REFLECTING SELF: AN INTERACTIVE MIRROR
STUDY

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Abstract. Immersive environment provides a virtual environment immersion experience for the user, and allow users in-depth experience. In this study through research “self-reflecting” and “self-reflecting during interaction with the space environment” by entity makeup table for discussion. Makeup table reflect the role of people and the surrounding environment. We found the style selected by the user, often conform to the user's external style, and does not because of the age limit the user to interact with curiosity. We also found that in addition to the female user, make up table will also trigger young men of curiosity, they will close to observation and interaction with the table. Finally, we have statistical distribution of general user preferences. We also in accordance with the user's behavior, revised interactive processes, make recommendations when designing immersive environments.

Keywords. Immersive environment; virtual environments; reflecting self; avatar; virtual make up table.

1. Introduction

Creating the immersive space, usually by the surrounding environment, allowing users in-depth experience, such as to play a virtual role in a particular environment (an avatar). They will not be subject to static restrictions, like cameras, recording, the user can see their own virtual manifestation by dynamic changes (Kuijk et al, 2015); and under the environment of things that people can work, participate in the activities of field experience, social and
sharing experience. Because people are not in real life, so there is no time and space burdens and limitations.

The spatial environment of interaction with virtual information has three different problems: information can be effectively presented; user can effective operate; and consequence of operation can be effective represented. The above problems affect users in different level of immersion. Through research self-reflecting and self-reflecting during interaction with the space environment, a makeup system with table/mirror to reflect the role of people and the surrounding environment is implemented. With first-person perspective to space, augmented reality and virtual reality technologies are used, and self-reflection provides users with an immersive experience.

2. From immersive environments to self-reflecting

2.1. IMMERSIVE ENVIRONMENT

Immersive environment provides a virtual environment immersion experience for the user, effectively cross between the virtual and the real world (Boussemart et al, 2004). Prabhakaran (2009) who ask questions, in immersive environments which user’s interaction, users and the environment, users and other objects or users and computers. Three items will provide increased degree of user experience, and another research area of human gesture recognition combined (Prabhakaran 2009).

Boussemart et al (2004) proposed a visualization three-dimensional virtual environment and control mode, users do not use the traditional keyboard and mouse, they can avoid the embarrassment of operation interaction glossary; (Law et al, 2009) who developed the interactive system allows users to go on virtual natural materials, to provide users with tactile, auditory and visual feedback, allowing users to have immersive experience. Additionally, diverse different computer platforms and increasingly rich multimedia are two main factors can further enrich the user’s experience. New generation of users requires not only the functional requirements and entertainment, but also a variety of media for aesthetics and experience.

Therefore the user’s interaction includes users and the environment and the relationship between users and objects, and immersive environments should provide diverse added values to user. A daily life “makeup table” is used the media, and “makeup” to reflect their user own behaviour. Through interviews and questionnaires in a group of 20-30 year-old women, analysis and preliminary interactive design is conducted to testify the result.
2.2. NONVERBAL BEHAVIOUR OF SELF-REFLECTING

Through real human body acquired data, virtual characters simulate the interaction between real and imaginary including facial expressions, looks and gestures. (Schröder, 2010) proposed facial expressions and vamp gestures in virtual architecture referred to in real life, people interaction with a single character; while the other is shared virtual space with more than one virtual role players. Both will have different levels of immersion and interaction of different feeling. Therefore, self-reflecting is the key and the expression must be in line with reality, and ultimately nonverbal behaviours.

Related cases about self-reflecting are: Yoshida et al (1995) let the ATR combined with hand gestures and verbal description, the graphics object is the key for interaction; Capin et al (1997) developed VLNET (Virtual Life Network) system that is using a motor function, and with the role of a real environment combined with each other; Garau et al (2003) found that the use of matches man and semi-real avatar that will affect the quality of the user’s immersive. Therefore, we need to increase the effectiveness of avatar.

Virtual Vanity with digital LCD screen displays the image to encourage customers to try to use makeup. With the tips customers select their favourite look, and print a list of all products used in the end (Sephora, 2009). Estee Lauder launched a virtual makeup services in the official website, customers can upload their own photos; try the latest merchandise and colour. After trying, customers can decide whether to buy according to the customer's own wishes (Lauder, 2010); Visual Computing Lab uses face automatic tracking and colour system development Virtual Makeup, for face tracking, they use complete algorithm, and comparing, guiding active shape models (Active Shape Models, ASMs). ASM 115 select feature points on the face, then the researchers train 12,300 data in manual mode, and imported 135 female faces into the model library, when using the 135 will be derived from the face, making facial expressions and posture can fit (Louizis and Daras, 2014). The universality of mobile phones and tablet also bring out the real-time makeup used in mobile phones, virtual reality makeup used on the iPad (Ever, 2014) and ModiFace is a mobile phone application that has been downloaded more than 300,000 times (Aarabi, 2014) (Table 1).

According to reviews above, self-reflecting focus on semi-real projection or true projection, and it will affect the degree of user immersion in the interactive process. Thus, through facial shape and sharpness of the face makeup, the appropriate range is found. The level of immersion affects the self-reflecting, thus the real and gentle makeup will be proposed.
Table 1. Virtual Makeup case.

<table>
<thead>
<tr>
<th>Case</th>
<th>Related Images</th>
<th>Case</th>
<th>Related Images</th>
</tr>
</thead>
<tbody>
<tr>
<td>Virtual Vanity</td>
<td><img src="image1" alt="Virtual Vanity" /></td>
<td>ModiFace</td>
<td><img src="image2" alt="ModiFace" /></td>
</tr>
<tr>
<td>Virtual Makeup Tool</td>
<td><img src="image3" alt="Virtual Makeup Tool" /></td>
<td>My Studio</td>
<td><img src="image4" alt="My Studio" /></td>
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2.3. SELF-REFLECTING ENVIRONMENT CREATE AND INTERACTION DESIGN

To make users from the complete, natural interaction process, and users in the process can immerse into the space, to feel the complete atmosphere. Thus, the study allows the user to interact with the entity makeup table, use the mirror of medium, and explore “self-reflecting” and “self-reflecting during interaction with the space environment”, to further verification of immersive space’s information.

Through self-reflecting interface and interactive process design, with amplification reality technology, this study developed a complete set of interactive processes (Figure 1). When the user enters the sensing range, the interaction is activated. Through the cube and round brushes on the table, the either expert or custom mode is selected, When the user decides the makeup outlook, the camera mode is decided. Through scanning QR on coupons, the user can download makeup photos. The following will be described in detail
interface and interaction processes design, and how to match augmented reality technology, allowing users to achieve a natural use.

Figure 1. Immersive makeup interaction of use scenario planning.

3. Software technical and implementation of self-reflecting

Conducted by questionnaire in face shape data collection and analysis, as well as interviews with users and make-up expert. According to the results of interviews, to summarize Taiwanese women major face shape and classification: long face, diamond-shaped face, oval face, square face and round face; makeup basic categories: makeup base, facial, lip and face. Finally, situational makeups are decided in different context (Figure 2).

Figure 2. Situational makeup by the expert.
3.1. USER FACIAL FEATURES AND DYNAMIC IDENTIFICATION

Self-reflection and facial expressions, face shape have a great relationship, facial expressions and the true extent of face will affect the degree of immersion of the user. Thus, the study tested through facial shape and sharpness of the face makeup to find the appropriate range. We found that users still prefer the real and gentle makeup, in subsequent research, peripheral contour of makeup, details will be processed.

Because face shape may affect women in the makeup of the way, the facial expression will affect the authenticity of identification. This study uses a method that split face into a triangular, unlike traditional face recognition technology, a slight changes only affect regional triangle, for the entire image, it will not have much impact. Using this triangulation to determine facial features, if there is a change in a small range on the face, it can still be identified, and will not affect other triangles. The five faces are selected, and collection target multiple angles of the face are recorded. For the geometric characteristics of the face: eye, nose, mouth, eyebrow and head type, hairline relative position, and brought together into face repository.

3.2. AUGMENTED REALITY TECHNOLOGY AND SELECT INTERFACE

Interactive mode contains expert mode (situated makeup) and custom mode (interactive makeup). User uses turn, rotation and drag-n-drop operation (Figure 3) over a controller (cube) for the interaction. The cube with five sides responds to five scenarios and one for custom mode (Figure 4). User selects scenarios through flip the cube: work, travel, weddings, shopping and nightclubs, and through rotation to select adjective: elegant, sweet, sexy, bold and stylish. Custom mode icon is a round brush. The user chooses the product through rotating brushes: liquid foundation, eyebrow pencil, eye shadow, eyeliner, mascara, blush cake, trimming cake and lip gloss. Extra factors can be selected through rotation (Figure 3).
4. Interface and interaction processes design of self-reflecting

With focus groups studies on self-reflecting, the recommendations of makeup interactive experience systems along with the user interface and interactive processes are refined. Combing two components: “mirror” and “table”, the user is prompted with greeting on interaction process. User can act according to their needs, either expert or custom mode. Camera mode is reached after the determined makeup is done.

Custom mode allows users select a commodity, such when the user selects the lipstick on the table, the mirror will immediately fit lipstick effect on the user; or the choice of liquid foundation, the mirror will have beautiful skin and lighting. Up to eight types of merchandise, there will be immersive effect and each commodity at most three colours, users can choose according to personal needs. If the user wants to cancel the selected commodities, they can turn round brushes to cancel icon (X) position (Figure 5).

Expert mode is a recommendation that applies professional knowledge to mix and match each scenario. Expert mode is divided into five scenarios as described. When user selects expert mode of the wedding scenarios, table will change the interface into the wedding style to correspondence. User se-
lects “stylish”, then the eyebrows, eyelashes, eye shadow, lip gloss, and repair capacity will put the effect immediately on the self in mirror (Figure 6).

![Figure 6. Wedding scenarios interface of expert mode.](image)

When the user moves the square cube to camera icon, camera mode is reached. In the camera mode, users can choose different magazine covers to increase the durability of table. After the cover, three continuous shooting is activated (Figure 7). By selecting a favourite photo and through scanning QR code on coupons, the user can download makeup photos for sharing.

![Figure 7. Selection and continuous in camera mode.](image)

![Figure 8. (top) Selection and continuous in camera mode (bottom) User test.](image)
5. Conclusion

Through the user self-reflecting simulation and testing, we found the style selected by the user often conform to the user’s external style, and regardless of the age (Figure 8 bottom). Curiosity is higher if the immersive level is high. In addition to the female, make up table will also trigger young male of curiosity, they will close to observation and interaction with the table.

After statistical distribution of general user preferences found that users prefer to select Expert Mode, they like the makeup products combination according to the popular. The five kinds of situations rankings: shopping is most people choose, wedding and travel the same as the second, third work, fourth nightclubs. The choice of adjectives, whatever the situation, fashion as the first choice of the majority; the second choice for the travel situation is sexy; elegant and sweet is the second choice for wedding situations; shopping and nightclub situational second choice is elegant; in the work situation, users preferences sexy and sweet, and users does not like the bold as the first consideration.

Finally, we have statistical distribution of general user preferences. We also in accordance with the user's behaviour, revised interactive processes, make recommendations when designing immersive environments. The interactive criteria: must be intuitive, user can to interactive without going through teaching; everyone can participate; the interaction is diverse, but it is easy to modify. Then the finally interactive interface and initial interactive interface, the design will be adjusted, comprising: 1. augmented reality objects simplified modification; 2. augmented reality icon simplified modification; 3. custom mode cancel icon (X) adjustment the position; 4. modify the disk interface in expert mode; 5. in order to comply with “interaction is diverse, but it is easy to modify”, Thus consider planning the background, can be easily updated. Additionally there are still a few details would affect the degree of user immersion, the study will continue amendments, include: surrounding environment without cluttered background; in addition to individual users without other people beside; and interactive range size (here refers to the desktop).

References


