J. Inf. Technol. Appl. Manag. 31(4): 121~137, August 2024
https://doi.org/10.21219/jitam.2024.31.4.121

ISSN 1598-6284 (Print)
ISSN 2508-1209 (Online)

Analyzing the Effects of Anthropomorphism in NPCs Applied by GPT on User Satisfaction and Loyalty

Namjae Cho* · Zhilan Cao** · Giseob Yu***

Abstract

This research studies NPCs applied by Generative Pre-trained Transformer (GPT) Technology. This study set three independent variables as characteristics of the NPCs applied GPT. User immersion is set as a mediator variable, while user game satisfaction and loyalty are chosen as dependent variables. The Stimulus-Organism-Response (SOR) theory is employed to study user attitude changes, and immersion is examined through the Flow Theory. The study found that interactions between NPCs and users directly and indirectly influence user satisfaction and loyalty. This suggests that NPCs capable of providing users with desired information, rather than merely following predetermined protocols, can enhance the user's affinity for the game. Furthermore, the intelligence and human-likeness of NPCs were found to indirectly influence satisfaction and loyalty through immersion. These findings underscore the importance of GPT-applied NPCs in the gaming industry, with potential implications for the future development and enhancement of such NPCs within games.

Keywords : Non-player Characters, Satisfaction, Loyalty, Flow Theory, SOR Theory

Received : 2024. 06. 12. Revised : 2024. 07. 03. Final Acceptance : 2024. 08. 23.

* First Author, Professor, School of Business, Hanyang University, e-mail: njcho@hanyang.ac.kr
** Co-Author, MSc, School of Business, Hanyang University, e-mail: caozhilan2000@163.com
*** Corresponding Author, Adjunct Professor, School of Business, Hanyang University, 222, Wangsimni-ro, Seongdong-gu, Seoul, 04763, Korea, Tel : +82-2-2220-4142, Fax: +82-2-2292-3195, e-mail : yugs@hanyang.ac.kr

1. Introduction

Games have the unique ability to enable users to construct their own worlds [Turkle, 1994] and find enjoyment through competition within the game [Zubek and Khoo, 2002]. In this process, users reflect their identities through their game characters, leading to increased interest and engagement in the game [Hefner et al., 2007]. Additionally, game characters positively influence users' game preferences and playing intentions [Kempf, 1999; Mandryk and Atkins, 2007]. Therefore, game characters play a vital role in enhancing user concentration and retention within the game.

The concept of game characters, also known as avatars [Soutter and Hitchens; Wu and Hsu, 2018], can be understood as the user's representation in the virtual environment [Ducheneaut et al., 2009]. Players often choose intelligent or powerful characters to achieve success in the game [Ko and Park, 2021]. The importance of Non-player Characters (NPC), however, has recently gained prominence [Drennan et al., 2003]. NPCs play significant roles in users' gaming experiences, providing assistance, challenges, and services [Warpefelt and Verhagen, 2017]. Due to the significance of NPCs, most video games rely on them during game development [Aarseth, 2012; Warpefelt and Verhagen, 2016].

The relationship between users and NPCs is important because of the various impacts on users' gaming activities [Harth, 2017]. Depending on the level of NPC's technological sophistication, it can either enhance or hinder the enjoyment of the game [Bartle, 2004] and create intense experiences through emotional connections with the users [Ravenet et al., 2016; Yannakakis et al., 2011].

This study focuses on NPCs integrated with GPT technology. The target game is 'Justice Mobile'. The game involves a recent case in China where NPCs based on GPT technology were incorporated into the game setting. The study aims to investigate the influence of GPT-based NPCs on users' immersion, game satisfaction, and loyalty. Specifically, the study aims to assess users' responses based on the level of anthropomorphism among NPCs.

The research questions are as follows:

Q1: How does the anthropomorphic feature of GPT-based NPCs influence users' immersion?

Q2: Does the anthropomorphic feature of GPT-based NPCs have an impact on users' game satisfaction and loyalty?

To address the research questions, the theoretical background of Flow and SOR Theory is adopted. Flow theory is explained based on previous studies [Bartle, 2004] that suggested how NPCs' technological sophistication can either enhance or hinder users' enjoyment. There are three factors in the SOR framework. First, the environmental stimulus represents the anthropomorphic characteristics of NPCs. Second, the organism state reflects users' level of immersion. Lastly, the behavioral response explains users' game satisfaction and loyalty.

This study holds two implications. It analyzes the characteristics of NPCs utilizing the recent technology, GPT, from the users' perspective. By examining users' psychological states regarding this new technology, this research can serve as valuable evidence for future technology applications. Additio-

nally, it systematically approaches the relationship between NPC characteristics and users based on the theories. This is expected to contribute to the theoretical expansion of NPC-user relationships in the future.

2. Theoretical Background

2.1 Non-player Characters (NPCs)

Advancements in technologies such as automation and natural language processing systems [Luger, 2005; McCord et al., 2012] have greatly influenced the game industry. These technological developments have enriched the roles and values of NPCs within games. Generally, NPCs refer to characters in a game that are controlled entirely by the computer [Warpefelt and Verhagen, 2017].

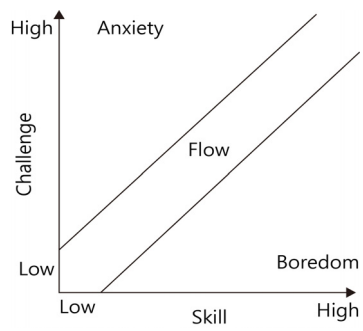
In most recently released video games, it is impossible for users to play without interacting with NPCs [Emmerich et al., 2018]. During gameplay, users expect NPCs to perceive users' characters and to respond appropriately [Lankoski and Björk, 2007]. This expectation causes users to trust the game and increases immersion in the game [Emmerich et al., 2018]. NPCs have evolved from merely providing information to becoming cooperative entities that help users focus on and prolong their engagement in the game.

Warpefelt and Verhagen [2017], who have conducted research on NPCs, categorized them into 12 forms based on their roles. These forms include functional roles such as Vendor, Services, and Questgiver, as well as user adversaries such as Enemy and Opponent. There are also forms of interaction with users, including Sidekick, Ally, Companion, Pet, and Minion which are grouped under the category of Friends. Finally, NPCs serve as the provider, including Storyteller or Loot Provider. The diversity of NPC forms signifies their substantial role in games. Among them, NPCs that enhance user interaction, such as Sidekicks and Companions, support users to stay engaged in the game for longer periods [Warpefelt and Verhagen, 2017].

Recently, NPC development based on GPT technology has been actively pursued to enhance user interaction. In particular, the game 'Justice Mobile,' released in China in 2019, has achieved significant success by utilizing this technology. In this study, the focus is on NPCs applied GPT technology and their anthropomorphic characteristics.

2.2 Flow Theory

Flow theory refers to the state in which a user intensely focuses on a specific activity, excluding any other thoughts or distractions [Csikszentmihalyi, 1990]. Typically, individuals with a strong intrinsic motivation are more likely to become immersed in a particular activity and experience enjoyment [Csikszentmihalyi, 2003]. In the context of gaming, the level of immersion in the game can be increased when users are exposed in challenges that are balanced with their abilities [Cho et al., 2021].



〈Figure 1〉 Flow Theory

In order for users to become immersed in a specific situation, various characteristics are required. These characteristics include enjoyment, emotional control, deep concentration, pleasure in the given tasks, time distortion, and a balance between challenges and the user's abilities [Su et al., 2016; Fabito et al., 2020].

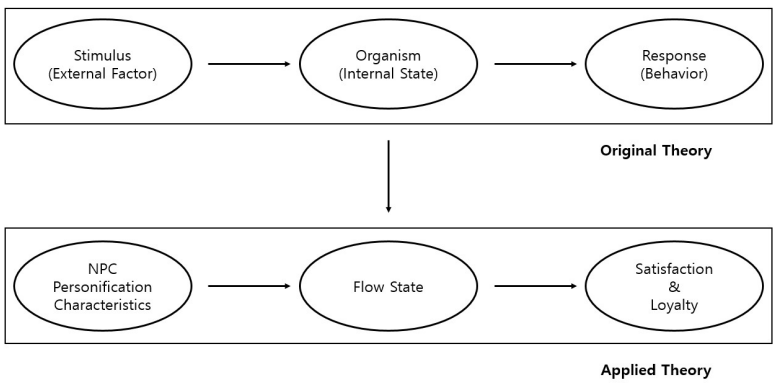
Among these characteristics, the balance between given challenges and skills to users is considered a key feature that induces user immersion in the game [Cho et al., 2021]. In this study, we set the level of user immersion as a mediating variable to explore the impact of GPT-based NPC characteristics concerning game satisfaction and loyalty of users.

2.3 Stimulus-Organism-Response (SOR) Theory

The Stimulus-Organism-Response (SOR) theory refers to the cognitive response process in which specific stimuli influence human emotions and cognition, leading to observable behaviors [Mehrabian and Russell, 1974; Kamboj et al., 2018]. According to this theory, external factors create certain cognitive and emotional responses in users, guiding them to engage in specific behaviors [Jacoby, 2002]. As a representative theory in environmental psychology, the theory has been applied and researched in various disciplines, including psychology, management, and computer science [Ali, 2016; Manthiou et al., 2017].

Stimulus means the physical environment and factors that influence users [Mehrabian and Russell, 1974; Machleit and Davis, 2001], representing external stimuli that impact users' internal states [Belk, 1975]. Organism, as a mediator between S and R, denotes users' internal states based on cognition and emotions [Mehrabian and Russell, 1974]. Therefore, O represents users' affective and cognitive states [Kamboj et al., 2018] and can be defined in terms of users' attitudes, beliefs, and comfort levels [Bitner, 1992]. Lastly, Response refers to behavior and includes psychological and behavioral reactions resulting from external stimuli and the organism's attitudes [Sherman et al., 1997].

In this study, we apply the SOR theory to analyze how GPT-based NPCs influence users' internal states and produce certain outcomes. Specifically, we limit the external stimulus factor to the humanization characteristics of NPCs. As for the organism factor, we define it as the level of user immersion, while the



〈Figure 2〉 Original Theory and Applied Theory

response factor is represented by user game satisfaction and loyalty. The application of the SOR theory in this study is depicted as follows:

3. Research Methodology

3.1 Hypothesis Development

3.1.1 Personification of NPC and Immersion

Personification stands for attributing life-like characteristics and personality to non-human entities, making animals or objects appear human-like [Aggarwal and McGill, 2007; Waytz et al., 2008]. The concept of personification has been studied in various contexts, such as religious contexts [Gilmore, 1919] and perspectives on animals [Cheney and Seyfarth, 1990], and more recently, applied to devices [Epley et al., 2008] across different academic disciplines. Personification encompasses a broad range of attributes, from attributing human-like physical appearances to making moral judgments [Golossenko et al., 2020; Kim and McGill, 2011; Puzakova et al., 2009].

As the level of non-human personification increases, humans experience enhanced feelings of security and positive emotions toward the entity, while uncertainty decreases [Nowak and Biocca, 2003]. These research findings are also evident in interactions between humans and computers, as users shows a similar response to computers like humans when users perceive social cues like human appearances and using language [Reeves and Nass, 1996]. These phenomenon has led to investigations into humanizing Chatbots [DiSalvo et al., 2002], cars, graphic agents, humanoid robots [Bartneck, 2006], and robotic vacuum cleaners [Kwak, 2014], among other devices and systems. Considering the mutual perspective between humans and machines [Steuer, 1992], it can be emphasized that the level of personification of NPCs within games is crucial in shaping users' positive perceptions.

Previous studies have explored the personification characteristics of NPCs, and notable research in this context includes interactions between avatars and players in games [Banks and Bowman, 2016], as well as studies in the field of artificial intelligence voice recognition [Wagner et al., 2019; Moussawi and Koufaris, 2019]. The interactions between in-game characters and players can be understood from cognitive, emotional, and behavioral perspectives, where both players and characters can serve as instruments of conveying meaning in digital and real-world contexts [Banks and Bowman, 2016]. This underscores the importance of the social attributes possessed by characters [Waytz et al., 2010].

The second characteristic of NPCs is intelligence. Intelligence is a factor directly influencing the personification of characters, enabling efficient, effective, and goal-oriented behaviors [Moussawi and Koufaris, 2019]. Intelligence is commonly defined by terms such as knowledge, mental strength, learning, and understanding [Legg and Hutter, 2007]. Thus, NPCs can engage intelligently with players, serving as assistants in problem-solving and goal achievement.

The final characteristic is human-likeness [Wagner et al., 2019]. Since personification entails attributes encompassing human characteristics and emotions [Epley et al., 2007], it is essential for NPCs to possess human-like features. It is considered to be highly humanized when interactions are smooth under the condition of question-and-answer exchanges

between NPCs and players in games [Wagner et al., 2019].

This study selected three specific NPC characteristics that are clearly defined and described, among the various attributes. They include intelligence, sociability, and human-likeness in NPCs that are applied GPT. To analyze the impact of these three variables on users' game immersion, we formulated the following hypotheses:

H1: NPC intelligence will be positively associated with users' immersion.
H2: NPC sociability will be positively associated with users' immersion.
H3: NPC human-likeness will be positively associated with users' immersion.

To measure the variables in this study, the following measurement items are employed. To assess the sociability of NPCs, it has a total of 8 items including emotional investment and companion consciousness, proposed by Banks and Bowman [2016]. Regarding the intelligence of NPCs, 5 items suggested by Moussawi and Koufaris [2019] are utilized. Additionally, for measuring human-likeness, a total of 8 items, encompassing autonomy and appearance, are selected [Banks and Bowman, 2016; Wagner et al., 2019]. Each measurement item is properly modified in accordance with the NPC attributes and the specific objectives of this study.

3.1.2 Flow, Users Satisfaction, and Loyalty

The optimal personal experience that users feel online can be defined as immersion [Hoffman and Novak, 1996]. In the case of online games, providing users with an optimal immersive experience as an engaging medium leads to overall satisfaction for users [Clark et al., 1994]. The relationship between users' immersion and satisfaction is significantly crucial. As this immersive experience ultimately influences users' intention to continue using the online game [Hoffman and Novak, 1996].

Loyalty can be seen as a kind of user preference that emerges after satisfaction is formed [Aaker, 1991], and it causes a continuous and repetitive consumption attitude [Kotler and Keller, 2009]. The user's positive perception should be researched in this area from immersion and satisfaction to loyalty when loyalty to a game leads users to engage in repetitive gaming activities.

To analyze the area, users' immersion is set as an independent and mediating variable, and the following hypotheses are established:

H4: Users' immersion will be positively associated with users' satisfaction.
H5: Users' immersion will be positively associated with users' loyalty.
H6-1: Users' immersion will have a positive mediating effect between NPC intelligence and users' satisfaction.
H6-2: Users' immersion will have a positive mediating effect between NPC sociability and users' satisfaction.
H6-3: Users' immersion will have a positive mediating effect between NPC human-likeness and users' satisfaction.
H7-1: Users' immersion will have a positive mediating effect between NPC intelligence and users' loyalty.
H7-2: Users' immersion will have a positive mediating effect between NPC sociability and users' loyalty.
H7-3: Users' immersion will have a positive mediating effect between NPC human-likeness and users' loyalty.

To measure the immersion variable, a total of 6 items are used based on Csikszentmihalyi's [1990] definition [Susan et al., 2010; Jackson, 1996]. Users' satisfaction is composed of 4 items [Oliber, 1980; Garbarino and Johnson, 1999], and users' loyalty consisted of 6 items, including word-of-mouth recommendations [Methlie and Nysveen, 1999; Wong and Sohal, 2006]. These scales are modified to proper the objectives of this study while ensuring that their meanings remained unchanged.

4. Research Results

A survey questionnaire was administered to users who had participated in a GPT-based NPC appearing game, for the purpose of analysis in this study. Considering that the subject game, "Justice Mobile," operates within China, the study was conducted targeting users within China. To validate the research hypotheses, analysis was performed using SPSS 21 Version and AMOS 21 Version. Exploratory factor analysis, frequency analysis, and correlation analysis were conducted using SPSS. Hypothesis testing analysis was conducted through AMOS.

4.1 Characteristics of the Sample

Data collection was carried out both online and offline. A total of 201 data points were collected, and after excluding 6 instances of unreliable data, a total of 195 data points were

〈Table 1〉 Characteristics of the Sample

Classification	Response categories	Frequency	Rate	Total responses
Gender	Male	84	43.1	195
	Female	111	56.9	
Age	20 ~ 25 age	26	13.3	195
	26 ~ 30 age	119	61.0	
	31 ~ 35 age	30	15.4	
	36 ~ 40 age	11	5.6	
	More than 40	9	4.6	
Education	Graduated High School	23	11.8	195
	Enrollment in University	58	29.7	
	Graduated University	90	46.2	
	Enrollment in Graduated University	17	8.7	
	Graduated from Graduate School	7	3.6	
Game Frequency	Under 1 a Month	11	5.6	195
	Once a Month	18	9.2	
	2~3 times a Month	31	15.9	
	Once a Week	34	17.4	
	Over 1 time Everyday	101	51.8	
Daily Usage	Under an hour	32	16.4	195
	1~4 hours	30	15.4	
	5~8 hours	81	41.5	
	Over 8 hours	52	26.7	
Knowledge in AI	Not at all	4	2.1	195
	Have heard of it before	29	14.9	
	Have some knowledge of it	122	62.6	
	Very familiar with it	40	20.5	

〈Table 2〉 Correlations and Means, Standard Deviations Results

	Mean	Standard Deviation	1	2	3	4	5	6
Interaction	3.9321	.74582	1					
Intelligence	3.8444	.74477	.557**	1				
human-likeness	3.4709	.9463	.533**	.600**	1			
Immersion	3.8282	.72942	.547**	.581**	.591**	1		
Satisfaction	3.8526	.78918	.433**	.552**	.450**	.572**	1	
Loyalty	3.8188	.83123	.509**	.470**	.473**	.588**	.673**	1

Pearson: $^{*}p < 0.05$, $^{**}p < 0.01$

used for analysis. Among the respondents, a higher proportion were female (Male: 84 individuals, 43.1%; Female: 111 individuals, 56.9%). The respondents were mainly in their 20s (20-25 years: 26 individuals; 26-30 years: 119 individuals). Regarding gaming frequency, a significant number of respondents played games more than once a day (101 individuals, 51.8%), and a substantial portion spent 5 to 8 hours (81 individuals, 41.5%) on gaming. Furthermore, a considerable proportion of respondents claimed familiarity with artificial intelligence. Detailed characteristics of the sample are presented in 〈Table 1〉.

4.2 Correlations and Means, Standard Deviations

The results of correlations, means, and standard deviations between variables are as follows. The range of mean values for the variables was derived between 3.4709 and 3.9321, and for standard deviations, values ranging from .7294 to .9463 were obtained. All correlations between variables were found to be significant, with the highest correlation observed between loyalty and satisfaction (result: .673). Detailed analysis results are as follows 〈Table 2〉.

4.3 Exploratory Factor Analysis Result

After excluding items that did not meet the criterion in the exploratory factor analysis results, a total of 30 items were used for the analysis. While some items had values below the criterion of 0.6 (Interaction 7: .545, Intelligence 4: .560, Loyalty: .557), these items were deemed conceptually significant and were retained for analysis. The Kaiser-Meyer-Olkin value was .921, and the total explained variance yielded a result of 71.434. The results of the exploratory factor analysis are as follows (〈Table 3〉).

4.4 Confirmatory Factor and Validity Analysis Results

The results of the confirmatory factor analysis are as follows. The model fit indices yielded the values of CMIN: 761.095, DF: 385, P: .000, CMIN/DF: 1.977. Additionally, RMR: .054, RMSEA: .071, GFI: .801, PGFI: .663, NFI: .835, IFI: .911, TLI: .898, and CFI: .910 were obtained, which generally or satisfactorily met the standard criteria. Based on these results, the model fit of the confirmatory factor analysis was found to meet the established criteria. Both Construct Reliability and Average Variance Extracted (AVE) analyses

〈Table 3〉 Exploratory Factor Analysis Result

Items	Factor Loading					
Interaction1	.664					
Interaction 2	.686					
Interaction 3	.803					
Interaction 4	.793					
Interaction 7	.545					
Intelligence3		.684				
Intelligence 4		.560				
Intelligence 5		.693				
Human-likeness1			.828			
Human-likeness 2			.824			
Human-likeness 3			.710			
Human-likeness 4			.735			
Human-likeness 5			.725			
Human-likeness 8			.620			
Immersion1				.700		
Immersion 2				.746		
Immersion 3				.604		
Immersion 4				.674		
Immersion 5				.854		
Immersion 6				.719		
Satisfaction1					.814	
Satisfaction 2					.772	
Satisfaction 3					.749	
Satisfaction 4					.842	
Satisfaction 5					.707	
Satisfaction 6					.707	
Satisfaction 7					.657	
Loyalty1						.587
Loyalty 2						.692
Loyalty 3						.557

Total explained variance: 71.434%
Kaiser-Mayer-Olkin: .921
Barttlett's chi-squared: 4351.091, the degree of freedom: 135, sig: .000

conducted to assess the reliability and validity of the model, met the predefined criteria 〈Table 4〉.

4.5 Results of Hypothesis Testing

The results of hypothesis testing, analyzed using AMOS, are as follows. The variables of interaction, intelligence, and anthropomorphism, set as independent variables, were found to have significant impacts on user immersion. Particularly noteworthy is the impact of intelligence, indicating that if users perceive the GPT-based NPC as having its own intelligence when interacting with it, it can

〈Table 4〉 Confirmatory Factor and Validity Analysis Results

Name	Items	Non-standardization coefficient / standardization coefficient	C.R.	p-value	AVE	Construct Reliability
Interaction	Interaction1	1.000 / .761	-		0.5988	0.8817
	Interaction 2	.937 / .736	10.154	***		
	Interaction 3	1.084 / .771	10.667	***		
	Interaction 4	.940 / .735	10.113	***		
	Interaction 7	1.043 / .725	9.995	***		
Intelligence	Intelligence3	1.000 / .710	-		0.6452	0.8445
	Intelligence 4	1.187 .832	10.307	***		
	Intelligence 5	.997 / .763	9.614	***		
Human-likeness	Human-likeness1	1.000 / .874	-		0.5557	0.8818
	Human-likeness 2	1.084 / .851	15.593	***		
	Human-likeness 3	.968 / .801	14.022	***		
	Human-likeness 4	.965 / .728	12.059	***		
	Human-likeness 5	.957 / .734	12.208	***		
	Human-likeness 8	.868 / .741	12.381	***		
Immersion	Immersion 1	1.000 / .696	-		0.6071	0.9019
	Immersion 2	.951 / .738	9.514	***		
	Immersion 3	.989 / .840	10.696	***		
	Immersion 4	1.048 / .841	10.713	***		
	Immersion 5	.786 / .668	8.640	***		
	Immersion 6	.923 / .704	9.084	***		
Satisfaction	Satisfaction1	1.000 / .808	-		0.6648	0.9326
	Satisfaction 2	.924 / .764	11.689	***		
	Satisfaction 3	1.010 / .876	14.199	***		
	Satisfaction 4	1.089 / .812	17.063	***		
	Satisfaction 5	1.019 / .734	11.176	***		
	Satisfaction 6	1.134 / .786	12.192	***		
	Satisfaction 7	.859 / .764	11.779	***		
Loyalty	Loyalty1	1.000 / .824	-		0.7077	0.8788
	Loyalty 2	1.099 / .864	13.732	***		
	Loyalty 3	1.078 / .784	12.142	***		

***$p < .001$

lead to an immersive effect through human-like interaction. Furthermore, the significant impact of interaction and anthropomorphism on immersion highlights the necessity for the GPT-based NPC to convey emotions naturally in conversations with users.

Regarding immersion, it was found to have significant effects on both loyalty and satisfaction. As observed in various prior studies, when users become immersed in a game, their satisfaction increases, and they develop a willingness to continue playing. The variables related to the NPC were found to mediate the effects on user satisfaction and loyalty through immersion. Detailed results of hypothesis testing are presented in 〈Table 5〉.

〈Table 5〉 Results of Hypothesis Testing

Path Analysis (Direct Effects, H1 ~ H5)						Estimate	S.E.	95% CI		P
								Lower	Upper	
H1	Immersion	←		←	Interaction	.319	.121	.066	.547	.004***
H2	Immersion	←		←	Intelligence	.294	.125	.043	.544	.011**
H3	Immersion	←		←	Human-likeness	.237	.117	.032	.478	.014**
H4	Satisfaction				Immersion	.415	.124	.171	.664	***
H5	Loyalty				Immersion	.450	.117	.208	.665	***

**p < .05, ***p < .001

Path Analysis (Total Effects, H6-1 ~ H7-3)						Estimate	S.E.	95% CI		P
								Lower	Upper	
H6-1	Satisfaction	←	Immersion	←	Interaction	.118	.147	-.175	.379	.457
H6-2	Satisfaction	←	Immersion	←	Intelligence	.613	.119	.410	.888	.002***
H6-3	Satisfaction	←	Immersion	←	Human-likeness	.010	.126	-.230	.263	.984
H7-1	Loyalty	←	Immersion	←	Interaction	.468	.140	.212	.759	.002***
H7-2	Loyalty	←	Immersion	←	Intelligence	.132	.159	-.200	.436	.377
H7-3	Loyalty	←	Immersion	←	Human-likeness	.118	.140	-.171	.397	.415

**p < .05, ***p < .001

Path Analysis (Direct Effects, H6-1 ~ H7-3)						Estimate	S.E.	95% CI		P
								Lower	Upper	
H6-1	Satisfaction	←	Immersion	←	Interaction	-.015	.139	-.310	.246	.894
H6-2	Satisfaction	←	Immersion	←	Intelligence	.491	.131	.268	.771	.002***
H6-3	Satisfaction	←	Immersion	←	Human-likeness	-.088	.130	-.353	.169	.441
H7-1	Loyalty	←	Immersion	←	Interaction	.325	.141	.065	.619	.016**
H7-2	Loyalty	←	Immersion	←	Intelligence	.000	.162	-.335	.315	.978
H7-3	Loyalty	←	Immersion	←	Human-likeness	.011	.126	-.238	.251	.998

**p < .05, ***p < .001

Path Analysis (Indirect Effects, H6-1 ~ H7-3)						Estimate	S.E.	95% CI		P
								Lower	Upper	
H6-1	Satisfaction	←	Immersion	←	Interaction	.132	.073	.020	.306	.016**
H6-2	Satisfaction	←	Immersion	←	Intelligence	.122	.062	.015	.272	.028**
H6-3	Satisfaction	←	Immersion	←	Human-likeness	.098	.059	.010	.233	.034**
H7-1	Loyalty	←	Immersion	←	Interaction	.143	.068	.024	.289	.016**
H7-2	Loyalty	←	Immersion	←	Intelligence	.132	.067	.015	.286	.027**
H7-3	Loyalty	←	Immersion	←	Human-likeness	.107	.060	.009	.243	.034**

**p < .05, ***p < .001

5. Conclusion

The results of this study are as follows. In this study, the interaction between NPCs and users was identified as a crucial factor influencing user satisfaction and loyalty. The ability of NPCs to provide users with desired information significantly enhances user immersion, leading to an increased preference for the game. Specifically, when an NPC stimulates users through external factors, it alters their internal state, leading to deeper im-

mersion and resulting in increased loyalty and satisfaction. This suggests that if the NPC possesses conversational capabilities beyond merely adhering to predefined protocols, such as delivering information users desire or require during interactions, it can further enhance user immersion and extend their engagement with the game. Applying the S-O-R (Stimulus-Organism-Response) theory to interpret user behavior within the gaming industry demonstrates the practical relevance of this approach. Further research exploring various NPC characteristics as external factors could deepen our understanding of user behavior.

Second, the intelligence and human-likeness of NPCs were found to have an indirect influence on user satisfaction and loyalty. However, while human-likeness exhibited an indirect mediating effect, it did not show significant direct or total effects. This suggests that users expect NPCs to perform smooth and intelligent tasks similar to collaborators rather than engage in human-level conversations or interactions. These findings also highlight the potential challenges posed by the current state of GPT-based NPCs, which may not yet exhibit fully human-like qualities or be widely developed.

Third, as revealed in various previous studies, user immersion has been identified as a critical factor. User immersion had a significant direct impact on both satisfaction and loyalty, underscoring the need to consider immersion in game development as it directly affects game performance. As indicated in this study, the application and expansion of GPT-applied NPCs seem necessary to enhance user immersion. If users can receive assistance from NPCs at critical moments during gameplay, it could directly influence their psychological experience. Therefore, it is deemed necessary to develop NPCs with diverse forms and characteristics.

The significance of this study is as follows: First, the study analyzed the relationship between users and NPCs by selecting representative characteristics of GPT-applied NPCs. Through this analysis, the importance of NPCs was identified, and the need for their further development and expansion was proposed. Second, the applicability of the S-O-R (Stimulus-Organism-Response) theory to game users was confirmed. By applying the stimulus-cognition-response process to game users, the study identified the variables necessary for determining final user behavior.

The limitations and suggestions for future research are as follows: This study was conducted solely on Justice Mobile game users, which limits the generalizability of the results to other types of NPCs. Therefore, future research should consider conducting studies on other games that feature GPT-applied NPCs. Additionally, this study did not differentiate users based on their game usage. Future research could benefit from group analyses or correlation studies based on varying levels of game usage, which may provide a more detailed understanding of the impact of NPCs.

References

[1] Aaker, D. A., "Managing Brand Equity Capitalizing on the Value of a Brand Name", New York: The Free Press, 1991.

[2] Aarseth, E., "A narrative theory of games", In Proceedings of the International Conference on the Foundations of Digital Games. ACM, 2012, pp. 129-133.

[3] Ali, F., "Hotel website quality, perceived flow, customer satisfaction and purchase

intention", Journal of Hospitality and Tourism Technology, Vol. 7, No. 2, 2016, pp. 213-228.
〔4〕 Banks, J. and Bowman, N. D., "Avatars are (sometimes) people too: Linguistic indicators of parasocial and social ties in player-avatar relationships", New Media & Society, Vol. 18, No. 7, 2016, pp. 1257-1276.
〔5〕 Bartle, R. A., "Designing virtual worlds", Indianapolis, IN, USA: New Riders, 2004.
〔6〕 Bartneck C., "Reflection on robotic intelligence", Montreal, Canada: CHI2006 Workshop on HCI and the Face, 2006.
〔7〕 Bitner, M. J., "Servicescapes: The Impact of Physical Surroundings on Customers and Employees", Journal of Marketing, Vol. 56, No. 2, 1992, p. 57.
〔8〕 Cheney, D. L., and Seyfarth, R M., "How Monkeys See the World: Inside the Mind of Another Species", University of Chicago Press, ProQuest Ebook Central, 1990.
〔9〕 Cho, N., Wang, Y. R., Cheong, E., and Yu, G., "Factors influencing the intention for continuous use of augmented reality games: Immersion as a mediating variable", Journal of Information Technology Applications & Management, Vol. 28, No. 6, 2021, pp. 1-21.
〔10〕 Clark, S. G. and Haworth, J. T., "Flow experience in the daily lives of sixth-form collect students", British Journal of Psychology, Vol. 85, No. 4, 1994, pp. 511-523.
〔11〕 Csikszentmihalyi, M., "Beyond Boredom and Anxiety: Experiencing Flow in Work and Play", Jossey-Bass, 2003.
〔12〕 Csikszentmihalyi, M., "Flow: The psychology of optimal experience", New York: Harper & Row, 1990.
〔13〕 DiSalvo C. F., Gemperle F., Forlizzi J., and Kiesler S., "All robots are not created equal: The design and perception of humanoid robot heads", Proceedings of the Designing Interactive Systems, 2002, pp. 321-326.
〔14〕 Drennan, P., Viller, S., and Wyeth, P., "Engaging game characters: Informing design with player perspectives", In: Rauterberg, M. (eds) Entertainment Computing - ICEC 2004. ICEC 2004. Lecture Notes in Computer Science, Vol.3166. Springer, Berlin, Heidelberg.
〔15〕 Ducheneaut, N., Wen, M. D., Yee, N. and Wadley, G., "Body and mind: A study of avatar personalization in three virtual worlds", in Olsen, D.R., Arthur, R.B., Hinckley, K., Morris, M.R., Hudson, S.E. and Greenberg, S. (Eds), Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, New York, ACM Press, 2009, pp. 1151-1160.
〔16〕 Emmerich, K., Ring, P., and Masuch, M., "I'm glad you are on my side: How to design compelling game companions", In Proceedings of the 2018 Annual Symposium on Computer-Human Interaction in Play (CHI PLAY '18). Association for Computing Machinery, New York, NY, USA, 2018, pp. 141-152.
〔17〕 Epley, N., Akalis, S., Waytz, A., and Cacioppo, J. T., "Creating social connection through inferential reproduction: Loneliness and perceived agency in gadgets, gods, and greyhounds", Psychological Science, Vol. 19, No. 2, 2008, pp. 114-120.
〔18〕 Epley, N., Waytz, A., and Cacioppo, J. T., "On seeing human a threefactor theory of Anthropomorphism", Psychological Review, Vol. 114, No. 4, 2007, pp. 864-

886.

[19] Fabito, B. S., Trillanes, A. O., Bermudez, J. R. D., Ramirez, E. Q., and Guadaña, R. R. H., "Mediating flow theory in pc game addiction and cyberbullying: A quantitative study", In 2020 The 4th International Conference on E-Society, E-Education and E-Technology (ICSET'20), Association for Computing Machinery, New York, NY, USA, 2020, pp. 140-144.

[20] Garbarino, E. and Johnson, M. S., "The different roles of satisfaction, trust, and commitment in customer relationships", Journal of Marketing, Vol. 63, No. 2, 1999, pp. 70-84.

[21] Gilmore, G. W., "Animism or thought currents of primitive peoples", Boston: Marshall Jones Company, 1919.

[22] Golossenko, A., Pillai, K. G., and Aroean, L., "Seeing brands as humans: Development and validation of a brand anthropomorphism scale", International Journal of Research in Marketing, Vol. 37, No. 4, 2020, pp. 737-755.

[23] Harth, J., "Empathy with non-player characters? An empirical approach to the foundations of human/non-human relationships", The Journal of Virtual Worlds Research, Vol. 10, No. 2, 2017.

[24] Hefner, D., Klimmt, C., and Vorderer, P., "Identification with the player character as determinant of video game enjoyment", International Conference on Entertainment Computing 2007, Berlin: Springer, 2007, pp. 39-48.

[25] Hoffman, D. L. and Novak, T. P., "Marketing in hypermedia computer-mediated environments: Conceptual foundations", Journal of Marketing, Vol. 60, 1996, pp. 50-68.

[26] Jacoby, J., "Stimulus-organism-response reconsidered: An evolutionary step in modeling (consumer) behavior", Journal of Consumer Psychology, Vol. 12, No. 1, 2002, pp. 51-57,

[27] Kamboj, S., Sarmah,B ., Gupta, S., and Dwivedi, Y., "Examining branding co-creation in brand communities on social media: Applying the paradigm of stimulus-organism-response", International Journal of Information Management, Vol. 39, 2018, pp. 169-185,

[28] Kempf, D. S., "Attitude formation from product trial: Distinct roles of cognition and affect for hedonic and functional products", Psychology & Marketing, Vol. 16, No. 1, 1999, pp. 35-50.

[29] Kim, S. and McGill, A. L., "Gaming with Mr. slot or gaming the slot machine? Power, anthropomorphism, and risk perception", Journal of Consumer Research, Vol. 38, No. 1, 2011, pp. 94-107.

[30] Ko, D. W. and Park, J., "I am you, you are me: game character congruence with the ideal self", Internet Research, Vol. 31, No. 2, 2021, pp. 613-634.

[31] Kotler, P. and Keller, L., "A Framework for Marketing Management", 4th edition, Pearson Education International, 2009.

[32] Kwak, S. S., "The impact of the robot appearance types on social interaction with a robot and service evaluation of a robot", Archives of Design Research, Vol. 27, No. 2, 2014, pp. 81-93.

[33] Lankoski, P. and Björk, S., "Gameplay design patterns for believable non-player characters", In Digital Games Research Association International Conference, September, 2007.

[34] Legg, S. and Hutter, M., "A collection of definitions of intelligence", Frontiers in Artificial Intelligence and applications,

Vol. 157, 2007, pp. 17-24.

〔35〕 Luger, G. F., Artificial intelligence: Structures and strategies for complex problem solving, Pearson education, 2005.

〔36〕 Mandryk, R. L. and Atkins, M. S., "A fuzzy physiological approach for continuously modeling emotion during interaction with play technologies", International Journal of Human Computer Studies, Vol. 65, No. 4, 2007, pp. 329-347.

〔37〕 Manthiou, A., Ayadi, K., Lee, S., Chiang, L., and Tang, L., "Exploring the roles of self-concept and future memory at consumer events: The application of an extended Mehrabian-Russell model", Journal of Travel & Tourism Marketing, Vol. 34, No. 4, 2017, pp. 531-543.

〔38〕 McCord, M. C., Murdock, J. W., and Boguraev, B. K., "Deep parsing in Watson", IBM Journal of research and development, Vol. 56, Issue 3, 2012, pp. 264-278.

〔39〕 Mehrabian, A. and Russell, J. A., Anapproach to environmental psychology, the MIT Press, 1974.

〔40〕 Methlie, L. B. and Nysveen, H., "Loyalty of on-Line Bank Customers", Journal of Information Technology, Vol. 14, No. 4, 1999, pp. 375-386.

〔41〕 Moussawi, S. and Koufaris, M., "Perceived intelligence and perceived anthropomorphism of personal intelligent agents: Scale development and validation", Hawaii International Conference on System Sciences, 2019.

〔42〕 Nowak, K. L. and Biocca, F., "The effect of the agency and anthropomorphism on users' sense of telepresence, copresence, and social presence in virtual environments", Presence: Teleoperators & Virtual Environments, Vol. 12, No. 5, 2003, pp. 481-494.

〔43〕 Oliver, R. L., "A cognitive model of the antecedents and consequences of satisfaction decisions", Journal of Marketing Research, Vol. 17, No. 4, 1980, pp. 460-469.

〔44〕 Puzakova, M., Kwak, H., and Rocereto, J., "Pushing the envelope of brand and personality: Antecedents and moderators of anthropomorphized brands", Advances in Consumer Research, Vol. 36, 2009, pp. 413-420.

〔45〕 Ravenet, B., Pecune, F., Chollet, M., and Pelachaud, C., "Emotion and attitude modeling for non-player characters", In: Karpouzis, K., Yannakakis, G. (eds) Emotion in Games: Theory and Praxis, Part of the Socio-Affective Computing book series, Vol. 4, 2016, pp. 139-154.

〔46〕 Reeves, B. and Nass, C. I., "The media equation: How people treat computers, television, and new media like real people and places", New York: Cambridge University Press, 1996.

〔47〕 Sherman, E., Mathur, A., and Smith, R. B., "Store environment and consumer purchase behavior: Mediating role of consumer emotions", Psychology & Marketing, Vol. 14, No. 4, 1997, pp. 361-378.

〔48〕 Soutter, A. R. B. and Hitchens, M., "The relationship between character identification and flow state within video games", Computers in Human Behavior, Vol. 55, 2016, pp. 1030-1038.

〔49〕 Steuer, J., Biocca, F., and Levy, M. R., "Defining virtual reality: Dimensions determining telepresence", Communication in the Age of Virtual Reality, Vol. 33, 1995, pp. 37-39.

〔50〕 Su, Y. S., Chiang, W.-L., Lee, C.-T., and Chang, H.-C., "The effect of flow experience on player loyalty in mobile game ap-

plication", Computers in Human Behavior, Vol. 63, 2016, pp. 240-248.

[51] Turkle, S., "Constructions and reconstructions of self in virtual reality: Playing in the MUDs", Mind, Culture, and Activity, Vol. 1, No. 3, 1994, pp. 158-167.

[52] Wagner, K., Nimmermann, F., and Schramm-Klein, H., "Is It Human? The Role of Anthropomorphism as a Driver for the Successful Acceptance of Digital Voice Assistants", Hawaii International Conference on System Sciences, 2019.

[53] Warpefelt, H. and Verhagen, H., "A model of non-player character believability", Journal of Gaming & Virtual Worlds, Vol. 9, No. 1, 2017, pp. 39-53.

[54] Warpefelt, H. and Verhagen, H., "A typology of non-player characters", In Proceedings of 1st International Joint Conference of DiGRA and FDG, 2016.

[55] Waytz, A., Cacioppo, J., and Epley, N., "Who sees human? The stability and importance of individual differences in anthropomorphism", Perspectives on Psychological Science, Vol. 5, No. 3, 2010, pp. 219-232.

[56] Wong, A. and Sohal, A. S., "Understanding the quality of relationship in consumer services: A study in retail environment", International Journal of Quality & Reliability Management, Vol. 23, No. 3, 2006, pp. 244-264.

[57] Wu, S. and Hsu, C., "Role of authenticity in massively multiplayer online role playing games (MMORPGs): Determinants of virtual item purchase intention", Journal of Business Research, Vol. 92, 2018, pp. 242-249.

[58] Yannakakis, G. N., Karpouzis, K., Paiva, A., and Hudlicka, E., "Emotion in games, affective computing and intelligent interaction: Fourth international conference, ACII 2011", Memphis, TN, USA, October 9-12, 2011, Proceedings, Part II, Springer Berlin Heidelberg, 2011, pp. 497-497.

[59] Zubek, R. and Khoo, A., "Making the human care: on building engaging bots", In Proceedings of the AAAI Spring Symposium on Artificial Intelligence and Interactive Entertainment, 2002, pp. 103-108.

Author Profile

Namjae Cho

Dr. Namjae Cho is the professor of MIS at the School of Business of Hanyang University. He received his Bachelor's degree in industrial engineering from Seoul National University, Master's degree in Management Science from KAIST, and Doctoral degree in MIS from Boston University, U.S.A.. He has published research papers in Industrial Management and Data Systems, Asia Pacific Management Review, International Journal of Information Technology and Decision Making, International Journal of Management Digest, Management Insight, Journal of Contemporary Management, etc. He also published several books and over 50 papers domestically. He has provided extensive consulting to the government and well-known companies, such as Microsoft, SK, POSCO, Sun Microsystems, LG, and Samsung. His research interests include IT planning, analysis of IT impacts, strategic alignment between IT and business, IT governance, e-business strategy, knowledge management, and industrial policy.

Zhilan Cao

She previously earned Master's degree in Management Information Systems at Hanyang University, and bachelor's degree in Business Administration at Sungkyunkwan University. Her research interests are applying IT technology in business, digital strategy and e-commerce.

Giseob Yu

Dr. Giseob Yu is a adjunct professor at Hanyang University. He received a bachelor's degree from Kangwon National University and graduated from Y.E.S. MBA (Family Business Track) and Ph.D. in MIS at Hanyang University. His research interests include trend prediction utilizing big data and user experience analysis. He also has an interest in entrepreneurship and family business management, particularly in succession planning and digital transformation within family enterprises.