THE ATTRACTION OF MOBILE FACIAL ART IN AUGMENTED REALITY

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Abstract - Augmented Reality (AR) is a technology applied in the mobile application in recent `years. It can effectively enhance users' interaction toward content, add a virtual object in the real space, and combine the recognition technology of the camera with the computer program. Due to the convenience use of the mobile phone, the facial augmented reality applied to the mobile camera applications. The aim of the study is to explore the attractive factors of facial augmented reality app to help designers effectively improve users' satisfaction. Applying Evaluation Grid Method, Kano quality model to evaluate 4 facial augmented reality apps : B612 、 LINE CAMERA 、 MSQRD and Beauty Show-show. First, deep interview 6 high-involved experts to obtain the EGM of facial augmented reality app. Based on the factors from EGM , Kano questionnaire and analysis were adopted to extract the quality attribution of the factors. Conclude the attractive quality factors of facial augmented reality app are "Interface intuition use", " Facial organs Modify ", "Live effect" and "Effect Fine Tuning " Improve the attractive factors could enhance users' satisfaction and preference.

Keywords - Facial augmented reality, Evaluation grid method, Attractive Factors, Kano Model

I. INTRODUCTION

Augmented Reality (AR) is a technology applied in the mobile application in recent years. It can effectively enhance users' interaction toward content, add a virtual object in the real space, and combine the recognition technology of the camera with the computer program. When the set picture appears in the lens, the corresponding virtual object will appear and interact with the user. The appeal of augmented reality is to attach virtual objects on the real environment images to show much information.

Due to the convenience use of the mobile phone, the facial augmented reality applied to the mobile camera applications, which recognize users' face and place the virtual image to them. Facial augmented reality apps provide users' to create funny photos, play make-ups, costume-change and role-player games. In addition, gradually applied to marketing tools, facial augmented reality apps could make a user's personal face become a commodity or movie character, and create one's fresh entertainment experience. Facial augmented reality app is a face-mark recognition technology that could combine one's real face pictures with the virtual image or character. It enables users to arouse their visual perception, manipulation and get the reflective pleasure of sharing photos. Thus, they are topic issues worthy of study when the augmented reality is gradually being widely used, such as what is the fascinating charm of facial augmented reality apps? How facial augmented reality apps arouse the users' feeling of euphoria? How facial augmented reality apps satisfy users' need while they interact with apps?

Accordingly, the aim of the study is as below:

1. Exploring the attractive factors of mobile social arts in facial augmented reality apps
2. Exploring the main design factors of mobile social arts in facial augmented reality apps
3. Exploring the satisfaction of mobile social arts in facial augmented reality apps

II. LITERATURE REVIEW

A. Augmented Reality

Augmented reality (AR) combines reality and virtuality to expand virtual objects in the real world and provide more information for real life. Augmented reality proceeds with capturing the image by the camera, analyzing and detecting the position or angle of the target card or image, and superimposing the corresponding images, video, sound on the identified target card or image. Azuma [1] mentioned the features of augmented reality include:

1. Combines real and virtual
2. Is interactive in real time
3. Is registered in three dimensions)

Augmented reality is mainly based on image recognition technology which comprises two kinds of identification technology: marker and markerless. Marker augmented reality requires the specific marks and patterns (usually black-white patterns) for system identification. It could identify and position the specific marks and patterns. It possibly cause unsightly on the screen but has the advantage of better identification efficiency[11], as shown in Figure 1.

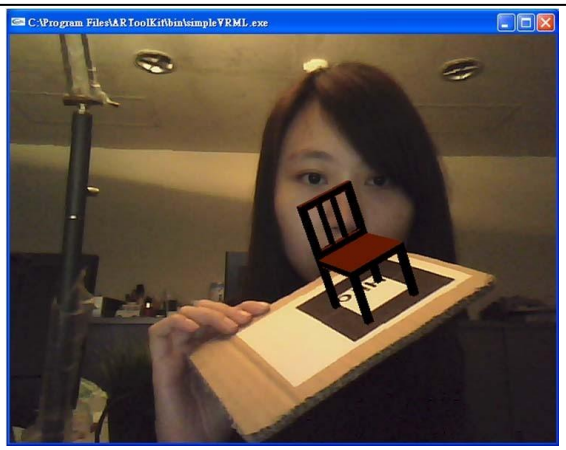
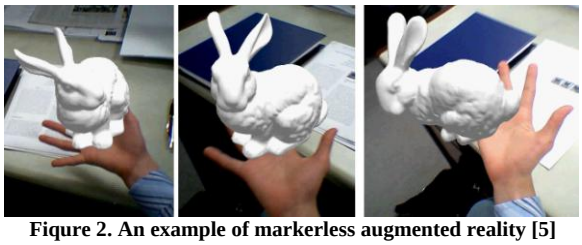


Figure 1. An example of marker augmented reality [9]

Markerless augmented reality is suitable to any identification picture or objects but require the specific card or images. It is commonly used to identify objects and face recognition, such as application for facial augmented reality APPs such as MSQRD, SNOW, B612. Compared to marker technology, the mark-free technique is more difficult to identify. Though freely setting the pattern or outline of objects, markerless technology is much more beautiful than the marker technology. It is more widely used now [11], as shown in Figure 2.



Fiqure 2. An example of markerless augmented reality [5]

Augmented reality technology enhances the interaction of the presentation. The computer program recognizes the set object or image, and the corresponding virtual object correctly superimposed to the position of the real space image could interact with users. To put it simply, AR provides users the real-time presentation and interaction of the virtual objects and information in the real environment.

B. Evaluation Grid Method

In 1985, Japanese scholars Sanui Junichiro and Inui Masao [10] proposed "Miryoku Engineering" (also known as Preference-based Design) and its basic theory structure by improving the Repertory Grid Method (RGM) proposed by the Clinic Psychologist Kelly. In 1991, Ujigawa Masato gathered several scholars to conduct studies of Miryoku Engineering. Miryoku Engineering is a technique system or a Preference-based Design to explore attractive objects, which focuses on building "Attractiveness Sensing Mechanism" and "Quantitative Attractiveness Evaluation Method" [10]. Moreover, the "Evaluation Grid Method" (EGM) was proposed by Sanui and Inui by improving RGM of Kelly[10], which is an important study method in Miryoku Engineering. It provides stimulus based on the theme scope. At first, it presents the subjects in pairs in front of the respondents, ask the respondents to compare the preference degree. The respondents are required to answer if they like or dislike it. Then it uses the additional questions to guide the respondents to clarify the answer or condition toward their preference. Based on Original evaluation items obtained from the respondents' instinctive understanding of the preferred object, further ask about the Ladder-Up Abstract reasons and Ladder-Down Concrete conditions related to the Original evaluation items. Repeat these steps to build the hierarchical grid structure of EGM (Figure 3), and further sort out the individual evaluation grid of the respondents towards the specific object.

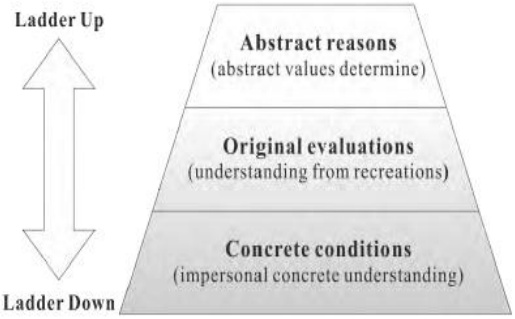


Figure 3. Ladder construction concept of EGM

C. Kano Model

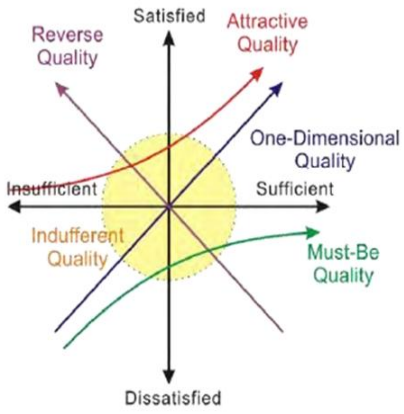


Figure 4. KANO Two-dimensional Quality Model [4]

In order to improve the concept about the quality that people emphasized the "physical quality" but ignored the "psychological quality", Kano [4] proposed the "two-dimensional quality model" as shown in Figure 4. He divided into the following five categories of quality attributes: (1) Attractive quality: These attributes will provide customer satisfaction if it is sufficient; and if not, dissatisfaction will increase. (2) One-dimensional quality: These attributes will result

in the customer satisfaction when it is sufficient and dissatisfaction when it is not sufficient. (3) Must-be quality: These attributes will not rise the customer satisfaction when it is sufficient because the customer thinks it is naturally, but it will make customers feel unsatisfied if when being insufficient. (4)Indifferent quality: These attributes will not result in any customer satisfaction or dissatisfaction whether sufficient or not. (5) Reverse quality: These attributes will result in customer dissatisfaction when it is sufficient, but make the customer satisfied if being insufficient.

By judging the quality attributes, it can explore the relationships between quality preference and customer satisfaction, and can identify the main attribute that can raise the customer satisfaction substantially. To judge the attributes of quality, the most commonly used and clearly method is Kano questionnaire survey. The Kano survey employs a questionnaire format with paired questions; it includes one functional and one dysfunctional form of the same question. Both forms of the question include five different response options for the customer to choose. Moreover, by using the Kano's matrix, you can crosscheck an individual's response to a functional question and to a dysfunctional question into one of five types of product features [4]. Following, Table 1 is the Kano Quality Attribute Matrix:

Product Requirement		Insufficient				
		I like it~	It must be~	Neutral	I can live~	I dislike it~
Sufficient	I like it~	Q	A	A	A	D
	It must be~	R	I	I	I	M
	Neutral	R	I	I	I	M
	I can live~	R	I	I	I	M
	I dislike it~	R	R	R	R	O

Table 1 KANO Quality Matrix [4]

Once the data is tabulated, the absolute importance values of customer requirements can be calculated by means of two terms: impact on "customer satisfaction" and impact on "customer dissatisfaction" [3]. In addition, the high and low of "Compute Customer satisfaction coefficient (CS coefficient)" could assist to understand the influence to "customer satisfaction" and "customer dissatisfaction" if the quality sufficient or not. The judgment of CS/DS is show as Figure 5. Gitlow also propose the guide to judge the quality attribution. [3] To sum of A+D+M and I+Q+R and compare which value is higher.

Extent of Satisfaction (CS): (A+D)/(A+D+M+I) (1)

Extent of Dissatisfaction (DS): -(M+D)/(A+D+M+I) (2)

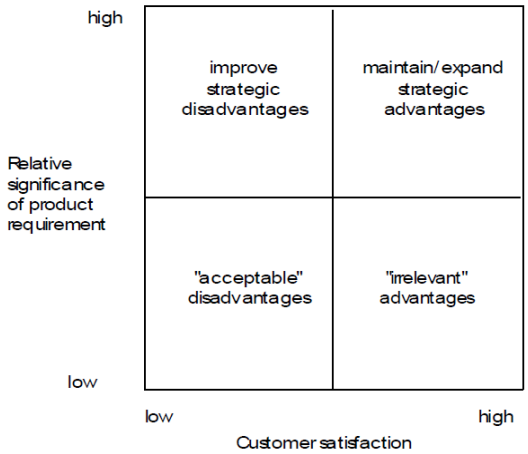


Figure 5. Satisfication coefficient matrix [7]

III. METHODOLOGY

A. Methodology

1. Methods and Steps

The experiment of this study adopts the qualitative and quantitative study methods in different stages. Firstly, this study collects four popular samples of Facial Augmented Reality APP from the platforms of ios App store and Andorid Google Play, conduct EGM interview to investigate the respondents' preference degree and the reason for the preference, and sort out the adjectives of the attractive factors. Then conduct the Kano questionnaire survey of the fun chairs, and conduct factor analysis and regression analysis, as well as summarize the correlation between the attractive factors and the consumer's satisfaction. Finally propose the design strategy for the Facial Augmented Reality APP. The steps described are as following:

2. Interview

Utilize EGM to interview six highly involved people in digital content industry, including users, producers and planners, digging deeper concept of Facial Augmented Reality APP. The interview could be separated to three parts: (1) Assign participants several tasks to use sample Apps . (2) Inquire participants' preference and distinguish the difference of the sample Apps. (3)Ask the participants' the original factors to affect their preferred evaluation.

Then, follow the original factors to ask the abstract reasons and the concrete conditions.

3. Construction of Evaluation Grid Diagram

In order to refine the different types of the attractive factor, after interviewing highly involved people in depth, we used KJ method to decrease the amount of Evaluation Grid groups, and integrated all the data by attractions and opinions from highly involved people. Classify the original evaluation objects explicitly, which included the concrete factors and the abstract factors, and merged the similar elements to build up the evaluation grid diagram with hierarchical relationships.

4. Develop KANO Questionnaire

The questionnaire aims to measure the qualitative attractive factor by quantitate method, and evaluate the attractive factor of facial augmented reality APP preference of general. Due to the classification of original evaluation object, this study used the concrete factor as evaluative object, which goes through Likert five scales (I like it~, It must be~, Neutral, I can live~, I dislike it) to measure the score. The KANO questionnaire was developed to understand participants' perspectives by separately assessing two satisfaction measures for each feature that is functional or not dysfunctional on the product.

5. KANO Analysis

In this study, the online questionnaire was collected and shared through the online community platform. The necessary conditions for the subjects were having use experience of facial augmented reality APP to qualify for the questionnaire. A total of 64 valid questionnaires were obtained, and there were 23 male subjects and 41 female subjects. 30 subjects were younger than 30 years old (including 30), 34 subjects are older 31 (including 31). The most use frequency of 56 subjects is once a week, , 4 subjects twice a week, 4 subjects have 4 times a week. Reliability analysis using IBM SPSS Statistics 20, Cronbach's Alpha value of 0.891, between 0.8 and 0.9, is a good confidence

This step is to explore users' opinion by the paired questions and determine the quality attribution of factors (Attraction, Dimensional, Must, in-differential, and Reverse) according to the Kano matrix. Meanwhile, this study utilize "customer satisfactory coefficient" to get the "Extent of Satisfaction"(CS) and "Extent of dissatisfaction" (DS), these two coefficients can explain the credibility of classification of the attribute. Additionally, Gitlow's method is also adopted for judgement reference.

B. Sample

Four Facial Augmented Reality APPs The most popularly downloaded from the platforms of ios App store and Andorid Google Play are selected: MSQRD, SNOW, B612 and Beauty Show-Show (Table 2). They are adopted as the samples to compare the preference during the period of the experts' interview.

MSQRD	
SNOW	
B612	
Beauty Show-Show	

Table 2 The selected representative sample

IV. RESULT

A. EGM Result

Utilize EGM to interview 6 highly involved people in digital content industry, including 2 users, 2 producers and 2 planners, digging deeper concept of Facial Augmented Reality APP. All respondents are female who often use Facial Augmented Reality APP and their ages are from 22-27. The interview period is during from November to December 2018. According the protocol data, classify four "original evaluation" objects explicitly, which included 25 "concrete factors" and 21 "abstract factors", and merged the similar elements to build up the evaluation grid diagram with hierarchical relationships. The EGM is shown as Figure7.

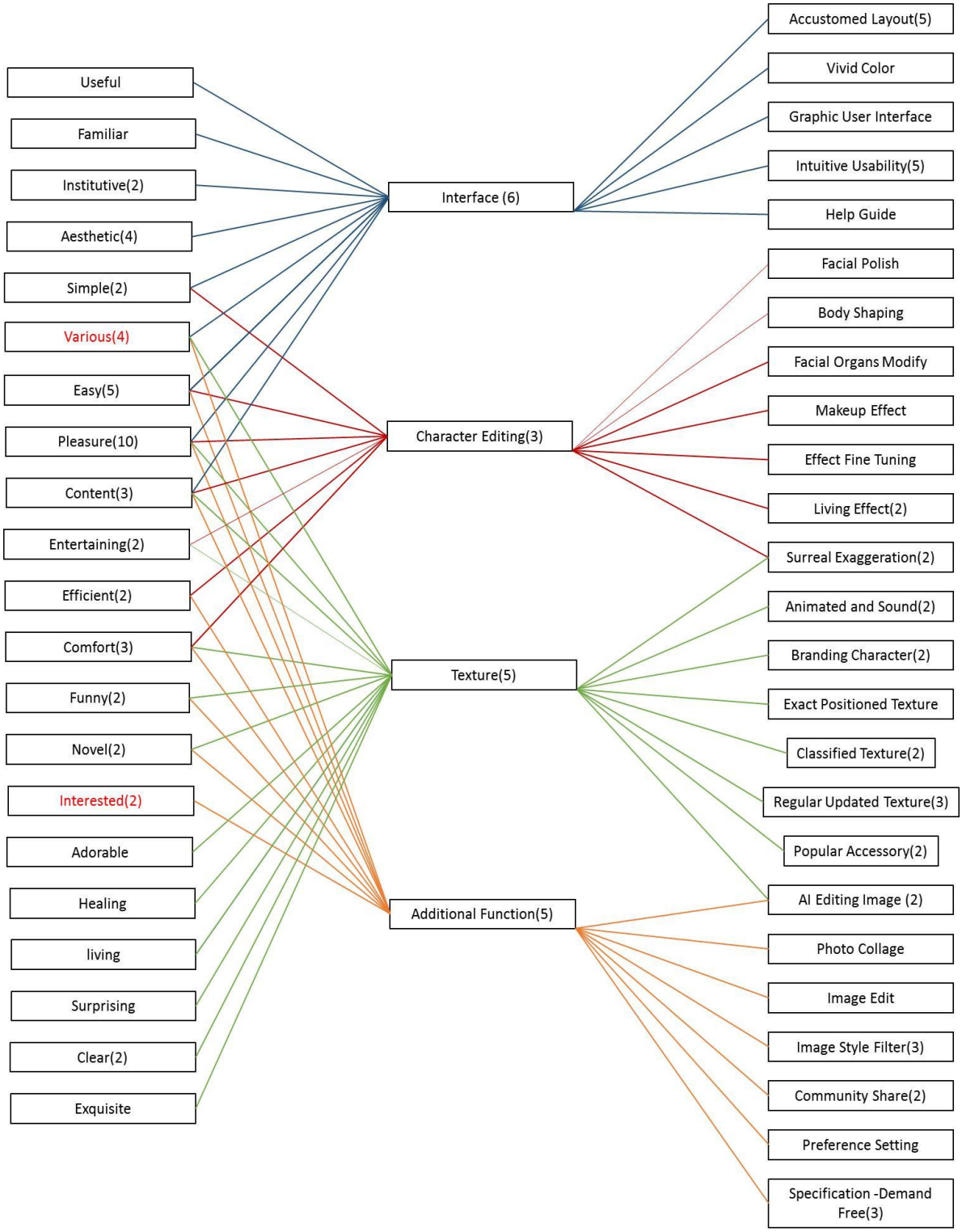


Figure 7. EGM Result

Through the test of Kano quality judgment, CS/DS value judgment and Gitlow quality attribute judgment; the final results could be obtained as Table 3. The result yields that "Interface intuition use", " Facial organs Modify ", “Live effect” and “Effect Fine Tuning “ are the attractive factors. The other 21 factors are the in-differential factors.

Item	Kano Quality	CS/DS Quality	Gitlow Quality	Adjusted Quality
Accustomed Layout	I	I	I	I
Vivid Color	I	I	I	I
Graphic User Interface	I	I	I	I
Intuitive Use	I	D	D	A
Help	I	I	I	I
Facial Polish	I	I	D	I
Body Shaping	I	I	I	I
Facial Organs Modify	I	D	D	A
Makeup	I	I	I	I
Effect Fine Tuning	I	D	D	A
Real effect	D	D	D	A
Surreal Exaggeration	I	I	I	I
Animated and Sound	I	I	I	I
Branding Character	I	I	I	I
Exact Texture	I	I	I	I
Classified Texture	I	I	I	I
Often Updated	I	I	I	I
Popular Accessory	I	I	I	I
Photo Collage	I	I	I	I
Image Edit	I	I	I	I
Style Filter	I	I	I	I
Community Share	I	I	I	I
Preference Setting	I	I	I	I
Specification –Demand Free	I	I	I	I
AI Recognition	I	I	I	I

Table 3.The quality attribution of factors

V. CONCLUSION AND SUGGESTION

The conclusions of this study are summarized as follows:

A. Conclusion

Interviews results through the evaluation grid methods: a total of 4 "original reasons", 25 "original reasons" and 21 "abstract reasons" were obtained. The original reasons comprises the following four categories.**:**

1. Interface: (accustomed layout, vivid color, graphic user interface, intuitive use, help guide)
2. Character editing: (facial polish, body shaping, facial organs modify, makeup effects, effect fine tuning, live effects)
3. Texture: (Surreal exaggeration, animated and sounds, branding characters, exact positioned texture, classified texture, regular updated texture, popular accessory)
4. Additional function: (AI editing image, photo collage, image edit, image style filter, community share, preference setting, specification demand free)

Through the test of Kano quality judgment, CS/DS value judgment and Gitlow quality attribute judgment; the final results could be obtained as Table 3. The result yields that "Interface intuition use", " Facial organs Modify ", “Live effect” and “Effect Fine Tuning “ are the attractive factors. The other 21 factors are the in-differential factors. It inferred that interface is very essential toward users. Three of them are related from “character editing” factors. The reason might be that most users would use facial augmentation reality APP for selfie, therefore, there are more requirements for the effect of character retouching.

Further explore the differences in the quality attributes of various-ages users' responses. 4 attractive factors under 30 years old (including): "interface intuition use", "live effect", "effect fine tuning" and “preference setting". The remaining 21 items are in-difference factors. 5 attractive factors over the age of 31 (inclusive): "Interface Intuitive use", "facial polish", "facial organs modify", "makeup effect" and "live effect”. The remaining 20 items are all in-difference factors.

Both groups thought that "interface intuitive use" is a attractive factor. Since such facial augmented reality apps are usually not used in a rapid and short time, the intuitive use interface makes users feel easy to learn and use. 31-year-old (inclusive) people reveal four attractive factors for character editing. The reason might be that the group is more likely to use facial augmented reality apps for selfie function. The relatively elder people usually hope to make themselves look younger in the photo, so they might have more requirements for the effect of character editing.

According to the analysis reduction, it could yield the design suggestions of facial augmented reality APP are following:

1. Interface intuitive use: In the Kano quality model analysis, it is most attractive factor for users of various ages. If the intuitive quality of interface is enhanced and improved, users' satisfaction of the user would be greatly improved.
2. Facial organs modify, effect fine-tuning, and live retouching effect: most users use facial augment reality apps for selfie and character retouching, so the character retouching is also an attractive factor. Among the factors of character retouching, facial organs modify, effect fine-tuning, and live retouching effect are the most frequently mentioned by users. Inferred that to improve the above three quality attributes, especially "live retouching effect ", users' satisfaction should definitely and greatly improved.
3. Texture style diversity: In terms of efficiency and satisfaction, "texture style" and "texture style diversity" is the attractive factor for users to add points to the app. The "texture style" should be mainly acceptable to the public and would be able to satisfy more users with different preferences. Thus texture style diversity could provide users more selection and choice free.

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