

Influence of Entertainment Virtual Anchor Live Broadcast Scene on Fans' Reward Behavior--A Case Study of the Chinese Market

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Abstract

Background and Aim: Recently, a new type of anchor has emerged among network anchors: Virtual Anchor. In China, the development of Virtual Anchors is also very rapid. This article studies the impact of the entertainment Virtual Anchor live broadcast scene on fans' reward behavior. This article is based on SOR Theory, with the help of Interaction Ritual Chain Theory, Social Presence Theory, Flow Theory, and Identity Theory, and constructs the reward behavior model of the users who have watched the live broadcast of Virtual Anchors.

Materials and Methods: In this paper, a quantitative research design is used to collect data and test the hypothetical model. This survey distributed 550 questionnaires, and finally successfully recovered 507 questionnaires. Quantitative data were analyzed using confirmatory factor analysis, path analysis, and a mediating effect test.

Results: The hypotheses put forward in this study have been confirmed by empirical analysis and can be supported, which shows that the structural equation model is appropriate. The mediating effects proposed in this study have been confirmed by empirical analysis and can be supported.

Conclusion: The analysis results demonstrated that the model was successfully fitted to the empirical data across all defined criteria under consideration. After the test, results show that the entertainment Virtual Anchor live broadcast scene will have a positive impact on fans' reward behavior. And also found that flow experience and identity can play a chain mediating variable role between the Virtual Anchor live broadcast scene and fans' reward behavior. Studying the Virtual Anchor industry can promote the development and innovation of the Virtual Anchor industry.

Keywords: Chinese market; Entertainment Virtual Anchor; Fans' Reward Behavior; Virtual Anchor in Live Broadcast Scene

Introduction

Since the dawn of the 21st century, driven by the growing material and cultural desires of individuals, as well as advancements in internet technology, live streaming has captured increasing attention from the public. There are many live broadcast platforms in the new webcast mode, such as Douyu, Huya, TikTok, Bilibili Live, Auto Quicker Live, etc. These platforms allow anyone to create live broadcast content, which can be spread and watched at the same time. Anchors, serving as content creators, play a crucial role in live broadcasting. They can present their content on screen and receive real-time comments from viewers worldwide. At the same time, users can not only watch the live broadcast, but also participate in various forms of interaction with the anchor and other users, such as sending barrage, sharing expressions, rewarding the anchor, and so on. Webcast is different from TV live broadcast and video live broadcast, and pays more attention to interactivity. The live broadcast content includes text, pictures, audio and video.

In recent years, China's Internet technology has achieved significant advancements. According to the 50th Statistical Report on Internet Development in China released by the China Internet Network Information Center (CNNIC), the scale of Internet users in China has continued to expand steadily. There were 19.19 million new Internet users compared to December 2021, and the Internet penetration rate increased by 1.4 percentage points during the same period. From the change of user scale, this study can see that the popularity of live broadcast is increasing day by day. With the characteristics of strong real-time and rich interactive forms, watching live broadcasts has increasingly become an important way for people to relax on the Internet (Zhou & Lertjanyakit, 2024).

Recently, a new type of anchor has emerged among network anchors: Virtual Anchor. The concept of Avatar-style Virtual Anchor studied in this paper was initiated by Kizuna in the form of Virtual Anchor. In November 2016, Kizuna, a 16-year-old 3D cartoon Japanese girl wearing a white formula suit and called Kizuna Jiang by fans, opened the first Virtual Anchor channel on YouTube, which was popular among fans. In China, the development of Virtual Anchors is also very rapid. According to iiMedia Research data, in 2021, China's virtual human industry is projected to drive the industrial market scale and core market scale, which are estimated at 107.49 billion yuan and 6.22 billion yuan respectively (iiMedia Research, 2022), and is expected to maintain a sustained growth trajectory over the next five years.

Objectives

RO1: To study how the Virtual Anchor live broadcast scene affects fans' reward behavior in Virtual Anchor live broadcast.

RO2: To study the Virtual Anchor live broadcast scene that affects the internal state of Virtual Anchor fans. To study whether flow experience and identity play a mediating variable.

Literature review

Definition of Virtual Anchor

Shang (2022) believes that Virtual Anchors are content producers who upload videos or broadcast live on online video platforms with virtual digital characters, which are common on YouTube, Bilibili, Facebook, and other platforms. Gong et al. (2021) think that the current Virtual Anchor is mainly Avatar-style Virtual Anchor, and this Virtual Anchor is formed by capturing facial expressions, motion capturing and sound processing for the live broadcaster himself, that is, the "the person in the Virtual Anchor", and presenting it virtually with live2D or 3D model, that is, "leather case".

Interaction Ritual Chain Theory

Collins (1988) first proposed the Interaction Ritual Chain Theory. Goffman (1970) studied the ritual process in daily life from the perspective of micro-interaction and put forward the concept of "interactive ceremony", which is of great significance to group life. Zhou (2017) believes that the audience who gains emotional energy in the live broadcast interaction will be flowed in the live webcast interactive ceremony and form an interactive ceremony chain of live webcast. Zhang (2020) believes that the interaction between Virtual Anchors and fans expands new ways of interpersonal communication, and enhances the authenticity of interpersonal communication and interaction in virtual society. Guan (2022) explored the phenomena in the interactive ceremony of Virtual Anchor live broadcast, as well as the group unity, individual emotional energy, symbols representing the group, and maintaining the moral sense of the group after the successful ceremony. Feng (2022) analyzed that live broadcast interaction can make users generate emotional energy, form group unity, and generate group identity. The results of live broadcast interaction will be influenced by the live broadcast style of anchors and the choice of interactive content. Mei (2022) found that interactive scenes in live webcasts can meet people's needs for self-presentation, self-expression, and social interaction.

Social Presence Theory

Short et al. (1976) first put forward the concept and Social Presence Theory. Gefen and Straub (2003) described social presence as the degree to which consumers can combine media attributes with social task characteristics and perceive rich information. Hassanein (2007) defined social presence as the warmth and social psychological feeling transmitted to users by websites in his research on the influence of social presence on consumers' online shopping attitude. Gao (2022) studied that consumers are more likely to have impulsive buying behavior when they have a strong flow experience.

Identity Theory

Erickson (1998) defines identity as a sense of self-familiarity, understanding one's future goals, anticipating recognition, and inner self-confidence from trusted individuals. Azzahro et al. (2020) analyzed the factors influencing users' willingness to pay for subscription-based On-Demand streaming services, discovering that identity salience directly impacts willingness to pay. Huang (2022) found that the goods that users choose to consume not only have certain practical value to users, but also include the emotional and conceptual resonance between users and businesses, consumers' love for video owners, consumers' recognition of video content, and an emotion to realize their own value recognition. Lin (2022) thinks that the audience actually recognizes the overall image and personality charm of the Virtual Anchor while consuming the Virtual Anchor, and this recognition of him and me can be transformed into self-recognition.

Entertainment of Live Broadcast

The entertainment of live broadcast refers to the entertainment behavior that can make consumers feel satisfied or happy in the live broadcast of Virtual Anchor (Ma et al., 2019). Sewak et al. (2005) believe that content with strong vividness is more likely to bring a certain sense of pleasure and trust

to the viewer, thus producing a positive behavior attitude. Vivid online product displays can not only bring sensory stimulation to consumers, but also provide more information clues, and then let consumers make better decisions (Jiang & Benbasat, 2015). Zhang (2022) made a comprehensive discussion on the theoretical connotation of content marketing and put forward that live broadcasts should pay attention to informational, entertaining, and emotional content.

Flow Theory

Csikszentmihalyi (1990) proposed nine original dimensions of flow. For entertaining digital systems, it is argued that the primary attributes of flow can be effectively reflected through four key dimensions: focused concentration, sense of potential control, time distortion, and enjoyment (Suh et al., 2017). Focused concentration signifies the experience of complete engagement (Agarwal & Karahanna, 2000). Sense of potential control refers to the user's perception of exercising control over the activity (Suh et al., 2017), which reduces potential frustration and negative emotions during internet activities (Pelet et al., 2017). Time distortion implies that users lose track of time while engrossed in the activity (Agarwal & Karahanna, 2000). Enjoyment not only represents one's pleasant feelings but also reflects intrinsic interest in the activity (Guo & Poole, 2009).

SOR Theory

Mehrabian & Russell (1974) put forward the SOR (Stimulus-Organism-Response model) Theory. Belk (1975) regarded it as a model to describe consumers' purchasing decisions. When consumers are stimulated by external situations and commodities, their internal emotions and cognition will change to some extent. Xiang and Chen (2022) explore user behavior from the perspective of user experience, and constructs a theoretical model of user experience on user stickiness based on SOR Theory and expectation confirmation Theory.

Definition of Fans' Reward Behavior

Wan (2017) believes that user reward behavior on social media means that users can reward a content creator or the content created by him through cash or virtual gifts. Du and Xu (2017) think that reward is a form of online knowledge payment, and the launch of the reward function is regarded as a signal of the arrival of the content payment era and online knowledge payment.

Conceptual Framework

This study selected interactivity, presence, and entertainment of live broadcasts these three dimensions as independent variables. Flow experience and identity are selected as the mediating variables, and fans' reward behavior is taken as the dependent variable (conceptual framework based on Zhou & Lertjanyakit (2024) papers). The conceptual framework of this article is shown in Figure 1.

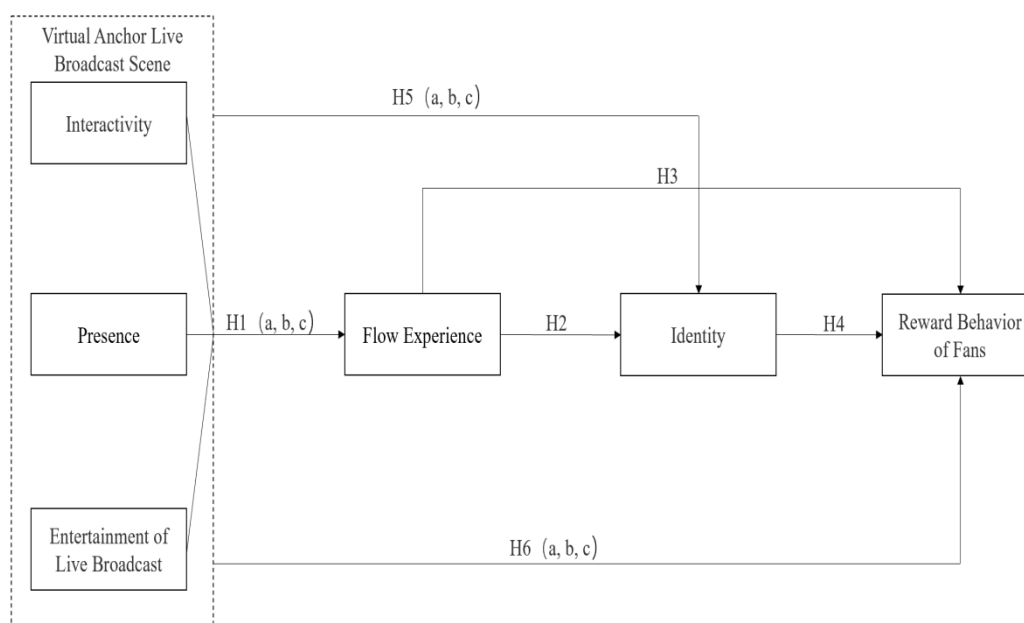


Figure 1 Conceptual Framework

Research Hypothesis

- H1: Virtual Anchor live broadcast scene has a positive impact on the flow experience.
 H2: Flow experience has a positive impact on identity.
 H3: Flow experience has a positive impact on fans' reward behavior.
 H4: Identity has a positive impact on fans' reward behavior.
 H5: Virtual Anchor live broadcast scene has a positive impact on identity.
 H6: Virtual Anchor live broadcast scene has a positive impact on fans' reward behavior.
 H7: Flow experience and identity have a chain mediating effect between the Virtual Anchor live broadcast scene and fans' reward behavior.
 H8: Flow experience has a mediating effect between the Virtual Anchor live broadcast scene and fans' reward behavior.
 H9: Identity has a mediating effect between the Virtual Anchor live broadcast scene and fans' reward behavior.

Methodology

This study adopted the convenient sampling method and distributed questionnaires online, and distributed questionnaires in the target group, which was composed of people watching the live broadcast of Virtual Anchors. Finally, we distributed 550 questionnaires, and finally successfully recovered 507 questionnaires, with a recovery rate of 92.2%.

The survey comprised two sections. Section one gathered participants' demographic information, including gender, age, and occupation to effectively control variables and enable researchers to concentrate on the subject. Section two involved comprehensive questions aimed at assessing the constructs in the research model. A 7-point Likert scale was utilized to gauge the items, with values ranging from "1 = Strongly disagree" to "7 = Strongly agree".

A small-scale pilot test was carried out to ensure comprehensibility and evaluate responses to the survey items (Hult et al., 2004; Matsuno et al., 2014). In this paper, this study uses the convenient sampling method of 110 questionnaires (EFA type of guideline stipulates absolute minimum sample sizes; recommendations of 100 to 250 are common (Cattell, 1978; Gorsuch, 1983).) were distributed to the (these 110 people were not included in the formal questionnaire), a total of 106 valid questionnaires were collected, and the recovery rate was 96%.

To ensure the consistency of the scale and the credibility of the analyzed data, the reliability of the sample data should be tested before the exploratory factor analysis. The data reliability of 9 variables

collected from the pilot test questionnaire was tested by software. The results of Cronbach's alpha values for 9 variables are shown in the following Table 1.

Table 1 The Results of Cronbach's Values for 9 Variables

Variable	Cronbach's a
INT	0.800
PRE	0.721
ENT	0.784
FOC	0.753
TID	0.790
CON	0.886
ENJ	0.829
IDE	0.822
REB	0.873

INT, Interactivity; PRE, Presence; ENT, Entertainment; FOC, Focused Concentration; TID, Time Distortion; CON, Sense of Potential Control; ENJ, Enjoyment; IDE, Identity; REB, Reward Behavior.

It can be seen that 9 variables have good internal consistency, and the measurement reliability of the components of each variable is high.

In this study, item-objective congruence (IOC) was used to test the content validity of project development (Rovinelli & Hambleton, 1977). This study invited three experts to carry out the inspection, the IOC test results of items in this study are greater than 0.5. So, all the problems involved in this study are acceptable. This shows that the content validity of the scale is good.

Exploratory factor analysis is used in this paper. Before judging the validity of the questionnaire, that is, before the validity test, the KMO test and Bartlett's sphere test are first passed to ensure that the data are suitable for factor analysis.

The data validity of 9 variables collected from the pilot test questionnaire was tested by software. This study first passes the KMO test and Bartlett's sphere test to ensure that the data are suitable for factor analysis. The result is shown in Figure 2.

Kaiser-Meyer-Olkin metric of sampling adequacy.	.876
Bartlett's sphericity test	Approximate chi-square
	1687.871
	df
	435
	Sig.
	.000

Figure 2 Test of KMO and Bartlett

Through the above figure, this study can see that the KMO value of the sample data of the questionnaire is 0.876, $KMO > 0.7$, and $Sig < 0.05$. That is, the statistical test is significant, indicating that this questionnaire is suitable for the following exploratory factor analysis (Kaiser, 1974).

Composition										
	1	2	3	4	5	6	7	8	9	
INT1	.145	.102	.057	-.066	.158	.785	.260	.201	.052	
INT2	.126	.192	.190	.258	.114	.771	.026	.125	.151	
INT3	.077	-.015	.084	.162	.187	.614	.216	.068	.453	
PRE1	.300	.010	.197	.248	.059	.167	.188	.578	.047	
PRE2	.105	.207	.066	.092	.262	.042	.159	.674	.171	
PRE3	.091	.068	.241	.160	-.009	.202	.158	.758	.087	
ENT1	.062	.198	.209	.746	.242	.118	.131	.188	.140	
ENT2	.058	.108	.104	.686	.253	-.071	.100	.225	-.063	
ENT3	.031	.118	.131	.740	.053	.230	.235	.034	.173	
IDE1	.061	.731	.004	.025	.273	.073	.149	.252	.075	
IDE2	.034	.732	.013	.240	-.080	.155	.086	-.048	.211	
IDE3	.128	.773	.179	.071	-.037	.096	.161	.118	.193	
IDE4	.258	.760	.058	.059	.148	-.090	-.071	-.020	.037	
IDE5	.212	.585	.244	.196	.054	.350	-.068	.155	-.361	
FOC1	.167	.165	.187	.150	.749	.182	.026	.074	.072	
FOC2	.129	.060	.226	.140	.699	.096	.214	-.019	.098	
FOC3	.201	.000	-.009	.241	.662	.104	.133	.295	.159	
TID1	.144	.235	.213	-.100	.213	.208	.051	.228	.682	
TID2	.286	.190	.216	.400	.023	.120	.048	.172	.663	
TID3	.155	.274	.158	.336	.286	.231	.006	.049	.533	
CON1	.112	.088	.812	.094	.193	.162	.168	.201	.114	
CON2	.063	.165	.788	.141	.221	.106	.175	.181	.080	
CON3	.172	.058	.828	.192	.030	.039	.156	.072	.160	
ENJ1	.126	.057	.216	.170	.282	.163	.759	.073	.032	
ENJ2	.288	.092	.142	.144	.035	.137	.767	.254	.062	
ENJ3	.188	.148	.270	.231	.114	.151	.616	.282	.055	
REB1	.782	.150	.135	.019	.108	.070	.242	.190	.022	
REB2	.787	.226	-.140	-.072	.211	.032	.081	.124	.116	
REB3	.787	.221	.150	.100	.064	.134	.143	.069	.213	
REB4	.796	.000	.249	.153	.131	.119	.071	.046	.034	

INT, Interactivity; PRE, Presence; ENT, Entertainment; FOC, Focused Concentration; TID, Time Distortion; CON, Sense of Potential Control; ENJ, Enjoyment; IDE, Identity; REB, Reward Behavior.

Figure 3 Rotating Component Matrix

As can be seen from the above figure, through exploratory factor analysis and principal component analysis, this study found that the factor load value of each measured item is greater than 0.5 in its associated variables and less than 0.5 in other factors. The correspondence between items and factors is consistent with our theoretical expectation in advance, which shows that the questionnaire has good construction validity.

Results

Demographic Analysis of the Respondents

The results of the demographic of the respondents are shown in Table 2.

Table 2 Demographics Distribution of Samples (N=507)

Demographic Variables	Characteristics	Frequency	Valid Percent
Gender	Male	323	63%
	Female	184	37%
Age	18-24	166	32.7%
	25-30	224	44.1%
	31-40	106	20.9%
	41-50	8	1.5%
	>50	3	0.5%

According to descriptive statistical results, the total number of valid samples is 507. In terms of gender, the number of males is greater than that of females, respectively accounting for 63% and 37%. In terms of age, the largest number is 25-30 years old, accounting for 44.1% of the total number, followed by 18-24 years old (32.7%).

Reliability

To ensure the consistency of the scale and the credibility of the analyzed data, the reliability of the sample data should be tested. (Cronbach, 1951). The Cronbach's Alpha coefficients are shown in Table 4 and Table 6, ten variables are all greater than 0.7. It can be seen that all variables have good internal consistency, and the measurement reliability of the components of each variable is high.

Confirmatory factor analysis

To confirm the theoretical model, this research uses the structural equation modeling analysis method and used software to test the data about ten variables collected from questionnaires. Flow experience includes four dimensions, focused concentration, time distortion, sense of potential control, and enjoyment, and each dimension has corresponding observation indicators, so the second-order confirmatory factor analysis is carried out for flow experience. The fitting index of the second-order structural equation model of flow experience is shown in Table 3 and the second-order structural equation model is shown in Figure 4.

Table 3 Fitting Index of Structural Equation Model

Fit Measure	Acceptable Fit	Result	Support
χ^2/df	$1.00 < \chi^2/df < 3.00$	1.428	Acceptable
SRMR	< 0.05	0.259	Acceptable
AGFI	> 0.90	0.965	Acceptable
PGFI	> 0.50	0.627	Acceptable
NFI	> 0.90	0.973	Acceptable
CFI	> 0.90	0.992	Acceptable
RMSEA	< 0.05	0.029	Acceptable

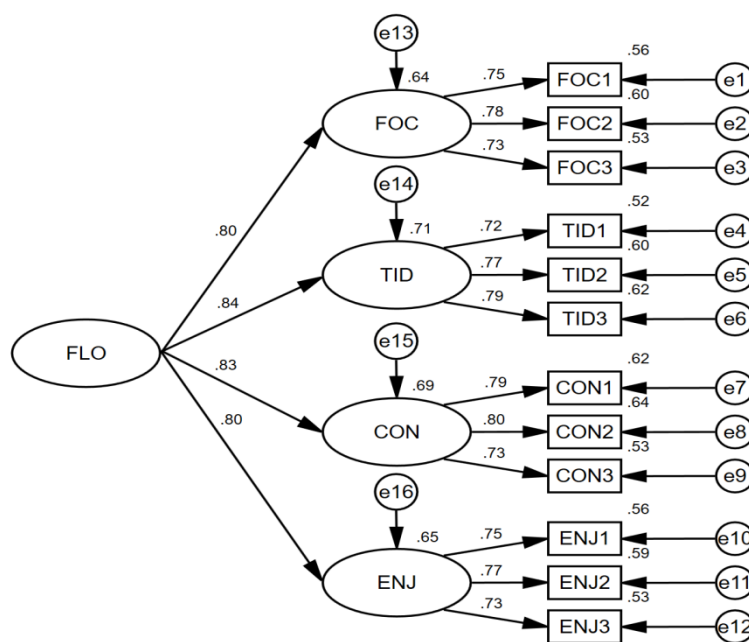


Figure 4 Second-order Structural Equation Model

The above Table 3 shows that the overall adaptation index of the model meets the test standard. From the results of Figure 4 and Table 4, the observed variables all fall on the corresponding factors. The factor loads of the observed variables in the initial factor and the factor loads of the initial factor in the high-order factor constructions are all higher than 0.7 and lower than 0.95, and all the regression coefficients are significant at the level of $p < 0.001$, which shows that the high-order structure of flow experience can explain all the first-order factor constructions. Therefore, this study thinks that the second-order structural equation model of flow experience is valid.

According to the value of the standardized regression coefficient, this study can find the Composite Reliability (CR) and Average Variance Extracted (AVE) of each latent variable, and the results are shown in Table 4.

Table 4 Convergent Validity of Second-order Structural Equation Model

Relationship	Standardized Estimates	S.E.	C.R.	P	CR	AVE	Cronbach's Alpha
FOC1←FOC	0.748						
FOC2←FOC	0.777	0.065	15.468	***	0.796	0.566	0.789
FOC3←FOC	0.731	0.078	14.776	***			
TID1←TID	0.722						
TID2←TID	0.772	0.075	15.323	***	0.805	0.579	0.802
TID3←TID	0.788	0.069	15.549	***			
CON1←CON	0.787						
CON2←CON	0.802	0.060	17.341	***	0.816	0.597	0.815
CON3←CON	0.727	0.058	15.861	***			
ENJ1←ENJ	0.750						
ENJ2←ENJ	0.766	0.074	15.300	***	0.793	0.561	0.792
ENJ3←ENJ	0.731	0.068	14.763	***			
FOC←FLO	0.800			***			
TID←FLO	0.840	0.109	11.087	***	0.891	0.671	0.895
CON←FLO	0.830	0.134	11.582	***			

Relationship	Standardized Estimates	S.E.	C.R.	P	CR	AVE	Cronbach's Alpha
ENJ←FLO	0.805	0.105	11.06	***			

Notes: *** $p < 0.001$

FOC, Focused Concentration; TID, Time Distortion; CON, Sense of Potential Control; ENJ, Enjoyment; FLO, Flow Experience.

It can be seen from above Table 3 that whether the initial factors or the high-order factor, the standard factor load coefficient is greater than 0.7, which indicates that the topic has enough reliability (Fornell & Larker, 1981), and the Composite Reliability is greater than 0.7, which indicates that there is enough internal consistency (Bagozzi & Yi, 1988). The average Variance Extracted is greater than 0.5 (Fornell & Larker, 1981). It shows that there is Convergent Validity between dimensions. To sum up, the Second-order structural equation model of flow experience is valid.

To confirm the theoretical model proposed in the research, this study uses the structural equation modeling analysis method, and software to analyze the influence of Virtual Anchor live broadcast scene on fans' reward behavior. The fitting index of the structural equation model is shown in the following Table 5 and the structural equation model is shown in Figure 5.

Table 5 Fitting Index of Structural Equation Model

Fit Measure	Acceptable Fit	Result	Support
χ^2/df	$1.00 < \chi^2/df < 3.00$	1.237	Acceptable
SRMR	< 0.05	0.313	Acceptable
AGFI	> 0.90	0.931	Acceptable
PGFI	> 0.50	0.783	Acceptable
NFI	> 0.90	0.939	Acceptable
CFI	> 0.90	0.988	Acceptable
RMSEA	< 0.05	0.022	Acceptable

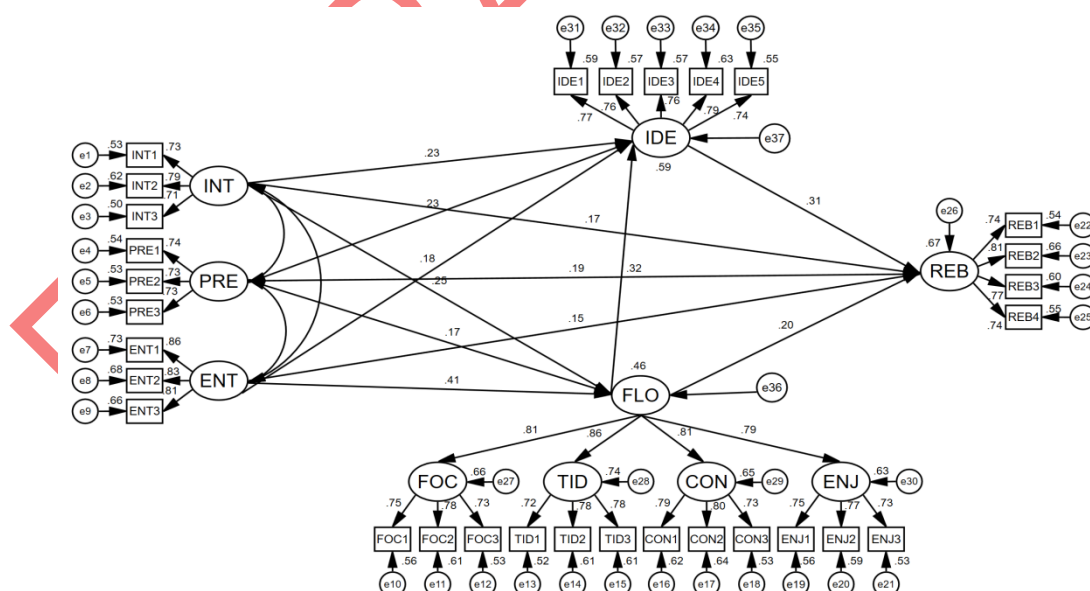


Figure 5 Structural Equation Model

Figure 5 and Table 5 show that a series of fitting indexes in the structural equation model is in line with the standard, which also shows that the theoretical model fits well with the actual observation data from different aspects.

According to the value of standardized regression weights, this study can find the CR and AVE of each latent variable, and the results are shown in Table 6.

Table 6 Convergent Validity of Structural Equation Model

Relationship	Standardized Estimates	S.E.	C.R.	P	CR	AVE	Cronbach's Alpha
INT1 ← INT	0.712						
INT2 ← INT	0.807	0.098	12.956	***	0.787	0.553	0.785
INT3 ← INT	0.707	0.080	12.931	***			
PRE1 ← PRE	0.747						
PRE2 ← PRE	0.732	0.072	12.425	***	0.774	0.534	0.773
PRE3 ← PRE	0.712	0.071	12.383	***			
ENT1 ← ENT	0.835						
ENT2 ← ENT	0.852	0.047	20.160	***	0.871	0.692	0.870
ENT3 ← ENT	0.807	0.048	19.481	***			
FOC ← FLO	0.800						
TID ← FLO	0.840	0.109	11.087	***	0.891	0.671	0.895
CON ← FLO	0.830	0.134	11.582	***			
ENJ ← FLO	0.805	0.105	11.06	***			
REB1 ← REB	0.737						
REB2 ← REB	0.802	0.081	16.498	***	0.851	0.589	0.849
REB3 ← REB	0.813	0.077	16.654	***			
REB4 ← REB	0.712	0.075	14.835	***			
IDE1 ← IDE	0.761						
IDE2 ← IDE	0.750	0.055	16.517	***			
IDE3 ← IDE	0.759	0.057	16.733	***	0.874	0.580	0.873
IDE4 ← IDE	0.798	0.060	17.610	***			
IDE5 ← IDE	0.740	0.059	16.283	***			

Notes: ***p<0.001

INT, Interactivity; PRE, Presence; ENT, Entertainment; IDE, Identity; FLO, Flow Experience; REB, Reward Behavior.

It can be seen from the above table that the standard factor load coefficients of all variables are greater than 0.7, which indicates that all the items have sufficient reliability (Fornell & Larker, 1981), the Composite Reliability is greater than 0.7, which indicates that there is sufficient internal consistency (Bagozzi & Yi, 1988), and the Average Variance Extracted is greater than 0.5 (Fornell & Larker, 1981). It shows that there is Convergent Validity between dimensions.

This study uses the Fornell-Larcker criterion to study the Discriminant Validity of the whole model. The test standard is whether the square root of the Average Variance Extracted from the facet is greater than the correlation coefficient between the facet and other facets (Fornell & Larker, 1981). The Discriminant Validity of the structural equation model of the whole study is shown in Table 7.

Table 7 Discriminant Validity of Structural Equation Model

	ENT	PRE	INT	FLO	IDE	REB
ENT	0.832					
PRE	0.471	0.731				
INT	0.465	0.442	0.744			
FLO	0.606	0.475	0.515	0.819		
IDE	0.594	0.570	0.583	0.659	0.762	
REB	0.620	0.603	0.604	0.672	0.736	0.767
AVE	0.692	0.534	0.553	0.671	0.580	0.589

Notes: The diagonal is the square of AVE

INT, Interactivity; PRE, Presence; ENT, Entertainment; IDE, Identity; FLO, Flow Experience; REB, Reward Behavior.

It can be seen from above Table 7 that the square root of the Average Variance Extracted from all

facets is greater than the correlation coefficient between this facet and other facets, so this study thinks that the structural equation model in this study has Discriminant Validity.

After the above test, this study finds that the Convergent Validity and Discriminant Validity of the structural equation model of this study have passed the test, so this study thinks that this study has good Construct Validity.

Hypothesis Test

The hypotheses are tested by combining the results of the above structural equation model analysis. The hypothesis verification results are shown in Table 8.

Table 8: Results of Hypothesis Test

Hypothesis	Standardized Estimates	S.E.	C.R.	P	Support
H1a: INT→FLO	0.249	0.044	4.231	***	Yes
H1b: PRE→FLO	0.173	0.037	2.956	0.003**	Yes
H1c: ENT→FLO	0.409	0.031	6.794	***	Yes
H2: FLO→IDE	0.319	0.094	5.169	***	Yes
H3: FLO→REB	0.203	0.066	3.367	***	Yes
H4: IDE→REB	0.311	0.047	4.830	***	Yes
H5a: INT→IDE	0.232	0.061	4.357	***	Yes
H5b: PRE→IDE	0.230	0.051	4.353	***	Yes
H5c: ENT→IDE	0.184	0.043	3.393	***	Yes
H6a: INT→REB	0.167	0.043	3.211	0.001**	Yes
H6b: PRE→REB	0.186	0.036	3.577	***	Yes
H6c: ENT→REB	0.148	0.030	2.845	0.004**	Yes

Notes: *** $p < 0.001$, ** $p < 0.01$

INT, Interactivity; PRE, Presence; ENT, Entertainment; IDE, Identity; FLO, Flow Experience; REB, Reward Behavior.

To sum up, the hypotheses put forward in this study have been confirmed by empirical analysis and can be supported, which shows that the structural equation model is appropriate.

Mediating Effect Test

The mediating effects proposed in the study were tested by the Bias-Corrected Bootstrap method. In this study, 5000 Bootstrap samples were selected from the original data ($n=507$) by a repeated random sampling method, and an approximate sampling distribution was generated. The confidence interval of the 95% mediating effect was estimated by the 2.5 percentile and 97.5 percentile. If the 95% confidence interval of the mediating effect does not include 0, it indicates that the mediating effect is meaningful (Efron & Tibshirani, 1993). The results of the mediating effect verification are shown in Table 9.

Table 9: Mediating Effect Test

Parameter	Standardized Estimates	S.E.	Bias-Corrected 95%CI	
			Lower	Upper
stdIndINT1	0.025	0.010	0.011	0.053
stdIndINT2	0.051	0.020	0.020	0.101
stdIndINT3	0.058	0.020	0.027	0.106
stdIndPRE1	0.017	0.009	0.005	0.041
stdIndPRE2	0.035	0.018	0.008	0.078
stdIndPRE3	0.040	0.018	0.012	0.082
stdIndENT1	0.041	0.014	0.019	0.078
stdIndENT2	0.083	0.029	0.034	0.149
stdIndENT3	0.075	0.031	0.026	0.149

stdIndINT1: INT→FLO→IDE→REB, stdIndINT2: INT→FLO→REB, stdIndINT3: INT→IDE→REB, stdIndPRE1: PRE→FLO→IDE→REB, stdIndPRE2: PRE→FLO→REB, stdIndPRE3: PRE→IDE→REB, stdIndENT1: ENT→FLO→IDE→REB, stdIndENT2: ENT→FLO→REB, stdIndENT3: ENT→IDE→REB

To sum up, the mediating effects proposed in this study have been confirmed by empirical analysis and can be supported.

Discussion

For H1, it can be seen that the Virtual Anchor live broadcast scene positively impacts the flow experience. When fans accept the Virtual Anchor live broadcast scene, they will gradually pay attention to Virtual Anchors and form a flow experience with Virtual Anchors. Pelet et al. (2017) point out that enhanced remote presence can make it easier for individuals to enter the flow experience state and can improve their satisfaction and loyalty to social media. Bruce et al. (2018) argue that social interaction and entertainment significantly contribute to explaining at least one aspect of live-stream engagement, such as watching, subscribing, or donating. The inclusion of social interactions adds valuable insight, further substantiating the social motivations behind engaging in livestreams. Peng (2020) argues that live broadcasts' presence and entertainment value exert a notably positive influence on users' immersive experiences. The entertaining nature of live broadcast content provides users with a sense of pleasure and enjoyment, consequently enhancing the flow experience.

For H2, it can be seen that flow experience has a positive impact on identity. When fans have a flow experience with the Virtual Anchor live broadcast, they will gradually form their self-identity and their identity with the fan group. Zhong (2020) suggests that a heightened focus on flow experiences, coupled with the integration of behavioral awareness and goal control, can foster community identity. Lin (2022) believes that the primary audience for virtual anchors comprises predominantly "Generation Z" teenagers, who migrate a significant portion of their social interactions to online platforms and establish a virtual "community" through interactions therein, immersed in the virtual field of the live broadcast room. Throughout this process, they construct both self-identity and group identity within the community. Tong (2023) believes that audiences of virtual idols increasingly crave emotional comfort and solace. Watching live broadcasts of virtual idols serves as a form of companionship for them, eliciting flow experiences during live broadcasts. Through perceiving similarities in psychology and behavior with virtual idols, fans of virtual idols develop self-identity based on certain entertainment activities, lifestyles, and even cultural beliefs, thereby constructing a sense of collective identity.

For H3, it can be seen that the flow experience has a positive impact on fans' reward behavior. When fans have a flow experience with the Virtual Anchor live broadcast, they will pay more attention to the Virtual Anchor, express their love for the Virtual Anchor, and may reward the Virtual Anchor. Suh et al. (2017) illustrate that the flow experience signifies a crucial holistic component of user experience and serves as a pivotal predictor of the intention to continue usage. Flow experience is positively correlated to continued use. Guan et al. (2022) confirmed the significance of flow as a

desired psychological state in stimulating purchase behavior in computer-mediated environments and demonstrated this by elucidating how flow states can emerge from viewers' social perceptions of both the streamer and the viewer crowd within highly social contexts.

For H4, it can be seen that identity has a positive impact on fans' reward behavior. When fans form self-identities and the fan group, they will express their love for the Virtual Anchor and may reward the Virtual Anchor. Azzahro et al. (2020) believe that the factors related to identity salience positively influence users' willingness to pay for services. Huang (2022) thinks that Virtual Anchors not only thrive through commercial and media channels but also uphold their distinctive subcultural styles during evolution. Song and Liu (2023) point out that group identity leads users to subconsciously compare the values espoused within the community with their own, thereby hastening the emergence of usage behavior when users are motivated to watch.

For H5, it can be seen that the Virtual Anchor live broadcast scene has a positive impact on identity. When fans accept the Virtual Anchor live broadcast scene, they will gradually form their self-identity and their identity with the fan group. Chen (2006) believes that interactivity can foster identity formation in social virtual worlds, thus gradually leading to group identification to further boost user engagement. Zhou (2017) believes that when internet broadcasters and audiences log into live streaming platforms, interaction is facilitated through voice and barrage messages. Audience members who gain emotional energy through live-streaming interaction become deeply immersed in the experience. They continue to log in to live streaming platforms and participate in subsequent interactive sessions to derive pleasure and a sense of identity. Zhang (2020) points out that interacting in the main communication scene of a virtual live broadcast may enhance the audience's flow experience, which may affect their sense of identity with the virtual anchor.

For H6, it can be seen that the Virtual Anchor live broadcast scene has a positive impact on fans' reward behavior. When fans accept the Virtual Anchor's live broadcast scene, they will express their love for the Virtual Anchor and may reward the Virtual Anchor. Yong (2021) believes that during live broadcast experiences, consumers find themselves in highly socialized environments, and they are inclined to engage with anchors and other viewers in the live chat room, gradually cultivating a sense of flow and identity, thereby fostering the emergence of continued purchase intentions. Wang (2021) revealed that augmenting the interactions between the audience and the anchor strengthens the audience's sense of participation. This heightened participation enhances feelings of belonging and immersion for viewers of the live broadcast, cultivating a loyal fan base and encouraging users to engage in rewarding behaviors.

Furthermore, from Table 8, this study found that interactivity, presence, and entertainment of live broadcasts not only directly and positively affect fans' reward behavior, but also indirectly affect fans' reward behavior through the intermediary role of flow experience and identity. Moreover, this study found that there is a close relationship between flow experience and identity, and the two constitute an intermediate link in the influence path of interactivity→flow experience→identity→fans' reward behavior, presence→flow experience→identity→fans' reward behavior, entertainment of live broadcast→flow experience→identity→fans' reward behavior. There is a chain intermediary role in the process. Peng (2020) believes that the live broadcast scene of the anchor will bring users a sense of pleasure and enjoyment, so that users can focus on the live broadcast, thereby promoting the immersive experience. When users have an immersive experience, they are willing to contribute their resources and generate rewards. Gao (2022) believes that presence exerts a substantial positive influence on the flow experience, indicating that heightened presence perception during e-commerce livestreaming significantly impacts consumers' flow experience. Moreover, consumers' flow experience demonstrates a significant positive effect on impulsive buying behavior, suggesting that consumers are more prone to impulsive purchases when experiencing a robust flow state. Flow experience serves as an intermediary role between presence and impulsive buying behavior.

Conclusion

The results show that there is a significant relationship between the live broadcast scene of virtual anchors and fans' reward behavior. This study found that identity and flow experience have a positive impact on fans' reward behavior. This study believes that when the Virtual Anchor broadcasts live, fans will have a flow experience during the live broadcast, have a fan group identity, and also have self-identity. Fans' flow experience and identity will further encourage fans to watch the live broadcast of Virtual Anchors and exhibit reward behavior. Therefore, the results of this study confirm that when fans watch Virtual Anchor, the live broadcast scene of Virtual Anchor plays an important role, which means that the live broadcast scene of Virtual Anchor has a positive impact on fans' reward behavior.

This study found that flow experience and identity can play a chain mediating variable role between the Virtual Anchor live broadcast scene and fans' reward behavior. Flow experience can play a mediating variable role between the Virtual Anchor live broadcast scene and fans' reward behavior. Identity can play a mediating variable role between the Virtual Anchor live broadcast scene and fans' reward behavior.

Contribution

Theoretically speaking, the Virtual Anchor industry provides a new research field for media and communication scholars. First of all, little research has been conducted on the influence of the perspective of the Virtual Anchor live broadcast scene on fans' reward behavior. This study enriches the research perspective of Virtual Anchor's behavior to reward live broadcasts, from the Virtual Anchor live broadcast scene. Secondly, by exploring the driving factors of Virtual Anchor fans' reward behavior, the research fills the gap of user behavior research. Based on Emotional Attachment Theory, Flow Theory, and Identity Theory, this paper presents the influence mechanism of the characteristics of Virtual Anchor.

The contribution of the Virtual Anchor industry in the commercial field is also very significant. This study can help consumers understand their recognition and support for Virtual Anchors. This can reveal consumers' cognition of Virtual Anchor content, and let consumers know why they like Virtual Anchor.

Recommendation

First, future research can explore the influencing factors of user behavior for other types of Virtual Anchor live broadcasts (such as virtual e-commerce anchors, virtual education anchors, virtual tour guide anchors, virtual news anchors, etc.).

Second, future research can select survey objects from different regions and cultures. For example, Japan, as the birthplace of virtual anchors, has a wide cultural foundation of Two-dimensional and virtual singers. The acceptance of virtual anchors is logical, and Japanese virtual anchors are all active on the YouTube platform, this is also different from Chinese virtual anchors. Virtual anchors in the United States are mainly distributed in the game field, and they attract fans through game live broadcasts. Compared with Japanese virtual anchors, American virtual anchors pay more attention to technology and content innovation. They constantly try new technical means and game methods to attract fans. There are not many virtual anchors in the UK, but their style is unique and they are often combined with animation, music, and other fields. And pay attention to the depth of content, they create their characteristics by studying a certain field in depth. Therefore, the research results of the survey subjects in different regions and cultures may lead to different findings.

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