시청자 경험에 의한 TV장르별 화질

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Image Quality for TV Genre Depending on Viewers Experience

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요 약

기존 정지 이미지를 활용한 화질 연구는 '자연스러움'에 초점을 맞추고 있으며 이는 기억색과 깊은 관련을 맺고 있다. 기억색은 주로 선경험이 있는 친숙한 대상에 대해 형성되며 이러한 기억색을 충실히 반영할수록 화면에 재현된 화질의 자연스러움이 증가한다. 특히 기억색의 밝기와 채도는 '자연스러움'뿐만 아니라 화질의 선호도를 증가시키는데 중요한 역할을 갖는다. 이에 기존의 화질 연구의 경우 기억색이 있는 자연물과 인물 중심으로 화질 특성을 연구한 바 있다. 본 연구에서는 TV 컨텐츠를 장르별로 분류하여 각 장르별 화질 특성을 도출하였다. 이를 위해 각 장르(스포츠, 다큐멘터리, 뉴스, 오락 및 음악, 영화)의 대표 이미지를 추출하고 각 이미지의 밝기, 대비, 채도를 조절한 후 인지된 화질을 평가하는 실험을 진행하였다. 실험 결과, TV 컨텐츠 장르를 상황적 맥락에 따라 근접 경험과 간접 경험의 두 가지 범주로 분류할 수 있었다. 근접 경험은 야외 스포츠, 드라마, 자연 다큐멘터리 컨텐츠를 포함하며 근접 경험 컨텐츠의 화질은 밝기와 대비와 밀접한 관련이 있었다. 간접 경험은 뉴스, 음악 쇼, SF/액션 영화 컨텐츠를 포함하며 해당 컨텐츠의 화질은 대조와 채도와 밀접하게 연관되었다. 이러한 결과에 따라 근접 경험으로 분류되는 컨텐츠의 경우 밝기와 대비 조절에 따라 최적 화질을 구현할 수 있으며, 간접 경험으로 분류되는 컨텐츠의 경우 대조와 채도 조절에 따라 최적 화질을 구현할 수 있다.

Abstract

Conventional image quality studies have been focused on 'naturalness' and has relied on memory color. Memory colors are mainly formed for familiar objects with prior experience, and the more faithfully these memories are reflected, the more naturalness of the reproduced image quality increases. In particular, the brightness and saturation of memory colors play an important role in increasing the preference of image quality as well as naturalness. Therefore, in the case of existing image quality studies, image quality characteristics were studied focusing on natural objects and people with memory. We extracted representative images of each genre (sports, documentaries, news, entertainment and music, and movies), adjusted the brightness, contrast, and saturation of each image, and conducted an experiment to evaluate perceived quality. Based on situational context, the results of this classification indicated that genres of television content can be divided into two categories: proximate and indirect experiences. Proximate experience best characterizes outdoor sports, dramas, and nature documentaries, where their image qualities have shown to have a strong correlation with brightness and contrast. On the other hand, indirect experience best characterizes news, music shows and SF/action movies. The image quality perception for indirect experiences was shown to be closely related to and optimized by contrast and saturation.

Keywords: Image Quality, TV genre, Experience, Still images, Moving images

Ⅰ. Introduction

This to improve perceived image quality has involved both software and hardware approaches. However, research into improving image quality in color reproduction has largely focused on the still image [1-6]. An earlier series of studies demonstrated that a rich color representation on the image helps to improve image quality [1,2,3,4]. In nature scenes, a significant number of findings reveal that image quality, or naturalness, was higher in cases where colorfulness was higher than in the actual subject of representation because of the cognitive impact of memory color [3,5]. Therefore, the strong relationship between image quality and naturalness is demonstrated and further explains that higher perceptual and psychological factors play a prominent role in judging image quality. 'Naturalness' is the basis for classifying images for evaluation [7]. Several research experiments have focused on reproducing still images to 'look' natural [8] and classification of the natural scene to enhance image quality [9]. These efforts raise two prominent questions. Does carefully planned color reproduction of still images to make them look natural to have a similar effect on image quality of moving images shown on TV sets? Further, can we effectively classify all content into two categories of natural and non-natural images?

While watching TV, the image quality carefully studied in preceding studies is not performed for every scene, and still scenes presented to viewers are often unrelated. However, one may ask whether a study of image quality of still images is useful for moving images. The term 'image quality' may not be the proper word for evaluating moving images. Those are subjective assessments are precisely called 'video quality' [10] and most of these studies are related to compression. Therefore, video content in this paper is referred to as 'moving images,' and the captured images are 'still images.' The image quality for both 'moving images' and 'still images' is studied and compared.

Memory is the color of the object that we remember. (e.g., bananas are yellow and apples are red). Memory color is a common factor in determining image quality [11]. Memory color is based on the viewer's experience, such that cognitive factors strongly influence perceptual color recognition factors [12] and leads to preference [13]. For the still image, memory color is relatively specific by association or familiarity with the target, which is easily held in focus. However, for moving images, it is more difficult to rely on the color of the object as the main focus of the scene is switched to another object by a short time. As such, it is helpful to expand the research on still images to better understand image quality. It would be impractical and computationally difficult to apply an optimized quality to the videos on TV on a scene-by-scene basis. A more effective and workable approach is to classify TV content by genre. Also, the TV sets currently on the market offer image adjustment services that best suit the genre. Typical examples of TV modes include movie mode, sports mode, optimal mode, and comfort mode. Therefore, we have approached image quality for TV sets by genre classification. TV genre refers to the types of TV shows or movies, and the type of genre contains emotional information. The genre is also used symbolically to evoke emotions in the viewer. Viewers form their expectations based on their previous experience with video consumption, which can be formed from the titles and genres alone, without additional specific image information. Therefore, genres serve as devices to predict the experience of emotions, which is known as genre-specific expectation. The following paragraphs describe the selected genres and their characteristics.

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1. Genre of TV contents

Six genres of sports (outdoor), documentary, news, music shows (live performance), romance movies/drama, and SFI/action movies were selected among various TV content. Other genres such as indoor sports, comedy, and animation were excluded, based on previous pilot studies. These genres showed no consistency of color attributes affecting the image quality.

1.1 Outdoor sports (SP_O)

Among outdoor sports, golf is an individual sport, and the camera follows the movements of the golf ball, utilizing a variety of active camera angles such as close-up shots and full shots in the production process. Soccer and baseball are team sports, in which it is important for the camera angles to show the overall situation of the game. The production technique for team sports uses the full shot camera view, as it can show the overall flow of the match.

1.2 Documentary (DQ)

In documentary programs, the most important evaluation factors are reality and authenticity, as expressed in the camera angle, which encourages the use of the image composition paradigm that can most accurately express reality. Emphasizing reality requires a camera angle that can express the overall image, rather than a detailed shot, and it is also important to maintain a sense of objectivity by showing the wider background view using the full shot. Depending on the situational context, there may be a need for an elaborate scene focusing on a specific subject, but these cases nonetheless require an aesthetic visual display based on the concepts of reality and authenticity.

1.3 News (NS)

News is a genre in which objectivity is given greater emphasis than in any other genre, and the background takes on-screen priority. In particular, the background used for shots of the news anchor is most often static, such as a fixed shot of the studio. The start and end of the program utilize a full shot, while the most used camera angles when the news anchor is on air consist of a bust shot using a one-shot or a two-shot method. Other techniques include image-in-image screens for connecting reporters and correspondents to the studio from external sites and VR studios for weather forecasters. News videos avoid the use of close-up camera shots to minimize subjective interference, thus adhering to the realistic video paradigm.

1.4 Music Shows (MS)

In entertainment programs, a variety of camera shots is used in production to fully express the structural aesthetics of the screen, the background imagery, the decorative quality of lighting, and the rhythmic consistency of the background music. Stage video displays are designed to vary based on content. Unlike news footage or documentary videos, stage video displays frequently use video techniques based on subjective directions. Images of the filming site are shown in intentional displays using the movement of the camera, which frequently make use of the full shot, close-up shot, fast/slow motion, and high/low angles. In music productions, low-angle and high-angle camera shots are used more frequently than in other genres to entertain viewers and capture their attention and interest. By capturing the subject from below, heightened tension and an ambiance of superiority are created through the shots using camera angles that seek to enlarge and emphasize the character or subject. A variety of stage-setting techniques, including the use of lighting, are applied to produce entertainment show programs as well as to highlight the flamboyant movements and decorative quality of the performers. Using scenes where a downward-facing camera angle captures the subject from above, the height of the subject is reduced, thereby creating a form of emotional distortion. Subjective reactions are induced using divergent and drastic factors of shock or surprise that stand out in

contrast to a mundane scene. Stage video is most often produced using only achromatic color backgrounds and a single accent color, rather than extravagant stage setting elements.

1.5 Romance Movies, Dramas (RM)

The direction for romantic scenes uses shots with almost no background, emphasizing numerous close-up shots of kisses and full screen displays of emotional embraces. The romance genre enables video production in line with the director's intentions. Most of these scenes are the full shots and tight shots of the two male and female characters, capturing their side profiles. For most of these shots, skin color occupies more than 50 percent of the display. The movies selected for analysis were divided into Western and Asian films due to the differences in the characters and in the overall color schemes used. In the case of dramas, the experiment was conducted by adding romantic scenes that allow the use of a wider variety of colors compared to movies in which the overall color scheme is fixed.

1.6 Action and S/F Movies, Dramas (SF)

In the case of the action and science fiction genres, a variety of shots is used in production to express the dynamic movements of action scenes. The camera movements intentionally express images of the filming site through full shots, close-up shots, fast/slow motion, and high/low angles. There is no representative image, as with the case of the comedy genre. In the action genre, there are often scenes in which the camera rushes to follow a subject or a character, which is enlarged and emphasized to heighten tension in the scene. Also, each scene makes use of brightness and darkness to produce the ambiance of urgency and intensity. Science fiction movies generally feature characters that are different from those in other genres, while the overall compositions of scenes are very similar to those in the action genre. The pertinent objects can be divided into

two groups based on saturation level: those with high saturation and low saturation. In the science fiction genre, the main character is typically shown in numerous close-up shots.

Ⅱ. Experiment Setup

1. Still/Moving image selection

As described above, the representative images were extracted in consideration of production in terms of the key camera compositions in each genre. The representative images in each genre were captured by monitoring sports programs(four scenes), documentaries(two scenes), news programs(four scenes), entertainment & music programs(two scenes), and movies(Romance three scenes, SF/action two scenes). The collected images were monitored by the participating researchers, who then selected the images that best represented each genre. The final representative genre images for the comparative evaluation of sensibilities were established as the original images (Table 1). As the green was the dominant color in the outdoor sports genre, experiments were conducted with varied screen compositions.

The selected image size was FHD (1920X1080), with 8bits/pixel. Brightness (B), contrast (C), and saturation (S) were adjusted using Photoshop for the still images and Vegas for moving images. Saturation can be adjusted from -100 to +100 in the percentage of purity for each hue. Brightness and contrast involve adjusting all pixels higher and lower from -150 to 150 and -50 to +100, respectively. Both brightness and contrast were adjusted from -30 to +30 in intervals of 5. The total number of still and moving images was 21, and each was rendered to 12 (increments of brightness), 12 (contrast), and 12 (saturation) images, for a total of 36. Then the top 4-5 attributes for each image were combined, such as B+5 and C-10 as B+5_C-10. Therefore, 60 combined rendered images for each repre-

표 1. 각 장르의 대표 이미지를 스포츠 프로그램(SP_O), 다큐멘터리(DQ), 뉴스 프로그램(NS), 엔터테인먼트 및 음악 프로그램(MS), 영화(RM, SF)
Table 1. The representative images in each genre were captured by monitoring sports programs (SP_O), documentaries (DQ), news programs (NS), entertainment & music programs (MS), and movies (RM, SF)

SP_O	DQ	NS	MS	RM	SF

sentative image were prepared for the second part of the experiment. 5 points were selected within the final rendered images to be measured using a spectrophotometer (CS-1000). The measured CIExyY values were compared to the original to check the rendered color attributes.

Prior to the experiment, the Ishihara Test was conducted on the subjects for color vision screening. While watching the randomized original moving images and rendered moving images for each genre, the image quality for each genre was scored by the participants. The duration of the experiment was approximately 90-100 minutes for both experiments. The ambient lighting level was adjusted at 41.9cd/m2 in the front of the TV and the luminance level in the experimenter's position at 100.7cd/m2. The distance between the TV set and the subject was 3m, and the experiment used a 55-inch LCD (FHD) TV.

1.1 Evaluation

The aim of psychophysics is to quantify the human response to a stimulus. The psychometrics for image quality was well established by Engeldrum [14]. Among the psychometric techniques, the use of 'Quality Rulers' was employed for comparison against the original image (anchor) and to score the rendered image. The original image is given a score of 4, while there are 7 scales labeled 1: worst image quality, 2: moderately worse image quality 3: slightly worse image quality 4: same as the original 5: slightly better image quality, 6: moderately better image quality, 7: much better image quality. For each genre, the subjects were instructed to score the image quality from a set of original moving images and their respective paired comparison. The scores were then normalized to a 0-1 scale for easy comparison.

Both the evaluation for still and moving images took place in normal setting TV mode. Also, the experiment was devised to select the optimal image quality in the still image sector, in the manner used in the next experiment, to compare it with the moving image set. The 35 subjects were composed of males and females in their 20s, 30s, and 40s.

III. Results

1. Moving image

1.1 Outdoor Sports

Figure 1 shows the image quality score (0~1) when rendering the saturation and brightness. The data points are
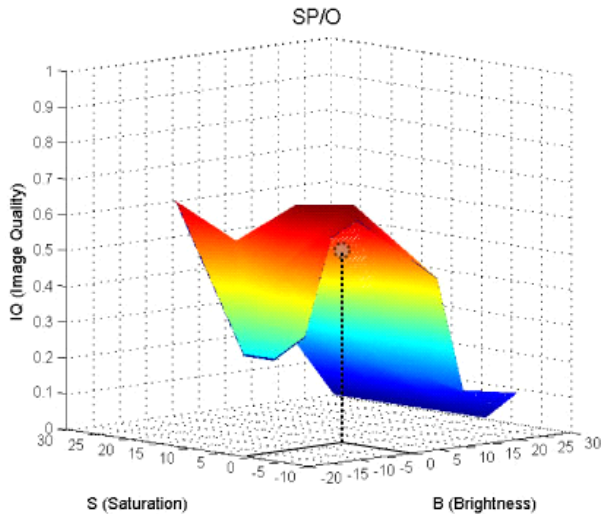
그림 1. 채도 및 밝기의 함수로서의 실외 스포츠(SP/O) 화질
Fig. 1. Outdoor sports (SP/O) image quality as function of saturation and brightness

the results of interpolation for all image quality scores responses. The circle indicates the original image with saturation and brightness each set to 0 and an image quality score of 0.5 as a reference. A similar scaling is used for Figs. 1 to 6, though with different x and y axes. The image quality and attributes show a rough nonlinear relation, which was suggested by Bartlson [15] and modeled by Engeldrums' study [16] on image quality models.

In the outdoor sports genre, the optimal image quality comparison showed that reducing brightness relative to the original was preferred in all seven content categories. Since outdoor sports are mostly played under sunlight and indoor sports under diverse lighting conditions, the experiment was unable to identify a common image quality shared by the two subgenres. The colors in the images of outdoor sports were mostly green from the grass and red from the dirt, while the range of movement was broad or slow in many cases. Games with rapid movements, such as soccer, were filmed using wide shots, with less focus on the details of the movements, compared to indoor sports. Games requiring cautious movements, such as golf or baseball, are associated with a slow speed with a slow variation in screen content. In conclusion, brightness appeared to affect the image quality more than saturation or contrast. It was notable that, while a brightness increase (B+) enhanced the image quality in the still image, a brightness decrease (B-) better improved image quality in the moving image.

1.2 Documentary

The image quality evaluation process resulted in higher scores for images rendered with increased saturation, which was mainly demonstrated in full shots of a scene. This may be related to the viewer's emotional expectation for the documentary genre to show realistic and objective scenes.
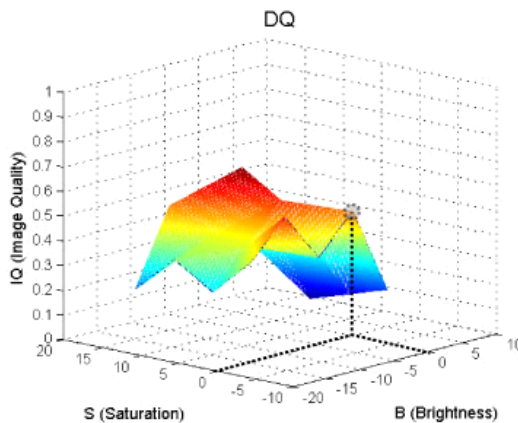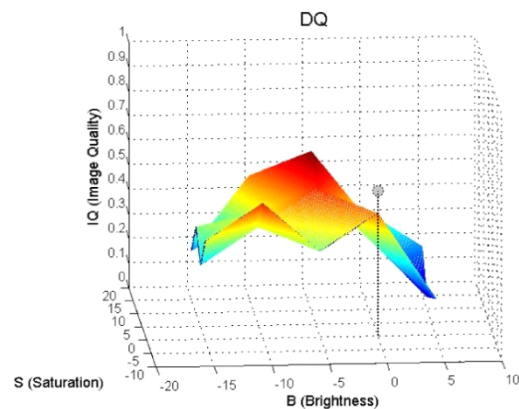

그림 2. 채도 및 밝기의 함수로서의 다큐멘터리(DQ) 화질
Fig. 2. Documentary (DQ) image quality as a function of saturation and brightness

In these images, the scene with the grassland background was like those of outdoor sports, but a scene regarding Mayan civilization also included computer generated scenes. In computationally simulated scenes, both saturation and brightness were found to affect the image quality. Using the same approach of Fig. 1, the image quality values for rendered saturation and brightness are shown in Fig. 2.

1.3 News

Whereas de-saturation stimulates the viewer's sensibility by inducing emotional immersion, increased saturation triggers objectivity by realistically depicting the scenes. In this context, the image quality evaluation tended to produce higher scores for images rendered with increased saturation that satisfied the realistic, clear, and emotional attributes of the news, which matched the viewer's expectations. Contrast affects the sharpness of the screen, which exerts a positive influence on the realistic emotional attribute expected by the viewer. Similarly, the more saturated the screen appears, exaggerating differences in color, the more realistic it appears to the audience. Sharpness increases in proportion to contrast, which predictably leads to higher scores in the image quality evaluation for images rendered

with increased contrast. Also, it is estimated that the viewers prefer somewhat exaggerated images with increased saturation, as the characteristics of the news genre such as the smaller proportion of moving images result in a lesser image quality dependence on brightness but a greater memory color effect, which is based on factors such as skin tones. The image quality for rendered contrast and saturation is shown in Fig. 3.

1.4 Music Shows

Contrast is related to discriminability, as it accentuates the object of interest within a frame by increasing sharpness. The enhanced dramatic impact of contrast through improved object extraction invokes dynamic and rhythmic emotions associated with the scene. As for scenes, which were rendered with enhanced contrast, the rhythmicity and movement that are normally expected from music programs were clearly recognized, which tended to result in higher image quality scores. The image quality scores of all scenes, with increased contrast, were relatively high in still and moving images. This is related to the tension and psychological excitement experienced by the viewer, which is both triggered by images with high saturation. This tendency for higher scores appears to have
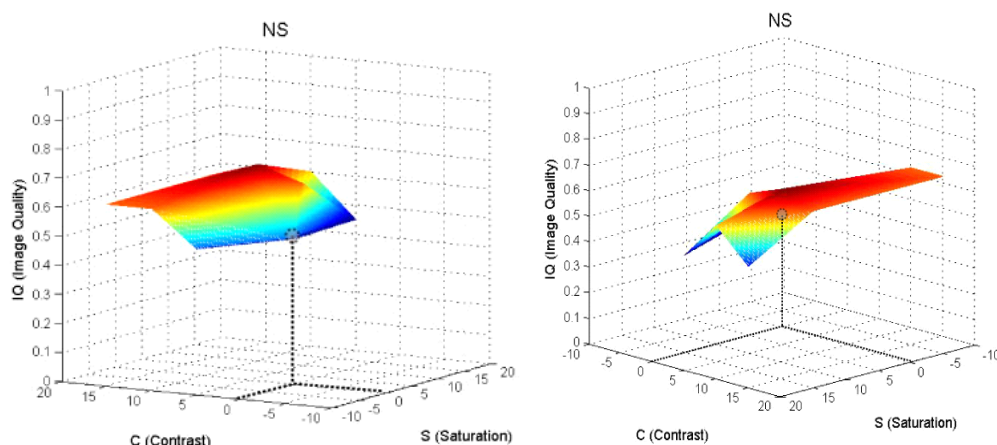

그림 3. 채도 및 대비의 함수로서의 뉴스(NS) 화질
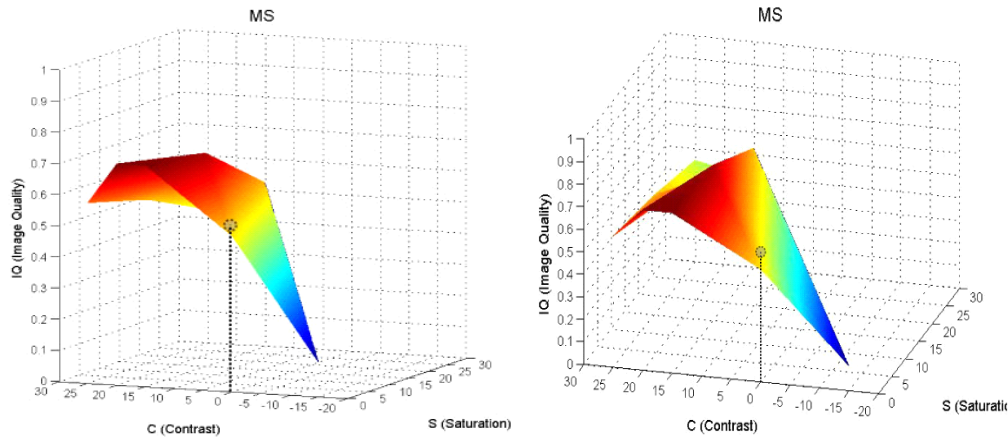Fig. 3. News (NS) image quality as a function of contrast and saturation

그림 4. 채도 및 대비의 함수로서의 뮤직쇼(MS) 화질
Fig. 4. The Music Show (MS) image quality as a function of contrast and saturation

been caused by the colorful scenes rendered with heightened contrast, which led the viewer to experience the extravagant emotions and psychological excitement expected of the music/performance genre. Fig. 4 is the same as Fig. 3, except that it depicts the Music show genre.

1.5 Romance

The romance genre, due to its nature, consists of a high percentage of full or tight shots with a greater area of skin color. Since moving images are affected by the background of the natural landscape, the influence of skin color on im-

age quality was smaller than it was for the still image. Figure 5 shows the relation between image quality and rendered brightness. The romance genre was the only genre in which scores were strongly related only to the one attribute of brightness.

1.6 Sci-fi/Action

In the sci-fi/action genre, scenes rendered with high brightness received a high score in the image quality evaluation. This is because an increase in brightness also increases the vivacity of the moving image, creating an en-
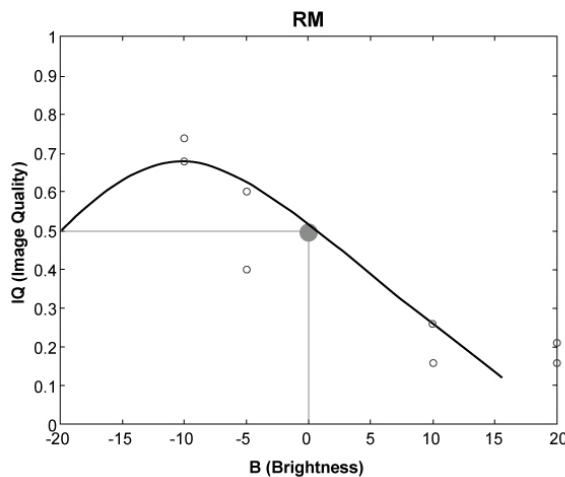

그림 5. 밝기의 함수로서의 로맨스/드라마(RM) 화질
Fig. 5. Romance/Drama (RM) image quality as a function of brightness
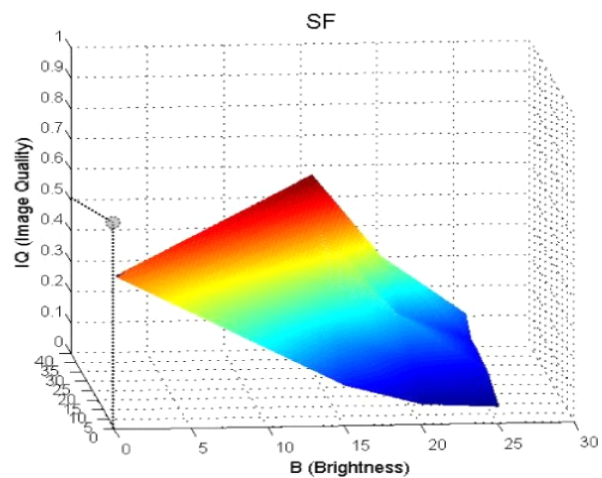

그림 6. 대비와 밝기의 함수로서의 SF/액션(SF) 화질
Fig. 6. Sci-fi/Action (SF) image quality as a function of contrast and brightness

ergetic ambiance. In addition, high contrast also showed a positive correlation with image quality. As high contrast makes the image more distinctive and discriminable, the viewer can feel the dynamism of the image, which satisfies the sense of dynamic rhythmicity expected of the sci-fi/action genre. Figure 6 shows the SF image quality score against contrast and brightness.

2. Still images vs. Moving images

The study compared the perceived attribute that affects the image quality of the still image and the perceptual attribute that affects the image quality of the moving image (Table 2).

표 2. 각 장르의 정지 및 동영상에 대한 화질 점수의 상위 요인의 값
Table 2. The top rendering values of high image quality scores for still and moving images of each genre

Genre	Still image				Moving image		
SP_O	B+20	S+20			B-5	S-5	S+5
DQ	S+20	S+10	B-10		B-5	S+5	
NS	S+10	C+10			S+10	C+10	
MS	C+20	C+10	S+20	S+10	SS+5	C+15	C+20
RM	B+20	B+10			B-5	B-10	B-15
SF	B+20	B+10	C+20		B+15	C+30	

B=brightness, S=saturation, C=contrast, attributes (B, S, and C) ± the rendered percentage increment

For the genre of outdoor sports, an increase in brightness and saturation corresponded to the increased image quality of the still image. In the still image, the aesthetic values of the natural landscape increased brightness. For the moving image, however, a decrease in brightness corresponded to improved image quality. In sum, the participants preferred a 20 percent brighter image for the still image, but in the moving image experiment, an increased brightness may have adversely affected the viewer's ability to focus on the dynamic movements. Thus, in the moving image, in contrast to the still image, an increase in saturation is achieved through decreased brightness, and vivid, realistic game scenes in the outdoor sports genre are preferred. Similar results were produced for the still image and the moving image in the documentary genre. For scenes of the natural landscape, an increase in saturation and a decrease in brightness effectively improved image quality, but this effect did not apply to non-natural landscape scenes. High saturation was preferred due to the memory color effect of the natural landscape [8,17]. High saturation is also considered to satisfy realism. Such results were found in both the still and moving images, improving the credibility of the replicated experiments.

In the news genre, the results for the still image and the moving image confirmed that an increase in saturation effectively improves image quality. This is because increased contrast in both the moving and still images not only delivers the details of images more effectively but also displays news images more vividly and realistically. In the music genre, an increase in saturation and contrast also resulted in improved image quality for both the still and moving images. The moving image, however, was preferred when the degree of saturation increase was low, possibly because the flashy stage lighting and movements of the performers match the genre's colorful characteristics, thereby avoiding an excessive increase in saturation. In the romance genre, an increase in brightness was preferred for the still image, while a decrease in brightness corresponded to improved image quality for the moving image, which is a similar result to the outdoor sports genre. For the still image, as skin color occupies over 50 percent of the display, the memory color effect of skin color is estimated to have influenced the improvement of image quality with an increase in brightness [18]. For the moving image, on the other hand, motions of the on-screen actor and constant changes of the natural landscape resulted in an image quality improvement with a decrease in brightness, which corresponded to the emotions expected of the romance genre. With the

SF/Action genre, an increase in contrast was effective in improving the image quality of the still and moving images. The vividness caused by increased contrast appears to enhance the dynamism of the image, which matches the expected emotions for the SF/Action genre.

For the still image, an increase in brightness and saturation in the genres of SPO, DQ, and RM corresponded effectively to improved image quality. For the moving images of the SPO, DQ, and RM genres, on the other hand, increased saturation and decreased brightness resulted in high image quality. Meanwhile, similar results were shown for the still image and the moving image in the genres on NS, MS, and SF. For both the still and moving images,

increased contrast led the robust details on the display to become more vivid and discriminable.

Ⅳ. Discussion

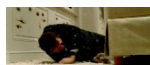Considering the expected sensibility of each genre, the results of assessing perceived properties affecting the quality of the image are as follows. The brightness affects the atmosphere of activity, imparting attributes such as pleasure, joy, and cheerfulness. Saturation increases the realism of what it describes, satisfying natural memory and increasing the motility of emotional images associated with glam-

표 3. 각 장르의 대표 정지 및 동영상에 대한 최적의 화질 요인 값
Table 3. The optimal rendering index for still and moving images of each genre with a representative image

Still image	Representative image		Moving image
B+20	Outdoor sports		B-5
Brightness increase			Brightness decrease
B-10_S+10	Documentary		B-5_S+5
Brightness decrease Saturation increase			Brightness decrease Saturation increase
S+10_C+5	NS		S+10_C+15
Saturation increase Contrast increase			Saturation increase Contrast increase
S+20_C+15	MS		S+5_C+20
Saturation increase Contrast increase			Saturation increase Contrast increase
B+10	RM		B-15
Brightness increase			Brightness decrease
B+20	SF		B+15_C+30
Brightness increase			Brightness increase Contrast increase

B=brightness, S=saturation, C=contrast, attributes (B, S, and C) ± the rendered percentage increment

our and excitement. Contrast is thought to affect sharpness and the ability of viewers to recognize objects, and contrast also increases the sense and discrimination of components in the frame, in a manner that increases the kineticists of the scene. The color of the skin on the screen seems to increase the perceived image quality when it appears to be a skin color that viewers remember and expect.

In the still image, an increase in brightness and saturation corresponds to improved image quality in the SPO, DQ, and RM genres. Also, an increase, in contrast, made many details on the display more vivid, distinctive, and discriminable for the NS, MS, and SF genres. For the moving image in the NS, MS, and SF genres, increased saturation and decreased brightness resulted in preferred images with high image quality. With the NS, MS, and SF genres, the increased contrast makes the image more distinctive and discriminable, allowing the viewer to feel the dynamism of the image and satisfy the emotional attribute of dynamic rhythmicity (Table 3). The correlation between naturalness and image quality was lowest when the brightness was lowered by 17 percent from the original value. The correlation between naturalness and quality determines the final image quality by varying the ratio according to the contents, using brightness as the constant variable. When the contrast increases, details and image quality are enhanced at the cost of unnaturalness. Although image quality improves with increased saturation, an excessive increase may lead to an unnatural image [8].

As mentioned in the introduction, conventional quality studies were limited to static images and limited to direct application to TV sets. Whereas conventional TV sets provide all kinds of scenes that are converted to different pictures so that they can be suitable for sports, movies and other genres, there are limitations in TV sets that are not enough to improve quality. I have identified and categorized not only sports and movies but also the best quality factors for different genres that can affect the improvement of image quality. Based on the above results, genres of television content can be classified into two types of experiences (Table 4):

Proximate experience: This refers to activities that a person might be involved in personally. Its genres include outdoor spots under sunlight, dramas, and nature documentaries. For proximate experience, artificial details account

표 4. TV 장르에 대한 두 가지 유형의 경험, 즉 직접 경험과 간접 경험에서 화질에 영향을 미치는 색채 속성
Table 4. Color attributes that effect image quality for two types of experiences for genres of television content; proximate experience and indirect experience

Proximate experience <SP/O, M_RM, DQ>	Indirect experience <NS, MS, M_SF>
There is a difference between still images and moving images.	Optimal image quality is generally similar for both still images and moving images.
• Contrast dependence low • Brightness dependence high • moving image -B	• Contrast dependence high (C+) • Brightness dependence high
Brightness	Saturation dependence (NS, MS : S(increase) / SF : S(decrease))
• No artificial details. • Naturalness close to 100%	• NS, MS ⇒ S + dependence high • No correlation between motion and saturation. Under an artificial lighting or setting the correlation with saturation high
	Contrast
	• As contrast increases, details in the image become more discriminable

for a small proportion of the overall image, and naturalness is the most important aspect.

Indirect experience: This refers to a situation that a person is unlikely to be in. Most circumstances take place under artificial lighting and feature numerous fictional characters. Images categorized by indirect experience have many artificial details and exhibit naturalness and unnaturalness at the same time. Indirect experience genres include news produced in an artificial studio, music programs filled with artificial lighting and stages, and SF movies with fictional characters and exaggerated action.

Table 4 Color attributes that effect image quality for two types of experiences for genres of television content; proximate experience and indirect experience.

While conventional TV sets could have provided optimal quality by choosing the mode for content or genre, this study provided basic data to implement the optimal quality by grouping genres into several or have more granularity within the genre. Also, the comparison of moving and still images showed the difference between the image quality studies and for TV sets. This research is highly applicable as it is categorized by experiences based on memory color despite the change of hardware (example LCD, OLED, HDR, etc.) of the TV set.

Ⅴ. Conclusion

TV genres were classified into the two categories of proximate experience and indirect experience based on the situational context for optimal image quality on TV sets. First is, a proximate experience which refers to activities that a person might have experienced, such as outdoor sports, dramas, and nature documentaries. For this category, increased saturation and decreased brightness resulted in high image quality. Second is an indirect experience that refers to news produced in an artificial studio, music programs filled with artificial lighting and stages,

and SF movies. The increased saturation and decreased brightness resulted in preferred images with high image quality for this category. The quality of the picture on TV cannot be applied to each scene as in previous studies, therefore, the mode was set to be robust based on the content genre. This research has shown important attributes in the reclassification process to achieve optimal quality of TV genre based on the viewer's experience. The study is meaningful in that even if new genres are created or existing genres are subdivided, color characteristics can be predicted with optimal picture quality depending on the viewer's experience.

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