

# Developing a Denotation Model from Luminance of Album Cover from 1980 to 1992 in Taiwan

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*Abstract:* - Based on the luminance attribute of pop album cover, a diachronic study was conducted. It was argued that the denotation is significant related to the luminance attribute. The population of this study was those pop albums published from 1980 to 1989. In those years, this country was gradual opening up of political and economic stability. The sampled representative pop album covers were collected and put on the computer screen for conducting content analysis. The denotation and luminance attribute of each sampled album cover were also identified for statistical test. The relation between luminance and color was verified by applying regression technique. It was concluded that luminance could be predict 100 percent by the values of RGB colors. A logit regression was used to predict denotation of pop album cover from mean value of luminance and standard deviation of luminance. The C5.0 model was used to build a rule set and a decision tree for further illustrate the relation between luminance attribute and denotation.

*Key-Words:* - POP album cover, diachronic study, luminance attribute, denotation

## 1. Introduction

Communication becomes critical than ever in this information ear. Both mobile technology and internet technology provide humankind's extended ability to grab information all day long. The advertise business already becomes part of the society daily life. It can be fulfilled that in the modern society, advertisement always shows the messages and the ideology of what it told to the general public. Advertising then, is used as the mass media communication that has its symbols, meaning and messages to the readers. The album cover also is a form of advertisement. It is not only as the

promotion of one product but also has become the design of a structure with its own value. One pop album cover represents various messages for the readers, in which the message is created by using signs and codes and for purpose that the readers can understand the messages that are sent. People use technology to support information exchange. Visualization enhances communication functions. In this mobile technology world where all things communicate, it is important that we determine what precisely we are trying to say. Wrapping pop album with a cover is not only providing protection to the black vinyl music disc, but also the information

related to that album all about. By printing sign on the cover, the visual communication could be recognized upon the text and image around the cover. A public publication, such as a pop album cover, should be design and layout according the designer's idea and the public perception.[1]

Codes are symbols with systematic meaning and signs are vital elements in languages and statement. By Barthes' definition, a sign is the combination of a signifier and signified. In this perspective, a sign cannot stand alone.[2]

In the findings of previous study [3], it was found that denotations of pop album cover could be predicted by the attributes of color. There is a need to find out the algorithm of illustrating denotation from attributes of luminance.

## 2. Conceptual Framework

Based upon the semiotics theories, the research foundations would be constructed.

With the slow removing of the embargo of Taiwan's political and economic democracy, the changing was mainly between 1980 and 1992. It was in 1987. The martial law was terminated in that year. Before and after the performance style of album covers have a very observable change in Taiwan's pop music on album covers. Several focuses were founded, such as "how to explore their roots", "returning" as well as the mirror image of the role of self-identity. The thought of the "subjectivity" and the thought of being part of the International Federation were all integrated into the of Phonographic Industry as a post-modern brewing out of graphic design clues, and it also illustrates that pop music album cover design in the 1980s was a prelude to open a turning point in post-modern for the 1990s.

In figure 1, the conceptual framework of this study was illustrated.

It is commonly accepted that the distribution of the Web as a ubiquitous communication medium has fostered a novel type of applications, whose main focus is on capturing the user's attention by providing facilitated access to information and services.[4] In this study, the denotation of album cover would be analyzed and identified by displaying album covers on computer screen for content analysis. A model development could further explore relations among research variables. [5]

### 2.1 Human Color Perception

Human color recognition depends upon light, objects that reflect light, and the viewer's eyes and brain. For a computer screen, the light is actively ignited from the monitor. The Light entering the eye is converted to neural signals in the retina. The signal is sent to the brain via the optic nerve. The eye reacts to the three integrable primary colors of red, green, and blue, and the brain perceives color as a combination of these three signals. In figure 2, the process of color luminance recognition was pointed.

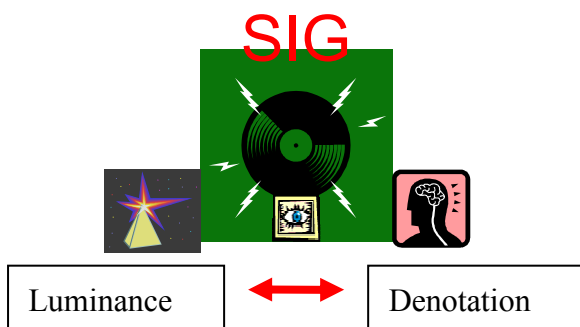


Figure 1 Concepts of Denotation of Pop Album Cover and Luminance Attribute

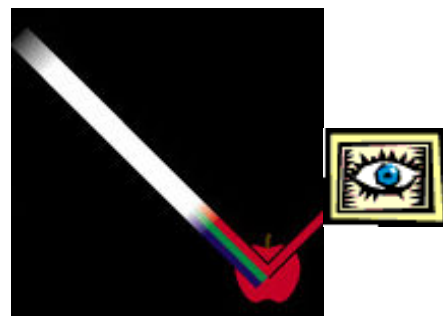


Figure 2 the color luminance recognition process

Light is defined to be the mediating means for perceiving objects it illuminates. When the light stimulates eyes by the reflected light from an object or the light emitted from a computer screen, people perceive and recognize the light as a color. When the light reflected off an object enters the human eye, it reacts with the photoreceptors in the retina, and the signals are sent to the brain. Some photoreceptors are sensitive to light and shade, and others to red, green, and blue wavelengths. When

these signals are received, the brain perceives color. Some animals cannot see in the dark, while others see very well under these conditions. Dogs and cats do not see colors. All of these variations are determined by the function of the optic nerves.

## 2.2 Self-luminous Color and Object Color

Humans can perceive two types of color. The color of a self-luminous object is called self-luminous color, and the color of an illuminated object is called object color. A self-luminous object may be natural, such as the sun, or artificial, such as computer displays, incandescent light bulbs, mercury lamps, and the like.

Object color is the color reflected from an illuminated object, and is comprised of both the light reflected from the object's surface as well as light reflected and scattered from beneath the object's surface.

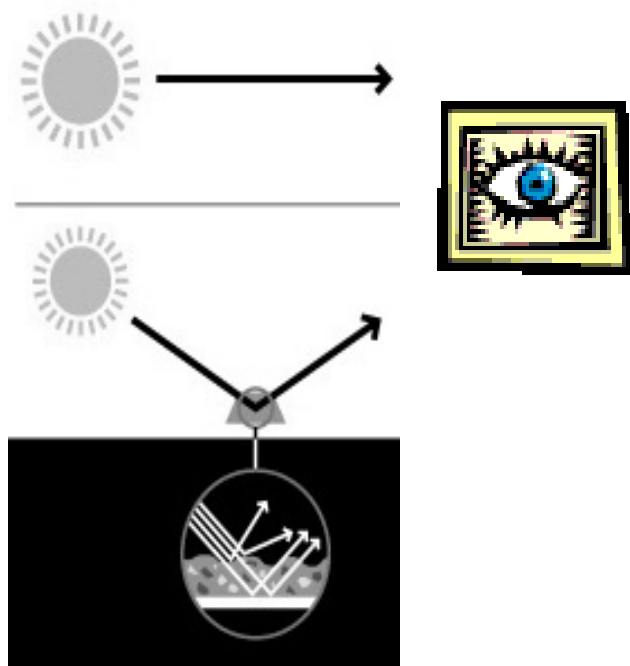


Figure 3 Self-luminous and object colors

## 2.3 Digitizing Luminous and Colors

Luminous and colors are specified as a three-byte hexadecimal number in luminous and RGB, where the three bytes represent the intensity of red, green, and blue of the color respectively. A single byte

represents a hexadecimal number in the range 00 to FF (0 to 255 in decimal notation), which allows 256 levels of intensity (shades) of a single color. A luminous or color is specified by concatenating the red, green, and blue bytes together, including a leading zero for each byte should the number be less than 10 hexadecimal (16 decimal). As each color (red, green, and blue) has a possibility of 256 shades, this scheme allows for 16,777,216 different colors ( $256 * 256 * 256$ ).

## 3. Methodology

The progress of both popular music and recording media are in parallel. Through the records publishing, pop music could be distributed to the general public. For this reason, this study assumes that the social phenomenon reflexes to music literature and art as well as the design of album cover.

The albums cover is design as a transporter to load pop music upon popular music culture. It was hoped that the design of album cover could be applied to explore the contrast historical backgrounds and to distinguish the relationship between design and luminance attributes.

### 3.1 Research Questions

The purpose of this study was to identify the relation between the denotation of a pop album cover and its luminance attributes. It was hypothesized that there existed significant relation between denotation and luminance attributes.

### 3.2 Sampling

It is important to know what how many data is good enough for reach research requirement. [6] For fulfilling the goal of this study, the time period would be those years from 1980 till 1992. Although there were vast numbers of pop music album in Taiwan during research targeted time, the sampling procedure would follow "Taiwan's pop music, one hundred best album," and "Past Golden Melody Award for best album." to collect data for analysis. Based on these two awards, each year select a representative album.

The aim was to choose representative design of album cover for each year.

### 3.3 Hypothesis and Models

Luminous attributes considered were mean, standard deviation, and median values and were used for conducting statistical analysis and models.

### 3.3.1 Research Hypothesis

For identifying the proposed relationship, several hypotheses were claimed for empirical data evaluation.

H<sub>01</sub>: There is no significant relationship between the chosen luminance attributes of distribution with effectiveness of logistics and denotation of pop music cover

H<sub>02</sub>: There exists no C5.0 model that could predict denotation of pop album covers from their luminance attributes.

### 3.3.2 Statistic models

The model used was the C5.0 node. For fulfilling the research purposes, two classification models were applied to test the research hypotheses. The C5.0 node builds either a decision tree or a rule set.

The model works by splitting the sample based on the field that provides the maximum information gain at each level. The target field must be categorical.

This node uses the C5.0 algorithm to build either a decision tree or a rule set. A C5.0 model works by splitting the sample based on the field that provides the maximum information gain. Each subsample defined by the first split is then split again, usually based on a different field, and the process repeats until the subsamples cannot be split any further. Finally, the lowest-level splits are reexamined, and those that do not contribute significantly to the value of the model are removed or pruned.

The C5.0 node can predict only a categorical target. C5.0 can produce two kinds of models. A decision tree is a straightforward description of the splits found by the algorithm. Each terminal (or "leaf") node describes a particular subset of the training data, and each case in the training data belongs to exactly one terminal node in the tree. In other words, exactly one prediction is possible for any particular data record presented to a decision tree.

In contrast, a rule set is a set of rules that tries to make predictions for individual records. Rule sets are derived from decision trees and, in a way, represent a simplified or distilled version of the information found in the decision tree. Rule sets can often retain most of the important information from a full decision tree but with a less complex model. Because of the way rule sets work, they do not have the same properties as decision trees. The most important difference is that with a rule set, more than

one rule may apply for any particular record, or no rules at all may apply. If multiple rules apply, each rule gets a weighted "vote" based on the confidence associated with that rule, and the final prediction is decided by combining the weighted votes of all of the rules that apply to the record in question. If no rule applies, a default prediction is assigned to the record.

Logistic regression is a statistical technique for classifying records based on values of input fields. It is analogous to linear regression but takes a categorical target field instead of a numeric range. Logistic regression, also known as nominal regression, is a statistical technique for classifying records based on values of input fields. It is analogous to linear regression but takes a categorical target field instead of a numeric one. Both binomial models (for targets with two discrete categories) and multinomial models (for targets with more than two categories) are supported.

Logistic regression works by building a set of equations that relate the input field values to the probabilities associated with each of the output field categories. Once the model is generated, it can be used to estimate probabilities for new data. For each record, a probability of membership is computed for each possible output category. The target category with the highest probability is assigned as the predicted output value for that record.

### 3.4 Content Analysis and Coding System

In this study, content analysis was conducted according following steps.

1. Theory and rationale.
2. Conceptualization decisions
3. Operational measures
4. Coding schemes
5. Sampling
6. Coding

Upon reviewing literature, the denotation codes were claimed as following:

1. Fresh and the continuation of folk music: 1980-1982
2. Young rebellious "new breed": 1982-1989
3. Confinement after the liberation and freedom: 1986-1989
4. Other than previous style "New Age": 1990-1992

Table 1 the denotation codes of fresh, new breed, and confinement listings by the year

	Fresh	New Breed	Confin ement
1980	1	0	0
1981	1	0	0
1982	1	1	0
1983	0	1	0
1984	0	1	0
1985	0	1	0
1986	0	1	1
1987	0	1	1
1988	0	1	1
1989	0	1	1
1990	0	0	0
1991	0	0	0
1992	0	0	0

## 4. Findings

### 4.1. Sampled Pop Album Covers

The aim was to choose representative design of album cover for each year. The sampling procedure followed "Taiwan's pop music, one hundred best album," and "Past Golden Melody Award for best album." to collect data for analysis. Based on these two awards, each year select one representative album.

### 4.2 Denotation of sampled album cover

In the early 1980s, album covers are still continued the campus folk music style, keep fresh, clean, simple layout in 1970s. In the Table 1, Mr. Hou presented his album "Descendants of the Dragon" with the calligraphy of running script font and picture wearing traditional long robe and holding a classical reed bamboo pipe wind instrument instruments. The background of the cover is a traditional architecture dragon column and traditional ink painting landscape of the rising sun, symbolizing the combination of explicit and stressed that China's modern simplicity inherent in the traditional elements of formal design.

It was intended to create the international identity of the Republic of China at that time on the "legitimacy" and "legitimacy". It also reflected the no formal diplomatic relation between Taiwan and the United States. The cover was also intended to echo to the highlighting of the legal status of the Republic of China in the United Nations before 1978. Because of the enthusiastic response to the publishing of the "Descendants of the Dragon", the commercial folk music continued to extend into the early 1980s. It also provided a vent for the pressure of the international isolation in the martial law era and appeases the tense atmospheres during the late 1970s and the early 1980s.

In 1981, the design of Sylvia Chang's "childhood" album cover presented in a way of using illustrations. By drawing a picture of Sylvia with her childhood memories, this album represents the singer's imagination and memories of childhood. In the font used on the application, it used particularly the emotional handwriting rather the rational printing font. In fact, album cover design with illustration style had been applied at early folk songs period.

With a children looking like Sylvia Chang holding a picture of a now Sylvia Chang in the hands, the "childhood" album presented a kind of design thinking than reality. The background of gold leaf

connected both the past and the present era. The conceptual album in such a form as the starting point is a unique example in the year. The included songs were easy to sing and not tend to be abstruse and convoluted for the highbrow.

Su's album, "the same moonlight" did not show "Moonlight" on the cover. The screen is only a young rebellious close-up side face. With Su's unruly temperament coupled with a short hair and the black and white combination, it did show a kind of gender unrecognized visual effects. This made "the same moonlight" becoming much more distinctive, which was representative works in year 1983.

Zongsheng Lee "Life in the Wizard," 1986 show a rope tied to the mailing package with the title of "Mr. Lee Zongsheng revenue". While the sender is also the receiver Zongsheng Lee, the wrinkling of the leather with Lee's picture. The leather with a few holes on seems to imply that leaking some information.

It is appropriate to illustrate mirror effect of this album cover form Lacan's mirror theory. It did show how "original I" "selfhood" and "superego" could be integrated on an album covers. While watching the "subjectivity" is produced by the autonomy of the viewer, but the concept of psychoanalysis is the interpretation of visual images of the face, especially the impact of the viewer, through a specific interpretation of the image articulation or re-interpretation of focused concept.

#### 4.3 Color and luminance attributes of album covers

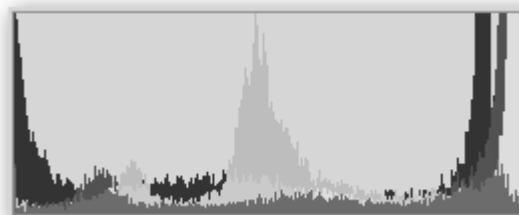
In Table 2, the RGB color distribution histogram of year 1980, 1981, 1982, 1983 and 1984 album covers were presented. The horizontal value is the level and the vertical value is the count.

In Table 3, the RGB color distribution histogram of year 1985, 1986, 1987, 1988, and 1989 album covers were presented.

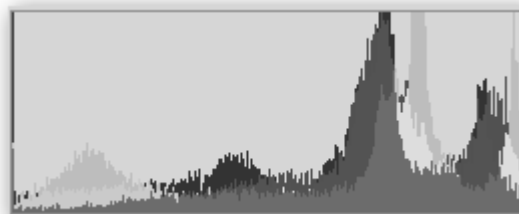
For further analyzing purpose, the Mean, Std. Deviation, and median of album cover luminance were measured and listed in Table 5.

In Table 6, the highest mean value is 191.97 and the lowest is 33.2. The highest standard deviation value is 107.46 of year 1983. The lowest standard deviation value is 39.13 of year 1985.

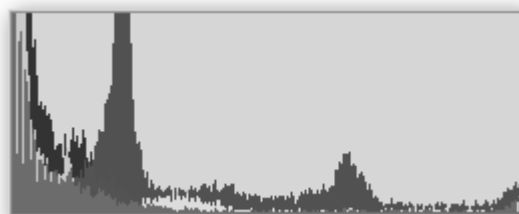
Table 2 RGB Color Distribution Histogram of Album Covers from year 1980 to 1984



1980



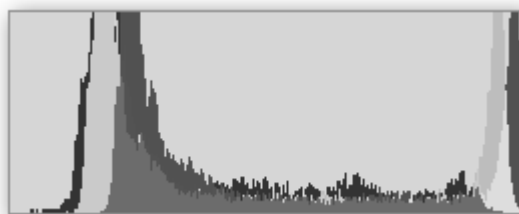
1981



1982

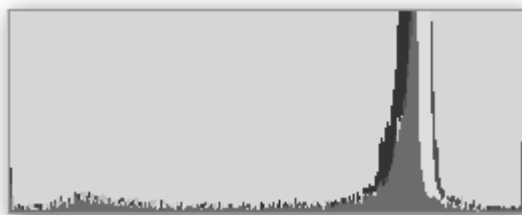


1983

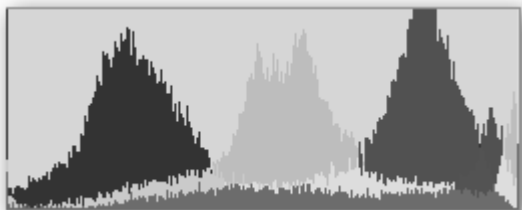


1984

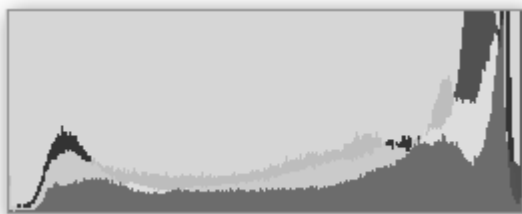
Table 3 RGB Color Distribution Histogram of Album Covers from year 1985 to 1989



1985



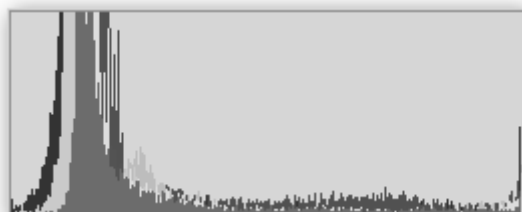
1986



1987

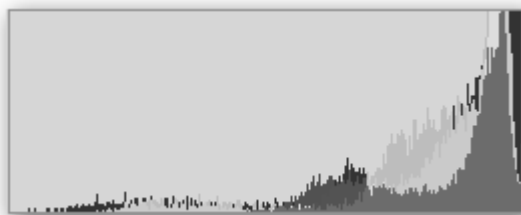


1988



1989

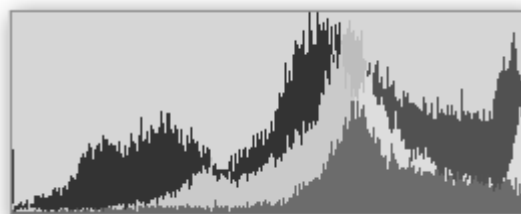
Table 4 RGB Color Distribution Histogram of Album Covers from year 1990 to 1992



1990



1991



1992

Table 5 Mean, Std. Deviation, and median of album cover luminance

Year	Mean	Std. Dev.	Median
1980	177.02	66.58	165.0
1981	167.36	63.37	189.0
1982	33.2	49.74	17.0
1983	125.0	107.46	94.0
1984	114.02	77.2	68.0
1985	191.97	39.13	204.0
1986	154.73	49.4	154.0
1987	166.15	70.8	188.0
1988	91.18	61.85	84.0
1989	56.22	52.91	35.0
1990	219.96	33.58	234.0
1991	92.99	97.35	40.0
1992	172.25	44.91	173.0

In Table 5, the highest mean value is 191.97 and the lowest is 33.2. The highest standard deviation value is 107.46 of year 1983. The lowest standard deviation value is 33.58 of year 1990.

Table 6 RGB Mean of album cover colors

Year	R Mean	G Mean	B Mean
1980	210.65	156.0	123.0
1981	181.69	192.0	176.0
1982	67.51	1.0	3.0
1983	124.38	95.0	96.0
1984	128.73	63.0	55.0
1985	193.15	205.0	199.0
1986	191.94	144.0	71.0
1987	183.71	177.0	177.0
1988	161.35	31.0	13.0
1989	69.28	33.0	30.0
1990	222.25	233.0	241.0
1991	94.04	41.0	34.0
1992	199.55	168.0	143.0

In Table 6, the mean values of RGB color channels are listed. A regression test was conducted to verify the relationship between luminance and color. The independent variable was luminance value and RGB mean values were set to be dependent variables.

Table 7 Regression model summary, ANOVA table, and Coefficients of predicting luminance by RGB colors

**Model Summary<sup>b</sup>**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	1.000 <sup>a</sup>	1.000	1.000	.03105

a. Predictors: (Constant), Bmean, Rmean, Gmean  
b. Dependent Variable: Lavg

**ANOVA<sup>b</sup>**

Sum of Squares	df	Mean Square	F	Sig.
36814.680	3	12271.560	1.273E7	.000 <sup>a</sup>
.009	9	.001		
36814.688	12			

a. Predictors: (Constant), Bavg, Ravg, Gavg  
b. Dependent Variable: Lavg

**Coefficients<sup>a</sup>**

Model	Unstandardized Coefficients		Standardized Coefficients		t	Sig.
	B	Error Std.	Beta			
1 (Constant)	-.020	.029			-.684	.511
	Ravg	.299	.000	.289	724.666	.000
	Gavg	.590	.001	.626	794.183	.000
	Bavg	.111	.001	.117	205.971	.000

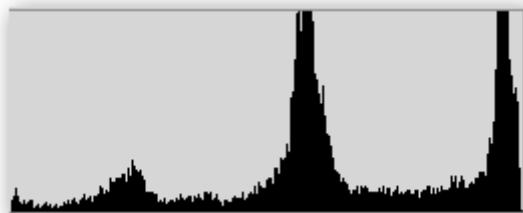
a. Dependent Variable: Lavg

In Table 7, the significant level provides verification of regression relationship between luminance and colors. The predict ability of the model was 100%. The regression model could be illustrated according to the standardized coefficients as follows.

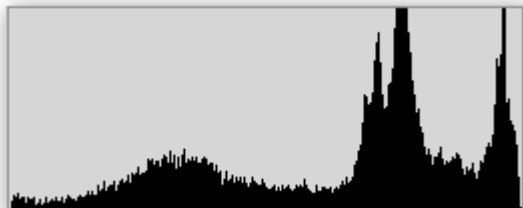
$$\text{Luminance} = 0.289 X R + 0.626 X G + 0.117 X B$$



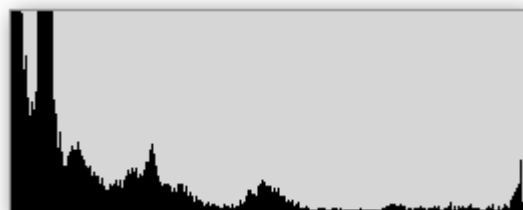
Table 8 Luminance Distribution Histogram of Album Covers from year 1980 to 1984



1980



1981



1982



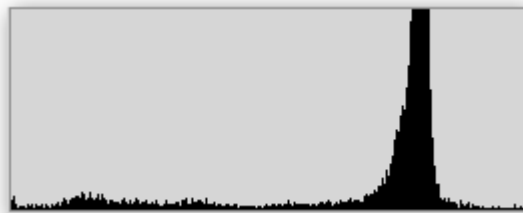
1983



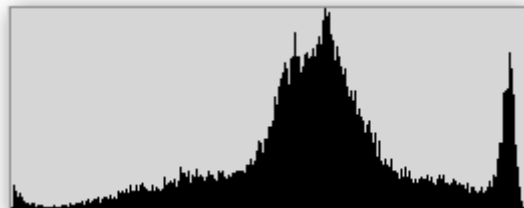
1984

In Table 6, the highest mean value is 191.97 and the lowest is 33.2. The highest standard deviation value is 107.46 of year 1983. The lowest standard deviation value is 39.13 of year 1985.

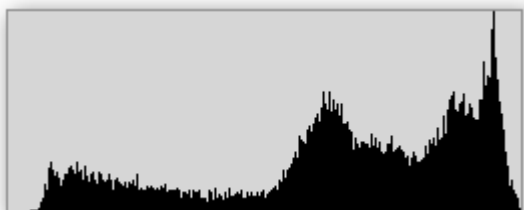
Table 9 Luminance Distribution Histogram of Album Covers from year 1985 to 1989



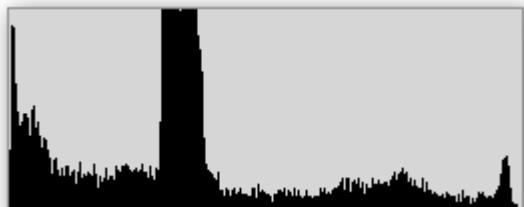
1985



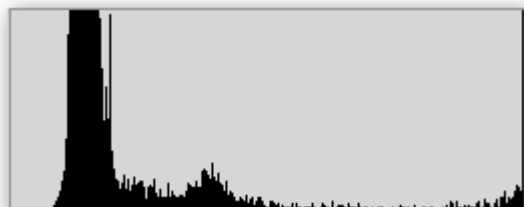
1986



1987

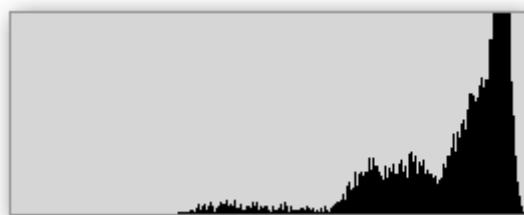


1988



1989

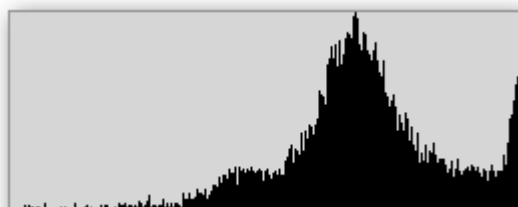
Table 10 Luminance Distribution Histogram of Album Covers from year 1990 to 1992



1990



1991



1992

**4.4 Classification model**

For verifying the model for predicting denotation from luminance attributes, the logistic model was reported in the following table.

Table 11 Model Fitting Information

Model	Model Fitting Criteria	Likelihood Ratio Tests		
		Chi-Square	df	Sig
Intercept Only	-2 Log Likelihood	39.642		.
Final		18.194	21.448	12 .0044
Pseudo R-Square		0.848		

The target was denotation. The inputs were mean values of luminance, median values of luminance and standard deviation values of luminance. The algorithm applied was Logistic regression with classification model type.

The model fitting information was listed in table 11. Since the significant level is less than 0.05, we could proceed as if the model is reasonable. According to the pseudo r-square, the denotations could be explained by the model at 84.8 percent. The equations for predicting denotations were listed in table 12.

Table 12 Equations for predicting denotation from luminance attributes

Equation For denotation “New Breed and Confinement” =

$$\begin{aligned}
 & -0.6464 * Lmean + \\
 & -0.08482 * Lsd + \\
 & 0.347 * Lmid + \\
 & + 52.6
 \end{aligned}$$

Equation For denotation “Fresh and New Breed”=

$$\begin{aligned}
 & -4.603 * Lmean + \\
 & -0.4047 * Lsd + \\
 & 3.208 * Lmid + \\
 & + 172.7
 \end{aligned}$$

Equation For denotation “Fresh” =

$$\begin{aligned}
 & -0.1076 * Lmean + \\
 & 0.1511 * Lsd + \\
 & 0.1384 * Lmid + \\
 & + -14.21
 \end{aligned}$$

Table 13 Rule set of the C5.0 model

```

Lmean <= 166.150 [ Mode: 011 ]
  Lsd <= 70.800 [ Mode: 011 ] => New Breed +
  Confinement

  Lsd > 70.800 [ Mode: 010 ] => New Breed

Lmean > 166.150 [ Mode: 000 ]
  Lsd <= 52.910 [ Mode: 000 ] => New Age

  Lsd > 52.910 [ Mode: 100 ] => Fresh
    
```

The C5.0 node build a rule set listed in table. The first rule for denotation “New Breed and Confinement” is Lmean equal or less than 166.15 and Lsd equal or less than 70.8. The second rule for denotation “New Breed” is Lmean equal or less than 166.15 and Lsd greater than 70.8. The rule for denotation “New Age” is Lmean greater than 166.15 and Lsd equal or less than 52.91. The rule for denotation “Fresh” is Lmean greater than 166.15 and Lsd greater than 52.91.

Decision tree of the C5.0 model were presented in figure 4.

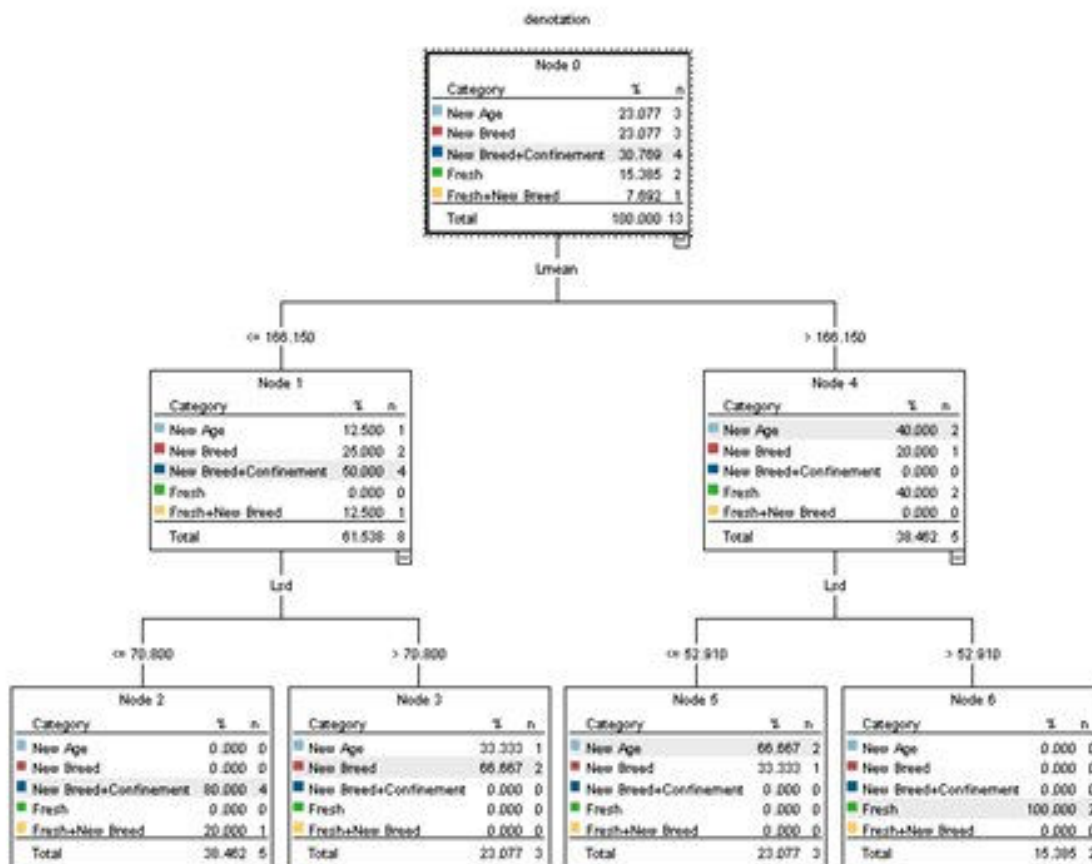


Figure 4 Decision tree of denotation by Lmean and Lsd

## 5. Conclusion

The development of both popular music and recording media are in parallel. Through the records publishing, pop music could be distributed to the general public. The album cover is design as a carrier to load pop music upon popular music culture. It was found that the design of album cover could be applied to explore the contrast historical backgrounds and to distinguish the relationship between design and color attributes.

In this study, first we find out the denotation of those represented pop-album covers by applying content analysis procedure. Then we verified the relation between denotation and luminance attribute.

Based upon the review literacy and content analysis of pop-album published in Taiwan from 1980 to 1992, it was found three categories of denotation.

1. Fresh and the continuation of folk music:  
1980-1982
2. Young rebellious "new breed": 1982-1989
3. Confinement after the liberation and freedom:  
1986-1989
4. Other than previous style "New Age":1990-1992

Upon statistic test results supported, it was concluded that color attributes are significant contribute to predict luminance and the luminance is also a well predictor for the denotation. The regression model was established for verifying the predicting relation between color attributes and luminance of pop album covers. The mean values of Red, Green, and Blue are significantly contributing to foresee the luminance of pop album covers.

A simplified pop-music album denotation predicting-model was also presented to illustrate the rule and the decision making tree. There are two major luminance attributes could be used as simplified model to describe the relation between denotation and luminance attribute. Those two attributes are values of mean and standard deviation.

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