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EXPLORING THE RELATIONSHIP OF USER'S EMOTIONS AND IMMERSIVE EXPERIENCE IN A VIRTUAL ENVIRONMENT OF LOCAL CULTURE

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ABSTRACT

Local culture and history is presented through an interactive virtual environment helps the user to understand the local culture and to connect with a user's imagination and memory. User can learn about the local culture through Human-Computer Interaction that could produce a deep immersive experience based on the user's subjective feelings. It makes a pluralism and continuous effectively transfer and for local culture. In this study, we reconstructed the local cultural characteristics of a region in a virtual environment. Questionnaire survey as a research method, the Partial Least Square (PLS) path coefficient is used to analysis questionnaire. The interactive immersive experience of 34 tourists' was analyzed after using the virtual environment system. The result showed that the achievement emotions and challenge emotions were very high and had a significant impact on immersive experience, inducing all users to experience excitement, anticipation, pleasure and satisfaction after using the virtual environment. This study would serve as an interactive guide to design a local cultural virtual environment system for future reference.

Keywords: Personal emotions, immersive experience, local cultural, virtual environment

1 INTRODUCTION

Virtual environment is a three-dimensional environment with interactive, immersive and multi-sensory perception (Huxor & Lansdown, 1996; Stuart, 1996), and is considered to provide entertainment and efficiency in training (Sylaiou et al, 2008). Virtual environment simulation is often used in rehabilitation and reconstruction of historic buildings to show the buildings in a different visual presentation from their current look (Chiu, & Lan, 2001; Kretschmer, et al., 2001; Mitchell, 1999; Mitchell, Beamish & Allibhai, 2007; Moltenbrey, 2001; Song et al, 2004; Wesche, 1999). This reveals how digital technology holds a very important position for saving monuments (Mitchell, Beamish & Allibhai, 2007).

Many countries are becoming aware of the characteristics of the region where a creative combination of historical aspects merge in the trend of globalization. It not only has economic benefits, but also reflects cultural connotations. This has provided future development and regeneration opportunities for historical cities (Castells, 1983). Boyer (1996) mentioned that local characteristics of a neighborhood including imagery, memory and imagination linked by digitized virtual environments would help people understand the historical and cultural background of the local characteristics of neighborhoods. Jennett et al. (2008) considered emotional immersion as a key factor to discern whether the user engages with the virtual environment or not. Immersion is a psychological state

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(Ellis, Voelkl & Morris, 1994) describing how the user shows their subjective feelings and emotions of self-experience, when the user concentrates on their experiences, challenges and techniques to balance each other, and has satisfaction and emotional investment to enter the immersion (Csikszentmihalyi, 1975).

There are very rich and varying cultures in Taiwan. In this study, Changhua City's (a small town in mid-Taiwan) neighborhood characteristics - "Xin-Si streets," the local architectural and historical culture were reconstructed in a virtual environment. This encouraged tourists to understand the local history, culture and information while evoking in local residents a collective memory. This process makes effective transfer and continuity of the local culture possible.

This study explored the emotional changes before and after the immersion experience. The purpose of this study was to analyze the differences between local residents and tourists regarding their subjective emotional experience before and after an interactive navigation system.

2 RELATED WORKS

2.1. PERSONAL EMOTIONS ABOUT THE NEW TECHNOLOGY

Emotion, a kind of message source, is important and valuable for people. It significantly influences emotional experience whether in navigating the system or solving a problem or access to new technologies. Therefore, it could be closer to the needs of a user when understanding one's emotions (Sas & Zhang, 2010). Inspiring the user's emotions from the game system would lead to a better feeling when linking the interface between people and technology (Roy, Hemmert & Wettach, 2009). Beaudry and Pinsonneault (2010) developed a framework for classifying emotions to analyze the different emotions on technology based on the integration of user's affordance with the emotional evaluation of the theoretical model. Divided into four emotions, the emotions of achievement and challenge characterize positive while those of loss and deterrence characterize negative ones. "A framework for classifying emotions" was proposed in 2-dimensional coordination for the navigation system. It could promote the link between human and system, and be a good tool to understand the emotion and interaction of humans (Roy, Hemmert & Wettach, 2009).

2.2. THE CHARACTERISTICS AND APPLICATION OF THE VIRTUAL ENVIRONMENT TO LOCAL CULTURE

3-dimensional virtual environments, in comparison to ordinary vision, extend to a complicated interaction, allowing the user to perceive the experience as though in the real world (Stanney, 2003). Krueger (1991) considered that the virtual environment contains three characteristics: immersion, imagination, and interaction; it makes the user generate a physical experience after gaming (Steuer, 1995). Building local culture blocks often occurs due to disrepair and dilapidated conditions, therefore, the use of technology to virtualize the culture and history has become a popular mode of experience (Parush & Berman, 2004). There are many studies that have applied virtual environments to the local cultural buildings in recent years (Danks et al, 2007; Mitchell, Beamish, & Allibhai, 2007). The virtual environment plays an increasingly important role, making visual imagination more diversified.

2.3. USER'S IMMERSIVE EXPERIENCE IN VIRTUAL ENVIRONMENTS

Immersive experience, proposed by psychologist Csikszentmihalyi (1975), is the emotional, attention and focused state when navigating the interactive system. It describes when one engrosses in some activity entering a unique experiential mode and control of the environment. Immersion is not only a positive experience, but also an important source of intrinsic motivation (Csikszentmihalyi & Nakamura, 1989). The positive emotions and experience would be enhanced effectively when one enters the immersive state. Finneran and Zhang (2005) mentioned that it allows users to reach the immersive state paying attention to person, artifact and task (person-artifact-task model, PAT model). Therefore, immersive experience occurs when the user feels pleasure regarding the task (Csikszentmihalyi, 1990). Bowman and McMahan (2007) considered that immersion degree is dependent on the realism of the virtual environment. Current studies have emphasized the factors that impact immersion, that bring the emotion of immersion into the virtual environment (Alrayes, & Sutcliffe, 2011; Hou, et al, 2012; Jacobson, 2010; Jennett et al, 2008; Snell, Majid, & Keshner, 2013). This study analyzed the causes of immersion and degree of immersive experience focusing on the personal interaction between emotion and task, based on the PAT model.

3 RESEARCH METHOD AND DESIGN

The local architectural and historical culture of "Xin-Si streets" was reconstructed in a virtual environment. It connects users' imagination and memory by navigating through the system to enjoy the local historical culture (including bicycle interactive games, video introduction, and navigating environment). The personal emotions and immersive experience would occur when the user has subjective feelings regarding navigating. The questionnaire survey was distributed twice examining emotions and immersive experiences before and after the interaction.

3.1 EXPERIMENTAL PROCESS AND RESEARCH TOOL

The "recall childlike journey" is a research tool for depicting historical feature blocks from 60 years ago. The user bikes around the Xin-Si streets to receive attractive information, and could make the user's own local culture richer through the realization in a virtual environment. In this study, a random sample of local residents aged 10 – 80 and tourists experienced the interactive navigation system. They filled out an emotional questionnaire and then explored the virtual environment without limitations on time, and then filled out the experimental questionnaire. A total of 57 valid questionnaires were obtained, 23 from local residents and 34 from tourists.

3.2 QUESTIONNAIRE DESIGN

The scale was divided into two regarding the emotions and immersive experiences following the virtual environment experience. The questionnaires were amended by three experts based on the Delphi method to obtain the most representative questionnaire. Semantic difference method (SD method) was used for the emotional scale. The emotional scale measured the personal feelings of positive emotions - achievement and challenge and negative emotions - lost and deterrence. A seven-point scale was used for the 8 questions.

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The immersive experience scale included six dimensions - attention, temporal dissociation, transportation, challenge, emotional involvement, and enjoyment with a Likert five-point scale for the 27 questions.

4 ANALYSIS AND DISCUSSION

4.1 COMPARISON OF EMOTIONS BEFORE AND AFTER EXPERIENCE FOR LOCAL RESIDENTS AND TOURISTS

The average age of local residents was over 50 years old (13 males and 10 females). Aachievement emotions were experienced at the beginning stage, and then tended towards challenge emotions after experiencing the interactive navigation system. The tourists were mostly young (16 males and 18 females). They tended to experience challenge emotions after the experience. Results showed both groups obtained positive emotion, as depicted in Table 1.

Table 1 Comparison before and after the emotional experience between local residents and tourists

	LOCAL RESIDENTS							
DIMENSION	**ACHIEVEMENT EMOTIONS**		**CHALLENGE EMOTIONS**		**LOSS EMOTIONS**		**DETERRENCE EMOTIONS**	
ELEMENT	**PLEASURE**	**SATIS-FACTION**	**EXCITEMENT**	**ANTICI-PATION**	**DISA-PPOINTMENT**	**ANNOYED**	**FRUS-TRATION**	**ANXIETY**
AVERAGE BEFORE EXPERIENCE	1.96	1.96	1.17	1.87	-0.13	0.0	0.22	-0.09
AVERAGE AFTER EXPERIENCE	2.39	2.35	2.22	2.43	0.0	0.0	0.0	0.0
INCREMENT OR DECREMENT	+0.43	+0.39	+1.05	+0.56	+0.13	0	-0.22	+0.09
	TOURISTS							
AVERAGE BEFORE EXPERIENCE	1.62	2.00	1.62	1.76	0.06	0.03	0.09	-0.06
AVERAGE AFTER EXPERIENCE	2.32	2.29	2.32	2.35	0.0	0.0	0.0	0.0
INCREMENT OR DECREMENT	+0.7	+0.29	+0.7	+0.59	-0.06	-0.03	-0.09	+0.06

From the emotions data, the local residents' achievement emotions (satisfaction +0.39) and challenge emotions (excitement +1.05) were higher than those of tourists, with local residents obtaining higher satisfaction and excitement for positive emotions; the tourists' achievement emotions (pleasure +0.7) and challenge emotions (anticipation +0.59) were higher than those of local residents, with tourists obtaining higher pleasure and anticipation for positive emotions.

4.2 PLS STRUCTURAL MODE FOR LOCAL RESIDENTS: ANALYSIS OF EMOTIONS AND IMMERSIVE EXPERIENCE

Anderson and Gerbing (1988) mentioned that Partial Least Square (PLS) provides satisfactory relationships between dimensions and demonstrates good prediction and explanation ability. Smart PLS was used to examine the relationships in this study. Figure 1 shows the results of PLS analysis for local

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residents, for both achievement emotion (R2=73.4%) and challenge emotion (R2=89.8%) reaching a significant level. Local residents found it easier to be placed into the context of their own familiar environment and to be immersed in the challenge emotion, even while using the new technology. They obtained recall, recognition and showed a high degree of positive emotions.
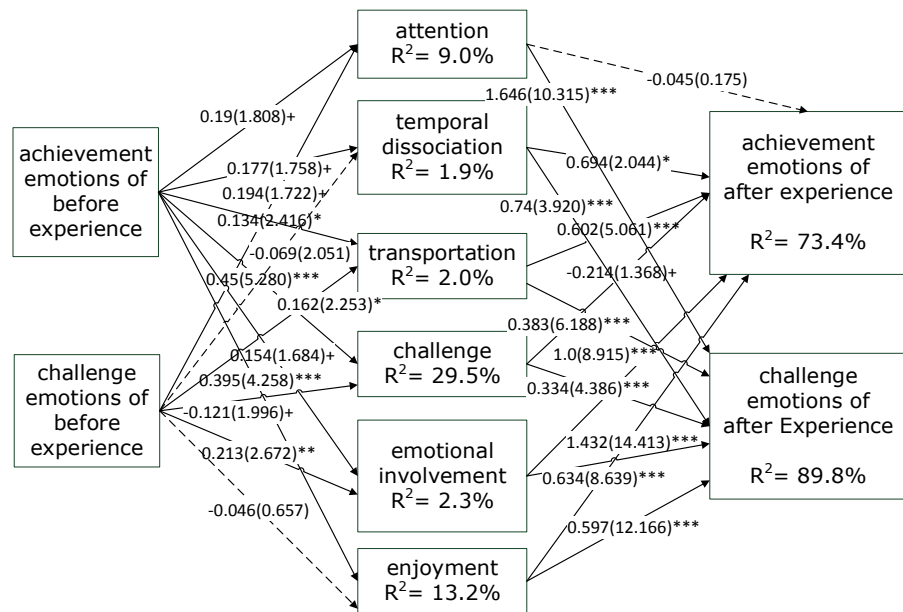
Note 1. the solid lines represent a significant relationship while dashed lines represent a non-significant relationship
Note 2. t> 1.28, reaches a significant level (t> 1.28, + p <0.1; t> 1.96, * p <0.05; t> 2.58, ** p <0.01; t> 3.29, *** p <0.001)

Figure 1 – Analysis of emotions and immersive experience for local residents by PLS

Taking participant L12 as an example, she experienced the interactive navigation system with pleasure, satisfaction, and anticipation from time to time and recalled her real environment of early Xin-Si Street, as shown in Figure 2. This illustrated the positive emotional response from the interactive navigation system that rendered the intersection of historical and virtual interesting. Its intimacy and familiarity meant the subjects recalled the early Xin-Si Street which generated positive emotions after the experience.

Figure 2 – The experience of Participant L12.

1. For local residents, positive emotions before the experience had a positive impact on attention. The "t" value of achievement emotion was 1.808+ and the challenge emotion was 2.416* for attention which was significantly impacting the experience before. Local residents felt a sense of intimacy and familiarity, and then showed positive emotions when effectively using the interactive game, video introduction and navigation environment.

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2. For local residents, positive emotions before the experience had a positive impact on transportation. The "t" value of achievement emotion was 1.722+ and challenge emotion was 2.253* for transportation before the experience which reached a significant impact. This meant that if local residents had experienced positive emotions, it would increase transportation in the immersive experience.

3. For local residents, positive emotions before the experience also had a positive impact on challenge. The "t" value of achievement emotion was 5.280*** and challenge emotion was 1.996+ for the challenge before the experience with a significant impact. The local residents had a deeper immersive experience when a more challenging task was presented. The subjects with more positive emotions had a higher impact on the challenges in the interactive navigation system.

4.3 PLS STRUCTURAL MODE OF TOURISTS: ANALYSIS OF EMOTIONS AND IMMERSIVE EXPERIENCE

Figure 3 shows the result of PLS analysis for tourists. The achievement emotions and challenge emotions reached significance for immersion before and after the experience, and obtained positive emotions.
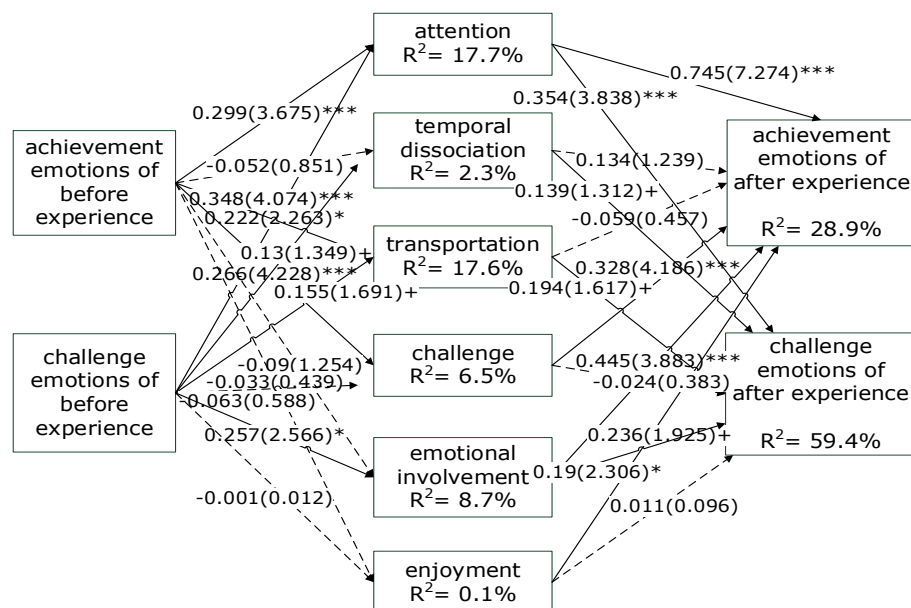
Note 1. the solid lines represent a significant relationship while dashed lines represent a non-significant relationship
Note 2. t> 1.28, reaches a significant level (t> 1.28, + p <0.1; t> 1.96, * p <0.05; t> 2.58, ** p <0.01; t> 3.29, *** p <0.001)

Figure 3 Analysis of emotions and immersive experience for tourists by PLS

1. For tourists, positive emotions before the experience had a positive impact on attention. The "t" value of achievement emotion was 3.675*** and challenge emotion was 2.263* for attention before the experience, reaching a significant impact. This study found that tourists experienced greater attention when obtaining the story of historical Xin-Si Street from the virtual environment. When the positive emotions were higher, the attention was also higher in the immersive experience.

2. For tourists, positive emotions before the experience had a positive impact on temporal dissociation. The "t" value of challenge emotion was 1.349+ for temporal dissociation before the experience, reaching a significant impact. Taking participant T02 as an example, the man operated a game-bike

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arbitrarily and repeatedly experienced temporal dissociation. It was found that the tourist excessively focused and forgot the time that went by in this study. This had a positive impact on the temporal dissociation in the immersive experience.

3. For tourists, positive emotions before the experience had a positive impact on transportation. The "t" value of achievement emotion was 4.074*** and challenge emotion was 1.691+ for transportation before the experience, reaching a significant impact. Tourists recognized the Xin-Si Street by the interactive navigation system with a curious freshness; therefore, the transportation was greater than among local residents.

4. For tourists, positive emotions before the experience had a positive impact on challenge. The "t" value of achievement emotion was 4.228*** on challenge which reached a significant impact. When the tourists had high challenge and high skill, this generated a high immersive experience. The high immersive experience also inspired one's positive emotion.

5. For tourists, positive emotions before the experience had a positive impact on emotional involvement. The "t" value of achievement emotion was 2.566* for emotional involvement which reached a significant impact. Taking participant T23 as an example, the woman experienced the interactive game as casting lots constantly and repeatedly responded positively. She showed a high emotional involvement.

6. Positive emotion after the experience had a positive impact for tourists. The achievement emotion was $R^2=28.9\%$, challenge emotion was $R^2=59.4\%$; loss emotion and deterrence emotion reached significance after the experience for tourists. But tourists' negative emotions were lower than local residents, thus the tourists compared to local residents found it easier to accept the new technology, resulting in fewer negative emotions. Additionally, tourists had higher immersion when challenge emotion was high in the virtual environment.

5 CONCLUSION

This study investigated the impact of personal emotions in the immersive experience before and after operating the interactive navigation system for local residents and tourists. The results were as follows:

1. The difference in personal emotions before and after experiencing interactive navigation system: Both local residents and tourists had positive emotions after experiencing the interactive games, video and virtual environment in the interactive navigation system. This is important for natural interaction and behavior for people who experience a technology system. The positive emotions would be enhanced for users when the system is suitable.

2. The personal emotions before the experience significantly impacted the immersion: positive emotions impacted immersion after experiencing the interactive navigation system. Similarly, Webster, Trevino and Ryan (1993) mentioned that a good design for human computer interactive system would obtain more positive emotions and trigger the subject to want further exploration. Therefore, the designer should use aids to enhance the subject's positive emotions before the experience to promote the immersive experience.

3. The immersive experience impacted personal emotions: The user's emotion was enhanced by the degree of realistic design and hearing and visual

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aspects of the interactive navigation system as shown by positive emotions. It was found that the local residents had more emotions and had higher positive emotions than tourists. The immersive state would increase the personal positive emotions and experience (Finneran & Zhang, 2005; Ghani & Deshpande, 1994).

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