

Synesthetic Sound-Color Cross-Modality in Animations

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Abstract

Synesthesia is a neurological condition in which stimulation of one sensory or cognitive pathway includes automatic and involuntary responses in another sensory or cognitive pathway. In this paper we performed a set of tests for sound-color synesthete and we were surprised at how consistently the test subjects associated colors with respective to the keys. We compared these representative colors in an animated American film and also discuss how synesthetic colors associated with musical key are adopted in recent Japanese animations. We could see how these colors create special effects and strongly enhances the emotional power.

Categories and Subject Descriptors (according to ACM CCS): H.5.1 [Information Interfaces And Presentation]: Multimedia Information Systems—Evaluation/methodology

1. Introduction

Synesthesia is a neurological condition as when, for example, one “see colors when listening to sounds,” or “feels shapes when tasting foods.” People who report such experiences are known as “synesthetes.”

Synesthesia is believed to be one of the most important keys to understand cross-modality [DRD09]. Applications of these synesthetic brain mechanisms to multimedia designs includes film, music, and interactive art etc.

The purpose of this paper is to show how synesthetic cross-modal mapping, especially sound-color mapping, has been utilized in animation films and to construct synesthetic cross-modal sound-color mapping schemes in animation designs.

2. Sound-Color Synesthetic Test

We performed a set of tests, based on a standard battery [DAS*07] that include: (1) a scale test, (2) a chord test, and (3) a musical key test. The test subjects select colors from a color map after hearing sounds or short musical segments generated by various scales, chords, and keys. We judge the level of the synesthesia based on the battery score formula [DAS*07]. We performed this test at Tokyo University of the Arts for subjects aged 18-22, including male and female, and tried to find a cross-modal map from sounds to colors.

3. Synesthesia test results

3.1. Typical Individual Test Results

We were very surprised at how strongly test subjects associated colors with keys, especially with major keys as shown in Figure 1.

The surprising outcome of Figure 1 is that the test subject selected almost the same colors in each trial for the major keys (outer one) for the three tests. In minor keys (inner circle), only the scale tests strongly reflect the results for the major keys. However, excepting the scale test, the selected colors in the chord and key tests are almost identical.

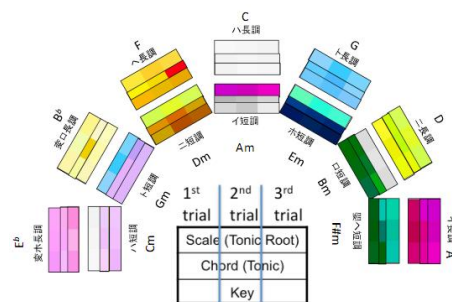


Figure 1: A typical individual test result in the synesthesia tests.

3.2. Clustered Test Results

We use the k-means method to cluster the selected colors of 52 test subjects, and obtained representative colors for each key. The representative colors for the scale, chord, and key tests are very strongly correlated. Synesthetes select only a few to several similar colors instead of the same for each key so that it generates clusters in the tests. We call this a synesthetic color palette.

4. Synesthetic Color-Sound Synchronization: Fantasia Color Scheme

We compared these representative synesthetic colors with those in “Fantasia,” a 1940 American animated film produced by Walt Disney. Synesthetic colors are associated with the musical keys, and we show how these colors create special effects in Fantasia. For example, as seen in Figure 2, during the musical chord F faded in, the orange color in the background also faded in. The music and synesthetic colors fade synchronously. This is one of the color-sound synchronization effects that are analogous to “cross-fading.”

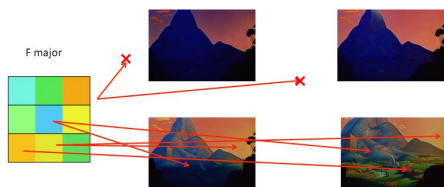


Figure 2: Synesthetic colors are associated with the musical keys in “Fantasia.”

The color-sound synesthetic synchronization in Fantasia strongly affects the audiences’ emotion, the audiences’ experiences pleasure, when the synesthetic color appears.

5. Key modulations using synesthetic color-sound cross-modality in Japanese animations

Next, we discuss how synesthetic color-sound cross-modalities are adopted in recent Japanese animations. Taking from the film “Spirited Away,” for example, in contrast with the synesthetic color in clustered results, which was shown in Figure 3, no synesthetic color palette appears in this animation as the music “Summer Day” fades-in.

Apparently, in this film, synesthetic color-sound synchronization like Fantasia is not adopted. Due to lack of time to change key in this music not like Fantasia, synesthetic cross-modality between its music and colors is substituted to give the same effect as change in key.

Lendvai Erno [LSM93] claims that not the absolute keys themselves, but only the relationship between the keys determines the meanings and story of the music. In the case of

“Spirited Away”, the key characteristics or emotions of an A-minor is “the past world” or “nostalgia,” which strongly implies the story and main theme of this animation. The synesthetic cross-modal sound-color effect leads the audience into the world of “Spirited Away” effectively. The emotion is always relative and can be invoked only by the change in key.

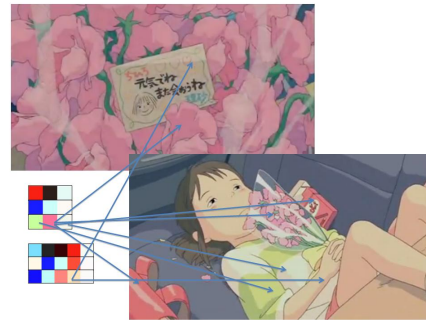


Figure 3: Two shots from the opening of “Spirited Away.”

6. Conclusions

We have focused on sound-color synesthesia to investigate synesthetic cross-modal mapping between sounds and colors using a standard synesthesia test. Our individual results show that the test subject tends to pick the same color in the scale, chord, and key tests associated with key structure and clustered results show that synesthetes do not pick one but several colors in each key.

In order to verify our synesthetic color-sound mapping we investigated how these colors are adopted in Fantasia and noted that sophisticated fading-in and cross-fading effects are adopted in the film, and synesthetic colors are used to enhance and reinforce affective key characteristics of the compositions.

We also investigated some Japanese animations and found that they used the cross-modal change in key relation to enhance and reinforce the emotions in the film.

Synesthetic cross-modalities are a very effective way to invoke a strong emotion for the audience. Further, researches on the synesthesia and cross-modalities may lead to new cross-media expressions in films and multimedia.

References

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