Research on Flow Experience From the Perspective of Gamification in Virtual Reality Tourism: A Chain Mediation Model

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1. Introduction

The advent of the digital era and the development of media and mobile technology have spawned the development of gamification. spread to the field of tourism (Deterding et al., 2011; Pasca et al., 2021). Gamification is considered to be an effective tool to improve tourism enjoyment and satisfaction, which can affect individual's emotion and cognition, such as arousal, immersion, attention and motivation. As a result, gamification is more and more widely used in tourism, including online OTA platform (Shi, Leung, & Munelli, 2022), tourism applications (Sigala, 2015; Tsai & Lee, 2017), offline tourism scene (Liu et al., 2019), and even virtual tourism scene (Jang & Hsieh, 2021).

Virtual travel experience is currently mainly concentrated at several levels. The existing research on virtual tourism is mainly based on short-term virtual tourism experience, and the conclusion has certain timeliness. Tourists usually stay long in the destination. To the best of my knowledge, there are no studies that have focused on long-term virtual travel experiences. With the convergence of psychology, neuroscience, and tourism research, academia has begun to provide a coherent set of lenses to observe time in travel (Pearce, 2020). Therefore, it is necessary to study the long-term VR tourism experience.

However, long-term virtual travel may bring some negative experiences, such as fatigue and motion sickness (Cheong, 1995; Kemeny *et al.*, 2017). Tourist' attention, enjoyment and satisfaction may change over time. According to previous studies, gamification can improve tourists' emotions and attention by providing motivation and flow experience, and maintain tourists' satisfaction for a long time. However, the application of gamification and flow theory in virtual tourism research is rare. Furthermore, few researchers have studied the relationship between the internal structure of the flow experience under the gamification. According to the internal clock theory, attention, enjoyment and time perception have a certain relationship, which is easily ignored in the perspective of flow theory.

This study attempts to answer: How gamification affects the virtual reality travel experience in a long-time duration? Whether the internal factors of flow experience in virtual tourism experience from the perspective of gamification influence each other? Therefore, the main purpose of this paper is examining how virtual reality tourism experience from a gamification perspective affects tourist flow experience and satisfaction by examining a chain mediation model including arousal, focused attention, enjoyment and time distortion. Gamification was integrated into a long-duration virtual tourism experience (50-60 mins) for 60 participants. The experience data of tourists were obtained through questionnaire survey, and the mediation model was tested by SPSS Process. The findings provide valuable understandings for the research on flow experience in long-duration virtual reality tourism and extend the flow theory with internal clock model, giving practical implications in the application of gamification and flow experience for destination practitioners.

2. Literature review and hypothesis development

2.1. Gamification and VR tourism

Gamification is defined as the incorporation of gamified elements into a non-

gamified environment that enhances the game experience and increases immersion and satisfaction (Ryan, Rigby, & Przybylski, 2006) (Deterding et al., 2011). The characteristics of the game is that the game experience is removed from the natural game environment, and the desire to indulge and escape from the fantasy world is considered to be one of the most important motivations for users to experience the gamificatin (Xu et al., 2017; Zichermann and Cunningham, 2011; Sigala, 2015; Pasca et al., 2021). As a stimulating environment, gamification can trigger users' psychological state and form the experience of engagement, flow and enjoyment (Pasca et al., 2021; Cheong et al., 2013).

Gamification is considered as a tool with the potential to combine augmented reality, virtual reality and 3D technology to create immersive entertainment experience for tourist attractions (Xu et al., 2016). The use of gamification allows tourists to imagine and enjoy, by allowing tourists immersed in a simulated tourism world, with emotion and more attractive experience to enhance the tourist experience (Xu, 2011; Sigala, 2015b, p.202). However, in the field of tourism, the combination of gamification and AR technology is relatively more, and the research related to VR technology is relatively lacking (Paliokas et al., 2020; Thirumaran et al., 2021). Jang and Hsieh (2021) designed and developed a gamified VR-enhanced tourism web system (VRTWS) to study the relationship between gamification, media richness, perceived value, satisfaction and other variables. However, there is no in-depth study on the perspective of gamification and VR experience, including emotion, immersion and its internal mechanism. Overall, the combination of gamification and VR technology in tourism research needs further exploration.

2.2. Flow experience

Understanding optimal experiences is a vital research area in positive psychology (Seligman & Csikszentmihalyi, 2000). Relatedly, tourism scholars have studied aspects of exploration tourism actions based on diverse theoretical points of view, including understanding tourism behavior from the perspectives of interests, motives, and flow theory (Csikszentmihalyi, 1990) as well as the theory of emotional arousal (More & Averill, 2003). In the case of hiking, Coble et al. (2003) suggested that flow experience may appear as the goals and challenges of hiking reach equilibrium with the skill abilities of hikers. Flow is the best theoretical framework for understanding optimal experiences. "Flow" is a conscious state that individuals occasionally experience when in-depth participated in a pleasant thing. Zatori et al. (2018) applied flow theory to tourism experiences by outlining and testing the model of on-site travel experience formation between service providers and consumers. They also distinguished flow experiences from the flow concept, identifying four aspects of on-site travel experiences: mental, emotional, social experience involvement, and flow-like. Although flow theory has been applied frequently in tourism experience studies, the relationship and interaction mechanism among flow state dimensions have rarely been examined.

As Vittersø et al. (2001) noted, when in a state of flow, individuals' attention is attracted to the activities and goals, while they are unable to perceive the tools needed to achieve the events and objective. Emotions can be distinguished using arousal and enjoyment (Russell & Pratt, 1980), of which only arousal is an inevitable result of production (Bigné et al., 2005). According to the attention theory of time perception, the neglect of time will lead to the lower intensity of affection (Zakay, 2005).

2.3 Flow experience and internal clock model

Zakay (1993) put forward the attentional allocation model to illustrate the research results under the dual-task paradigm, which suggests that one's ability for attention is finite. In other words, when the attentional capacity is split between two tasks, attention to one task may begin after its onset of the other one, be suspended during the other task occurrence, or stop before the other task offset. In general, if precise time estimations rely on directed attention, in this way any challenging mission which is full of competition and detracts attention from the time task will lead to shorter standard (Zakay & Block, 1997). Regarding flow experiences in tourism, individuals' attention will presumably be focused on engaging tourism experiences rather than time perception.

To reach a flow state, it is necessary to keep one's attention on the matter at hand. Some scholars defined concentration as the degree to which one' s attention is fully attracted by an event so that no other activity is important (Csikszentmihalyi, 1990); in other words, the level of one's focus to a given task is paramount (Domina et al., 2012). Research had shown a relationship between attention and enjoyment such that, when players were deeply immersed in a game, they could become less conscious and attentive to their surroundings and responsibilities (Sanjamsai & Phukao, 2018). Emotions have an important impact on time perception, and some scholars believe that happy emotions can speed up tourists' time perception judgment (Lake, 2016; Noulhiane et al., 2007).

Based on these past results, the resulting hypothesis is provided:

H1. Gamification positively affects arousal in virtual reality experience.

H2a. Arousal evoked by a virtual reality experience positively affects satisfaction in virtual reality experience.

H2b. Arousal evoked by a virtual reality experience positively affects focused attention.

H2c. Arousal evoked by a virtual reality experience positively affects enjoyment.

H2d. Arousal evoked by a virtual reality experience positively affects time distortion.

H3a. Focused attention positively affects satisfaction.

H3b. Enjoyment positively affects satisfaction.

H3c. Time distortion positively affects satisfaction.

H4a. Focused attention positively affects time distortion.

H4b. Enjoyment positively affects time distortion.

H4c. Focused attention positively affects enjoyment.

H5. Focused attention mediates the arousal on satisfaction.

H6. Enjoyment mediates the arousal on satisfaction.

H7. Time distortion mediates the arousal on satisfaction.

H8. Focused attention, enjoyment and time distortion mediates the arousal on satisfaction.

Based on the hypotheses, the conceptual model (Fig. 1) represents the network of relationships among gamification, arousal, flow experience (focused attention, enjoyment, time distortion) and satisfaction.

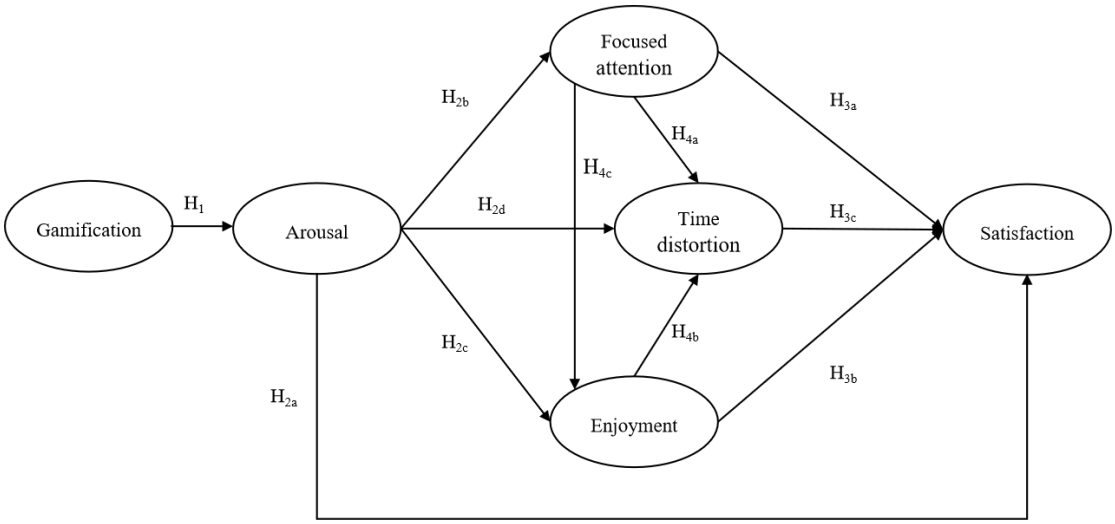

Figure 1 Research Framework

3. Method

3.1. Measures and materials

IdeaVR2019, a virtual reality content creation software, was used to create virtual reality tourism environments. In the virtual experience, visitors can visit mountains, view lakes and wander between buildings. In the virtual reality tourism experience, participants can travel the mountains, watch the lake, and can linger between buildings. Rich experience allows participants to visit virtual tourism scenes for at least an hour or so.

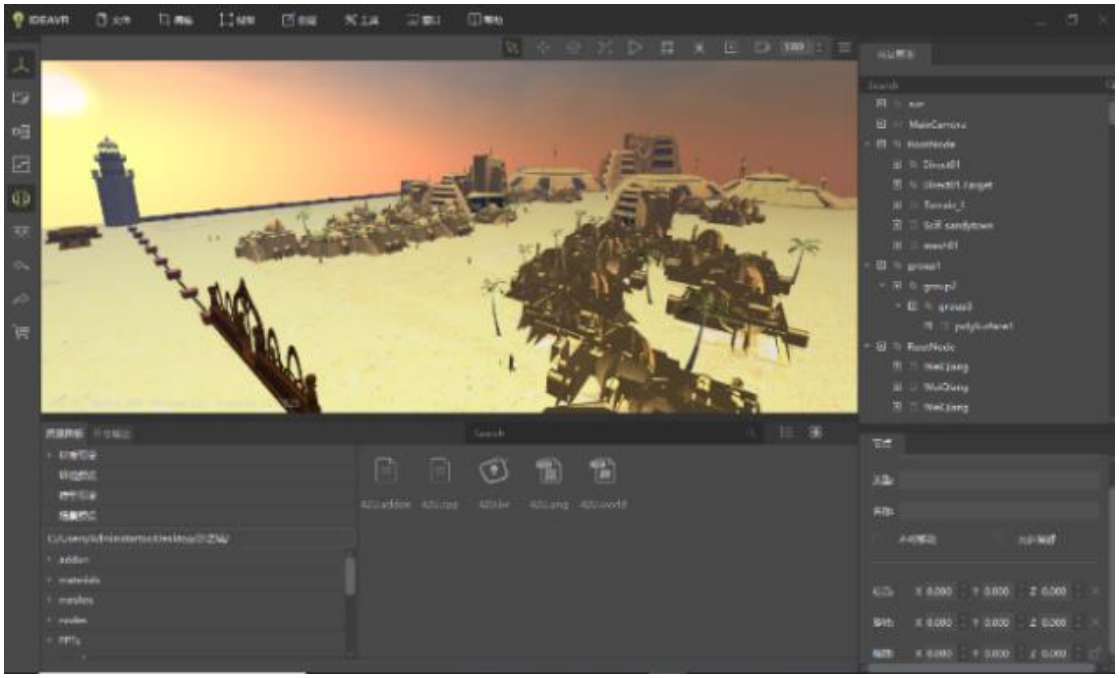

Figure 2 Virtual tourist attraction

Points, challenges, badges and awards are commonly used in tourism research (Liang et al., 2017; Shen et al., 2020; Xu et al., 2016). In this study, gamification elements are integrated into the virtual travel experience, including points, challenges, awards, etc. For participants in gamified experience, they can complete challenges, earn points and exchange prizes. The number of points depends on the completion of the task, between 4000 and 6000. For non-gamified participants, their experience is more inclined to sightseeing experience, and they can obtain fixed points (5000) to exchange prizes after the experience.

In questionnaire, the first section measured arousal and enjoyment. The arousal scale adapted three items from Mehrabian and Russell (1974) using 7-point semantic differential scales. The enjoyment and focused attention scale drawn from Koufaris's (2002) measure using a 7-point Likert scale. The satisfaction scale included four items drawn from Westbrook & Oliver (1991). Time distortion were measured with scales from Novak et al (2000). In order to facilitate the understanding of the participants, the items of the questionnaire were modified accordingly.

3.2. Pretest of the measures

A pretest was conducted before the formal survey, which is an effective way to improve the validity of formal survey data. This study conducted a pretest with 24 samples, who were not participating in the final survey. There were no procedural issues during the experience. These participants answered all the questions and raised some thoughts and concerns after the virtual reality tourism experience. The standard factor loading of each item was more than 0.500, and the Cronbach's Alpha of all scales valued exceed than 0.70 (Su & Swanson, 2019).

3.3. Data collection

Volunteers were recruited by online recruitment. After volunteers arrived, the researcher would explain the research process and purpose, and ask them to fill in the

informed consent. Before the formal experience, researcher would tell volunteers how to use virtual reality devices. After wearing a virtual reality headset, volunteers could see the virtual reality tourism scene, and use the operating handle to walk in the virtual scene. When volunteers were ready, they would have a formal experience. In this process, any irrelevant interference would be avoided to ensure the immersion of the experience. When finishing the experience, volunteers could exchange prizes through points and would be asked to fill out a questionnaire.

Figure 3 Participant during a virtual tourism experience

4. Empirical analyses

4.1. Profile of the respondents

The formal experiment lasted 15 days from December 17 to December 31, and 60 samples were collected. The sample demographics are summarized in Table 1. The sample consisted of 16 men and 44 women between 18 and 27 years old. Participants were generally highly educated, with most (98.33%) holding at least a bachelor's degree. All of the participants had traveled at least once in the previous 12 months

Table 1

Sample Demographics (N = 60)

Demographics		Frequency	%
Gender	Male	15	25.00%
	Female	45	75.00%
Age	18-24	57	95.00%
	25-30	3	5.00%
Educational level	Some college / Associate degree	1	1.67%
	Bachelor's degree	47	78.33%

	Graduate degree	12	20.00%
Number of trips taken in past 12 months	1	15	25.00%
	2	20	33.33%
	3-4	17	28.33%
	5-6	6	10.00%
	7-8	1	1.67%
	9-10	1	1.67%

Before evaluating the measurement model, we examined the multivariate normality of the data. The results show that the absolute value of skewness of all single variables is less than 2.0, and the absolute value of kurtosis of most single variables is less than 3.0. Therefore, the data did not deviate significantly from the normal distribution (Kline, 1998).

Table 2

Summarized Results of Measurement Model

Constructs and measurement items		Mean	Kurtosis	Skewness	Factor loadings	Cronbach's alpha	Composite Reliability	Average variance extracted
Arousal	SA3	3.917	-0.37	-0.408	0.784	0.804	0.817	0.605
	SA4	4.55	0.036	-0.702	0.719			
	SA5	4.746	0.262	-0.385	0.792			
Enjoyment	EN1	4.917	3.015	-1.299	0.651	0.941	0.945	0.813
	EN 2	5	0.09	-0.449	0.68			
	EN 3	4.9	-0.529	-0.315	0.625			
	EN 4	4.75	1.329	-0.894	0.702			
Focused Attention	FA1	4.583	0.121	-0.417	0.87	0.873	0.869	0.572
	FA 2	5.55	0.202	-0.642	0.868			
	FA 3	5.517	-0.007	-0.579	0.732			
	FA4	5.167	-0.006	-0.611	0.674			
	FA5	5.45	-0.136	-0.704	0.612			
Time distortion	TD1	4.683	-0.415	-0.357	0.712	0.835	0.837	0.563
	TD2	4.917	-0.572	-0.34	0.702			
	TD3	4.05	-0.439	-0.215	0.764			
	TD4	3.967	-0.495	-0.065	0.826			
Satisfaction	S1	6.267	2.705	-1.483	0.821	0.922	0.932	0.778
	S2	5.5	0.4	-0.824	0.822			
	S3	5.783	1.43	-0.845	0.884			
	S4	6.117	0.342	-1.019	0.773			

All constructs had Cronbach's alpha over 0.800(0.804-0.941). The composite reliability (CR) was 0.817-0.945. All factor loadings were more than 0.500, which was statistically significant (P =.001). The average variance extraction (AVE) for each factor was more than 0.500. AVE and CR were used for analysis of convergent validity. In general, AVE greater than 0.5 and CR value greater than 0.7 indicated high convergent validity (Hair, Black, Babin, and Anderson, 2010). According to the table, this study has satisfying reliability and convergent validity. According to Table

3, the AVE square root value of each variable is greater than the maximum absolute value of correlation coefficient between factors, which means that it has good discriminative validity (Anderson & Gerbing, 1988).

Table 3

Discriminant validity: Pearson correlation with AVE square root value

	Factor1	Factor2	Factor3	Factor4	Factor5
Factor1	0.778				
Factor2	0.486	0.756			
Factor3	0.677	0.517	0.902		
Factor4	0.443	0.427	0.572	0.75	
Factor5	0.525	0.503	0.766	0.55	0.882

Note: The diagonal number is the AVE square root value

Regression analysis was used to examine the relationship between gamification and arousal. The results showed that gamification had a positive effect on arousal (B=0.771, t=2.651, p=0.010). Thus, H1 was supported.

Table 4

Linear regression analysis results

	B		95% CI	VIF
	4.044**			
Constant		-21.324	3.673 ~ 4.416	-
	0.711*			
Gamification		-2.651	0.185 ~ 1.237	1
R^2	0.108			
Adjusted R^2	0.093			
F □	F (1,58) = 7.029, p=0.010			
Dependent variable: arousal				
D-W avlue： 2.018				

* p<0.05 ** p<0.01. The t values are in parentheses

This study used SPSS PROCESS to test the mediating effect (Hayes, Kristopher, & Myers, 2011). We generated 5000 bootstraps with a 95% confidence interval. As shown in Table 5, the results showed that the effect of arousal on satisfaction was significant (Boot LLCI = 0.27, Boot ULCI = 0.654, which doesn't included the value of zero), and the effect size was 0.462, confirming H_{2a}; In terms of indirect effect, arousal has a positive effect on focused attention and enjoyment, whereas arousal was not significantly related to time distortion, supporting H_{2b}, H_{2c}, and rejecting H_{2d}. Focused attention has a positive effect on enjoyment, supporting H_{4c} and rejecting H_{3a}, H_{4a}. At the same time, enjoyment has a positive effect on time distortion and satisfaction, supporting H_{3b} and $H_{4b.}$ Time distortion doesn't show any effect on satisfaction, rejecting H_{3c}. In addition, the direct effect of arousal on satisfaction was not significant, indicating a complete mediation effect.

Table 5

Direct, indirect, and total effects.

Relationships between Variables	Effect	SE	t	p	LLCI	ULCI

Direct effect	Arousal→ Satisfaction	-0.031	0.102	-0.305	0.762	-0.231	0.169
	Arousal→ Focused attention	0.437	0.103	4.247	0.000	0.235	0.639
	Arousal→ Enjoyment	0.595	0.114	5.227	0.000	0.372	0.817
	Focused attention→ Enjoyment	0.291	0.127	2.296	0.025	0.043	0.539
Indirect effects	Arousal→ Time distortion	0.063	0.155	0.406	0.686	-0.241	0.367
	Focused attention→ Time distortion	0.189	0.148	1.273	0.208	-0.102	0.479
	Enjoyment→ Time distortion	0.433	0.148	2.919	0.005	0.142	0.724
	Focused attention→ Satisfaction	0.133	0.099	1.346	0.184	-0.061	0.327
	Enjoyment→ Satisfaction	0.526	0.105	5.024	0.000	0.321	0.732
	Time distortion→ Satisfaction	0.120	0.088	1.364	0.178	-0.052	0.292
Total effect	Arousal→ Satisfaction	0.462	0.098	4.712	0.000	0.27	0.654

Note: LLCI refers to the lower limit of 95% of the estimate and ULCI refers to the upper limit of 95% of the estimate

The results of mediation analysis are shown in Table 6. Arousal plays a significant mediating role on enjoyment through focused attention and enjoyment, confirming the H_5 and H_6. Time distortion did not play a mediating role in arousal and satisfaction, H_7 are all rejected. Specifically, the Arousal → Focused attention→ Enjoyment→ Time distortion→ Satisfaction path is significant, supporting the H_8.

Table 6

Mediating analysis results.

Mediation Paths	Effect	Boot SE	BootLLCI	BootULCI	p
H5: Arousal → Focused attention→ Satisfaction	0.058	0.028	0.085	0.193	0.037
H6: Arousal → Enjoyment→ Satisfaction	0.313	0.039	0.183	0.34	0.000
H7: Arousal → Time distortion→ Satisfaction	0.008	0.035	-0.058	0.08	0.831
H8: Arousal → Focused attention→ Enjoyment→ Time distortion→ Satisfaction	0.007	0.006	0.000	0.024	0.279

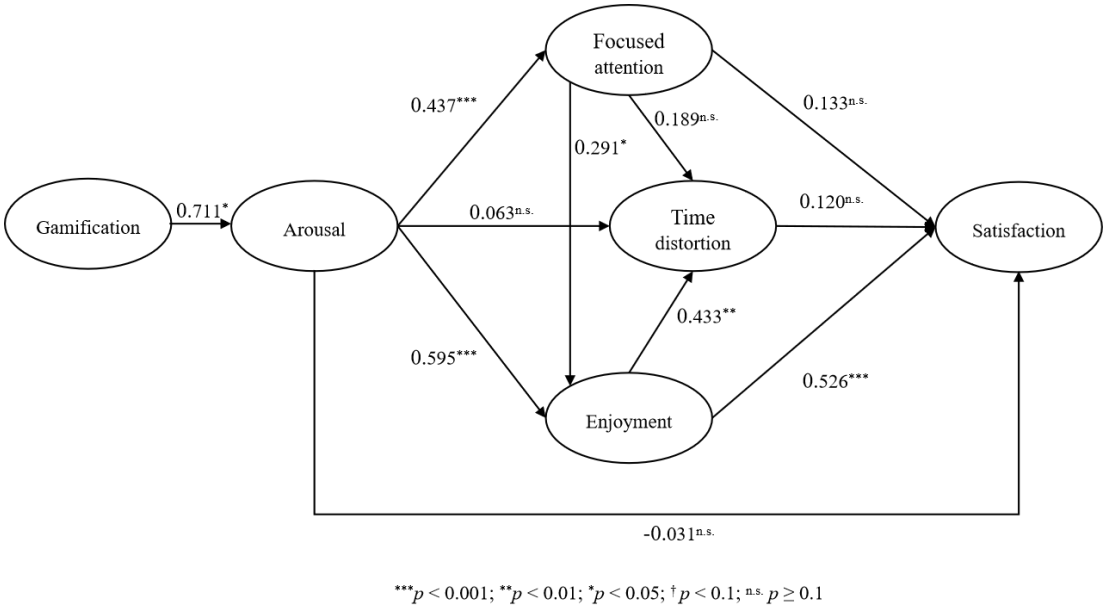

Figure 2 Path Model Results

5. Discussion and conclusion

Table 7

Hypothesis summary

No.	Hypothesis	Result
H_1	**Gamification→ Arousal**	**Supported**
H_{2a}	**Arousal→ Satisfaction**	**Supported**
H_{2b}	**Arousal→ Focused attention**	**Supported**
H_{2c}	**Arousal→ Enjoyment**	**Supported**
H_{3a}	**Focused attention→ Satisfaction**	**Supported**
H_{3b}	**Enjoyment→ Satisfaction**	**Supported**
H_{3c}	Time distortion→ Satisfaction	Rejected
H_{4a}	Focused attention→ Time distortion	Rejected
H_{4b}	**Enjoyment→ Time distortion**	**Supported**
H_{4c}	**Focused attention→ Enjoyment**	**Supported**
H_5	**Arousal → Focused attention→ Satisfaction**	**Supported**
H_6	**Arousal → Enjoyment→ Satisfaction**	**Supported**
H_7	Arousal → Time distortion→ Satisfaction	Rejected
H_8	**Arousal → Focused attention→ Enjoyment→ Time distortion→ Satisfaction**	**Supported**

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