THE STUDY OF THE COMMUNICATION EFFECT ON EMOTIONAL DESIGN IN VIRTUAL REALITY TECHNOLOGY USING VR APPLICATION – FACEBOOK SPACES AS EXAMPLE

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ABSTRACT

With the rapid development of information technology, the speed of information transmission has been greatly enhanced. The relationship between people has gradually become indifferent. As if separated by a wall, communication often results in barriers and misunderstandings. The CEO of Facebook - Mark Elliot Zuckerberg at the Oculus developers’ conference launched the first fully immersive virtual reality (VR) software Facebook Space, an online social software that attend to break the distance between people through VR devices. Immersive VR is an interactive human-computer interface that shortens the distance between people through visualization, presence and interaction, Users can share, create, and communicate with each other in different alternative locations.

This research adopts an experimental method to use HTC VIVE to operate Facebook Spaces. Based on Norman (2005) who proposed Emotional Design comprised three levels, the (1) visceral (2) behavioural and (3) reflective to explore whether a well-designed VR makes it easier for users to enter the flow experience (Csikszentmihalyi, 1990), thereby reducing the messaging barriers and enhancing their communication effect with the visual characteristics. Finally observations were made through the Technology Accept Model (Davis, 1989) to understand whether the users are willing to continue using the tool when the communication is good. After completed the experiment, a relevant questionnaire. Led to final analysis and data integration and to the conclusions of the experiment.

The results of this study found the hypothesis to be supported and the feature of immersion and visualization in a completely immersive VR, reduce the obstacles in the communication process and the sense of distance between people. In addition, this research found that when using information technology, users pay more attention to the ease of use and understanding of the system. At the end of the research, some suggestions are put forward for the future development of VR.
Keywords: Virtual Reality, Presence, Emotional Design, Flow Experience, Communication Effects, Technology Accept Model,

1. INTRODUCTION

In the past, we explored how users accept new technology by using the Technology Accept Model (Davis, 1989). VR boomed in 2016 and has subverted the modern definition of science and technology by creation and interactive Human Machine Interface (HMI) technology with computer software that simulates a three-dimensional space. The immersive virtual reality (VR) brings the user a strong sense of presence, which arouses a strong empathy with the users. VR provide the user with visual, listening, smelling, touching and other sensory simulations, breaking the barrier between the virtual and the real world, so that we can go to any place, previously not easily accessible, but also enable us to invert the imagination of many industries.

At the 2017 Facebook-F8 Developer Conference, launched Facebook’s first social VR application “Spaces”. This environment allows Oculus Rift users at any distance to interact with each other through Spaces. Facial expressions and movement are replicated in the VR, resulting in a ‘real’ interaction, changing the imagination and possibilities for future personal interaction.

The application of VR is still in the development stage, but its potential output is vast. Understanding the application of VR will be the trend of our times. The emotional design proposed by Norman (2005) points out that a good product must respond to the user’s visceral, behavioural & reflective levels for a good positive experience to result. How to properly design and apply the characteristics of VR and deliver the message to users will be the key direction of future research.

2. Literature Review and Hypotheses Development

2.1 Emotional Design

In "Emotional Design: Why We Love (or Hate) Everyday Things" Norman (2005), believes that emotional design is composed of three levels: visceral, behavioural and reflective. These levels influence each other and create different behavioural reactions. An idea supported by Sharp, Rogers & Preece (2007) and the HCI, a theory widely adopted by HCI researchers to study how to arouse users' emotional experiences. Triberti & Chirico & Rocca & Riva (2017) point out that Emotions can engage in interaction rather than just be a final output and modify or influence the final result through the input of digital technology.

i. Visceral Level

The Visceral level is the most direct biological response and the first to be triggered, an instinct, a reminder to warn the brain of danger, good or bad, and prompt a response. On the product side, users' perceptions of use can be subjective, tactile, and sensory (Norman, 2005). Gu (2006) proposed that the appearance elements of the product can be divided into five aspects: Visual, Touch, Listen,
Smell, Taste, The same could also be summarized as: Style, Material, Smell, and Taste. The style indicates that the appearance of the product and includes: colour, shape, symbol, pattern, and vision; the material indicates the appearance of the product: texture, touch, temperature; the smell indicates the sense of smell of the product; the taste is the sour, sweet, bitter, spicy and other taste experiences.

Lin (2008) arranged research at the visceral level (Norman, 2005; Creusen & Schoormans, 2005; Gu, 2006): Appearance includes four factors: style, texture, smell and taste; and style includes colour, shape, pattern, symbol, visual material and size; texture include material, temperature, hardness, weight; and smelling includes gradation, aroma, tasteless; taste includes sweet, sour, salty, bitter and spicy.

ii. Behavioural Level

The behavioural level is the brain control visceral and the main level of human behavioural response. It is the most important level when many companies develop products. At this level of efficacy and usability of the product is measured. Good behaviour levels can be divided into: functional, understand ability, ease of use, and physical sensations. Functionality refers to what the product can do. Ease-of-use means that the product can be conveniently used. Understanding means that the product's function can be understood. The body's feeling is the same when using the product (Norman, 2005).

Norman (2005) argues that poor behavioural levels can cause significant frustration and negative emotions for the user, which in turn can affect the user experience, negative emotions such as frustration; or anger in the user experience is a bad level of behaviour which will leave the user a negative experience. Positive emotions allow users to more efficiently navigate the interface or perform system tasks (Norman, 2005).

iii. Reflective Level

The reflective level is mainly composed of self-image, personal satisfaction and memory. As different people's personality, culture, age, gender, memory, etc. will affect experiences, so for the same reason the VR experience will be different.

Self-image can be divided into three categories: actual self, ideal self and social self: Actual self is that the individual's subjective feelings about himself, that is, what kind of person ‘I think I am’. Ideal self is that in an ideal world, what kind of personal desire or attributes would you want to achieve the perfect self-image? Social self is also known as self-projection, individuals think of others as a whole for themselves, meaning what others think I am (Wright, Claiborne and Sirgy, 1992; Burna and Farina, 1987; Malhotra, 1981).
Personal satisfaction is the subjective evaluation of the overall experience on behalf of the user, is the experience of all the products after the experience of the whole face-down.

Memory refers to the overall impression of the user after a period of time, on the interface or experience of the product, that is, the memory of the past experience of the brain, after the recall process, and then recalls all the relevant experiences of the past.

2.2 Virtual Reality

I. Immersive VR

The concept of VR can originate from "The Ultimate Display" proposed by Sutherland (1965), which is said to be the goal now desired by VR companies. VR is understood to be a human-machine interface that uses a 3D graphics system in conjunction with a variety of interface devices, to provide immersive and interactive virtual environments (Pan, Cheok, Yang, Zhu, & Shi, 2006).

The user can have a strong presence, the immersive VR can be deification by Lin(1997) : This is the best immersive experience among the four types of VR, giving users a strong feeling of immersion. Users can easily be immersed into the VR. A head-mounted-display separates the screen into left and right eyes, and displays them in front of both eyes separately, playing through both ears with stereo sound. A digital type controller is used to control the operating system and enhance the user experience. Coupled with the spatial positioning system, the computer can track the position of the helmet, and give immediate feedback into the system, which means that when the user moves or even gets on the ground, the virtual characters will be follow by making the same action.

II. Three elements of Virtual Reality

The feature of the VR is to provide users with real-time interactive feedback, immersing people in the virtual world. Burdea (1993) explains that VR consists of three elements, Immersion, Interaction and Imagination. The following is a brief description of these three elements:

a. Immersion: Immersive VR is an important feature which engages the user at a psychological point of view and means to get the user to participate fully in the action, and makes people feel immersed in the experience, people feel like part of a virtual world.

b. Interaction: Users interact with the virtual world through VR devices. When people move around, their role in the virtual world follows. When the person takes an object or moves an arm, the characters in the virtual world will perform the same actions. The user may manipulate the character in a diversified manner to provide more imaginative possibilities.

c. Imagination: VR through sensual stimulation leads the user to never gone before places. Such as: the universe, deep sea, sky, etc., so that users can freely explore the
environment, and even imagined scenes such as science fiction, as long as the computer can simulate it, VR can lead the user to experience it.

VR has been continuously applied to many different areas of research. VR becomes a learning environment. (Shin, 2008) Examples include: The experimental study of escaping the crowd, in a VR shopping mall experience. (Ven Kerrebroeck, 2017) Exploring VR for travel marketing Huang & Backman, K & Backman and Chang (2016) and so on.

2.3 Presence

Presence is one of the most striking features generated when the user & his/ her human psychological perception is immersed in the virtual environment (Draper, Kaber, and Usher, 1998). Through the computer simulation of the visual environment, the placement becomes the guide and director for the interactive feedback. The experience becomes intuitive and in the moment, & is applied to all the users in the social environment (Shin, 2018).

Lee (2004) proposed three different aspects of presence: physical presence, social presence and self-presence:

I. Physical Presence: The meaning of physical presence is that the objects in the virtual system are considered real by the users. For example, users will actively attempt to escape a flying stone in the virtual world. This argument is confirmed by Slater (2003) who points out that if the user's behaviour in the virtual environment and their behaviour in the real environment can be integrated, there will be a greater sense of presence. This argument is also confirmed in the study of VR by Bessa & Melo & Augusto de Sousa and Vasconcelos-Raposo (2018).

II. Social Presence: Social presence is a state of mind that represents the user's interacting with the person in the virtual world in a sensory or non-sensory way, as if in the real world, as if interacting with a real person.

III. Self-Presence: Self-presence is a state of mind, which means that what the user is experiencing in a sensory or non-sensory way, is not perceptible to the falsity of the avatar. In short, the users think that they are identical with their avatars in the virtual world, activating like real identities. Shin (2018) points out that immersive VR provides a feeling that allows users to think of themselves as part of a VR, as the avatar.

2.4 Communication

The word communication comes from the Latin "Communis" which means “to share, have in common or to make common by establishment.” Schramm (1971) believes that communication is sharing information, facts, to establish a common understanding and opinion with other people or groups. Lewis (1975) argues that communication is the transmission of messages, the sharing of
ideas and attitudes to achieve a degree of common understanding between the sender and the receiver. VR imagines something that does not exist, by sensually stimulating people creatively, simply because of visualization skills, and VR technology and is well suited to convey difficult abstract concepts (Burdea & Coiffet, 2003).

Visualization helps users reach conclusions faster because they are better understood in an immersive environment (Ulewicz & Pantförder and Vogel-Heuser, 2016). A previous study of the VR as a learning environment points out that conceptualization of thinking is facilitated by the visualization of the VR that enhances the user’s imagination, reduces the cognitive load, and reduces the barriers to messaging. (Wetzel & Radtke and Stern, 1994). One of the potential benefits of immeasurable immersiveness in VR, is its potential to reduce information confusion and so increase environmental comprehension, in turn present users results of discussion (Bowma & McMahan, 2007).

*Figure 1* Lunenburg & Ornstein (2000) Communication Way shows the message exchange between the sender and the receiver. The sender creates the message by concept coding and then sends it to the receiver, who decodes the message and takes action. Communication obstacles are likely to occur in the process, most often between sending and receiving messages and between receiving messages and decoding, in order to ensure that effective communication is feedback.

**2.5 Flow Experience**

When people are further experiencing pleasure and good optimal experience through various activities, most of them are due to the experience called the *Flow Experience*. Flow Experience is presented by Csikszentmihalyi (1990). The definition of Flow is the feeling that the spirit of the individual is completely absorbed in a certain activity. At the same time, there is a high degree of excitement and enrichment. When doing some kind of activity, people will fall into the emotional area when the task is not too difficult or too simple. In the theory of the flow experience, *skill and challenge* are two important factors (Moneta & Csikszentmihalyi, 1996). Striking a balance between these two factors can drive individual self-growth (Csikszentmihalyi, 1975), and varies in people and environment. The flow experience is a dynamic process of individual perception, skills and challenges.
The experience of each person's heart is different, and these aspects impact the flow experience, as does the description of the situation. Compiled literature on the flow experience adopts nine aspects of the state of the flow (Hong, 2009; Csikszentmihalyi, 1990, 1997; Jackson & Eklund, 2004; Nakamura & Csikszentmihalyi, 2009). They differentiate into the following nine characteristics:

I. Complete concentration on the task: This is an important level of heart flow. At this level, the user is strongly focused on the task on hand, and the individual will not be disturbed by other factors. This process is spontaneous, and an individual can focus on the task at hand without additional effort.

II. Loss of self-consciousness: At this point the individual will not pay attention to other people's comments or ideas; this time is a loss of self-awareness. At this stage the self is not really lost, but can not be felt for a while. This process allows the individual to have a more powerful feeling; such an experience gives the individual a more complex experience.

III. Transformation of time: In the process, the individual starts to feel a distortion about the sense of time, and most people will feel particularly absorbed at this stage, only realising later that much time has passed yet rather unknowingly!

IV. Clear goals: Set a well-established, clear goal that helps individuals respond to their goals when they are in a state of Flow. At this moment, the individual will clearly know what he or she should do and provide a basis for the action to be taken.

V. Immediate feedback: Immediate feedback means individuals have enough internal and external feedback to understand clearly how they behave. This stage is accompanied by a clear goal, which means that the individual can get enough instant feedback besides the definite goal.

VI. Sense of control: Control is the feeling that an individual can take control of his or her actions. It is a subjective feeling that an individual can know what's going to happen and respond to it during the process, but this does not mean that it has complete control of all behaviour. However, some sense must be maintained in the process to achieve a certain sense of balance, just as the balance of skills and challenges in general, else the excessive sense of control will lead to the individual dropping to a state of boredom.

VII. Challenge - skill balance: Challenges are goals or opportunities we want to achieve, and skills are the ability to help you accomplish your goals when dealing with goals. Challenges and skills should balance and as in this state, our own skills continue to
improve, in order to continue to strike a balance, the difficulty of the future challenges ought to improve, in order to maintain the balance of the state.

VIII. *action-awareness merging:* In the state of Flow, the individual, for his part because of his preoccupation, has a coordinated perception of the body as though he was himself part of the action. All actions are nonsense, yet the individual feels completely integrated with the action.

IX. *Autotelic experience:* The word Autotelic, created by Csikszentmihalyi (1990), consists of two Greek words *Auto = self* and *telos = goals*. Spontaneous experience means that an individual is spontaneously doing something, and in the doing something is able to get back a strong sense of feedback. This experience makes people think they want to repeat the experience again and again. This level is also the last level of experience, and as challenges and skills begin to strike a balance and begin to receive positive feedback, individuals will begin to feel the value of doing so.

2.6 Technology Accept Model

*Technology Acceptance Model* (TAM) Davis (1989) & according to Fishbein and Ajzen, (1975) the behavioural mindset is developed by the theory of reasoned action (TRA). By exploring the influence of *Perceived usefulness, perceived ease-of-use, Attitude toward using, Behavioural intention to use,* and *External variables* the behaviour of computer technology users is explained, as is their readiness to accept new information systems and analyse the factors that affect user acceptance. The TAM is shown as Figure 2 following:

![Figure 2: Technology Accept Model, Source: Davis, Fred, Bagozzi, & Warshaw, 1989](image)

I. *Perceived Usefulness:* Davis (1989) pointed out that when users believe that the system can increase the effectiveness of their work, then they use the system. When the user perceives that information technology is easy to use, the user is urged to make the same effort to improve the efficiency of work and the possibility of learning performance. The perceived usefulness expresses the systematic user’s expectation of performance on work or learning. When the usefulness of the performance is higher, there will be a more positive attitude towards the system.

II. *Perceived Ease of Use:* Davis (1989) pointed out that users subjectively consider the operation of a particular information system technology. When the system is easy to use,
users have more confidence in self-efficacy and self-control. Attitudes will be more positive.

III. **Attitude Toward Using**: Taylor and Todd (1995) argue that attitude refers to the user's feelings about whether they are good or not good at using information technology. When users think that the more useful and Perceived Ease of Use, the user will have a more positive attitude to the technology.

IV. **Behavioural Intention to Use**: Taylor & Todd (1995), the degree of willingness to drive a person's use of an IT system in the future, is the possibility of using a technology or information system under the subjective personal perception. Users' behavioral intentions are influenced by the personal attitudes and perceived usefulness of technology. Perceived usefulness may also affect the user's intention without user's attitude. When the user thinks the information system is useful and can help improve the efficiency of the work or task, it will affect the higher behaviour intention.

V. **External Variables**: Refers to perceived usefulness and perceived ease of use will be affected by external variables include: the user's external environment, computer equipment, user preferences, etc., will affect the user's cognitive beliefs.

**2.7 Research Hypotheses**

i. **A Well designed immersive VR has a positive influence on the user's Visceral level**.

At the visceral level, people's gaze, feeling and voice govern everything (Norman, 2005) and further based on Gu's (2006) product appearance elements, these five feelings stimulate the senses and input. Immersive VR is a new type of interactive HCI. **HCI theory** by Sharp&Rogers and Preece (2007) was adopted by HCI researchers. And this theory has also been proven through the Emotional design of Norman (2005) to explain how a good human interface can impact to the user's emotional experience. Kruger (1991) put forward that VR is one of the imagination and the scenes of sound, light and video effects stimulate and create a different imaginative environment. The physical immersion proposed by Sherman & Craig (2003) refers to that in the virtual environment, when the user follows the movement, the vision, hearing and touching sensations brought by the virtual world also help the user gather sensory messages and interact with their navigation and control system to enable physical immersion. Presence is one of the most striking features of the VR, a kind of human psychological perception generated when the user is immersed in the environment of the virtual world (Draper et al., 1998). Lee (2004) in which the presence of three kinds of physical presence of the proposed meaning, immersive VR to convey a computer-based environments when users interact with their realism experienced by thought it is real and exists in the real world (Biocca,
Harms and Burgoon, 2003). Therefore, this study argues that a well-designed immersive VR has a positive impact on the Visceral level of emotional design because of the real presence in the scene. We proposed the following hypotheses:

H1-1: Immersive VR have a Positive influence on the Visual Level of the User’s Visceral Level.
H1-2: Immersive VR has a Positive influence on the Hearing Level of the User’s Visceral Level.
H1-3: Immersive VR has a Positive influence on the tactile level of the User’s Visceral Level.

ii. **A Well-designed immersive VR has a positive influence on the user’s Behavioral level**.

The Behavioural level is the brain’s control instinct, & mainly responds, to the efficacy and usability of the product (Norman, 2005). The emotional design has also been shown to explain HCI theory (Sharp et al., 2007), a theory adopted by HCI researchers to study how to arouse users’ Emotional experience. Kruger (1991) proposed VR 3I, in which the interaction refers to operating the Human-machine interface and feeds off feedback, so we can understand the VR as a 3D graphics system and a variety of interface devices used in a human-machine interface, To provide an immersive and interactive virtual environment (Pan et al., 2006). Presence is one of the most striking features of the VR, a kind of human psychological perception is generated when the user is immersed in the environment of the virtual world (Draper et al., 1998). Lee (2004) proposed three presence social presences which means that when the user is interacting with objects in the virtual world of interactive sensory or sensory way, all interactions just like in the real world reaction, jsust interaction like with the a real human. Therefore, this study argues that a well-designed immersive VR has a positive impact on the behavioral level because of the real presence. We proposed the following hypotheses:

H2-1: **Immersive VR has a positive influence on the level of functionality at the user’s level of behavioural level.**
H2-2: Immersive VR has a positive influence on the level of understanding of the user’s behavioural level.
H2-3: Immersive VR has a Positive influence on the level of Usability of the user’s behavioural level.
H2-4: Immersive VR has a Positive influence on the level of Body Sensation of the User’s Behaviour Level.

iii. **Well-designed of immersive VR has a positive influence on the user’s Reflection level**.

The Reflection level is mainly composed of self-image, personal satisfaction and memory. After an experience, human beings use the brain to reflect and store different memories and images. So, the brain is affected by past experiences, and forms different feelings (Norman, 2005). The emotional design has also been shown to explain HCI theory (Sharp et al., 2007), a theory adopted by
HCI researchers to study how to arouse users’ Emotional experience. Because of the good potential of the immersive VR it provides intense interactivity as a HCI. As the user moves, the characters in the virtual world act accordingly, as Bailey (2016) points out that the user perceives the VR as part of his or her own body. Presence is one of the most striking features of the VR, a kind of human psychological perception generated when the user is immersed in the environment of the virtual world (Draper et al., 1998). Lee (2004) proposed three forms of presence, which refers to the self-presence in the virtual world, users think they play the same role in the virtual world as their true identity would in activities in general. Therefore, this study argues that a well-designed immersive VR has a positive influence on the reflective level because of the real sense of presence.

We proposed the following hypotheses:

H3-1: Immersive VR has a Positive influence on the level of Self-image of the User’s reflection Level.
H3-2: Immersive VR has a Positive influence on the level of Personal Satisfaction of the User’s reflection Level?
H3-3: Immersive VR has a Positive influence on the level of Memory of the User’s reflection Level?

iv. When the user uses the VR, user interaction at all levels of the Emotional Design.

Norman et. al. (2005) argue that the emotional attributes of human beings are caused by different levels of brain functioning. The automated pre-set level is the visceral level, which is the starting point of the emotional process. The working part, called the Behavioural level, is the feeling that can enhance instinctive behaviour; the last thought-provoking part of the brain is called the Reflective level, which monitors and reflects on our behaviour. Hasan (2016), in a study of online shopping environments, pointed out that the visual will affect the ease of use that impacts the behavioral level. This is consistent with the previous Norman (2005) Emotional Design Framework, so this study speculates that the user’s instinct level will affect the level of behavior, behavioral level and the reflective level. We proposed the following hypotheses:

H4-1: The emotional design of visceral level has a positive influence on the level of behaviour.
H5-2: The emotional design of behaviour level has a positive influence on the level of reflection.

v. Emotional design three levels - Visceral, behavior, reflection level has a positive influence on the user’s Flow experience.

Norman (2005) pointed out that Boorstin (1990) "The Hollywood Eye: What Makes Movies Work" put forward Visceral, Vicarious and Voyeur these three levels, and their instincts, behavior and reflection, these three levels form a perfect correlate. At the Visceral level, using content to capture the audience and trigger an automatic reaction, then the Vicarious level is to use the stories and emotional cues in the movie to get the audience into it. The key to the success of the film at
the Vicarious level is in the form and maintaining the state of flow (Norman, 2005). "The Meaning of Things" by Csikszentmihalyi & Rochberg-Halton (1981) points out that what is special for people is in fact a special memory or association that helps the owner to arouse particular emotions, They see psychic energy as the key factor, and the flow can interact with valuable things to make people feel excited, charming and fascinating. Flow experience is defined as a personal experience of spiritual power completely beting on some kind of feeling active, and when the flow experience generated, while there will be a high degree of excitement and a sense of fulfillment when we are carrying out an activity, when this task is not too difficult or too simple, meaning that when it is moderately difficult, people fall into the emotional area. Therefore, this study suggests that the good performance of emotional design at three levels will have a positive influence on the flow experience. Therefore, this study suggests that the good performance of emotional design at three levels will have a positive influence on the flow experience. We proposed the following hypotheses: H5-1: Visceral level has a positive influence on the flow experience. H5-2: Behavioural level has a positive influence on the flow experience. H5-3: Reflective level has a positive influence on the flow experience.

vi. **The user’s flow experience has a positive influence on the communication effect.**

Figure 1 Lunenburg & Ornstein (2000) Communication Way shows the message exchange between the sender and the receiver. Communication obstacles are likely to occur in the process, most often between sending and receiving messages and so, in order to ensure that effective communication feedback is key. Into the flow of state, focus on hand work, loss of self-awareness, distorted sense of time, challenge and skill to achieve a balance, control, unity of knowing, a clear goal, immediate feedback, spontaneous experience, can all contribute and help users to reduce the communication obstacles between the two users and bring them one step closer to each other. Chen & Yen & Hung and Huang (2008) arranged relevant literature of flow experience and found out that work outcomes and validity of relevance showed a positive influence on perceived flexibility, experimentation and the intended use of technology. (Csikszentmihalyi, 1990; Webster, Trevino and Ryan, 1993; Egbert, 2003). Therefore, this study suggests that users will have a positive influence on communication effect. We proposed the following hypotheses: H6: Flow experience has a positive influence on the communication effect.

vii. **The user’s communication effect has a positive influence on the Technology Accept Model.**

When users use the VR as a medium of communication and reduce the obstacles to the delivery of messages, it is expected that better communication can be achieved. Venkatesh & Morris & Davis, G and Davis, F (2003) define Effort Expectancy as: "Whether users should spend more time on new technologies, systems, or applications," meaning that when the system is easier to use and
better, the user's intention to act will be affected. The Technology Accept Model proposed by Davis (1989) mainly uses a user's perceived usefulness, perceived ease-of-use, attitude and behavioural intentions to determine a person's willingness to use information technology in the future. Therefore, this study argues that good communication effects will have a positive influence on users' acceptance of science and technology. We proposed the following hypotheses:

H7: Communication effect has a positive effect on the Technology Accept Model.

Based on the discussion above, the research purpose of this study is to explore the application of emotional design to the experience of VR, the communicative effect and the impact of technological acceptance. The relationship between the following is expressed in the research model (Figure 3.)

![Figure 3: Research model, Source: self arrangement](image)

3. METHODOLOGY

i. Research Design

The study expects subjects to be interviewed on the internet to obtain information about different ethnic groups and to make the data discernible. Of the sixty (60) subjects recruited for this study, each takes approximately 10 minutes to test. Two subjects are tested simultaneously, in order to reduce other external interference factors. Each subject is placed a different, independent space, respectively, using the VR device HTC- VIVE as the hardware medium. With the use of Revive to run Facebook Spaces - VR community software to experiment, in order to maintain the same feeling of experience, so with the HTC rental program launched in order to achieve the same experience, the same PC to experiment.

ii. Data Collection

In this study, online registration forms were open online registrations, published from October 19, 2017 to October 27, 2017, a total of 60 subjects were solicited, a total of 60 valid questionnaires were collected, the total number of valid questionnaires 60 copies. According to the statistics, the number of samples were assigned a narrative description, (gender, age, education, occupation,
monthly income, VR experience or not), and the subjects then grouped according to these seven variables.

iii. Survey instrument

a. Questionnaire Design

The survey consisted of questions related to six areas divided by section: (1) demographic information such as gender, age, education, occupation, income & previous VR experience and relationship to the subject (2) The personality and product personality scales (3) The emotional design scale (4) The flow experience scale (5) Communication effect Scale (6) Technology accept model scale. The second part of the personality and product personality scale was adapted from Malhotra (1981) and Weng (2010) translated to Chinese. The emotional design scale referenced Weng(2010)& Li (2012), and in response to Gu (2006) product appearance elements, but HTC VIVE only provides visual, hearing, touch sensory stimulation, so by only using these three kinds of sensory stimulation for the questionnaire design, all questions are asked other scholars And written to meet the emotional design of the three levels of the operational-oriented definition. The flow experience scales were adopted from Lan (2012) who arranged the reference of nine elements of the flow experience(Jackson & Eklund, 2004; Nakamura & Csikszentmihalyi, 2009). Communication effect is adopted by Cheng, Weng & Fan (1997) this research discussed the characteristics of the electronic conference room, which will eventually lead to the satisfaction of the communication and a positive evaluation, which is the same as the communication mode of the message in this study. Therefore, some of the characters are corrected for VR. The Technology accept model scale was adopted by Wu, Tsai (2014) the same social networking services as the Facebook-Space used in this study are all social networking services. Since this experiment is about the social software of VR, So for questions to be modified to meet the characteristics of VR.

The second part of the survey applied to the seven orders of Semantic Differentials to measure the semantics or meaning of words, particularly adjectives, and their referent concepts. And the other scales were measured using a 5-point Likert-type scale.

b. Data analysis way

This study using experience way, lead to the number of the samples use in the study is small. SmartPLS does sample analysis for a less restrictive sample size (Chiu, 2011), so this study uses this software to analyze samples.

4. Data Analysis

i. Sample descriptive statistics

Male participants comprised 45% of the respondents, and 55% were female. The majority of respondents ranged in age from 21 to 25(65%), followed by ages 16 to 20(28.3%) and ages 26 to 30;
31 to 35: 41 to 45; & 46 to 50 were (1.7%). The results indicated that 85% of respondents had completed a College/University education, while 15% were Doctorate/PHD graduates. The major occupation of the sample surveyed were students (81.7%). Seventy percent of the salary respondents reported 10,000 and below. Previous experience of VR before were 46.7%, and 53.3% hadn’t experienced VR before. The majority of respondents ranged in the ‘friend’ relationship (71.7%), followed by ‘strangers’(16.7%).

ii. Reliability analysis

In this study, the initial questionnaire focused on 73 questions. After reliability analysis, in order to improve the overall coefficient, VIF value was deleted by SmartPLS, and 68 questions reserved, as shown in Table 2. The Cronbach’s α coefficient for this study was between 0.832 and 1, and the results for the construct exceeded the acceptable 0.5 (Hair et al., 1992). The results of internal consistency show that the composite reliability (CR) of each question between 0.876 and 1, which is higher than 0.6 acceptable level recommended by Bagozi & Yi (1988). The Average Variance Extracted (AVE) was between 0.478 and 1, and the value proposed by Fornell & Larcker (1981) was 0.5. There were two constructs with lower AVE 0.478 for communication effect and 0.485 for flow experience . Fornell & Larcker (1981) showed that the AVE value of each facet as larger than that of the other variables, indicating that each facet has a discriminant validity. The discriminant validity of this research plane is shown in Table 3. The AVE values of behavioral level, reflective level, flow experience and technology accept model, are slightly less than those of other facets. However, because the above levels related to the maximum value of each facet; one of the important factors of facets and causal relationship. This study belongs to exploratory research, so its value is acceptable range.

<table>
<thead>
<tr>
<th>Construct</th>
<th>Cronbach's α</th>
<th>Composite reliability</th>
<th>AVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual</td>
<td>0.832</td>
<td>0.923</td>
<td>0.956</td>
</tr>
<tr>
<td>Hearing</td>
<td>0.803</td>
<td>0.909</td>
<td>0.922</td>
</tr>
<tr>
<td>Touching</td>
<td>0.1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Functionality</td>
<td>0.85</td>
<td>0.934</td>
<td>0.877</td>
</tr>
<tr>
<td>Understanding</td>
<td>0.88</td>
<td>0.981</td>
<td>0.937</td>
</tr>
<tr>
<td>Ease of use</td>
<td>0.801</td>
<td>0.946</td>
<td>0.933</td>
</tr>
<tr>
<td>Body feeling</td>
<td>0.1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Personal satisfaction</td>
<td>0.802</td>
<td>0.936</td>
<td>0.879</td>
</tr>
<tr>
<td>Memory</td>
<td>0.738</td>
<td>0.876</td>
<td>0.779</td>
</tr>
<tr>
<td>Flow experience</td>
<td>0.763</td>
<td>0.946</td>
<td>0.935</td>
</tr>
<tr>
<td>Communication effect</td>
<td>0.807</td>
<td>0.923</td>
<td>0.825</td>
</tr>
<tr>
<td>CAP</td>
<td>0.844</td>
<td>0.911</td>
<td>0.883</td>
</tr>
</tbody>
</table>

Table2 Reliability analysis

<table>
<thead>
<tr>
<th>PS</th>
<th>PU</th>
<th>BL</th>
<th>FE</th>
<th>EU</th>
<th>VL</th>
<th>CR</th>
<th>UN</th>
<th>TAM</th>
<th>HE</th>
<th>VI</th>
<th>TO</th>
<th>ME</th>
<th>BF</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.938</td>
<td>0.539</td>
<td>0.936</td>
<td>0.917</td>
<td>0.576</td>
<td>0.63</td>
<td>0.70</td>
<td>0.731</td>
<td>0.799</td>
<td>0.494</td>
<td>0.443</td>
<td>0.367</td>
<td>0.95</td>
<td></td>
</tr>
</tbody>
</table>

Table3 Fornell - Lacker Criterion

* A=Personal-Satisfaction B=Functionality C=Reflection Level D=Flow experience E=Easy-of-use F=Visceral Level G=Communication effect
H=Understanding I=Technology Accept Model J=Behavioural Level L=Visual M=Touching N=Memory O=Body-feeling
iii. Result

a. Assessing structural model

In this study, structural equation modelling (SEM) was used to analyze the data. Since the experimental method was used in this study, which resulted in fewer samples, the tool of structural model analysis using PLS (PLS)3.2.7 to study the strength and direction of the analysis of the relationship between variables. Structural model analysis must test whether the standardized path coefficients of all facets reach statistical significance and the explanatory power of facets is determined by the explanatory variable R2 of the endogenous facets (Fornell & Lacker, 1981; Hair et al. 2005), and re-sampled by bootstrapping proposed by Efron (1979) to verify whether the path coefficient is significant by t-test. This study will be based on the findings of Hair & Hult & Ringle and Sarstedt (2013) suggested that the number of samples to carry out analysis of 5000, if the path coefficient is significant after the analysis, the verification hypothesis.

As shown in Table 4 and Figure 4, hypothesis H5-1, hypothesis H5-2 were hot support while hypothesis H1-1, hypothesis H1-2, hypothesis H1-3, hypothesis H2-1, hypothesis H2-2, hypothesis H2-3, hypothesis H2-2, hypothesis H2-4, hypothesis H3-1, hypothesis H3-2, hypothesis H4-1, hypothesis H4-2, hypothesis H5-3, hypothesis H6, hypothesis H7 supported. The path coefficient of The fitness of the model is judged by the GoF value, the GoF value is lower than 0.308, the fitness is low, the GoF value is lower than 0.409, and the fitness is moderate; the GoF value is greater than 0.579, the fitness is good, and the GoF value of the model framework is 0.708 Have a good ability to fit.

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Path</th>
<th>Original Sample Mean</th>
<th>Standard Deviation</th>
<th>t Values</th>
<th>P Values</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>H5-1</td>
<td>Vis sweetheart &gt; Ideal self</td>
<td>0.537</td>
<td>0.038</td>
<td>20.222</td>
<td>0.049</td>
<td>** Support</td>
</tr>
<tr>
<td>H5-1</td>
<td>Ideal self &gt; Actual self</td>
<td>0.709</td>
<td>0.005</td>
<td>9.952</td>
<td>0.001</td>
<td>** Support</td>
</tr>
<tr>
<td>H5-2</td>
<td>Behavioral level &gt; Enjoyment</td>
<td>0.535</td>
<td>0.038</td>
<td>15.929</td>
<td>0.049</td>
<td>** Support</td>
</tr>
<tr>
<td>H5-2</td>
<td>Enjoyment &gt; Flow experience</td>
<td>0.535</td>
<td>0.038</td>
<td>13.929</td>
<td>0.049</td>
<td>** Support</td>
</tr>
<tr>
<td>H5-3</td>
<td>Behavioral level &gt; Emotional satisfaction</td>
<td>0.535</td>
<td>0.038</td>
<td>13.929</td>
<td>0.049</td>
<td>** Support</td>
</tr>
<tr>
<td>H5-4</td>
<td>Behavioral level &gt; Physical satisfaction</td>
<td>0.535</td>
<td>0.038</td>
<td>13.929</td>
<td>0.049</td>
<td>** Support</td>
</tr>
<tr>
<td>H5-5</td>
<td>Behavioral level &gt; Reflection level</td>
<td>0.535</td>
<td>0.038</td>
<td>13.929</td>
<td>0.049</td>
<td>** Support</td>
</tr>
<tr>
<td>H5-6</td>
<td>Behavioral level &gt; Communication effect</td>
<td>0.535</td>
<td>0.038</td>
<td>13.929</td>
<td>0.049</td>
<td>** Support</td>
</tr>
<tr>
<td>H5-7</td>
<td>Behavioral level &gt; TAM 1</td>
<td>0.535</td>
<td>0.038</td>
<td>13.929</td>
<td>0.049</td>
<td>** Support</td>
</tr>
<tr>
<td>H5-8</td>
<td>Behavioral level &gt; TAM 2</td>
<td>0.535</td>
<td>0.038</td>
<td>13.929</td>
<td>0.049</td>
<td>** Support</td>
</tr>
</tbody>
</table>

Table 4 Hypothesis testing.

*P<.05   **P<.01   ***P<.001

b. Self-concept and product image data analysis

This study compares the average number of users' actual-self, ideal-self, and product personality, by comparing the average number of user’s actual-self with the product personality, and
comparing the average number of ideal-self with the products personality, to get when consumer shopping the product is actually similar to the actual-self or the ideal-self, and the use of paired sample T test for the user in the two scales (the actual-self with the product personality; and the ideal-self with the product personality) to compare the average difference.

In the real part of my product personality, the results of the analysis [Rugged - Delicate], [Dominating - Submissive], [Thrifty - indulgent], [Organized - Unorganized] [Contemporary – Non-contemporary], [Rational - Emotional], [Youthful - mature], [Orthodox - Liberal], [Colourless - colourful], [Modest - Vain]. The above 10 adjectives, reached a significant level of P < 0.05. Only 5 adjectives did not reach the significant level of a = 0.05. Overall the actual-self did not significantly differ from the product personality.

In my ideal-self compared with product personality section, the results of the analysis [Exciting - Calm], [Comfortable - Uncomfortable], [Pleasant-Unpleasant], [Thrifty- Indulgent], [ Pleasant- Unpleasant], [Organized - Unorganized], [Contemporary – Non contemporary], [Youthful - Mature], [Modest- Vain] The above nine adjectives all reach P < 0.05 significant level, 6 adjectives did not reach a significant level of= 0.05. Overall the ideal-self showed a more significant difference on product personality.

In the part of actual-self that communicates with the other person's personality, the results of the analysis are showing that the only two categories of adjectives [Comfortable-Uncomfortable] and [Youthful-Mature] have a significant levels of P <0.05. Only 13 adjectives did not reach the significant level of = 0.05, and as a whole got the ideal. I think there is no significant difference in the individuality of the other person who communicates with the other. Overall, actual-self with communicate with each other that each other's personality is no statistical significance.

5. CONCLUSION
i. Research results and discussion
   a. The impact of immersive VR on the visceral level of the emotional design

The research results show that most VR systems are able to satisfy the visual, hearing and touching of most users, of which the visual path coefficient is the highest. This result is in line with that of Nomura (1996) in "Color Secrets" The five-sense visual perception is 87%, hearing sense is 7%, sense of touching is 3%, sense of smell is 2%, taste is 1%. The result is more echoed by body immersion proposed by Sherman & Craig (2003) Interaction, the system will bring the user's visual, hearing, touching and other sensory changes, thanks to a good five-sense experience so that users can be more immersed in the content, and Norman (2005) pointed out that the good visceral design needs focus on the user's five senses of experience, as well as Gu (2006) of the product appearance elements: visual, touching, hearing, smell, taste these five feelings, the above discussion can be
learned today's VR has been met to achieve good visceral level, thus making the hypothesis of this study all supported.

Nowadays, most manufacturers invest a great deal of resources to design VR devices that satisfy users' five senses of experience. As computing power of hardware and computing hardware of personal computers increases, it is reasonable to explain that the completely immersive VR has a positive impact on the instinct level of the emotional design of the user from this theoretical point of view. When the present study focuses on the interview, most users think that the current five senses Experience all good performance.

b. **The impact of immersive VR on the behavioral level of the emotional design**

This study found that the importance for the user is ease of use, understanding, functionality, body feeling, this can be interpreted as that users are most concerned with the ease-of-use for a immersive VR system because it is easy for the user to understand what the system is saying and to further explore whether the functionality meets the needs. Then the above discussion is in line with Lee (2004) who put forward the sense of social presence: “whether interaction between people can detect whether the other is real, all the interactive response is like the real person in the real world “Whether the system can be effectively understood in the VR and whether the interaction with the system is easy to use can meet the demand. Therefore, this study argues that this theory explains the immersive VR for the user's emotional design can have a positive influence on the behavioral level should be reasonable.

c. **The impact of immersive VR on the reflection level of the emotional design**

In the actual-self the communication is with each other that the other person's personality part, the results indicate that there is no significant difference, the study hypothesized that through VR users can more freely express the true self. In the part of personal satisfaction and memory, the path coefficient of personal satisfaction is higher than that of memory. This research suggests that a memory-oriented feeling will be generated due to personal satisfaction first.

d. **The influence of three levels of emotional design**

Since human beings are five-feeling animals, this study believes that users' visceral levels will affect the behavior level and that behavioral levels will further affect the level of reflection. Hypotheses H4-1, H4-2 are used for statistical analysis through SmartPLS, and the results are supported.

e. **The influence of three levels of emotional design on flow experience**

Through the SmartPLS statistical analysis, the results H5-1, H5-2 were not supported, and H5-3 hypothesis supported. Flow experience is a kind of internalized thought that is a state of mind immersion, psychic immersion as proposed by Sherman & Craig (2003) refers to the state of deep
engagement in the VR environment, guided by instinctual levels in good emotional design the behavioral level is then internalized by the behavioral level into the reflective level, which in turn allows the user to enter the flow experience.

f. Impact of flow experience and communication effect

The hypothesis is supported and this result confirms that the VR imagines something that does not exist by stimulating people creatively through visualization Abstract Conversations (Burdea & Coiffet, 2003). In the Lunenburg & Ornstein (2000) communication model that communication barriers are likely to occur in the process most often occur when transmitting and receiving messages, as well as accepting between the message and the decoding. This study argues that because of the balance of the challenges and skills, the sense of control, action-awareness merging, the definite goal and the instant feedback, these levels reduce barriers to communication and increase the effectiveness of communication.

g. Impact of communication effect and TAM

In the end, we want to know whether users can expect better communication through the VR as a medium of communication to reduce the barriers to communication. Venkatesh et al. (2003) define Effort Expectancy as: "Whether or not the individual user is engaged in the operation of new technologies, systems, and applications means that as the system becomes easier to use, it will affect the user's intention of behavior, which will make users have a positive impact on technology acceptance under the circumstance of increasing the communication validity. Therefore, the hypothesis H7 is proposed and analyzed by using SmartPLS. The result of the analysis indicates the hypothesis holds that the present study suggests that today's technology uses different approaches to interact with users using different past contacts and the result shows that users have a positive acceptance of technology for good communication effect, it is believed that the immersive VR has stimulated the user's feelings through different ways from the past. In the future, the science and technology acceptance model should be further studied and supplemented for the user's instinct level, behavior level and reflection level.

ii. Research limitation and suggestions

First, many people are using the VR for the first time, the operation is not smooth and not used to it, and even the freshness may cause the final measurement result to be an error. The sample size for this study was 60 with a small sample size and most of the respondents were students of similar backgrounds and could have biased results. Third, this experiment uses the Facebook Space to experiment, but through the hardware is HTC-VIVE, the original space for the Oculus hardware, so let VIVE through Revive run the program, Sometimes the system may not be able to properly integrate the hardware and the system, resulting in difficult to operate and control the poor
situation, and the speed of the network sometimes caused by the picture is not smooth and the
value of the decline is also sound unclear and inconsistent. Finally, the social VR system used in this
study is Facebook Space. Since this system is still in the BETA stage, the related functions and
settings are still in the development stage, which may be caused by the bug of the BETA version.

ii. Future research suggestions

This study found that most users expressed their willingness to use the VR again as their
entertainment option. Due to the convenience issues that make it difficult for them to be routine
communication tools at this stage, many also expressed their potential to see the future of VR Most
people in the interview process consider the environmental context in the VR to be of greater
importance than to give the user too much functionality because too many features can easily
distract the user and lead to forgetting the real task at hand and the real environment experience
allows users to better integrate into the effect of the scene to achieve the best results, and through
the glove-based control system or brain-based interface to control the VR world. Future
development and application of many immersive VR, many participants believe that if the future can
be developed as control agents in general, to experience the feelings never before, will allow users
to have a strong intention to use, and Applied to the entertainment and audio-visual industries, it
integrates into the environment that the prescribers want to deliver to the users. In addition, some
of the respondents think that the main application of the future VR will be in the mixed reality (MR),
breaking the line between the true and the false world by combining the characteristics of the actual
situation and the reality and implementing the glasses-type device to realize the convenience so that
the VR can be applied in our daily life.

6. ACKNOWLEDGEMENTS
Referencing


Lin, Z.G.(1997), SHEN RU SYU NI SHIH JING. Taipei: GOTOP INFORMATION INC.


Tsai, Y. J. (2010), Some Phenomena of College Students’ Use of Mobile Phone in terms of 3-Level Emotional Design. Ming Chuan University Master's Program in Design Innovation and Management in Department of Product Design.


Wu, C.H., Tsai, Y.C. (2014), Using technology acceptance model for investigating the social network website (facebook) usage intenton. National Taichung University of Education Department of Digital Content and Technology.