304	25
Yeraltı	2012	AVI	704	304	25

6.3.1 *C Blok*

Ordering of frames from darkest to lightest in Fig.109 : UR,UL,CC,MF,LR,LL

Figure 109. Overall Equivalent Colors of Main and Sub-Frames
- *C Blok*

Color distribution in Fig.110 : NPC=0, NCG=14, NAG=2

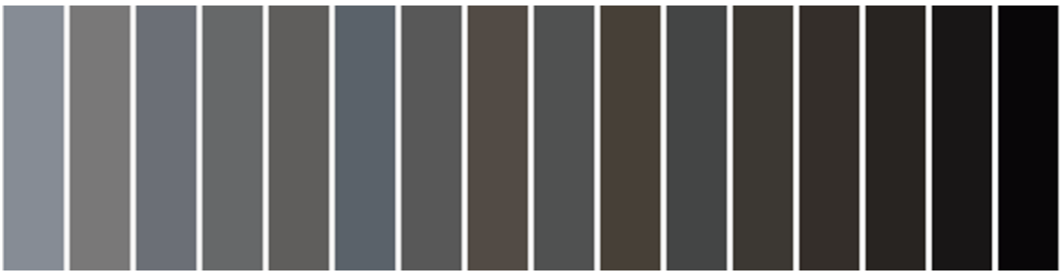


Figure 110. Color Palette
- *C Blok*

Figure 111. Equivalent Color Sequences of Main and Sub-Frames
- *C Blok*

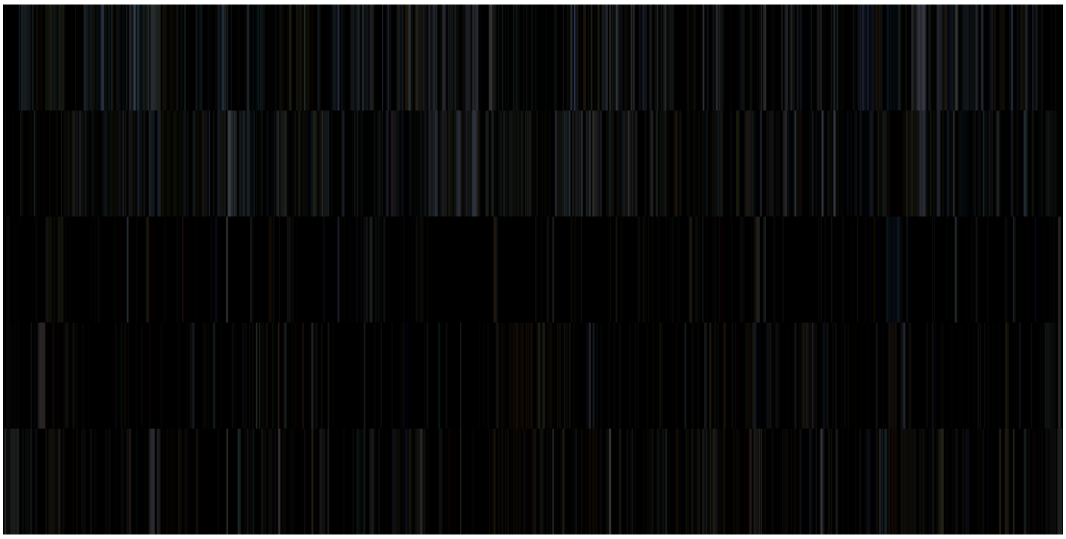


Figure 112. Difference Pattern for Color Sequences
- *C Blok*

Ordering of the areas of emphasis (3 sub-frames) : UR,UL,CC

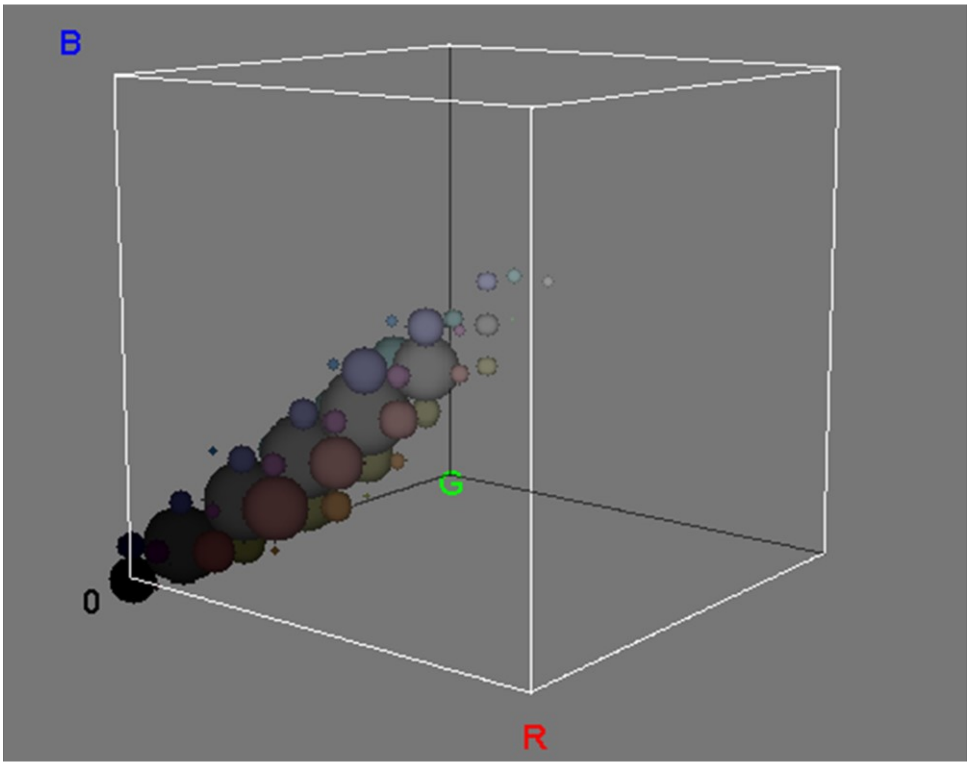


Figure 113. RGB-Space Color Distribution (view-1) - *C Blok*

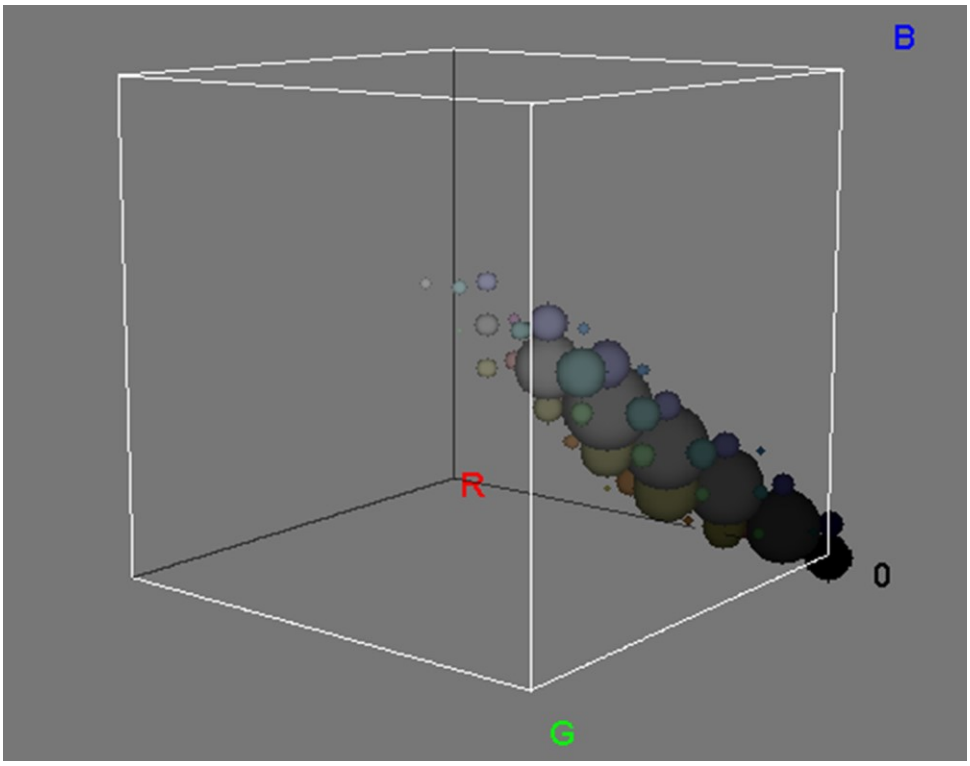


Figure 114. RGB-Space Color Distribution (view-2) - *C Blok*

Very narrow compact along zero saturation axis near black.

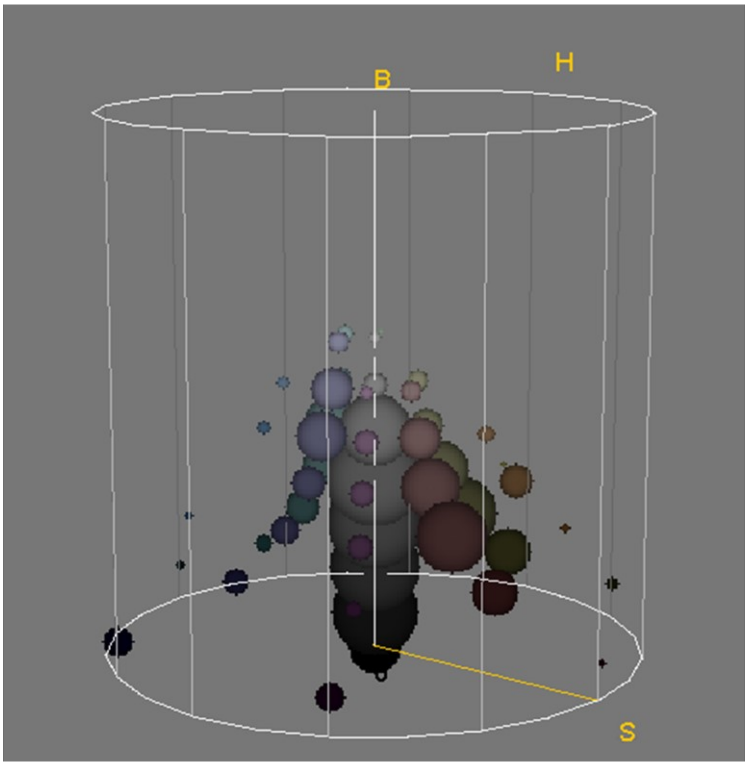


Figure 115. HSB-Space Color Distribution (view-1) - *C Blok*

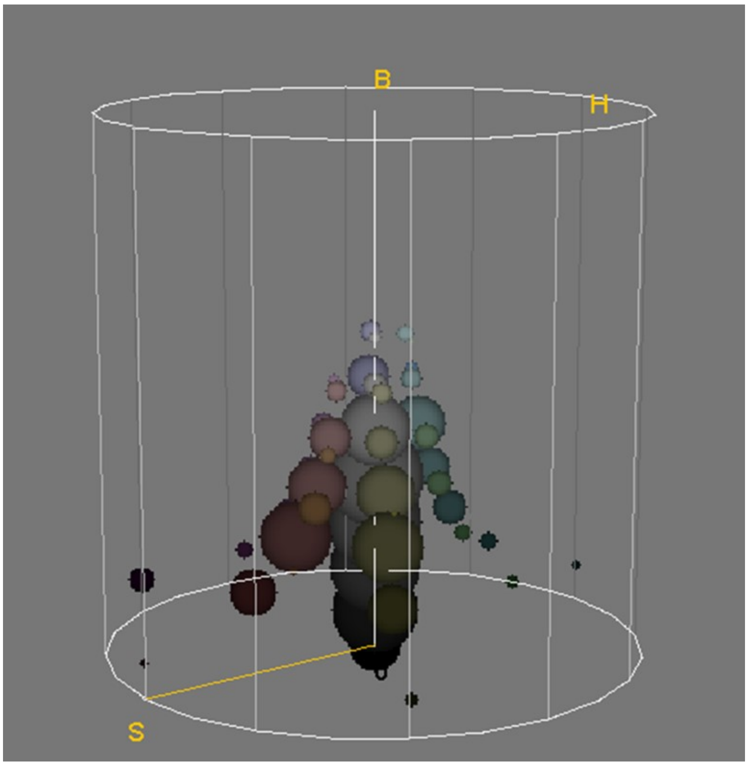


Figure 116. HSB-Space Color Distribution (view-2) - *C Blok*

Shades

6.3.2 *Masumiyet*

Ordering of frames from darkest to lightest in Fig.117 : UL,UR,CC,MF,LL,LR

Figure 117. Overall Equivalent Colors of Main and Sub-Frames
- *Masumiyet*

Color distribution in Fig.118 : NPC=2, NCG=13, NAG=1

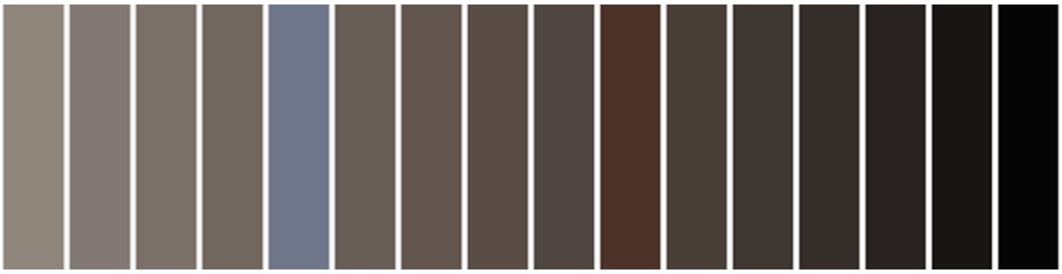


Figure 118. Color Palette
- *Masumiyet*

Figure 119. Equivalent Color Sequences of Main and Sub-Frames
- *Masumiyet*

Figure 120. Difference Pattern for Color Sequences
- *Masumiyet*

Ordering of the areas of emphasis (3 sub-frames) : UL,UR,LR

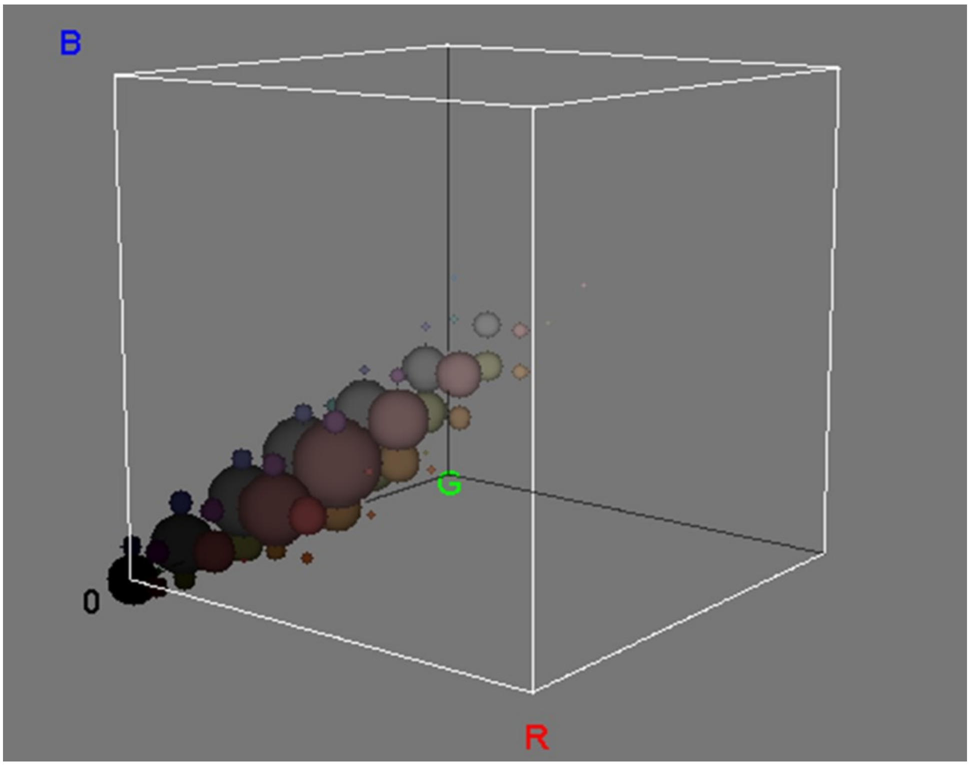


Figure 121. RGB-Space Color Distribution (view-1) - *Masumiyet*

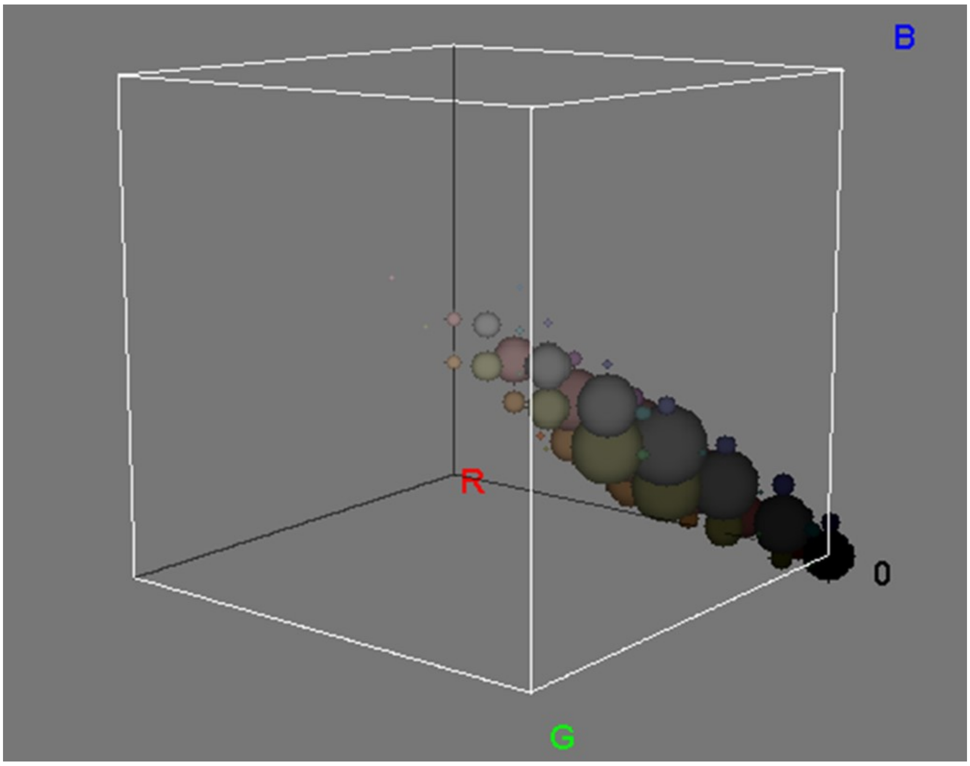


Figure 122. RGB-Space Color Distribution (view-21) - *Masumiyet*

Expanding distribution from black towards white along zero saturation axis

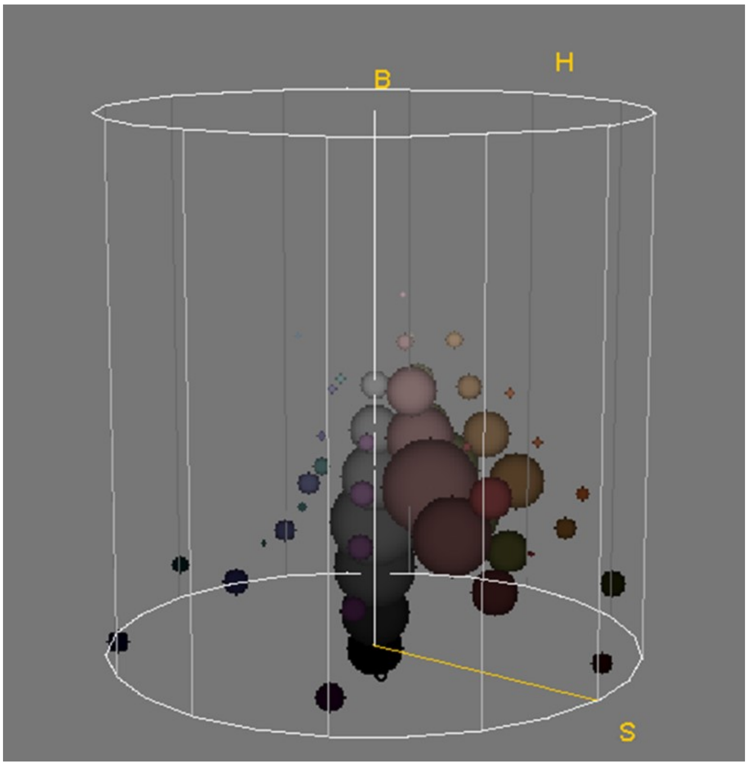


Figure 123. HSB-Space Color Distribution (view-1) - *Masumiyet*

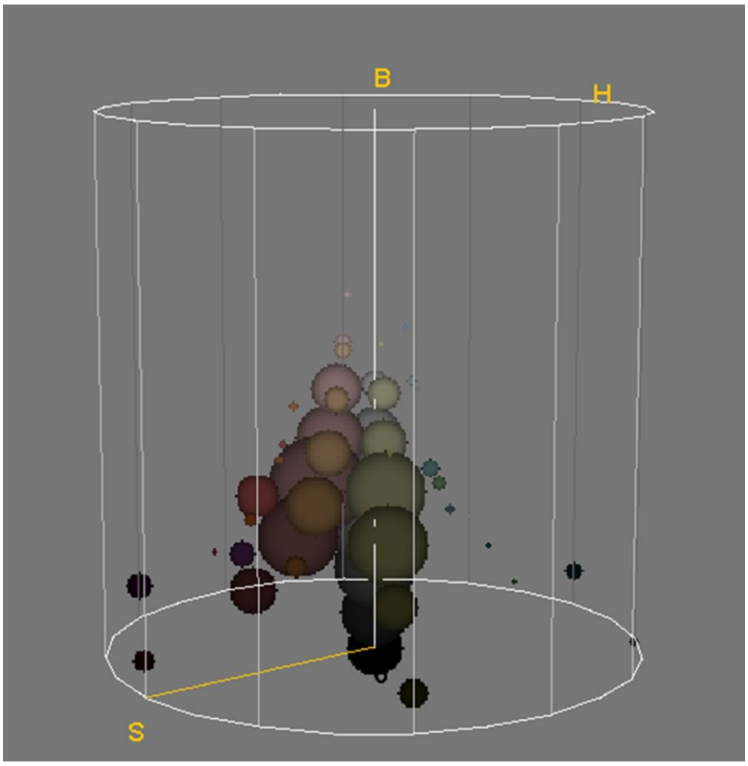


Figure 124. HSB-Space Color Distribution (view-2) - *Masumiyet*

Shades

6.3.3 *Yazgı*

Ordering of frames from darkest to lightest in Fig.125 : UL,UR,CC,MF,LR,LL

Figure 125. Overall Equivalent Colors of Main and Sub-Frames
- *Yazgı*

Color distribution in Fig.126 : NPC=2, NCG=13, NAG=1

Figure 126. Color Palette
- *Yazgı*

Figure 127. Equivalent Color Sequences of Main and Sub-Frames
- *Yazgı*

Figure 128. Difference Pattern for Color Sequences
- *Yazgı*

Ordering of the areas of emphasis (3 sub-frames) : UR,LR,UL

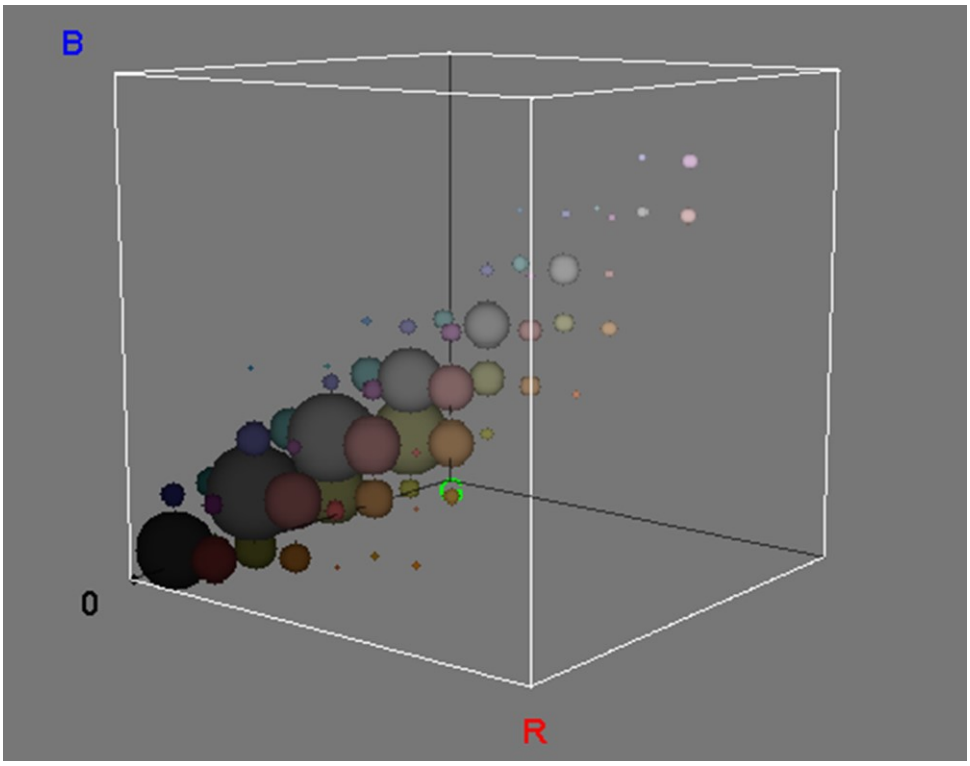


Figure 129. RGB-Space Color Distribution (view-1) - *Yazgı*

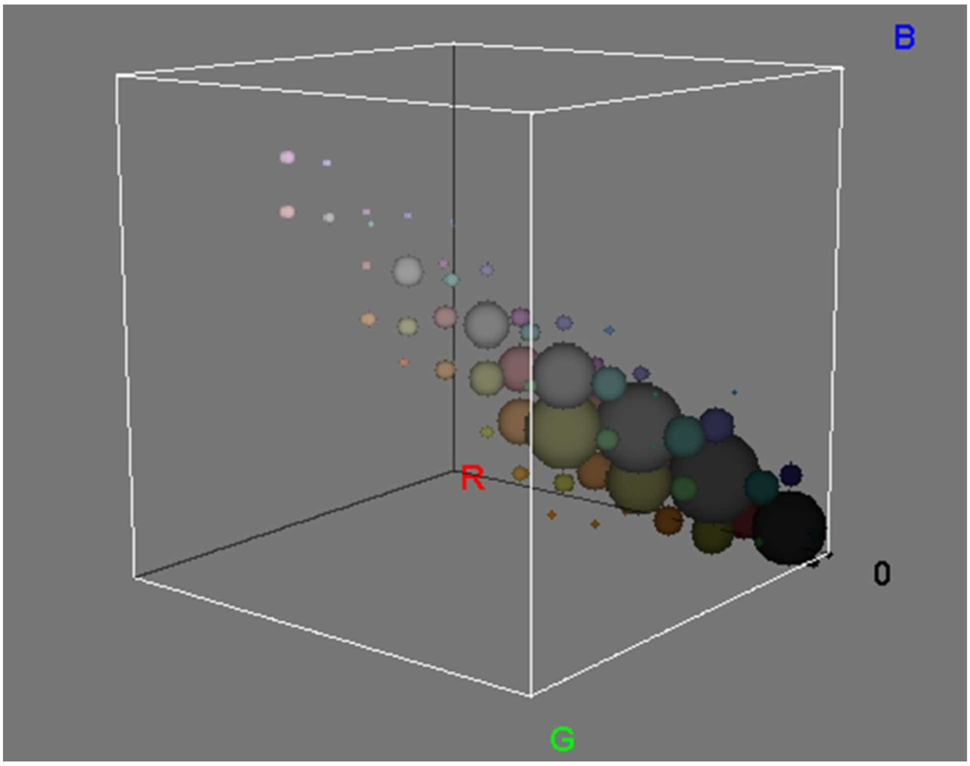


Figure 130. RGB-Space Color Distribution (view-2) - *Yazgı*

Heavy at black yet getting to white along the zero saturation axis

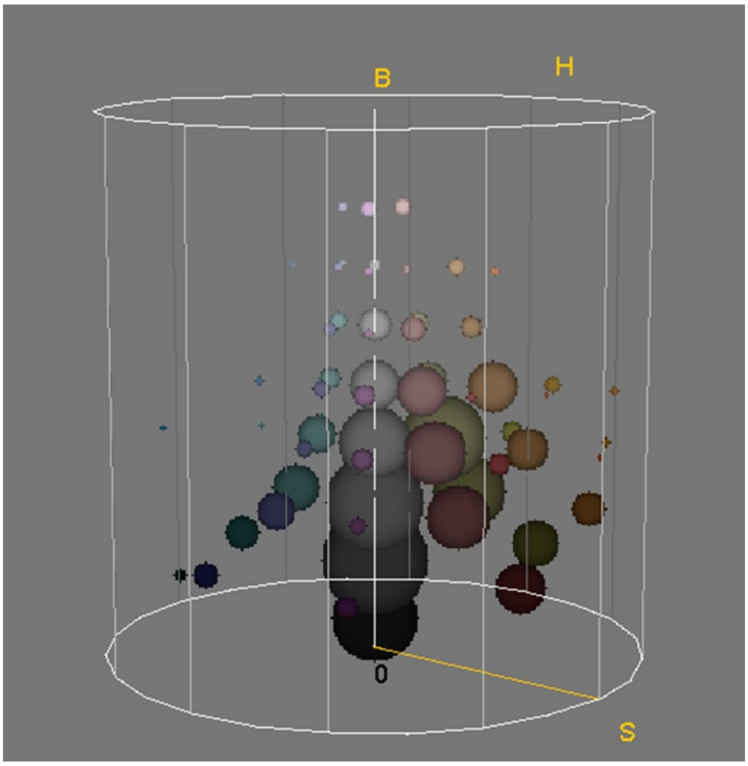


Figure 131. HSB-Space Color Distribution (view-1) - *Yazgı*

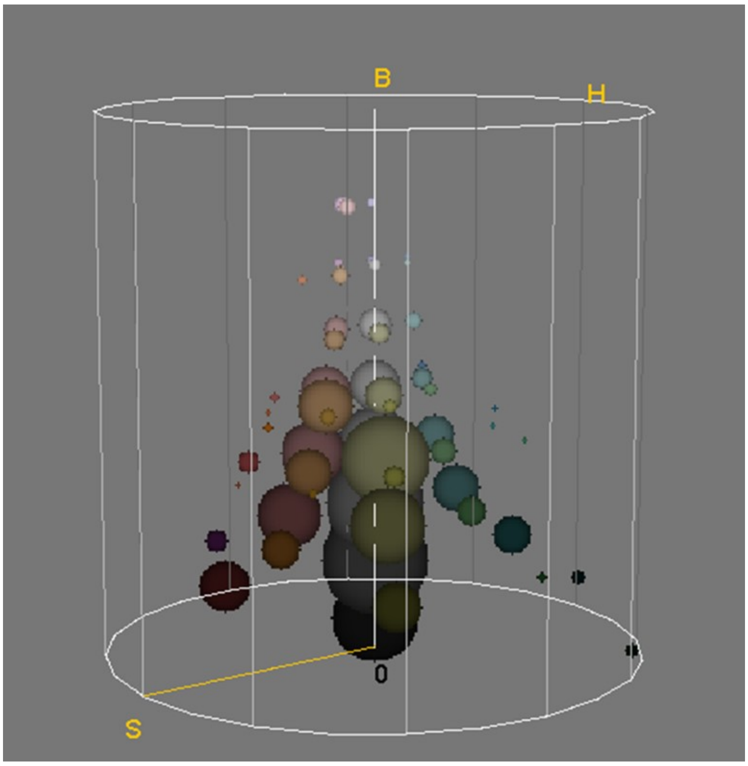


Figure 132. HSB-Space Color Distribution (view-2) - *Yazgı*

Shades with some tints

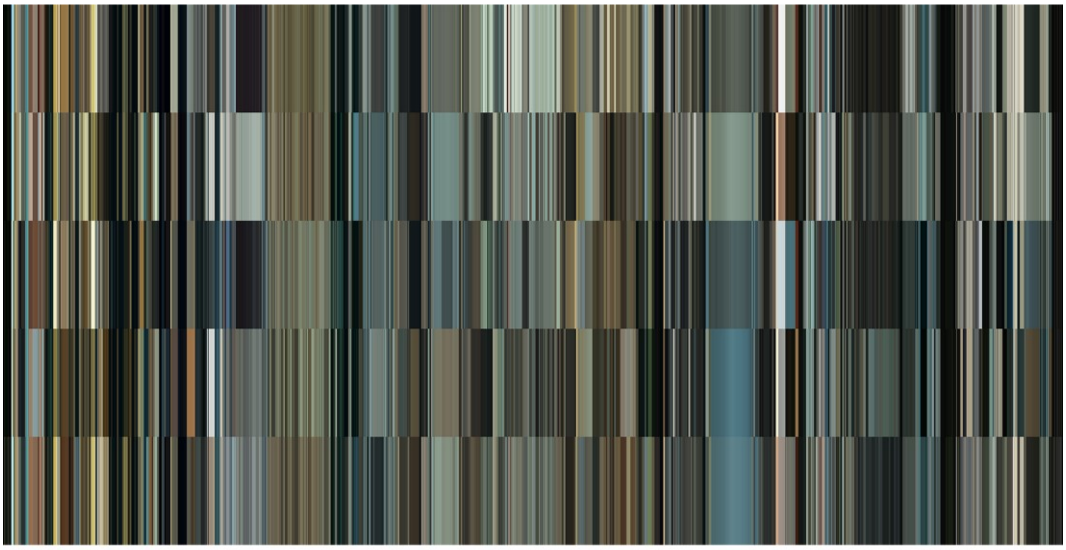
6.3.4 *İtiraf*

Ordering of frames from darkest to lightest in Fig.133 : UR,UL,CC,MF,LR,LL

Figure 133. Overall Equivalent Colors of Main and Sub-Frames
- *İtiraf*

Color distribution in Fig.134 : NPC=2, NCG=13, NAG=1

Figure 134. Color Palette
- *İtiraf*



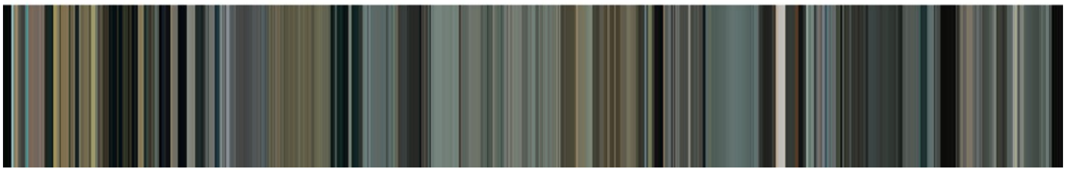


Figure 135. Equivalent Color Sequences of Main and Sub-Frames
- *İtiraf*

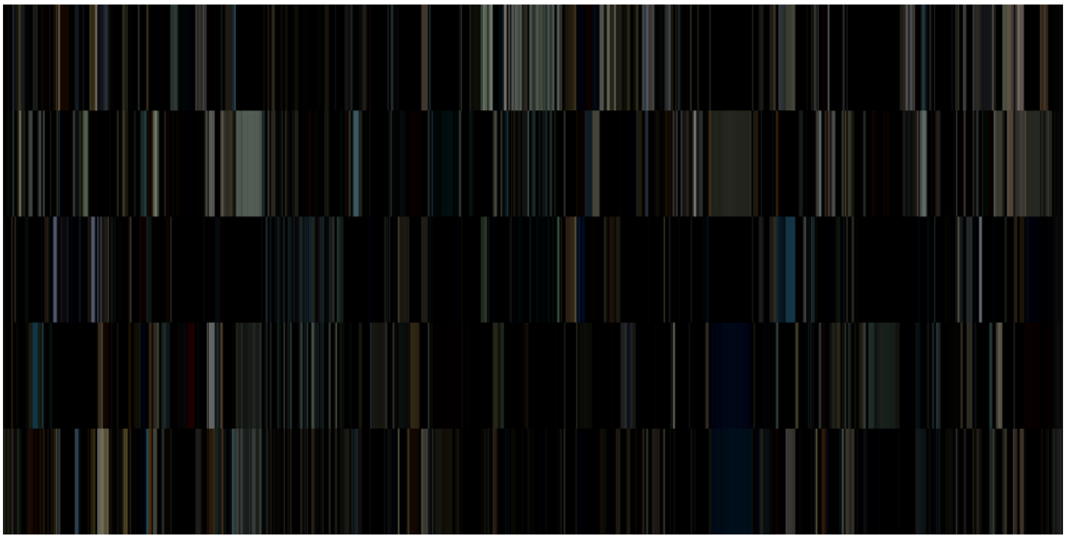


Figure 136. Difference Pattern for Color Sequences
- *İtiraf*

Ordering of the areas of emphasis (3 sub-frames) : UR,UL,CC

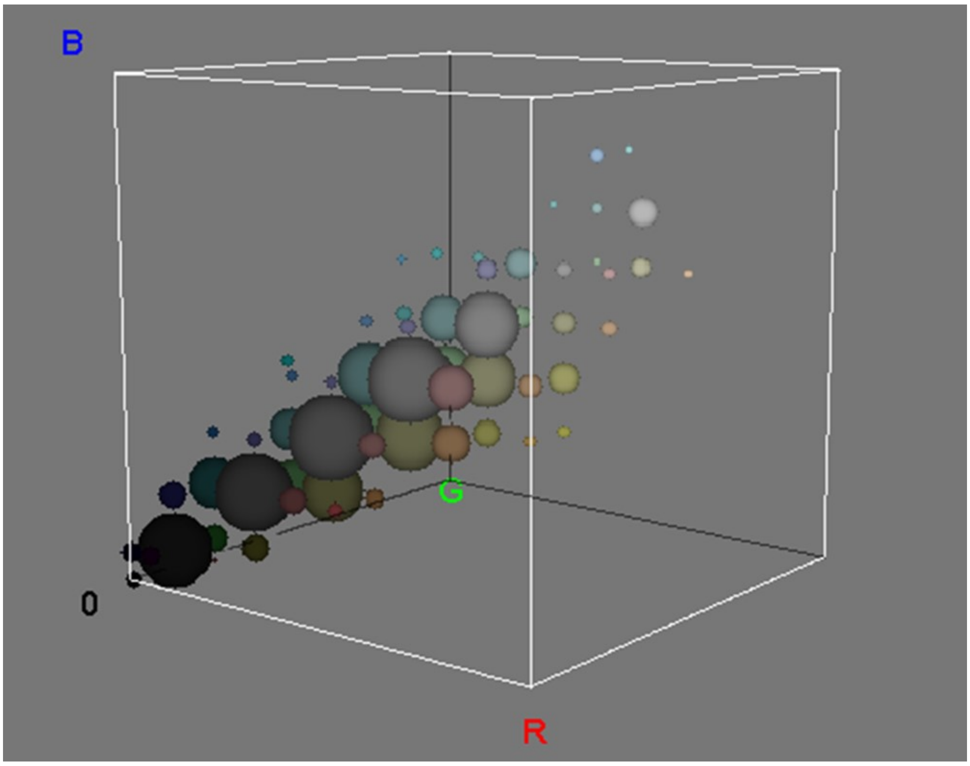


Figure 137. RGB-Space Color Distribution (view-1) - *İtiraf*

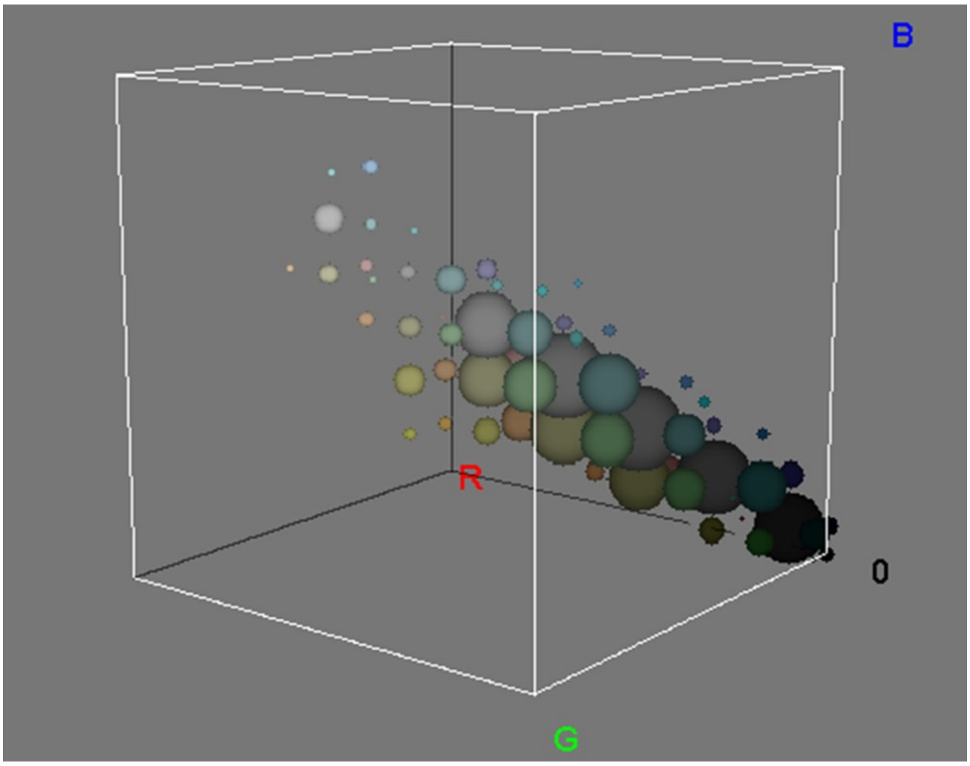


Figure 138. RGB-Space Color Distribution (view-2) - *İtiraf*

Well distributed along zero saturation axis

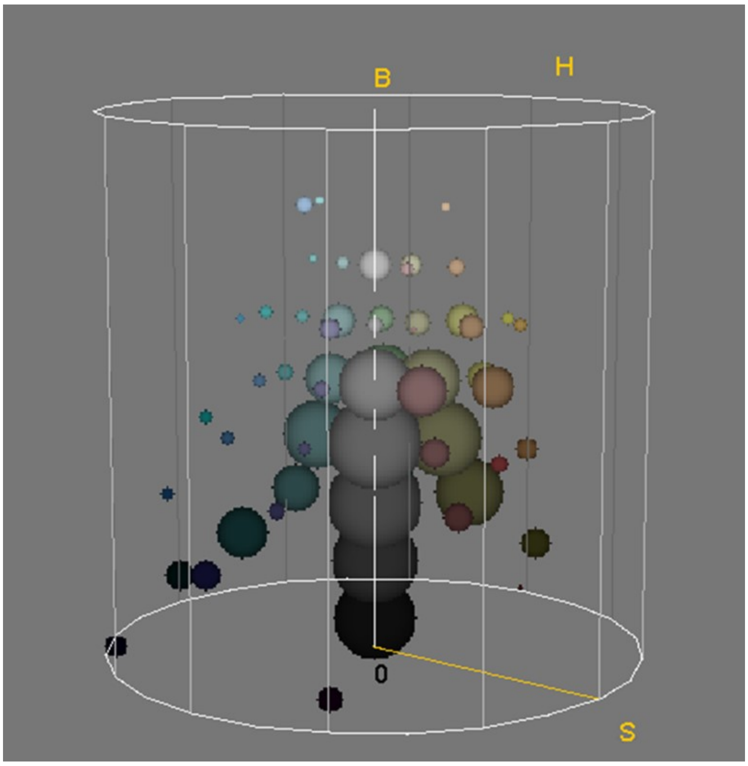


Figure 139. HSB-Space Color Distribution (view-1) - *İtiraf*

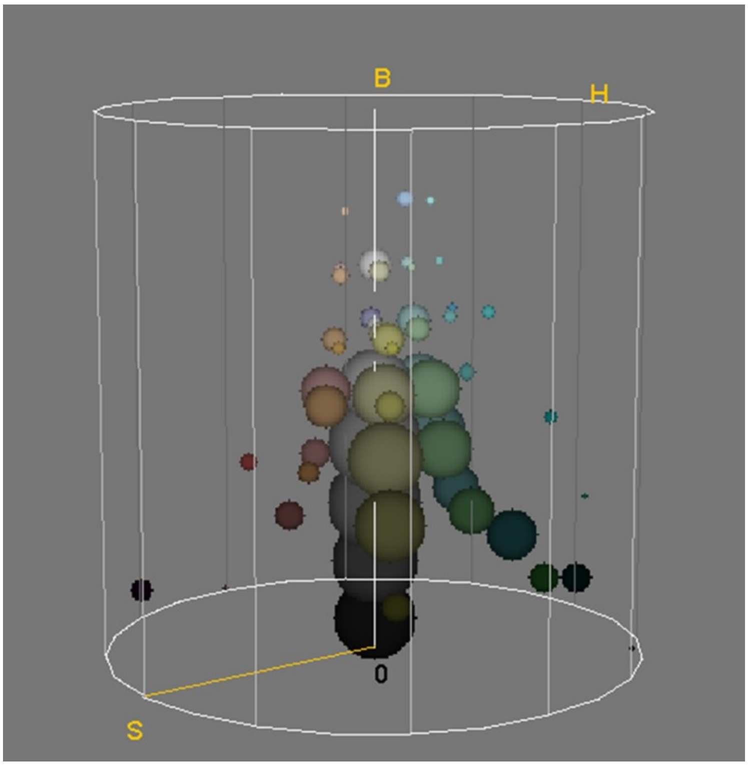


Figure 140. HSB-Space Color Distribution (view-2) - *İtiraf*

Shades and tints

6.3.5 *Bekleme Odası*

Ordering of frames from darkest to lightest in Fig.141 : UR,UL,CC,MF,LR,LL

Figure 141. Overall Equivalent Colors of Main and Sub-Frames
- *Bekleme Odası*

Color distribution in Fig.142 : NPC=3, NCG=12, NAG=1

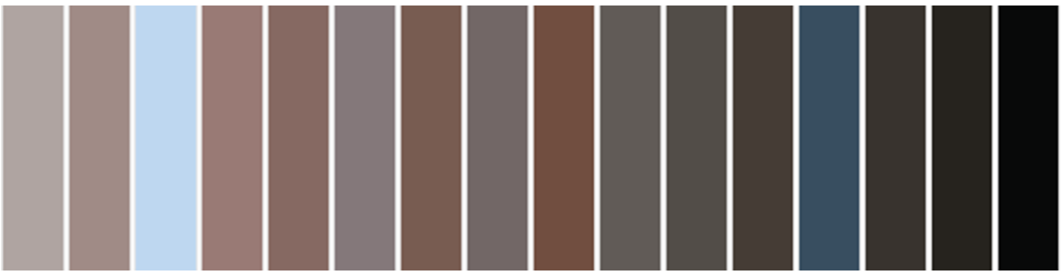


Figure 142. Color Palette
- *Bekleme Odası*

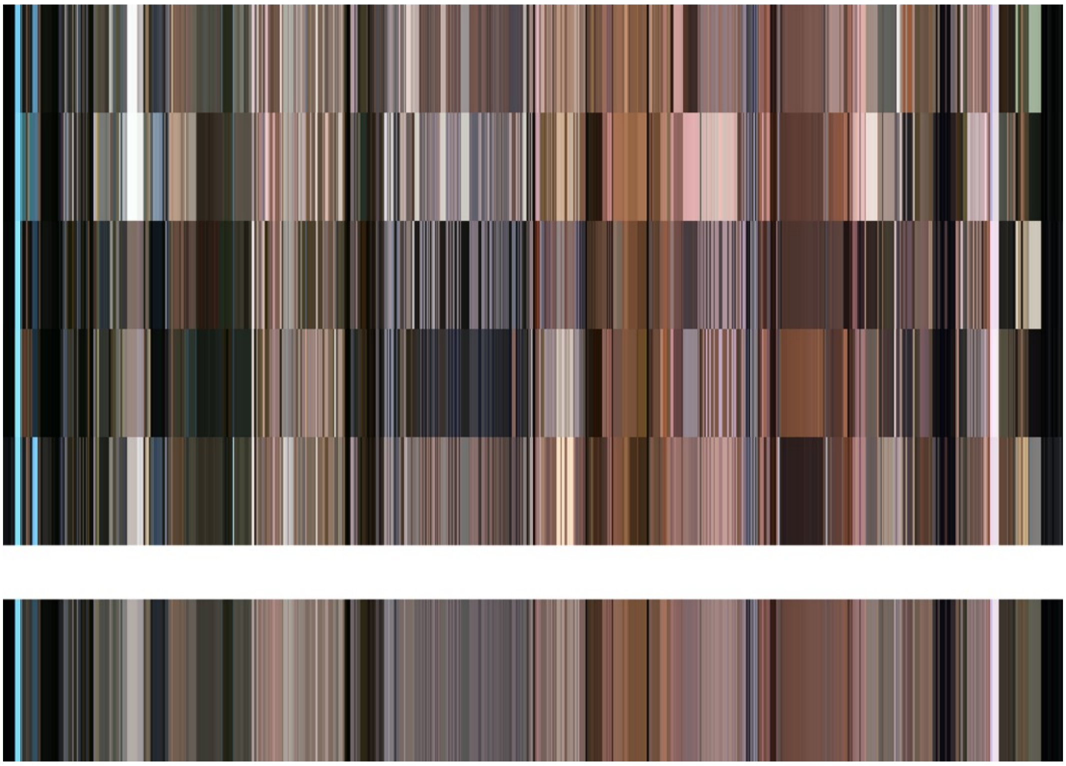


Figure 143. Equivalent Color Sequences of Main and Sub-Frames
- *Bekleme Odası*

Figure 144. Difference Pattern for Color Sequences
- *Bekleme Odası*

Ordering of the areas of emphasis (3 sub-frames) : UR,UL,CC

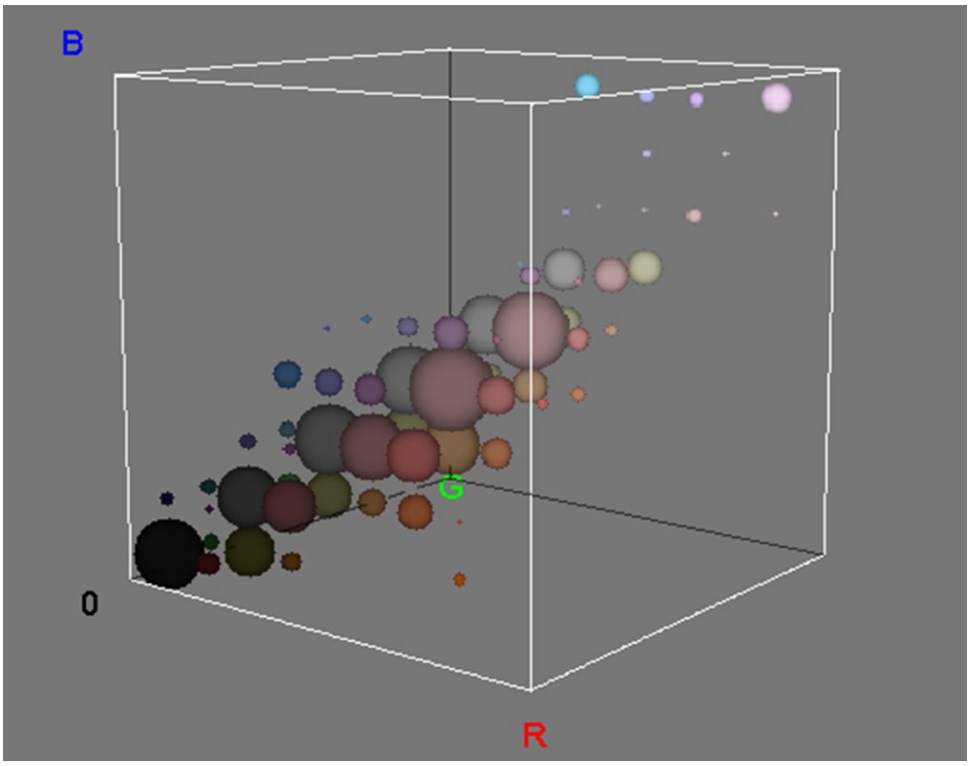


Figure 145. RGB-Space Color Distribution (view-1) - *Bekleme Odası*

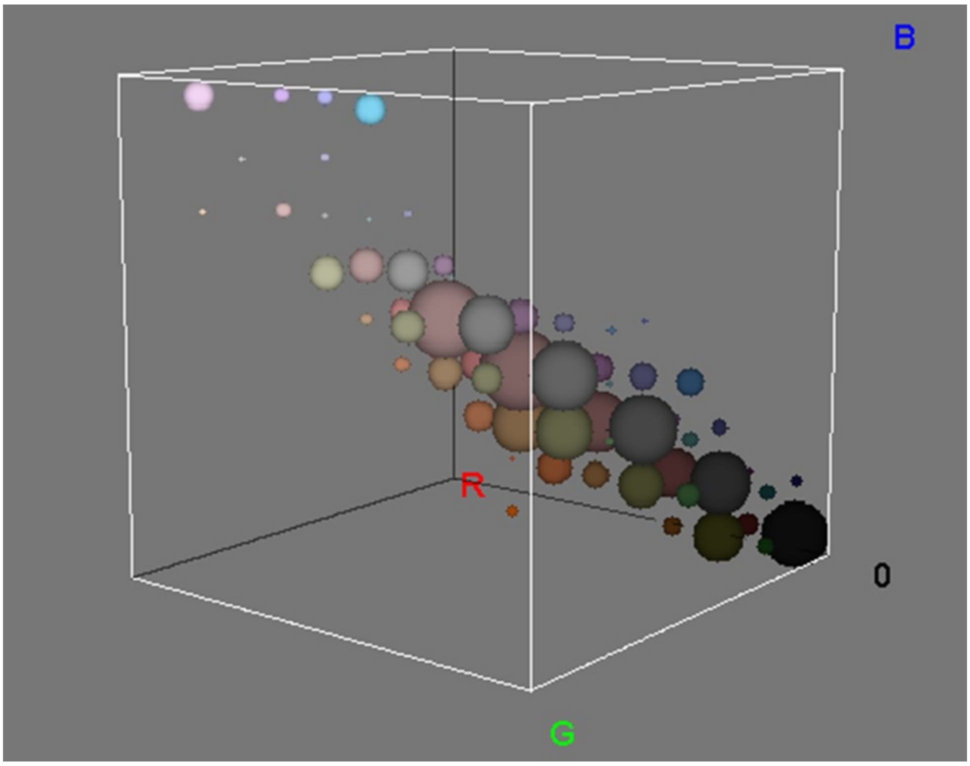


Figure 146. RGB-Space Color Distribution (view-2) - *Bekleme Odası*

Considerable presence near white, well distributed along zero saturation axis

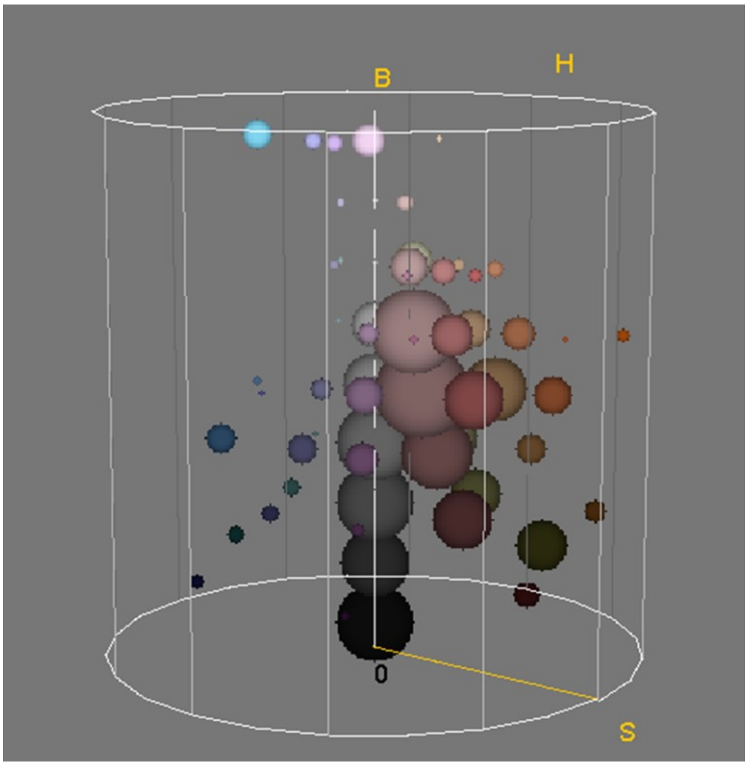


Figure 147. HSB-Space Color Distribution (view-1) - *Bekleme Odası*

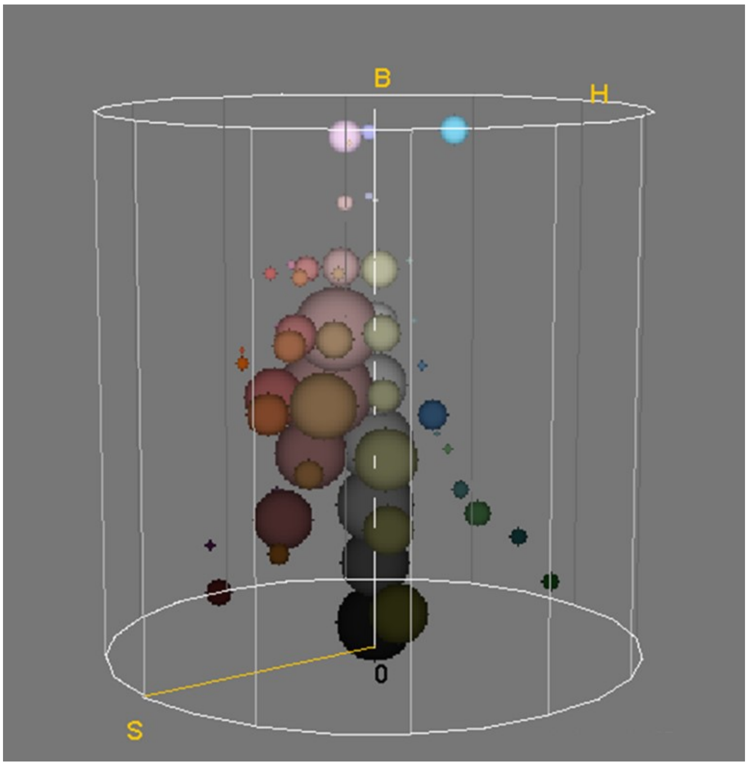


Figure 148. HSB-Space Color Distribution (view-2) - *Bekleme Odası*

Tints

6.3.6 *Kader*

Ordering of frames from darkest to lightest in Fig.149 : UL,UR,CC,MF,LL,LR

Figure 149. Overall Equivalent Colors of Main and Sub-Frames
- *Kader*

Color distribution in Fig.150: NPC=0, NCG=15, NAG=1

Figure 150. Color Palette
- *Kader*

Figure 151. Equivalent Color Sequences of Main and Sub-Frames
- *Kader*

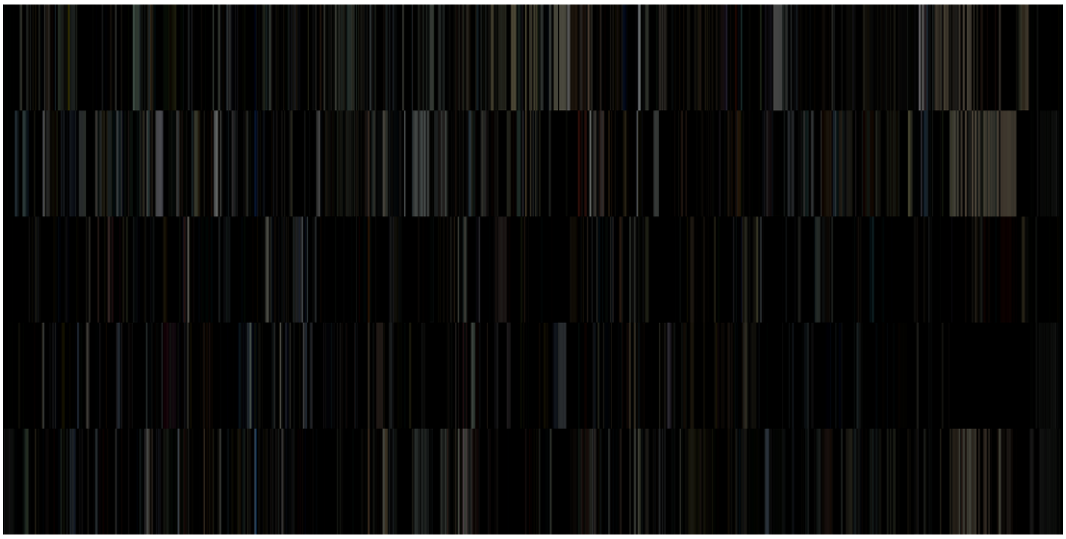


Figure 152. Difference Pattern for Color Sequences
- *Kader*

Ordering of the areas of emphasis (3 sub-frames) : UL,UR,CC

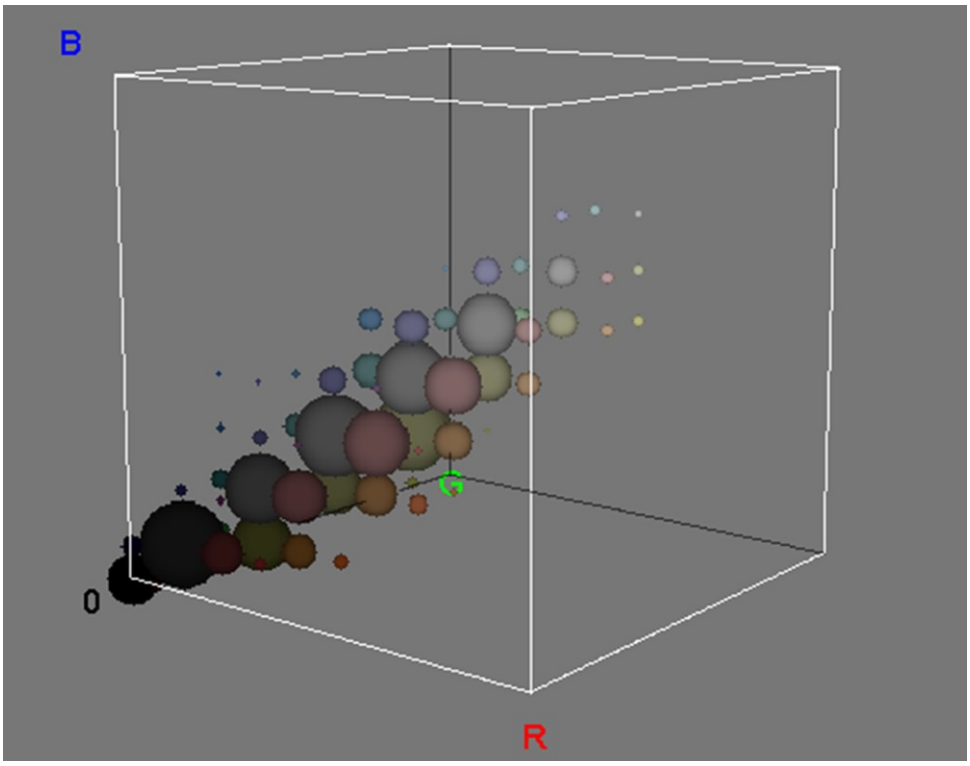


Figure 153. RGB-Space Color Distribution (view-1) - *Kader*

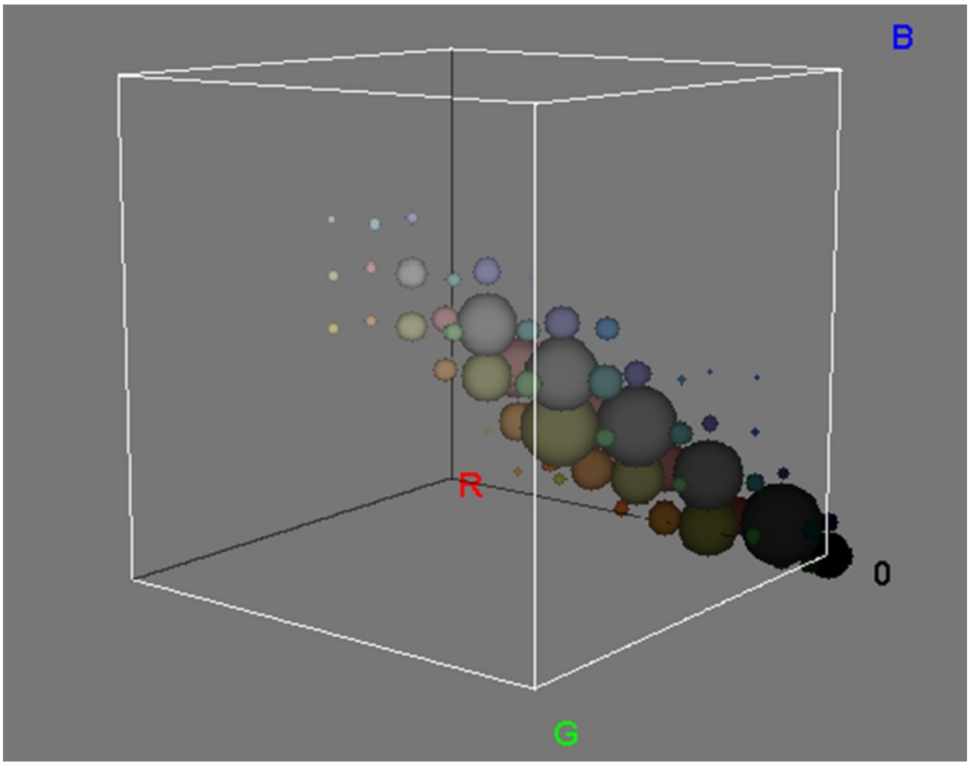


Figure 154. RGB-Space Color Distribution (view-2) - *Kader*

Very well distributed near the center of RGB space

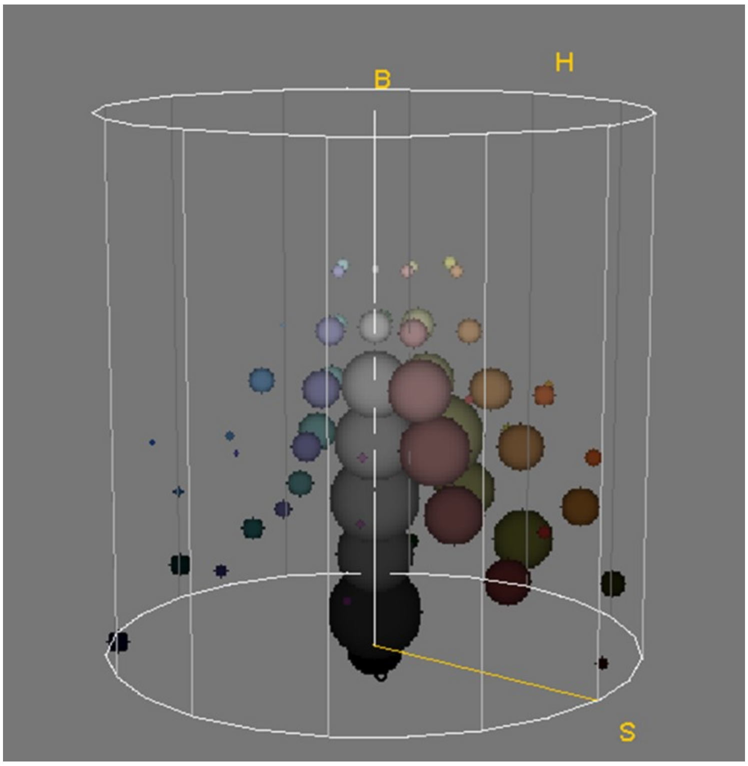


Figure 155. HSB-Space Color Distribution (view-1) - *Kader*

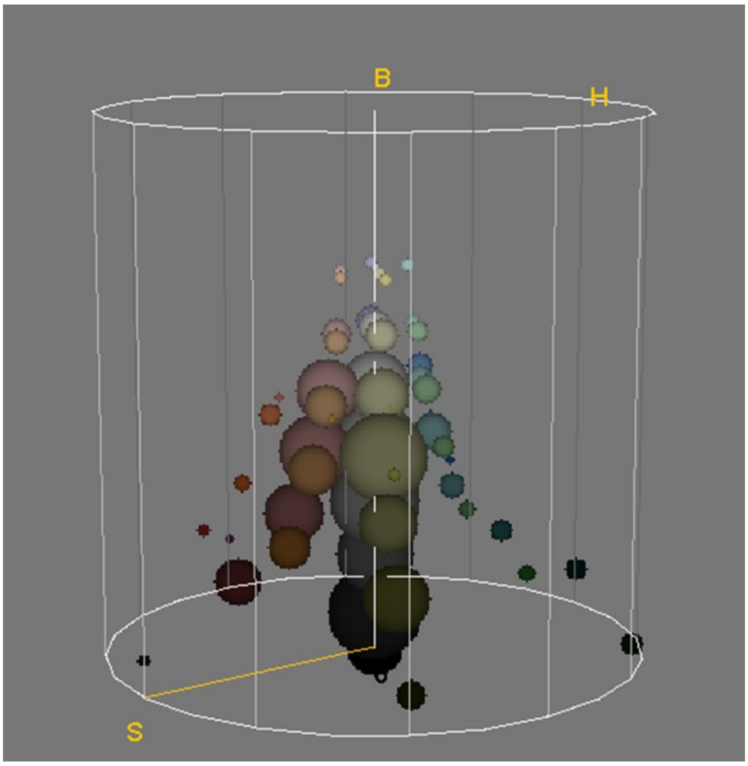


Figure 156. HSB-Space Color Distribution (view-2) - *Kader*

Equally shades and tints

6.3.7 *Kıskanmak*

Ordering of frames from darkest to lightest in Fig.157 : UR,UL,CC,MF,LL,LR

Figure 157. Overall Equivalent Colors of Main and Sub-Frames
- *Kıskanmak*

Color distribution in Fig.158 : NPC=1, NCG=12, NAG=3

Figure 158. Color Palette
- *Kıskanmak*

Figure 159. Equivalent Color Sequences of Main and Sub-Frames
- *Kıskanmak*

Figure 160. Difference Pattern for Color Sequences
- *Kıskanmak*

Ordering of the areas of emphasis (3 sub-frames) : UR,UL,LR

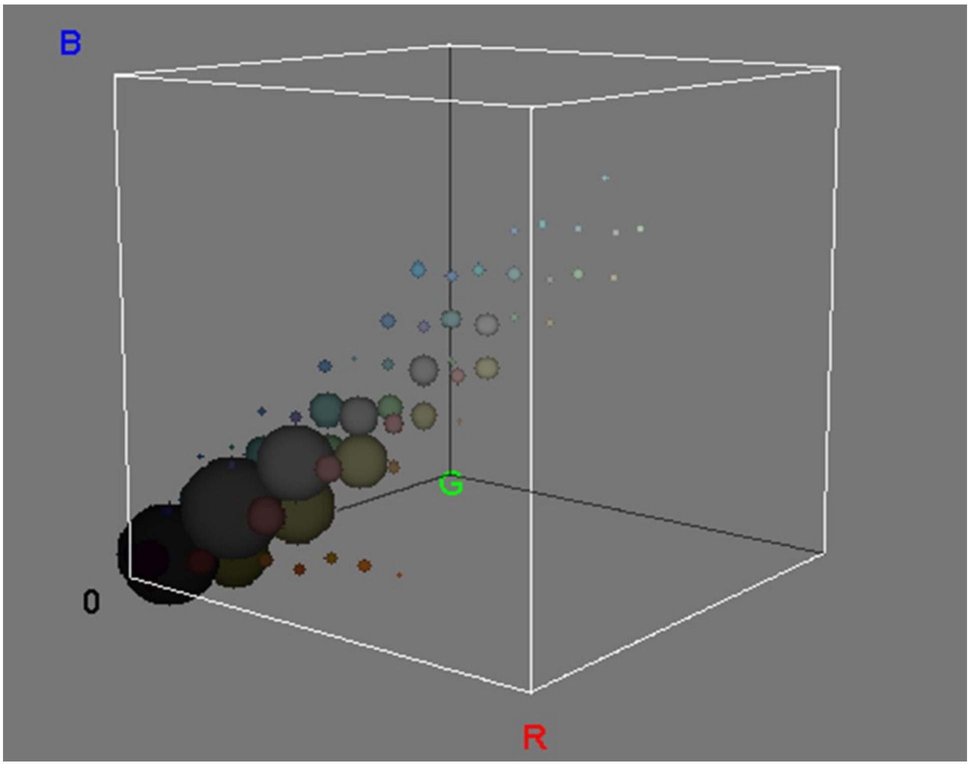


Figure 161. RGB-Space Color Distribution (view-1) - *Kıskanmak*

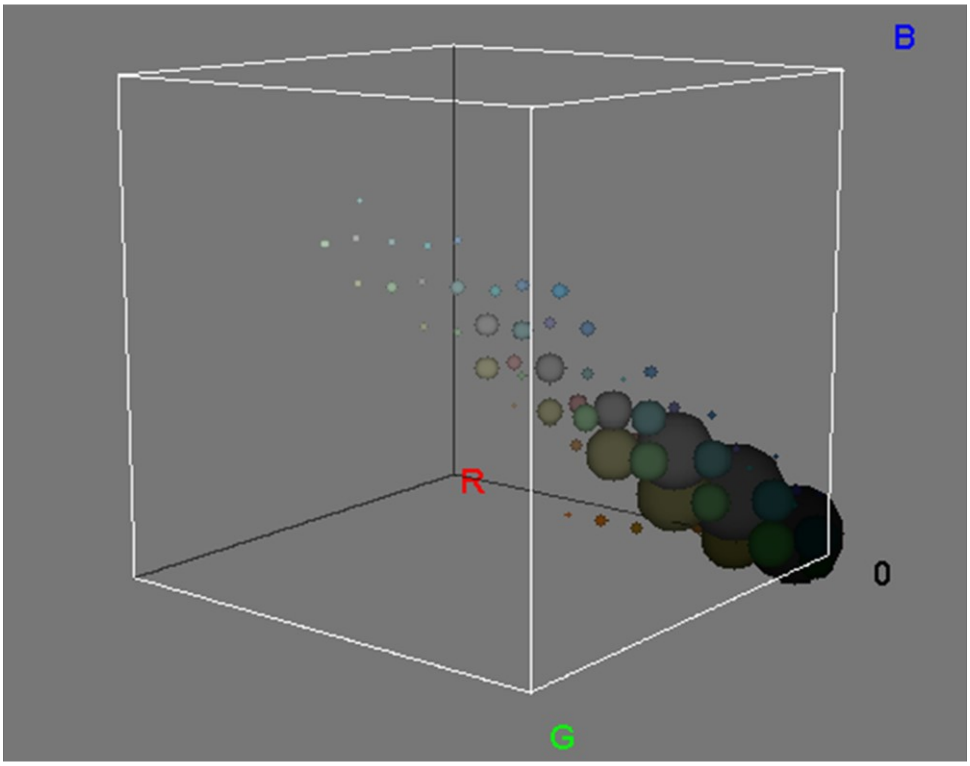


Figure 162. RGB-Space Color Distribution (view-2) - *Kıskanmak*

Heavy concentration around black with sparse bright colors

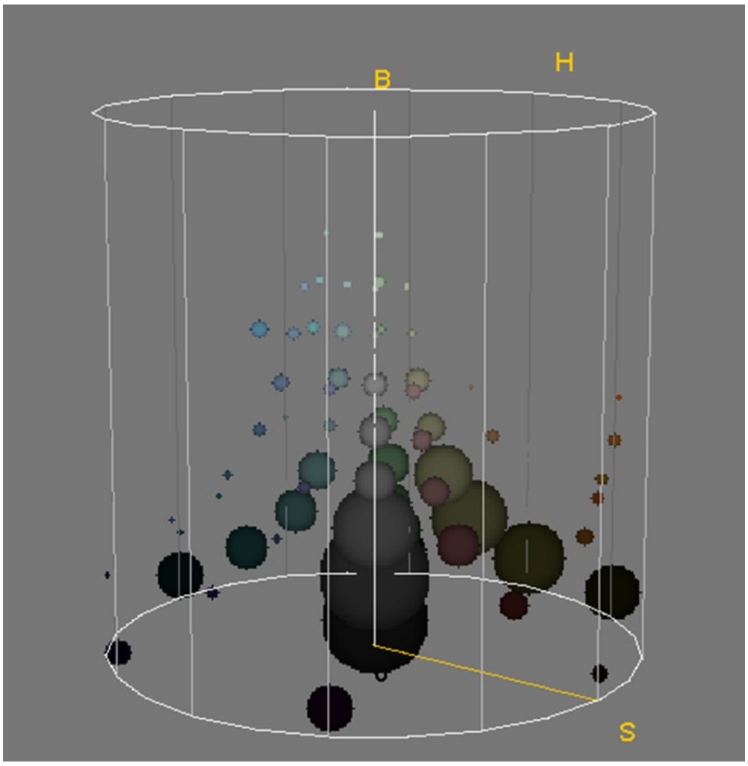


Figure 163. HSB-Space Color Distribution (view-1) - *Kıskanmak*

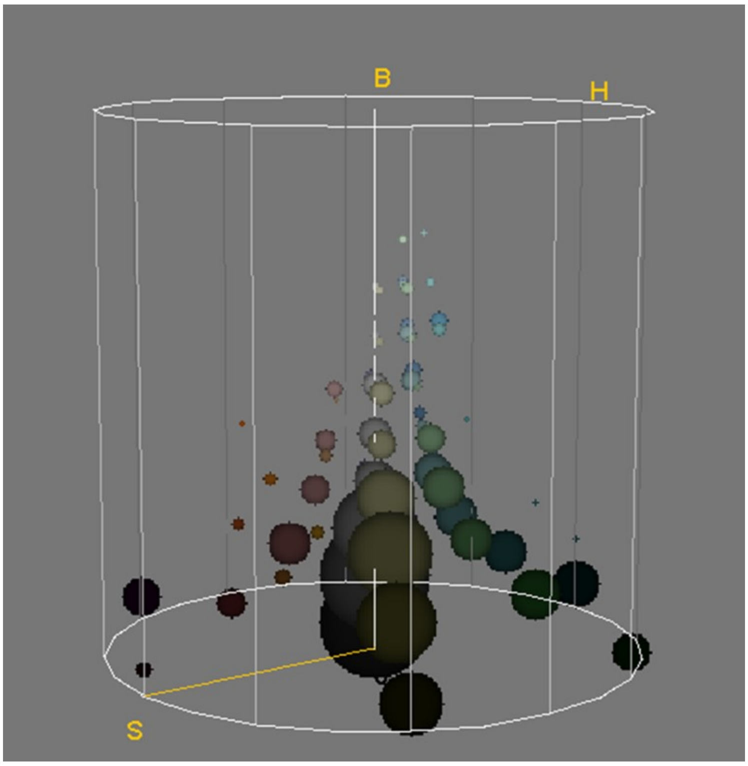


Figure 164. HSB-Space Color Distribution (view-2) - *Kıskanmak*

Shades with minimal tints

6.3.8 *Yeraltı*

Ordering of frames from darkest to lightest in Fig.165 : UR,CC,UL,MF,LL,LR

Figure 165. Overall Equivalent Colors of Main and Sub-Frames / Yeraltı
- *Yeraltı*

Color distribution in Fig.166 : NPC=1, NCG=14, NAG=1

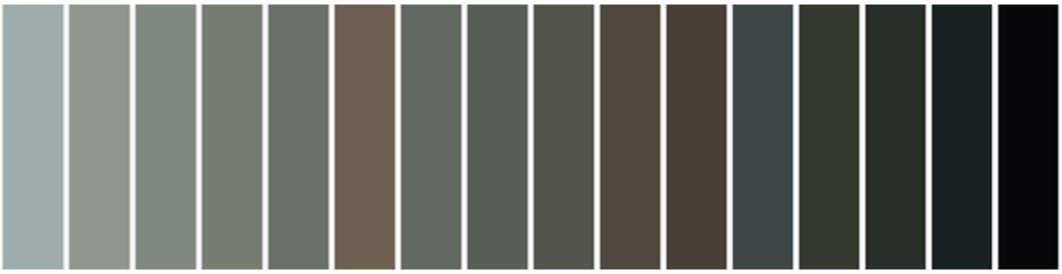


Figure 166. Color Palette
- *Yeraltı*

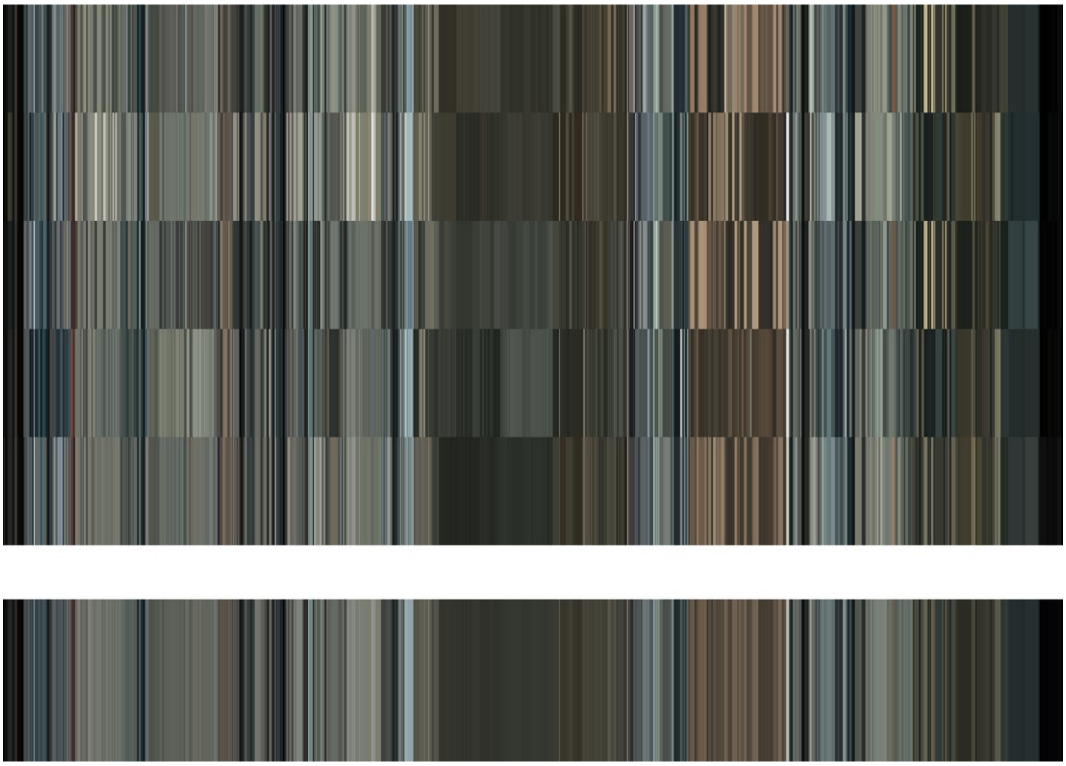


Figure 167. Equivalent Color Sequences of Main and Sub-Frames
- *Yeraltı*

Figure 168. Difference Pattern for Color Sequences
- *Yeraltı*

Ordering of the areas of emphasis (3 sub-frames) : UR,LR,CC

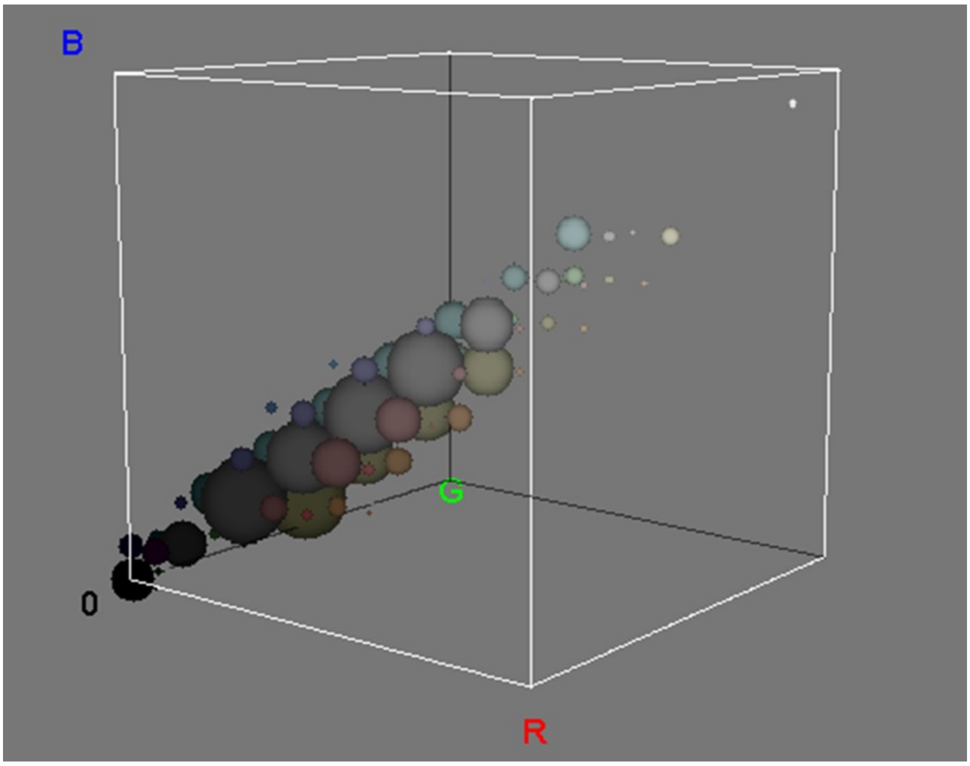


Figure 169. RGB-Space Color Distribution (view-1) - *Yeraltı*

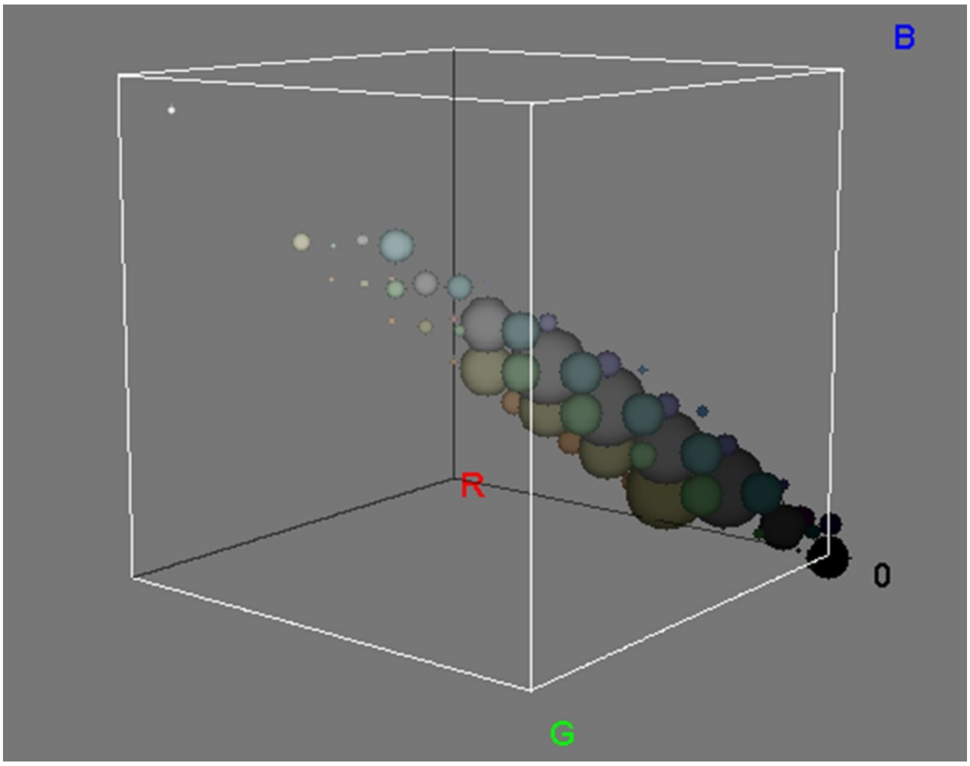


Figure 170. RGB-Space Color Distribution (view-2) - *Yeraltı*

Few around black, mainly concentrated at the center of the RGB space

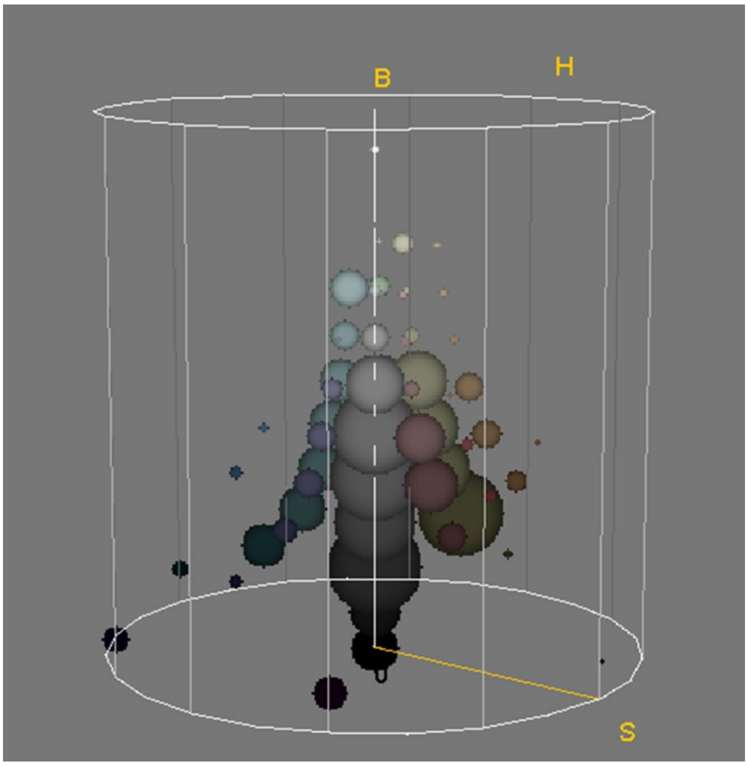


Figure 171. HSB-Space Color Distribution (view-1) - *Yeraltı*

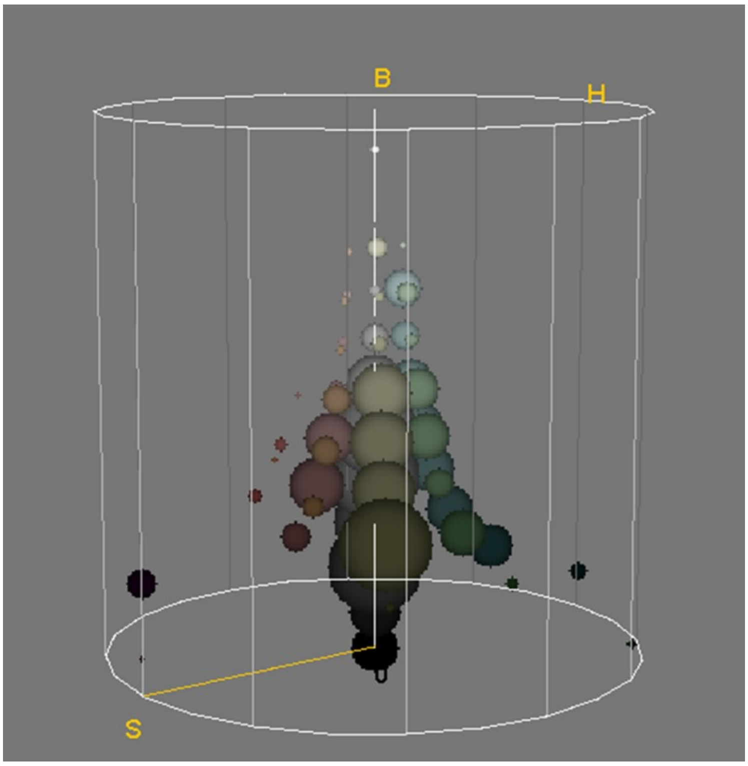


Figure 172. HSB-Space Color Distribution (view-2) - *Yeraltı*

Shades with some tints

CHAPTER 7

NUMERICAL ANALYSIS OF DIRECTORS

In this chapter, we will present the numerical analysis results of the films of the chosen directors. The main element to be used for the analysis will be the use of "histogram" feature of both ImageJ and Color Inspector 3D plugin of ImageJ (ImageJ). As explained before, histogram in a digital picture gives the number of pixels corresponding to a value of a color. In analysis, the histograms of R,G and B channels of the color strips of the films were taken besides the RGB histogram, which gives the overall value (lightness) of the frames. The histograms obtained by ImageJ and Color Inspector 3D have color ranges from 0 min. to 255 max. Thus, a value of zero indicates that lightness is zero (color is black), and a value of 255 indicates darkness is zero, which means that the color is white. For any color lightness (value) results in a spectrum of that specific color between black and white. Thus, all shades and tints of that color are discretized in a 255 interval range.

After the histograms, we will give the graphs corresponding to the contents of the histograms such that, mean values (average) and standard deviation values of the histograms can be evaluated.

In doing so, we will follow the same order of directors and their films as of in the previous chapter. At the end of the chapter, we will present the graphs corresponding to the comparative analysis of the three directors with respect to time.

Numerical analysis of the films of the directors quantizes the visual clues that can be obtained from the visual analysis. The same patterns of lightness and darkness are revealed in numerical terms as can be seen in the histograms. Also the overall lightness or darkness of the films can be obtained quantatively.

As can be seen from the histograms of the R,G and B channels, the maximum numbers of pixels at a given varies from color channel to color channel. This variance is also an indicator of the directors's use of color and should also be noted.

Another point to be remembered is the fact that, R,G,B channels may have any value between 0 and 255 to give a color in RGB. Thus the differences in the shapes visible in histogram graphs indicate a deviation from achromatic grays to chromatic grays and even into prismatic colors.

A high number of pixels in any value corresponding to lower pixel counts in other channels means the dominance of high pixel count color, which in turn means a recognizable hue which takes the color into prismatic color region of the color space.

7.1 FATİH AKIN

As can be seen in the following histograms of his films, Fatih Akın uses more prismatic colors compared to other directors besides the fact that he also uses more number of different colors. Thus the difference in the shape of the R,G and B channel histograms are evident.

With respect to RGB histograms, his preference of using colors having both dark and light colors is evident as can be seen in Figures obeying the formula:

Fig.176+4n, where n=0,1,2,3,4,5,6

His use of Green channel is also evident from:

Fig.174+4n, where n=0,1,2,3,4,5,6

Another important property of his color preference is the multiple peaks occuring in all of the histograms belonging to his films as can be seen in Figures obeying the formula:

Fig.173+4n, where n=0,1,2,3,4,5,6
Fig.174+4n, where n=0,1,2,3,4,5,6
Fig.175+4n, where n=0,1,2,3,4,5,6
Fig.176+4n, where n=0,1,2,3,4,5,6

7.1.1 *Kurz und Schmerzlos*

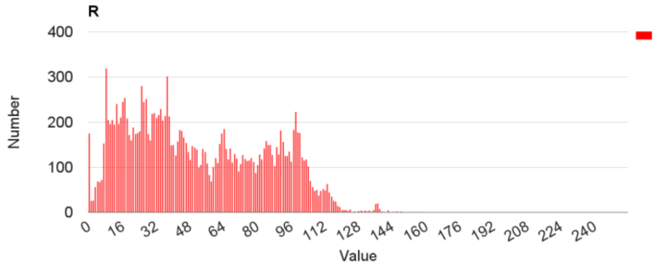


Figure 173. Histogram of R channel - *Kurz und Schmerzlos*

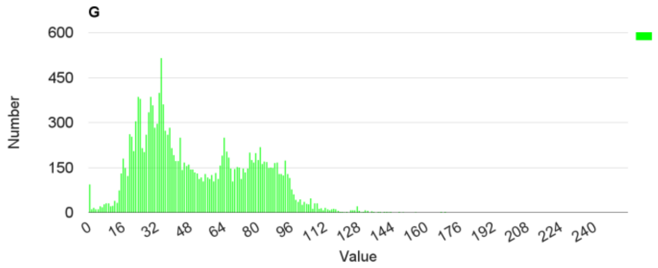


Figure 174. Histogram of G channel - *Kurz und Schmerzlos*

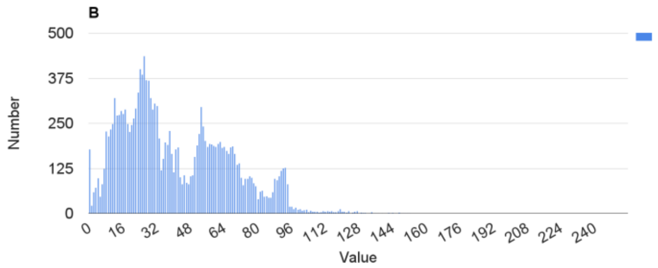


Figure 175. Histogram of B channel - *Kurz und Schmerzlos*

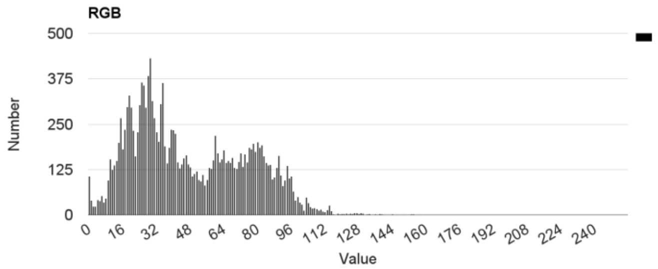


Figure 176. Histogram of RGB - *Kurz und Schmerzlos*

7.1.2 *Im Juli*

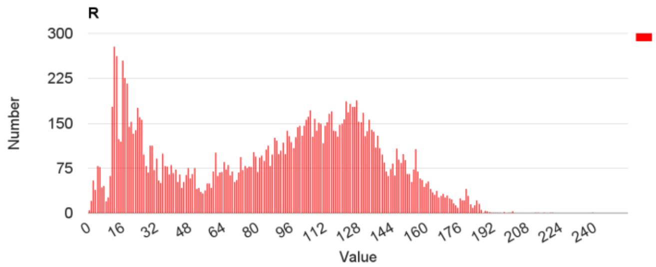


Figure 177. Histogram of R channel - *Im Juli*

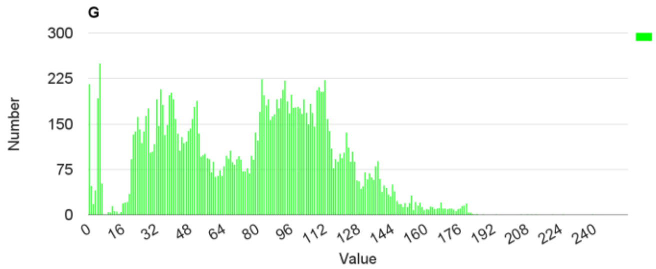


Figure 178. Histogram of G channel - *Im Juli*

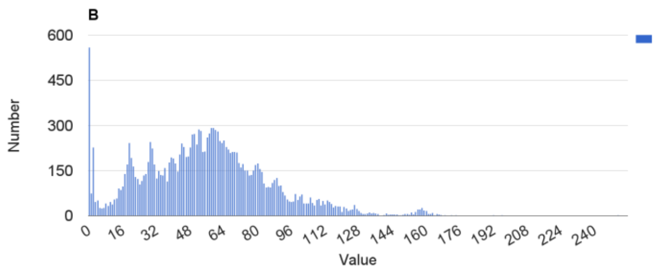


Figure 179. Histogram of B channel - *Im Juli*

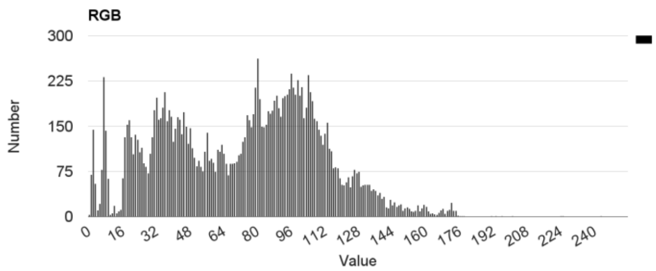


Figure 180. Histogram of RGB - *Im Juli*

7.1.3 *Solino*

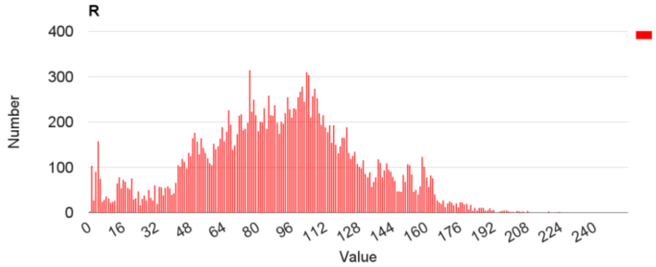


Figure 181. Histogram of R channel - *Solino*

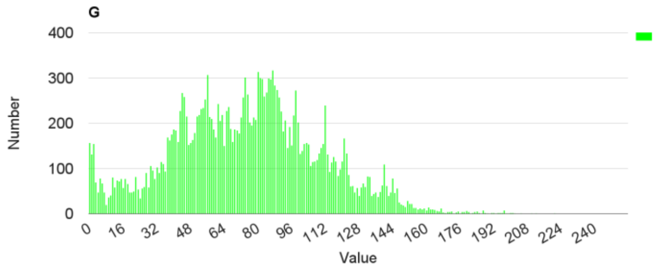


Figure 182. Histogram of B channel - *Solino*

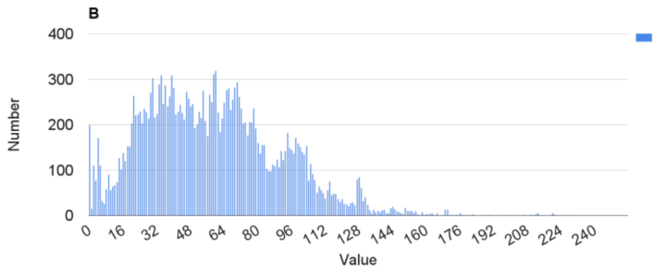


Figure 183. Histogram of B channel - *Solino*

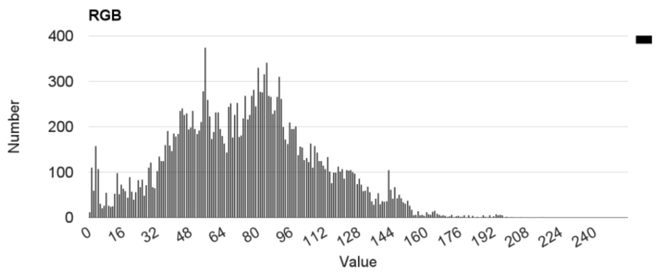


Figure 184. Histogram of RGB - *Solino*

7.1.4 *Gegen die Wand*

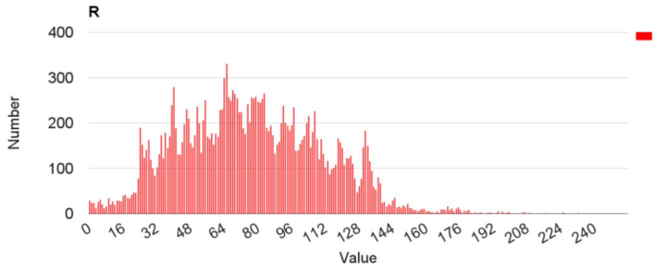


Figure 185. Histogram of R channel - *Gegen die Wand*

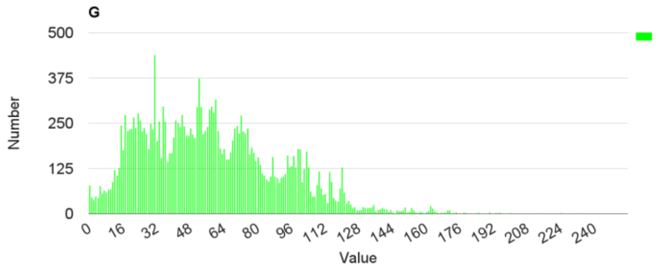


Figure 186. Histogram of G channel - *Gegen die Wand*

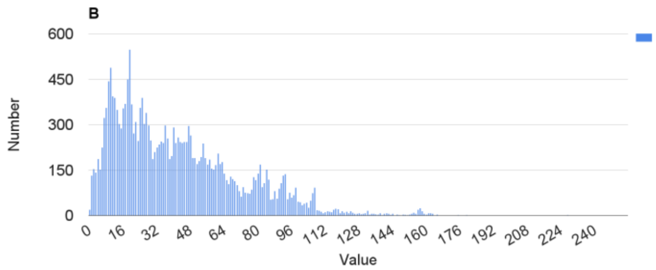


Figure 187. Histogram of B channel - *Gegen die Wand*

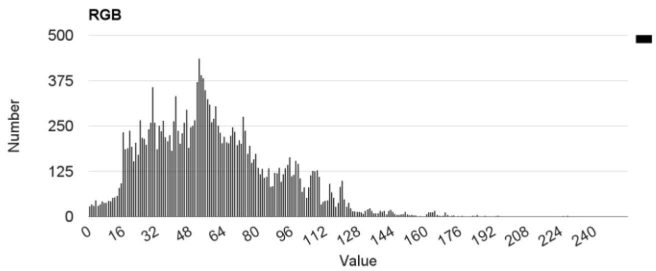


Figure 188. Histogram of RGB - *Gegen die Wand*

7.1.5 *Crossing the Bridge*

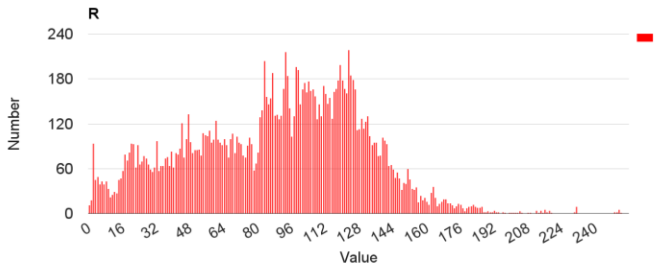


Figure 189. Histogram of R channel - *Crossing the Bridge*

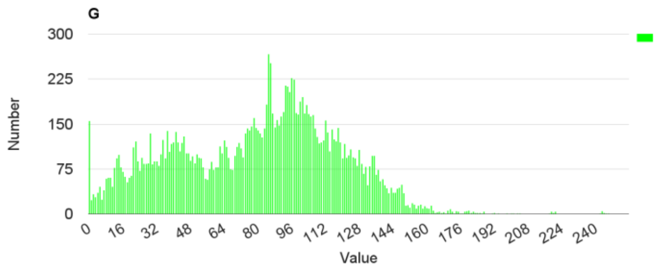


Figure 190. Histogram of G channel - *Crossing the Bridge*

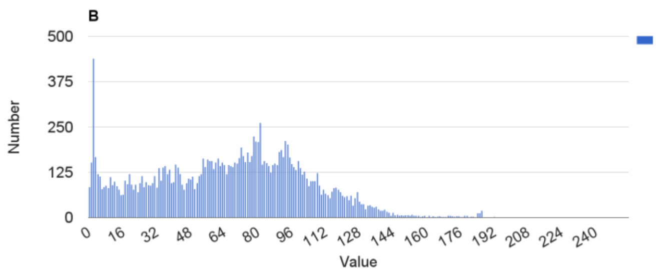


Figure 191. Histogram of B channel - *Crossing the Bridge*

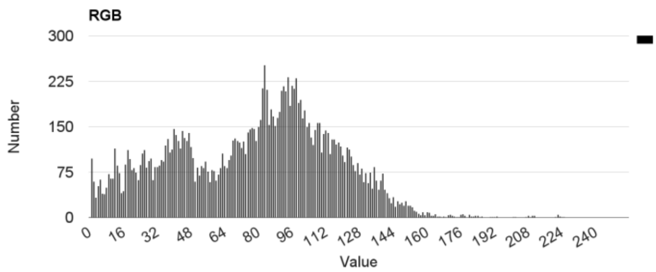


Figure 192. Histogram of RGB - *Crossing the Bridge*

5.3.6 *Auf der Anderen Seite*

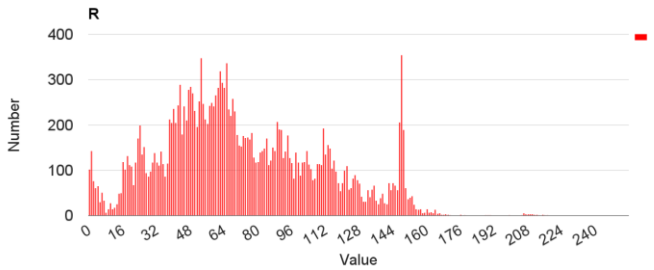


Figure 193. Histogram of R channel - *Auf der Anderen Seite*

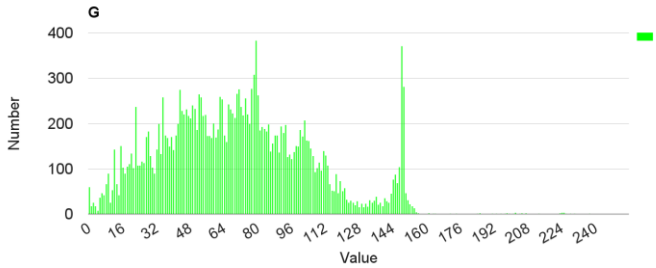


Figure 194. Histogram of G channel - *Auf der Anderen Seite*

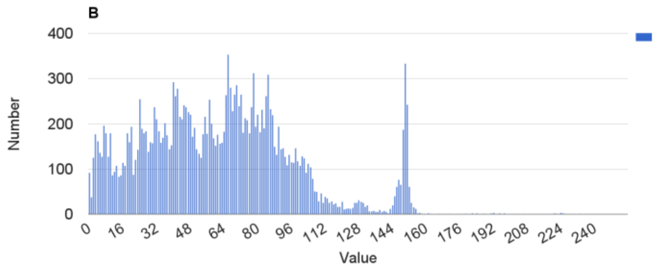


Figure 195. Histogram of B channel - *Auf der Anderen Seite*

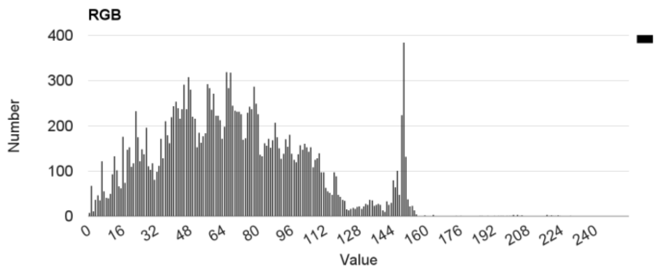


Figure 196. Histogram of RGB - *Auf der Anderen Seite*

7.1.7 *Soul Kitchen*

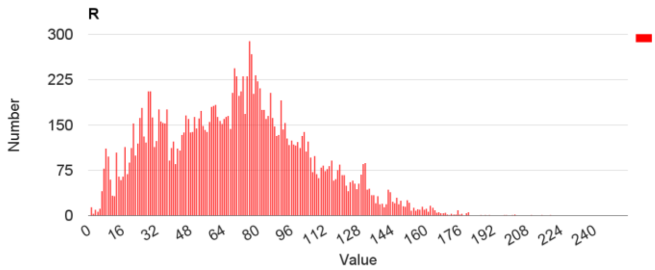


Figure 197. Histogram of R channel - *Soul Kitchen*

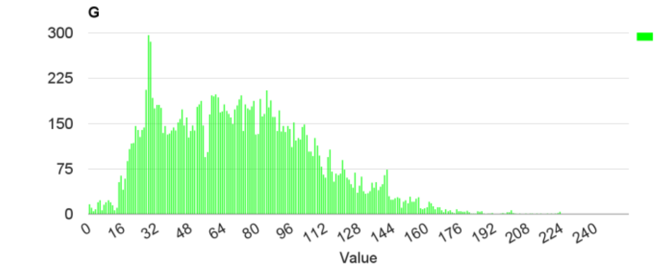


Figure 198. Histogram of G channel - *Soul Kitchen*

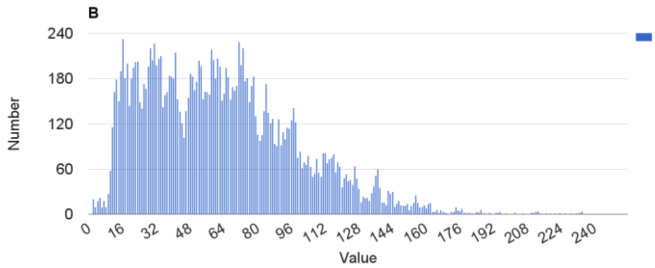


Figure 199. Histogram of B channel - *Soul Kitchen*

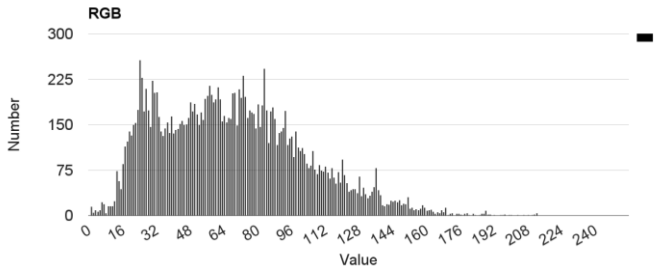


Figure 200. Histogram of RGB - *Soul Kitchen*

7.2 NURİ BİLGE CEYLAN

As can be seen in the following histograms of his films, Nuri Bilge Ceylan mainly uses less prismatic colors compared to other directors besides the fact that he also uses more chromatic and achromatic grays. Thus the similarities in the shape of the R,G and B channel histograms are evident.

With respect to RGB histograms, his preference of using colors on the dark side is evident as can be seen in Figures obeying the formula:

Fig.204+4n, where n=0,1,2,3,4

His use of Red channel is also evident from:

Fig.201+4n, where n=0,1,2,3,4

Another important property of his color preference is the multiple peaks occuring in all of the histograms belonging to his films as can be seen in Figures obeying the formula:

Fig.201+4n, where n=0,1,2,3,4
Fig.202+4n, where n=0,1,2,3,4
Fig.203+4n, where n=0,1,2,3,4
Fig.204+4n, where n=0,1,2,3,4

7.2.1 *Mayıs Sıkıntısı*

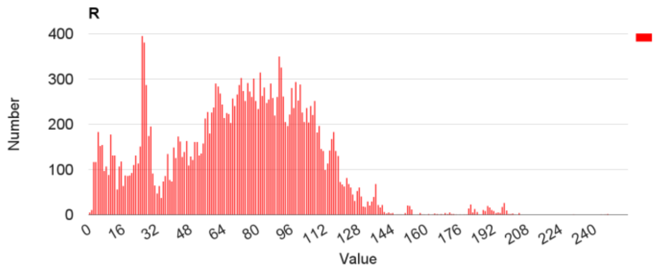


Figure 201. Histogram of R channel - *Mayıs Sıkıntısı*

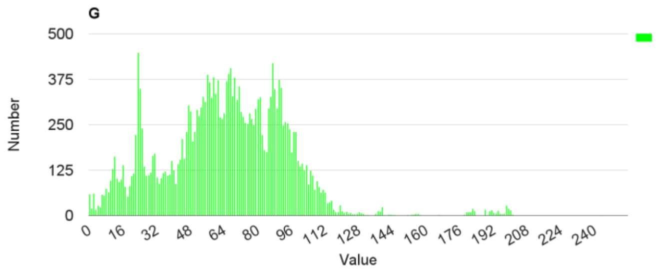


Figure 202. Histogram of G channel - *Mayıs Sıkıntısı*

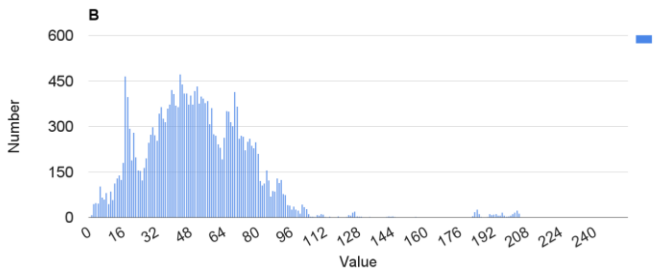


Figure 203. Histogram of B channel - *Mayıs Sıkıntısı*

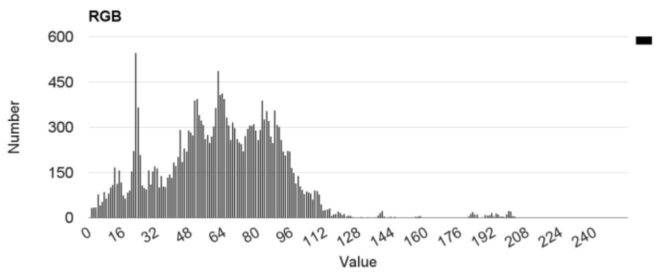


Figure 204. Histogram of RGB - *Mayıs Sıkıntısı*

7.2.2 *Uzak*

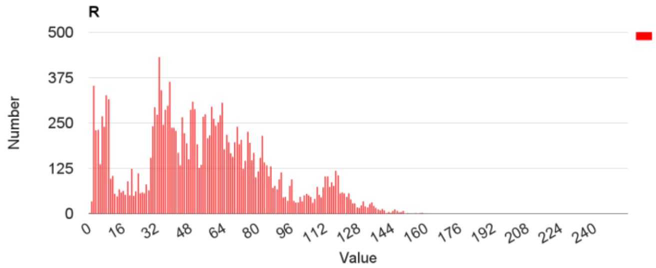


Figure 205. Histogram of R channel - *Uzak*

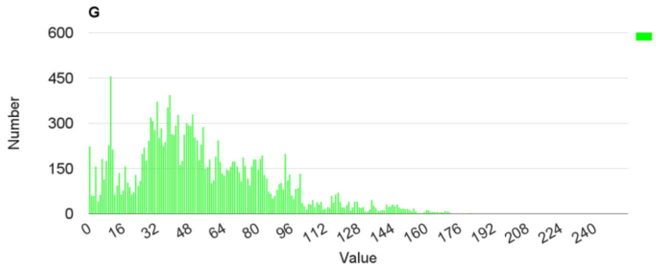


Figure 206. Histogram of G channel - *Uzak*

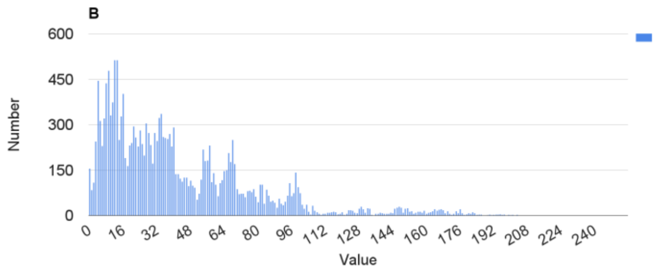


Figure 207. Histogram of B channel - *Uzak*

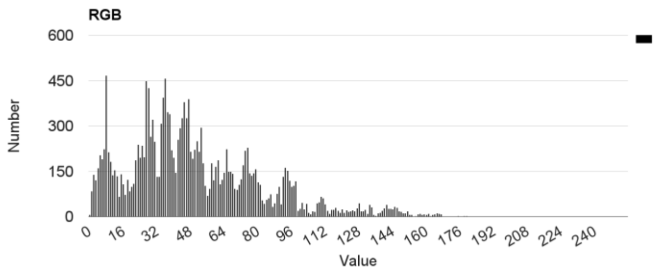


Figure 208. Histogram of RGB - *Uzak*

7.2.3 İklimler

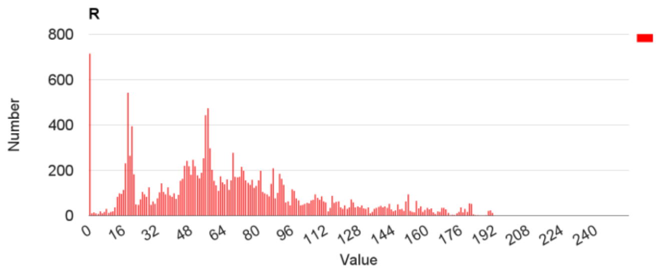


Figure 209. Histogram of R channel - *İklimler*

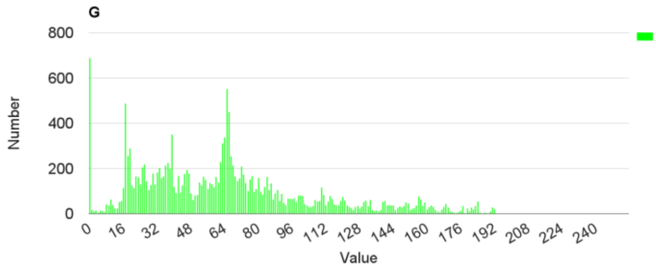


Figure 210. Histogram of G channel - *İklimler*

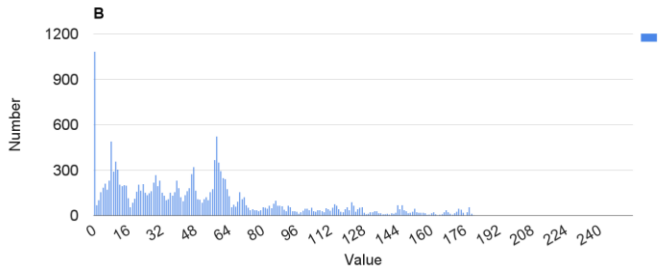


Figure 211. Histogram of B channel - *İklimler*

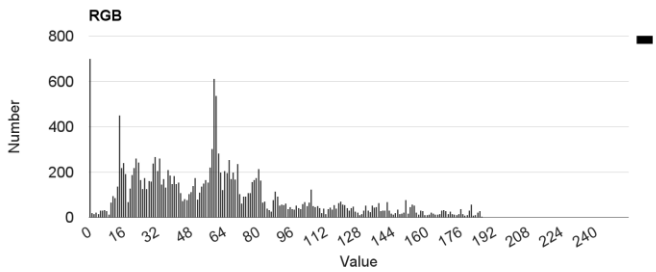


Figure 212. Histogram of RGB - *İklimler*

7.2.4 *Üç Maymun*

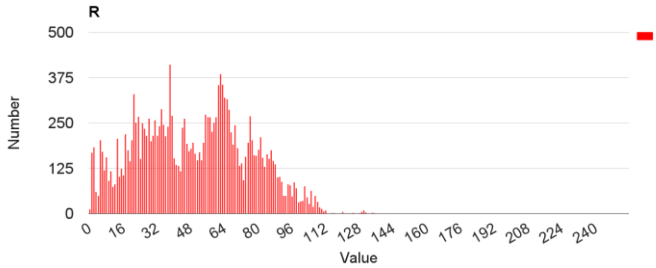


Figure 213. Histogram of R channel - *Üç Maymun*

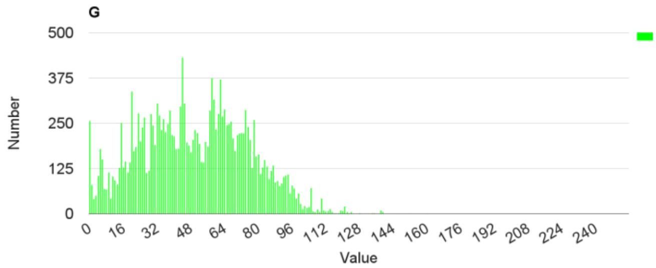


Figure 214. Histogram of G channel - *Üç Maymun*

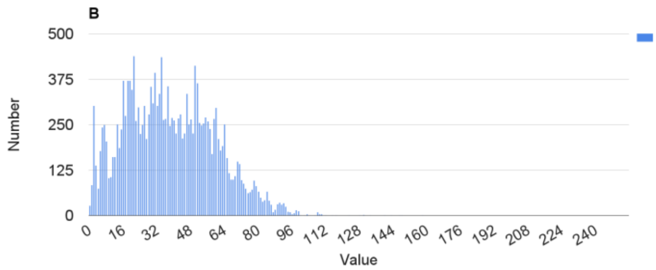


Figure 215. Histogram of B channel - *Üç Maymun*

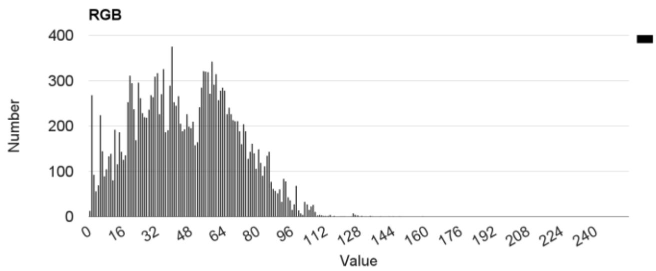


Figure 216. Histogram of RGB - *Üç Maymun*

7.2.5 *Bir Zamanlar Anadolu'da*

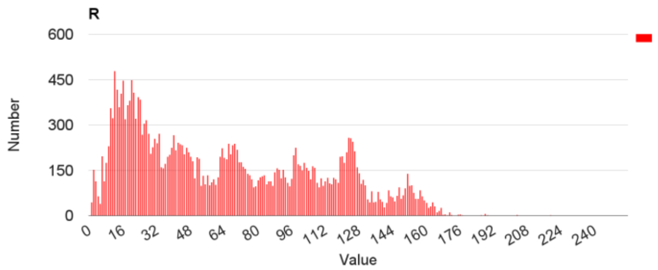


Figure 217. Histogram of R channel - *Bir Zamanlar Anadolu'da*

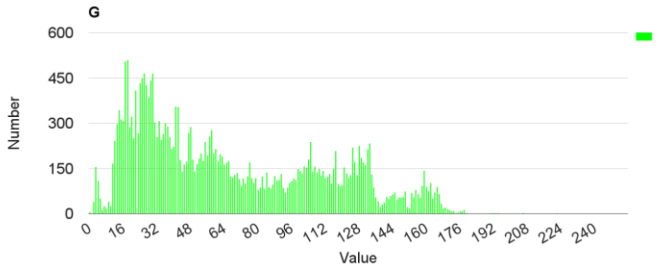


Figure 218. Histogram of G channel - *Bir Zamanlar Anadolu'da*

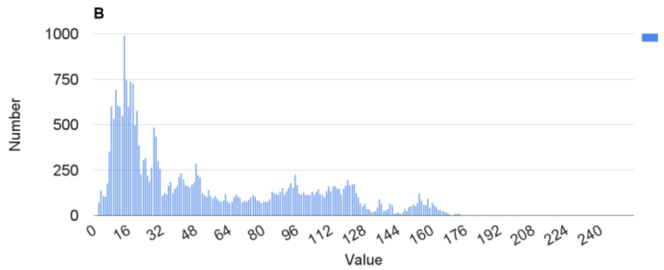


Figure 219. Histogram of B channel - *Bir Zamanlar Anadolu'da*

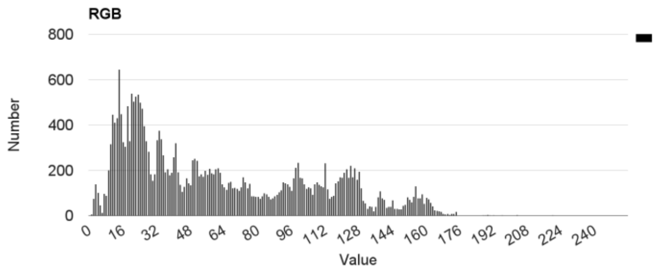


Figure 220. Histogram of RGB - *Bir Zamanlar Anadolu'da*

7.3 ZEKİ DEMİRKUBUZ

As can be seen in the following histograms of his films, Zeki Demirkubuz uses less prismatic colors compared to Fatih Akın besides the fact that he also uses less number of different colors almost most of them being chromatic grays and some achromatic grays. Thus the similarities in the shape of the R,G and B channel histograms are evident.

With respect to RGB histograms, his preference of using colors closer to darkness is evident besides that, light colors are rarely used. This is evident as can be seen in Figures obeying the formula:

Fig.224+4n, where n=0,1,2,3,4,5,6,7

Another important property of his color preference is that the histograms are almost lumped at mid dark range. And a few peaks can be observed,.as can be seen in Figures obeying the formula:

Fig.221+4n, where n=0,1,2,3,4,5,6
Fig.222+4n, where n=0,1,2,3,4,5,6
Fig.223+4n, where n=0,1,2,3,4,5,6
Fig.224+4n, where n=0,1,2,3,4,5,6

7.3.1 *C Blok*

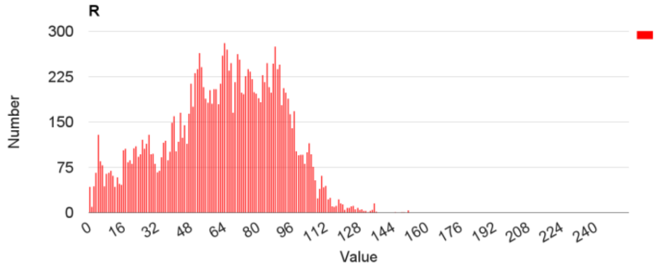


Figure 221. Histogram of R channel - *C Blok*

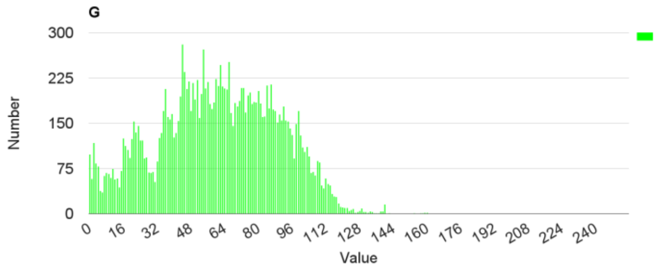


Figure 222. Histogram of G channel - *C Blok*

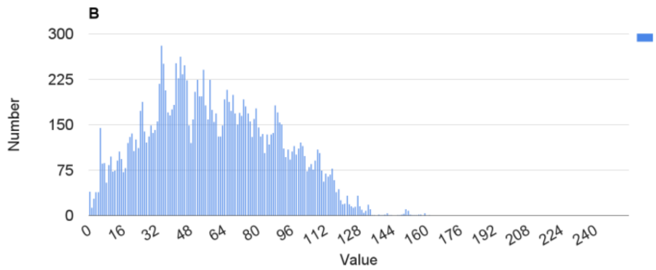


Figure 223. Histogram of B channel - *C Blok*

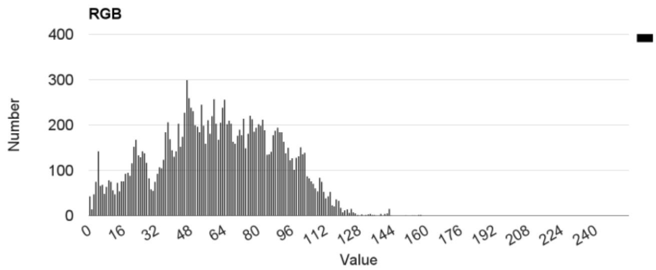


Figure 224. Histogram of RGB - *C Blok*

7.3.2 *Masumiyet*

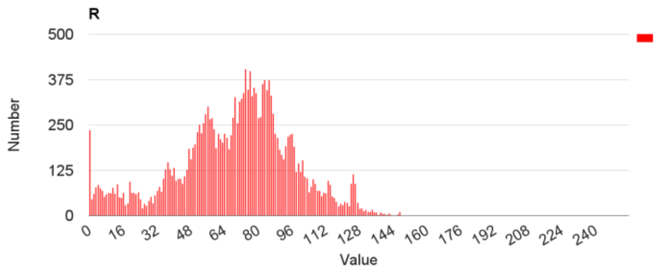


Figure 225. Histogram of R channel - *Masumiyet*

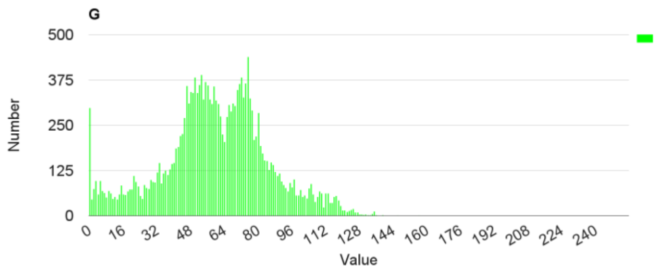


Figure 226. Histogram of G channel - *Masumiyet*

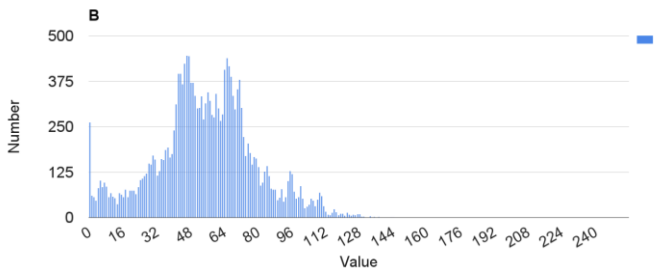


Figure 227. Histogram of B channel - *Masumiyet*

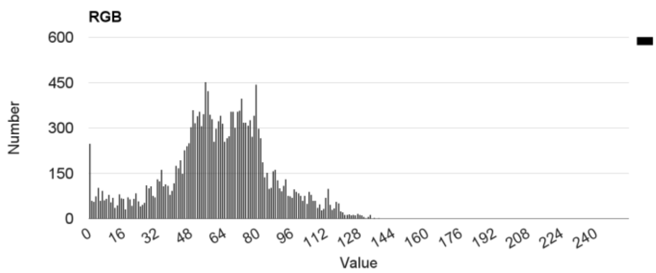


Figure 228. Histogram of RGB - *Masumiyet*

7.3.3 *Yazgı*

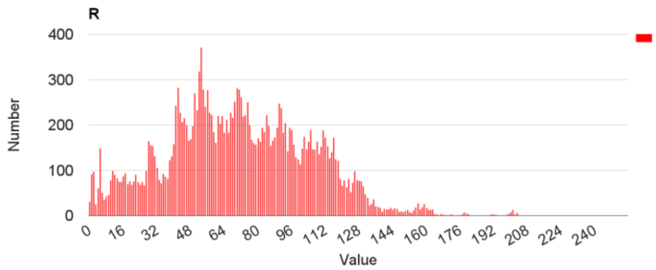


Figure 229. Histogram of R channel - *Yazgı*

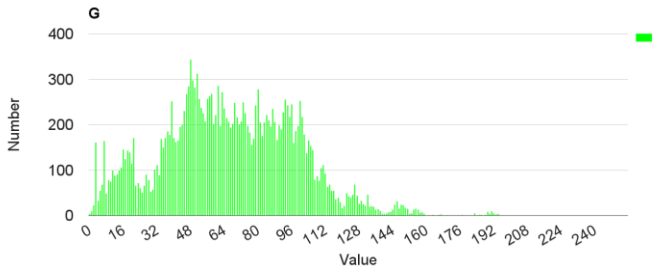


Figure 230. Histogram of G channel - *Yazgı*

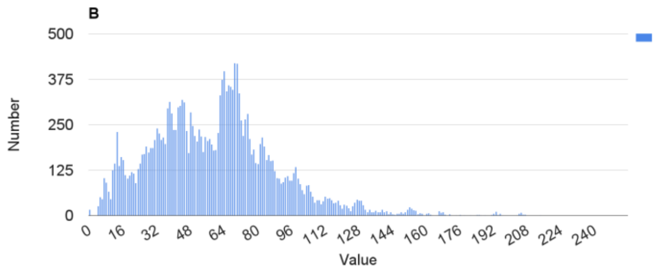


Figure 231. Histogram of B channel - *Yazgı*

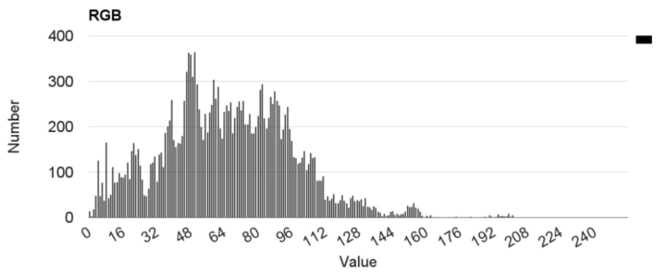


Figure 232. Histogram of RGB - *Yazgı*

7.3.4 *İtiraf*

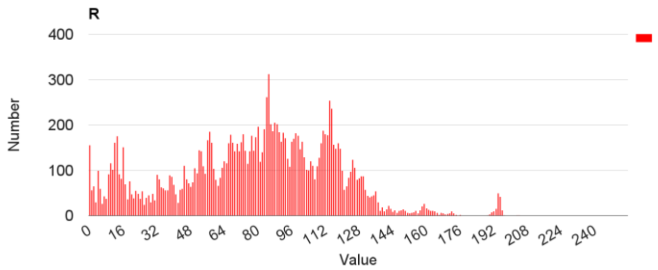


Figure 233. Histogram of R channel - *İtiraf*

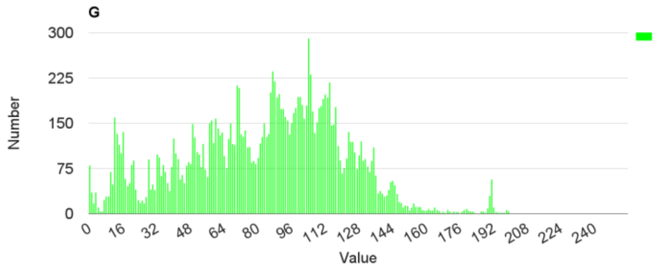


Figure 234. Histogram of G channel - *İtiraf*

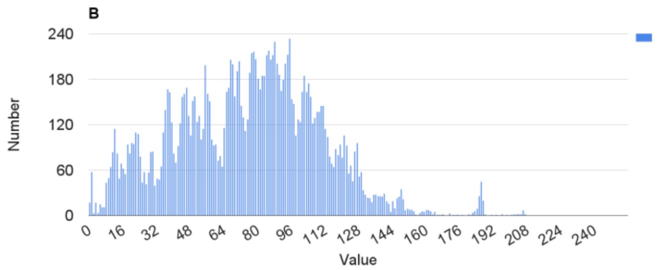


Figure 235. Histogram of B channel - *İtiraf*

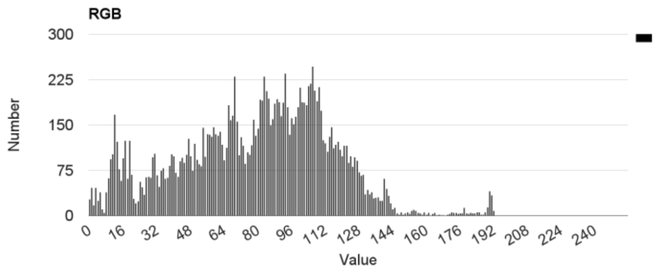


Figure 236. Histogram of RGB - *İtiraf*

7.3.5 *Bekleme Odası*

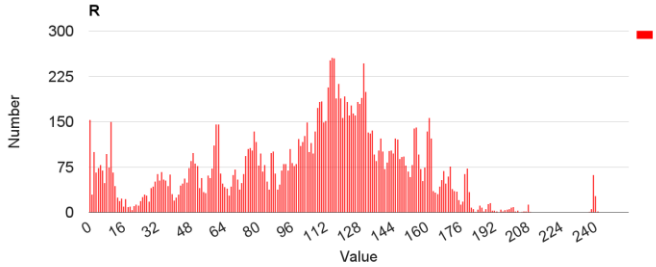


Figure 237. Histogram of R channel - *Bekleme Odası*

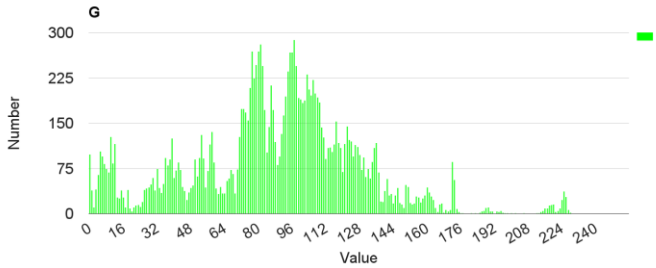


Figure 238. Histogram of G channel - *Bekleme Odası*

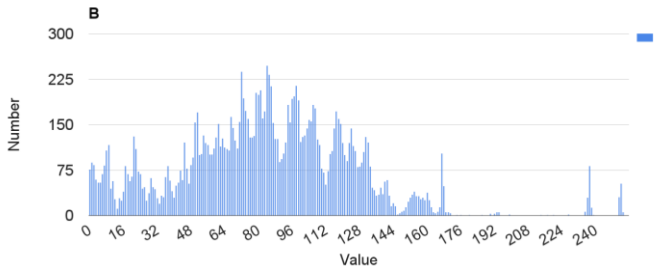


Figure 239. Histogram of B channel - *Bekleme Odası*

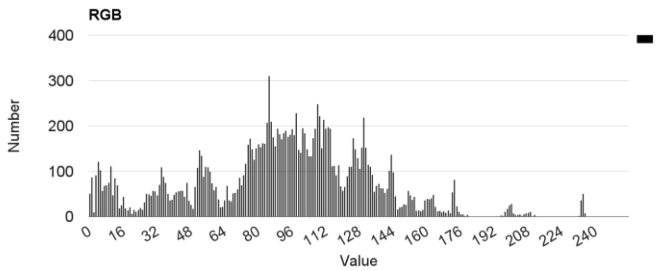


Figure 240. Histogram of RGB - *Bekleme Odası*

7.3.6 *Kader*

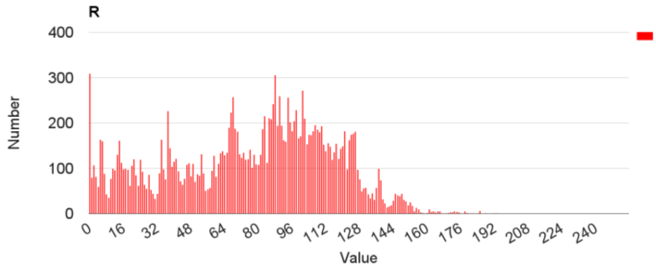


Figure 241. Histogram of R channel - *Kader*

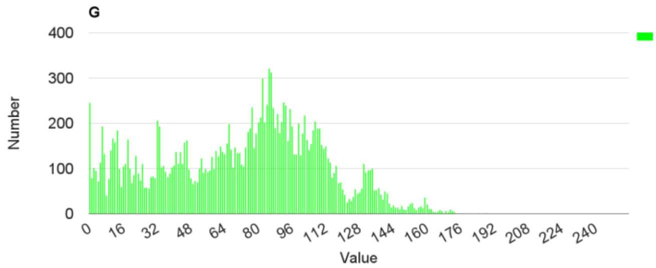


Figure 242. Histogram of G channel - *Kader*

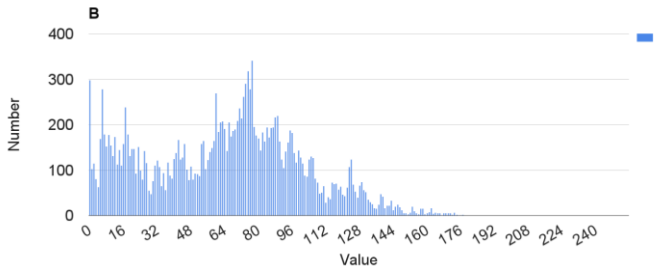


Figure 243. Histogram of B channel - *Kader*

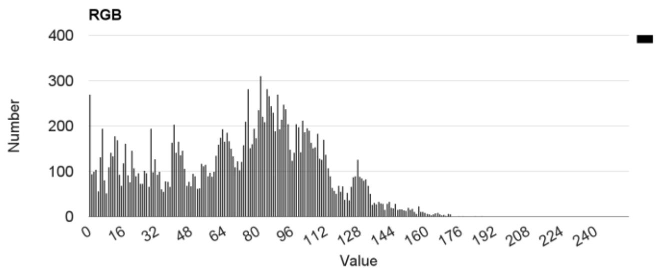


Figure 244. Histogram of RGB - *Kader*

7.3.7 *Kıskanmak*

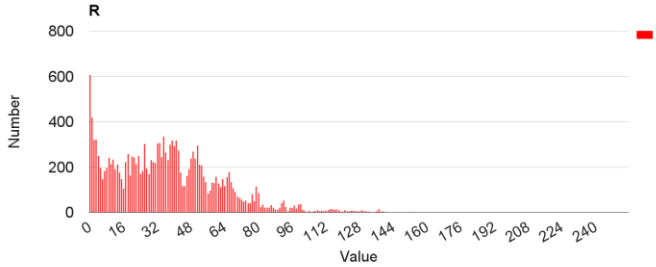


Figure 245. Histogram of R channel - *Kıskanmak*

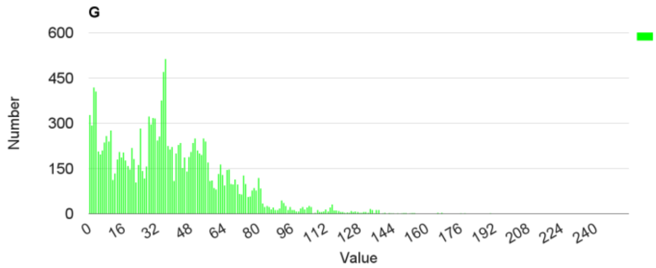


Figure 246. Histogram of G channel - *Kıskanmak*

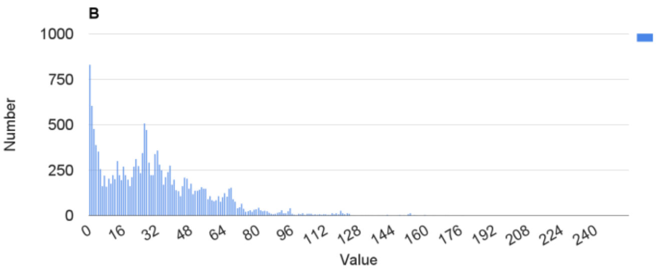


Figure 247. Histogram of B channel - *Kıskanmak*

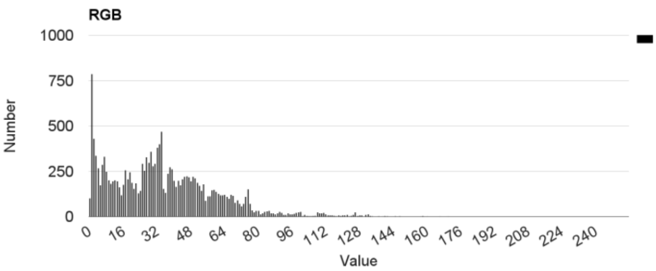


Figure 248. Histogram of RGB - *Kıskanmak*

7.3.8 *Yeraltı*

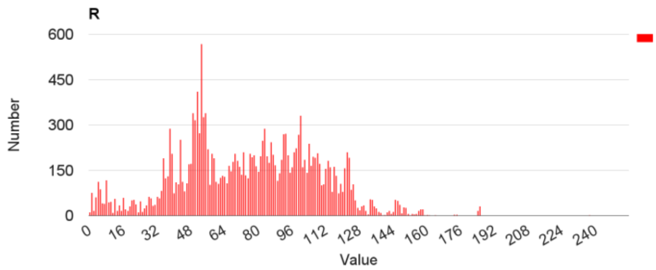


Figure 249. Histogram of R channel - *Yeraltı*

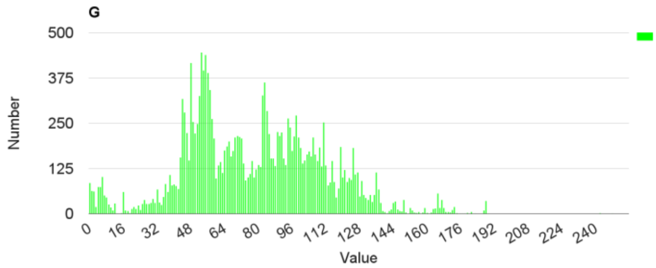


Figure 250. Histogram of G channel - *Yeraltı*

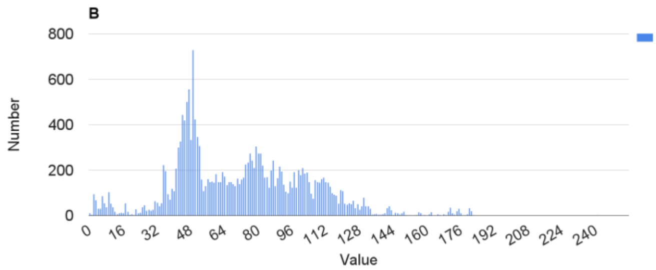


Figure 251. Histogram of B channel - *Yeraltı*

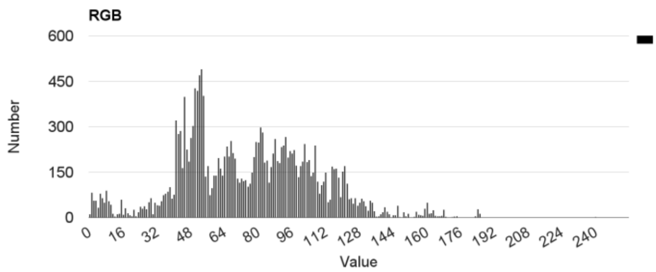


Figure 252. Histogram of RGB - *Yeraltı*

7.4 COMPARATIVE ANALYSIS

From the above given histogram data, the mean values, standard deviations can be obtained. In this section we will present these values in a comparative manner to question the differences among the three directors. In doing so, we will present the mean values of R,G and B channels and RGB values besides the standard deviation values. The mean values give a hint about the color preference of the director, whereas the standard deviation values are indicators of the width of the spectrum of colors used by the directors.

And as the final data we will give the graph of number of colors used in the films in a time dependent form.

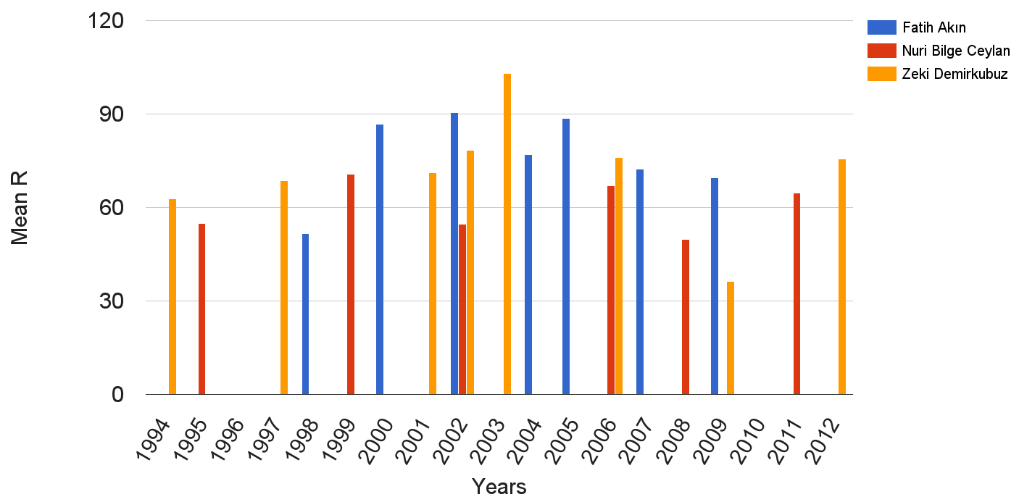


Figure 253. Mean Values of Histograms – R channel

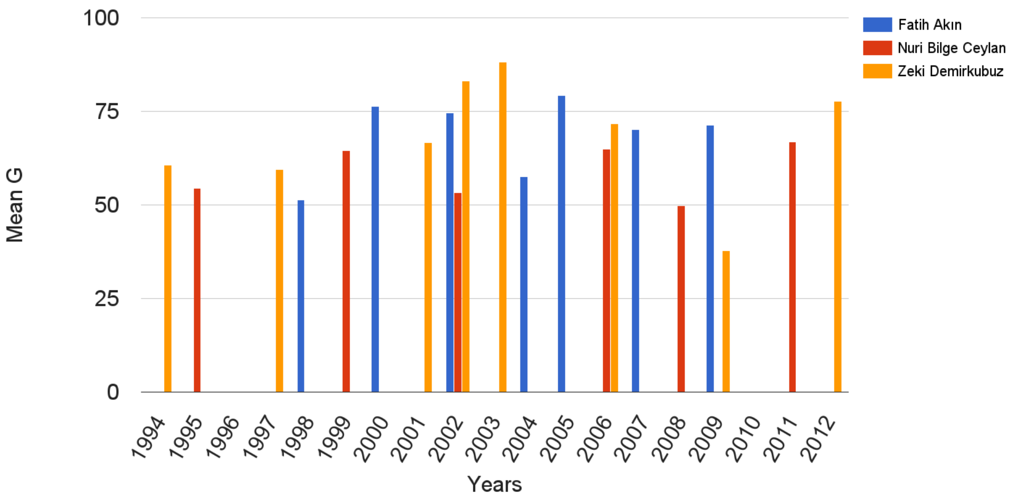


Figure 254. Mean Values of Histograms – G channel

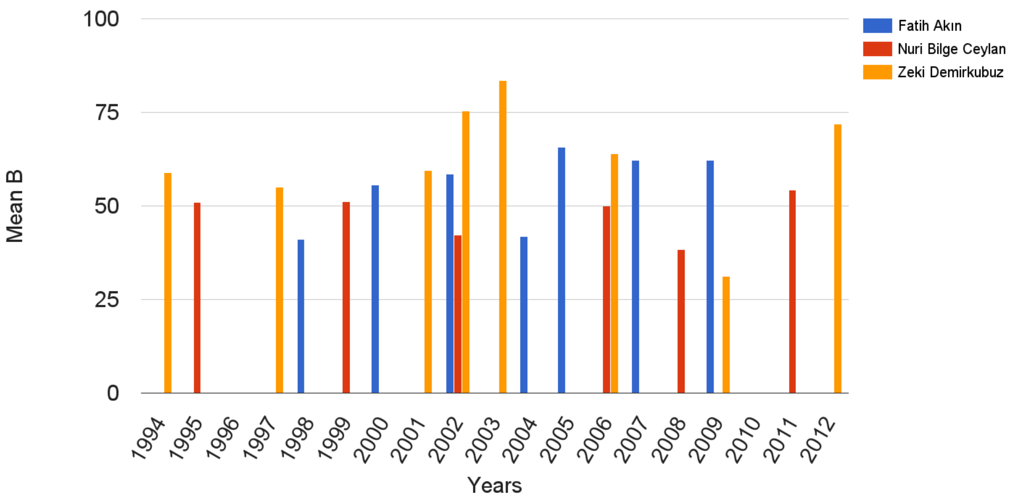


Figure 255. Mean Values of Histograms – B channel

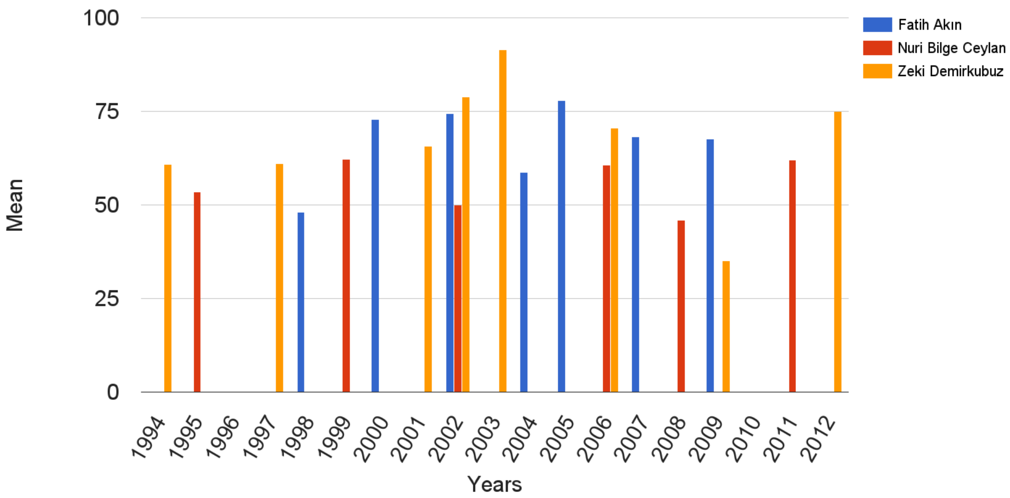


Figure 256. Mean Values of Histograms – RGB

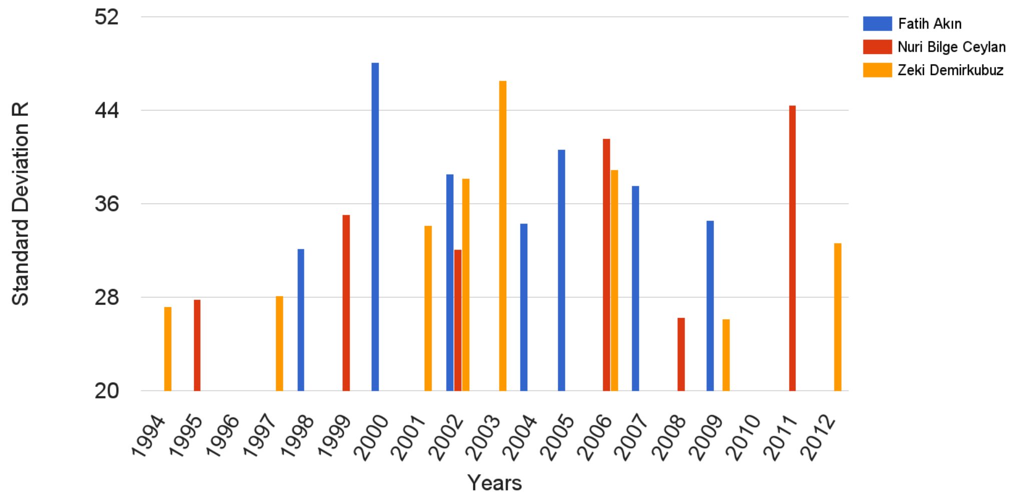


Figure 257. Standard Deviations of Histograms – R channel

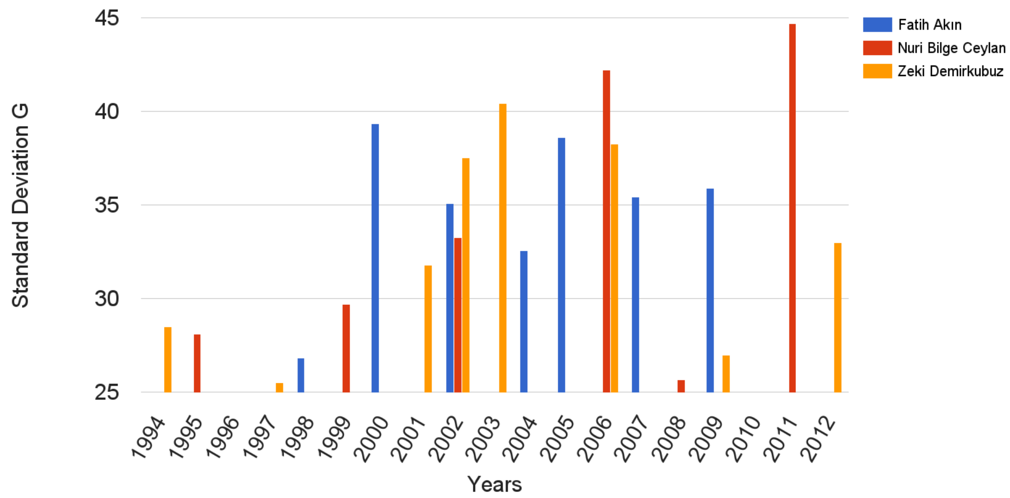


Figure 258. Standard Deviations of Histograms – G channel

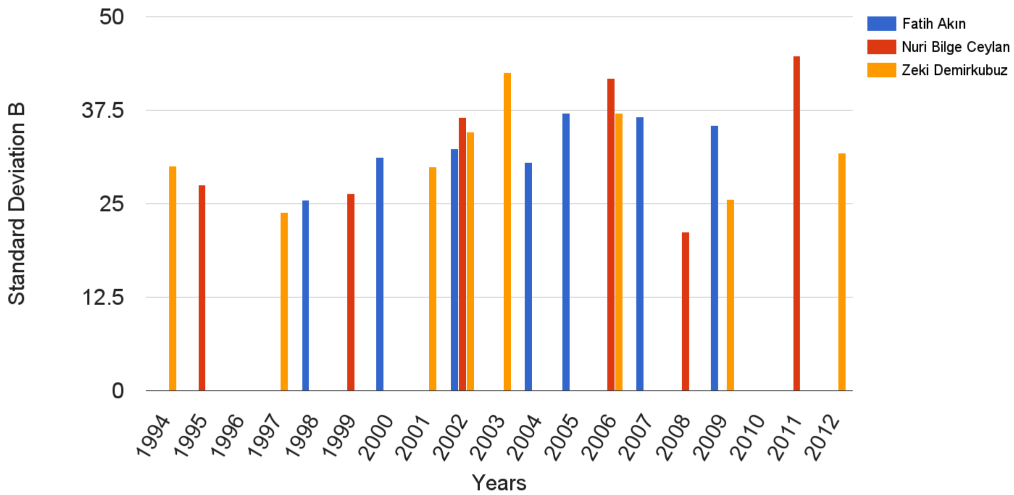


Figure 259. Standard Deviations of Histograms – B channel

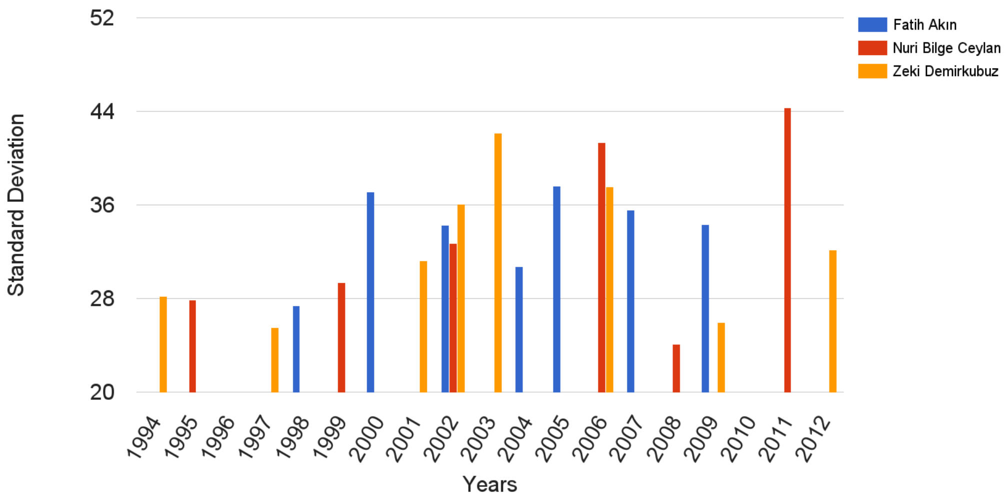


Figure 260. Standard Deviations of Histograms – RGB

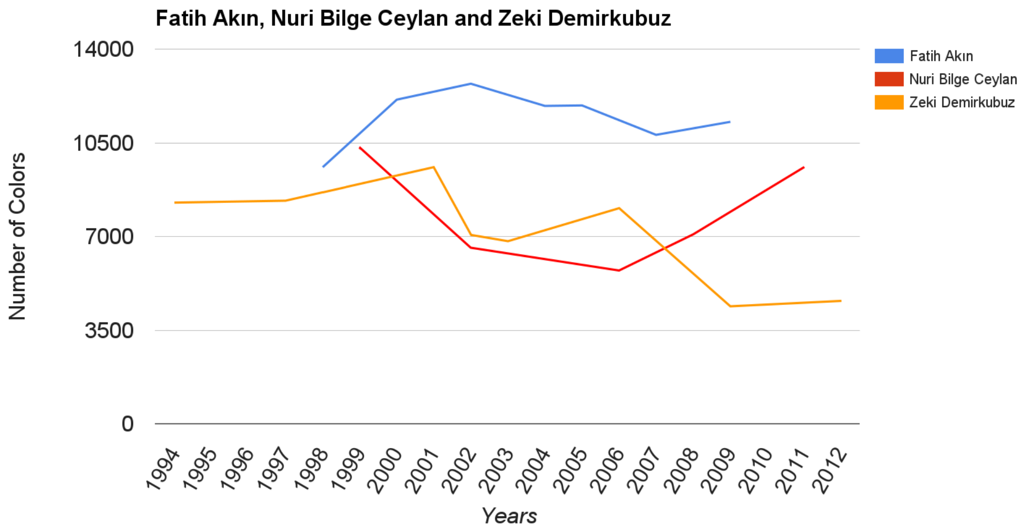


Figure 261. Number of Colors Used vs. Time

CHAPTER 8

COMPARISON AND EVALUATION OF RESULTS

Starting with the data of Chapter 6, three directors can be analyzed according to Ordering of frames from lightest to darkest.

Table 4. Ordering of frames – Fatih Akın

	Brightest	-----------	-----------	-----------	-----------	Darkest
Film 1	UR	CC	UL	LL	LR	MF
Film 2	CC	UL	UR	LR	LL	MF
Film 3	UR	UL	CC	MF	LR	LL
Film 4	UR	UL	CC	MF	LR	LL
Film 5	UL	UR	CC	MF	LR	LL
Film 6	UL	UR	CC	MF	LR	LL
Film 7	UR	UL	MF	CC	LR	LL

This is the pattern obtained for 7 films of Fatih Akın. The data obtained from Figures in Chapter 6 according to the formula: Fig.13+8n, where n=0,1,2,3,4,5,6

Similar pattern for Nuri Bilge Ceylan is:

Table 5. Ordering of frames - Nuri Bilge Ceylan

	Brightest	----------------	----------------	----------------	----------------	Darkest
Film 1	UR	UL	CC	MF	LR	LL
Film 2	UR	UL	CC	MF	LR	LL
Film 3	UL	UR	MF	CC	LL	LR
Film 4	UL	UR	CC	MF	LR	LL
Film 5	UR	UL	CC	MF	LR	LL

This is the pattern obtained for 5 films of Nuri Bilge Ceylan. The data obtained from Figures in Chapter 6 according to the formula: Fig.69+8n, where n=0,1,2,3,4

The pattern for Zeki Demirkubuz is;

Table 6. Ordering of frames - Zeki Demirkubuz

	Brightest	----------------	----------------	----------------	----------------	Darkest
Film 1	UR	UL	CC	MF	LR	LL
Film 2	UL	UR	CC	MF	LL	LR
Film 3	UL	UR	CC	MF	LR	LL
Film 4	UR	UL	CC	MF	LR	LL
Film 5	UR	UL	CC	MF	LR	LL
Film 6	UL	UR	CC	MF	LL	LR
Film 7	UR	UL	CC	MF	LL	LR
Film 8	UR	CC	UL	MF	LL	LR

This is the pattern obtained for 8 films of Zeki Demirkubuz. The data obtained from Figures in Chapter 6 according to the formula: Fig.109+8n, where n=0,1,2,3,4,5,6,7,8

As can be seen the most striking consistensy is in Zeki Demirkubuz's data. In all of his films the 4th brightest area is the main frame. The other data do not reveal any consistent property.

Another data that can be obtained from Chapter 6 is the number of prismatic color used in films. Combining the histogram data from Chapter 7, For Fatih Akın,

Table 7. Types of colors in palettes - Fatih Akın

	Prismatic	Chromatic Gray	Achromatic gray
Film 1	2	14	0
Film 2	3	13	0
Film 3	3	12	1
Film 4	3	12	1
Film 5	4	10	2
Film 6	0	14	2
Film 7	1	14	1

This is the pattern obtained for 7 films of Fatih Akın. The data obtained from Figures in Chapter 6 according to the formula: Fig.14+8n, where n=0,1,2,3,4,5,6

Table 8. Types of colors in palettes - Nuri Bilge Ceylan

	Prismatic	Chromatic Gray	Achromatic gray
Film 1	3	13	0
Film 2	2	13	1
Film 3	0	15	1
Film 4	0	13	3
Film 5	0	15	1

This is the pattern obtained for 5 films of Nuri Bilge Ceylan. The data obtained from Figures in Chapter 6 according to the formula: Fig.70+8n, where n=0,1,2,3,4

The pattern for Zeki Demirkubuz is;

Table 9. Types of colors in palettes - Zeki Demirkubuz

	Prismatic	Chromatic Gray	Achromatic gray
Film 1	0	14	2
Film 2	2	13	1
Film 3	2	13	1
Film 4	2	13	1
Film 5	3	12	1
Film 6	0	15	1
Film 7	1	12	3
Film 8	1	14	1

This is the pattern obtained for 8 films of Zeki Demirkubuz. The data obtained from Figures in Chapter 6 according to the formula: Fig.110+8n, where n=0,1,2,3,4,5,6,7,8

As can be seen from the data Zeki Demirkubuz has the most prismatic colors in hif film palettes, whereas Nuri Bilge Ceylan decreased his use of prismatic colors in time.

Another data that can be analyzed is for the most emphasized suf-frame of the screen. This generally means that the most action taking place in the most emphasized frame as its color content will be different from of the back ground.

Table 10. Most active sub-frames - Fatih Akın

	Most-------------------------		3rd most active
Film 1	UR	LR	CC
Film 2	CC	UR	LL
Film 3	UR	UL	CC
Film 4	CC	LR	UR
Film 5	LR	UR	LL
Film 6	UR	UL	LR
Film 7	UR	CC	LR

This is the pattern obtained for 7 films of Fatih Akın. The data obtained from Figures in Chapter 6 according to the formula: Fig.16+8n, where n=0,1,2,3,4,5,6

Table 11. Most active sub-frames - Nuri Bilge Ceylan

	Most-------------------------		3rd most active
Film 1	LL	UR	LR
Film 2	UR	CC	UL
Film 3	UR	UL	LL
Film 4	UR	LL	UL
Film 5	UR	UL	LR

This is the pattern obtained for 5 films of Nuri Bilge Ceylan. The data obtained from Figures in Chapter 6 according to the formula: Fig.72+8n, where n=0,1,2,3,4

The pattern for Zeki Demirkubuz is;

Table 12. Most active sub-frames - Zeki Demirkubuz

	Most--------------------------		3rd most active
Film 1	UR	UL	CC
Film 2	UL	UR	LR
Film 3	UR	LR	UL
Film 4	UR	UR	CC
Film 5	UR	UL	CC
Film 6	UL	UR	CC
Film 7	UR	UL	LR
Film 8	UR	LR	CC

This is the pattern obtained for 8 films of Zeki Demirkubuz. The data obtained from Figures in Chapter 6 according to the formula: Fig.112+8n, where n=0,1,2,3,4,5,6,7,8

In this data, Zeki Demirkubuz shows the most consistent most active sub-frame by selecting the Upper Right 1/3 frame (Fig.4).

The last data that we will investigate is from Fig.261.

As can be seen in Fig.261, in chronological order, Zeki Demirkubuz is constantly decreasing the number of different colored frames in his films. He is almost going towards mono-chromatic direction as the RGB and HSB space visuals from Chapter 6 show his use of colors is getting towards achromatic range and almost narrowed towards the zero saturation level as can be seen in Figures obeying the followng formula:

Fig.113+8n, where n=0,1,2,3,4,5,6,7,8
Fig.114+8n, where n=0,1,2,3,4,5,6,7,8
Fig.115+8n, where n=0,1,2,3,4,5,6,7,8
Fig.116+8n, where n=0,1,2,3,4,5,6,7,8

On the contrary, Nuri Bilge Ceylan seems to be increasing the different colored frames in his films, although he stays in chromatic gray range. This can be seen again from Fig.261 and the figures obeying the folowing formula:

Fig.73+8n, where n=0,1,2,3,4
Fig.74+8n, where n=0,1,2,3,4

Fig.75+8n, where n=0,1,2,3,4
Fig.76+8n, where n=0,1,2,3,4

Whereas, Fatih Akın is clearly uses most colors both prismatic and different colored frames in his films. This is clearly shown in Fig.261 and the figures obeying the following formula:

Fig.17+8n, where n=0,1,2,3,4,5,6,7
Fig.18+8n, where n=0,1,2,3,4,5,6,7
Fig.19+8n, where n=0,1,2,3,4,5,6,7
Fig.20+8n, where n=0,1,2,3,4,5,6,7

CHAPTER 9

CONCLUSION

There are three main pillars that this work is based upon. These are ‘Color Theory’, ‘Gestalt’ and ‘Autheur Theory’. We have investigated and given information about Color Theory and Gestalt in Chapters 2and 3. For the ‘Autheur Theory’ there is an uncertainty as mentioned by Elsaesser (2004:37:71). As he says, the days of the validity of ‘Autheur Theory’ might be over. However, in order to get an identity of color use in films there must be a person or entity whose decisions determine the color use and color space of the films. It might be possible that, that entity might be a different one than the director in some cases. Yet, for this study, taking into account that, the directors who were taken as examples are involved in the formation of the films (as can be seen in IMDb biographies and personal quotes of the three directors)(http://www.imdb.com) actively, it is safe to assume the validity of the ‘Autheur Theory’. In further studies using the method proposed in this thesis, the entity responsible for color space determination might change and the finger print thus will become of that identity’s.

In the light of the results obtained in this study, we have found out that directors have characteristic differences among them in terms of color preference and color use. Although we have examined various properties of 3 Turkish directors, many parameters do not reveal sufficient differences to be of characteristic property.

However, there are a few parameters that turned out to be strikingly different for each director. One of these is the number of equivalent colors used in films. We have revealed that the number of equivalent colors of the frames of the films is a good indicator for color identity for a director. We found out that Fatih Akın's films, frames of the film have more different equivalent colors than in the case of Nuri Bilge Ceylan's or Zeki Demirkubuz's films. As equivalent colors are the average colors of the frames, this result shows that Fatih Akın creates a continually changing colors for the frames of his films.

Another criterion was turned out to be the number of prismatic colors used in color palettes of the films. Again Fatih Akın is clearly the director among the three, who uses more prismatic colors in his films.

For Nuri Bilge Ceylan and Zeki Demirkubuz, there exists an interesting result. In chronological order, Nuri Bilge Ceylan started with fewer colors and has been increasing the number of colors he uses in his films, whereas Zeki Demirkubuz is in a decline in terms of color use. These two directors also share a similarity. They prefer to use chromatic grays in their films almost without any prismatic colors. This necessitates the use of other techniques and elements in the films to place emphasis on something that director wants that to be the focal point of attention. However, it must be noted that, Nuri Bilge Ceylan started cinema with black and white films. Thus it might be the effects resulting from his previous experiences with monochrome films that leading him to chromatic grays or even achromatic grays. Same can be mentioned about Zeki Demirkubuz. So, while analyzing the properties of the directors studied in this thesis, we have to take into account that, their starting styles might have played a role. However, even if this is a fact, then we have to admit that, the color character of them is shaped by their past. So color fingerprint of them may be based on a colorless past. This being shaped by monochromatic medium, does not invalidate the color identity of them. It is the result that, they have formed their color identity through various paths different than others. It is important that, the presence of multi paths to color identity, strengthens our proposal that different directors have different color identities.

The results obtained from the analysis of the films by these three directors display several properties and all of them might be out of reach for a single thesis. However,

the results can be seen in the graphs given in Chapters 6 and 7 and in Chapter 8 where we discuss the results given in Chapter 6 and 7. The use of both visual and numerical analysis resulted in a double check for the results. As in the case of use of prismatic colors, this can be seen in the palettes. However, the histograms in Chapter 7 also proved that, histograms of the color channels R, G and B are considerably different in shape and scale in the case of Fatih Akın's films. As this means that there must be prismatic colors in the data, the visual results are proofed by the numerical analysis also.

Another result of the 'Autheur Theory' is that, the director becomes an artist painting with light. As can be seen in art history resources (i.e. Bomford) color use is artist specific once that person reaches a certain level in art, presenting his/her style. This color preference and forming different color spaces become a property of that specific artist and this is no different in cinema, provided that 'Autheur Theory' can be validated for the specific case.

From the analysis of the histograms of Chapter 7, the visual analysis results of the Chapter 6 can be checked and it can be shown that both approaches produce consistent results. As one of the main aims of this thesis was to propose a method for the numerical analysis of the films in terms of color identity, this consistency in results is a positive indicator for the possible future use of the proposed method in color analysis of other directors in both local and international scale.

Also the color space visuals given in Chapter 6 are relatively important as they incorporate the histogram in their structures besides the color palette and the distribution of used colors in RGB or HSB space. The histogram values are represented by the radius of the spheres that have the color corresponding to the center of the sphere in the color space in question.

The color space visualizations provide us with the data that, whether the color use of the director is towards achromatic grays or prismatic colors besides the fact that whether they are mainly chromatic grays. This information is provided by the structure of the color space in question.

In RGB color space, the line joining the origin to the opposite corner of the cube defined by the color space is the line of achromatic grays, where only black and white are used for obtaining the various gray tones. Same line in HSB space is the line forming the axis of the cylinder that defines the color space.

So if the colors are concentrated towards the diagonal mentioned above, it must be clear that director has chosen to use colors with a tendency of using achromatic grays. On the contrary, if the colors used are scattered away from the diagonal axis, this is an indicator of prismatic colors being used.

Another data that can be obtained from the color space visuals is that, the value or brightness of the colors can be determined directly. The point of the origin in RGB and the bottom center point of the cylinder in HSB spaces correspond to maximum darkness or in other words, to minimum lightness, brightness. If the colors accumulate towards the dark part, it should be clear that the general mood of the film is towards the shades or dark colors.

For the histograms of Chapter 7, besides quantitative results, which are the percentage of the pixels at a certain color, the different distribution of histogram color channels represent another property. The more different the scale and the shape of the distributions in histograms of color channels, the more prismatic color is used. On the contrary, if the scales and the distribution shapes of the histograms of the color channels are similar, then there is a tendency towards achromatic grays.

Another important point that should be noted is that, all the films used are in AVI format, except one film which was in Flash Video format. In AVI format, there are severe limitations due to the structure of AVI format's representing and averaging the image data (https://msdn.microsoft.com/en-us/library/ms779636.aspx). This deficiency results in data loss in both picture space and color space of the films when being converted from high quality original films to AVI files. As the structure of AVI was not designed to handle very high quality image data, it is certain that, these loses occur in the process of conversions. As almost all the data that we used in this thesis was in AVI format, it is also possible that, certain color characteristics of the films of the directors who are being considered in this study.

However, as we are comparing the directors with a data set that is consistent in terms of video format, the deviations from the actual cases could be considered similar.

Yet, it must be noted that, due to the AVI formats limitations certain color characteristic might be prone to higher losses. This should also be taken into account in evaluating the results.

In order to minimize the differences due to digital formats used in the videos, chronological order was used in Chapter 7 when comparing the data about the films, so that any differences due to software versions will be affecting the similar dated films in a similar way. This is the reason why we have plotted number of used colors in films with respect to time in Fig. 261.

As the conclusion, we have shown that directors explicitly or implicitly shape the color space of the films so that, they leave a mark indicating their color personality or kolorit. Or in our terminology, they leave their color finger prints in their films. Some leave very clear finger prints as in the case of Fatih Akın, and some leave almost faded finger prints as in the case of Nuri Bilge Ceylan.

So, the answer to our starting question of, whether directors have color finger prints or not, the answer is a clear yes. They have color fingerprints and some of them clearly display definite color identities.

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