A Study on the Effects of Immersive Content Use on Positive affect, Self-esteem, and Psychological Happiness of Disabled Persons: To advocate the dissemination of immersive content facilities in island areas

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Abstract

The purpose of this study is to analyze the structural relationships among immersive content use satisfaction, positive affect, self-esteem, and psychological happiness of persons with disabilities and thereby investigate the positive effect of immersive content experience on disabled persons who wish to have immersive content facilities for disabled persons in island areas. Using survey data collected from physically and mentally disabled persons using immersive content facilities, the study found that disabled persons' satisfaction with immersive content was significantly and positively associated with their positive affect, self-esteem, and psychological happiness; positive affect and self-esteem of disabled persons using immersive content were significantly and positively associated with their psychological happiness; positive affect and self-esteem significantly mediated the relationship between use satisfaction of disabled persons using immersive content and their psychological happiness. This study is meaningful in that it is the first study that empirically investigated the effect of immersive content facilities on disabled persons and shed light on the potential role of immersive content in improving the quality of life and happiness of disabled persons by enabling them to virtually experience real-world programs.

Keywords

Disabled people, immersive content facilities, island areas, positive affect, self-esteem, psychological happiness

Introduction

As the number of disabled persons increases worldwide, various related issues, such as basic rights, human rights, and protection of the rights of disabled persons, are drawing attention. The World Health Organization (WHO) and the World Bank jointly published the 2011 World Report on Disabled persons; the world population was 6.9 billion in 2010, and among them, the estimate of disabled persons was about 1 billion (one in every seven persons). As of July 2022, the world's population is about 7.9 billion, and the estimated number of disabled persons is about 1.14 billion.

Disability is related to human rights and is subject to various rights violations, including violence, abuse, prejudice and rude behavior, and discrimination based on age, gender, or other factors (WHO website). Accordingly, the United Nations (UN) adopted the Convention on the Rights of Persons with Disabilities in December 2006, a comprehensive treaty called the Bill of Rights for Persons with Disabilities, as an international human rights convention. The UN Convention on the Rights of Persons with Disabilities consists of 50 articles, encompassing the inherent dignity, autonomy, independence, self-determination, non-discrimination principle, and the right to live in the community of disabled persons (Lee, 2021).

South Korea started participating in the '#WeThe15' campaign, a global human rights movement that aims to end discrimination and guarantee equal participation in society for disabled persons, who comprise 15% of the world's population (Korea Paralympic Games, 2022). As a result, changes have been made in the perception of discrimination against disabled persons and fundamental rights. However, despite these changes, South Korea is still known to be a society in which it is difficult for disabled persons to live. Although South Korea belongs to the '3050 Club', which is composed of only seven countries in the world, the infrastructure necessary for disabled persons to enjoy a life free from discrimination is weak (Hankyoreh Shimbun, 2022). The right to mobility of disabled persons has recently emerged as a serious, unresolved social issue. Not just the mobility rights for disabled persons that warrant an increased number of elevators and low-floor buses in subway stations, but also basic rights such as the right to health, residence, living, labor, education, childcare, cultural enjoyment, and voting are not being adequately protected (Kim et al., 2018).

According to the change in internal and external conditions in recent years, disabled persons' right to enjoy culture has drawn attention. In particular, a bill to amend the Content Industry Promotion Act to improve access to content for disabled persons was approved and promulgated in December last year. The right to enjoy culture is an essential factor in determining the quality of life of individuals. Although the desire to enjoy and participate in cultural content is growing, the reality is that disabled persons are still not provided with equal opportunities in society due to difficulties in accessing content. Despite the national interest in preparing for the 4th industrial revolution, social, economic, and geographical constraints have limited opportunities for the culturally marginalized, including disabled persons, to experience related content. Accordingly, a new provision was made to have the basic plan guarantee the right to access content for disabled persons and to provide administrative and financial support for the project to ensure the right.

With the government's budget support and the active participation of private companies, the immersive content industry in South Korea is expected to be a blue ocean in the convergence technology field in the future. However, disabled persons had lower satisfaction with cultural activities than the general public and had poor access to immersive content. Furthermore, despite the provisions related to the enjoyment of culture for disabled persons in the Contents Industry

Promotion Act and the Welfare Act for disabled persons, the institutional basis, such as standardization and guidelines, lagged behind the speed of technological and industrial development. Accordingly, in 2021, the Ministry of Culture, Sports, and Tourism opened and operated facilities where disabled persons, who are culturally vulnerable, can indirectly experience education, play, and tourism by utilizing the space in special education facilities for disabled persons so that disabled persons can enjoy immersive content. However, the number of facilities is still small. To effectively expand the policies, it is necessary to expand the business, develop and introduce mobile services that directly visit disabled persons in all parts of the country, and improve the cultural enjoyment of disabled persons through institutional supplementation such as the certification system.

Island areas attract attention as tourist destinations for recreation, experience, sightseeing, and sports activities. The comprehensive island development project has been promoted since 2008, resolving the backwardness to some extent. However, accessibility is limited from the standpoint of disabled persons because the living and industrial base is weak (Park and Kim, 2013). Therefore, it is necessary to establish a universal tourism environment that encompasses disabled and non-disabled persons, as in the case of Seoul, so that anyone can enjoy travel conveniently regardless of age, gender, nationality, etc. (Sketch, 2021). Hence, the purpose of this study is to analyze the structural relationships among immersive content use satisfaction, positive affect, self-esteem, and psychological happiness of disabled persons and thereby investigate the effect of experience using immersive content facilities on disabled persons who long for the dissemination of immersive content facilities in island areas.

Theoretical Background

Definition and Current Status of Immersive Content for Disabled Persons

In Article 2 of the Welfare Act of Persons with Disabilities, a person with a disability is defined as a person who has been severely restricted in daily life or social life for a long time due to a physical or mental disability. Physical disability refers to impairment of primary bodily functions and internal organ disorders, and mental disability refers to a disability caused by a developmental disability or mental illness. Furthermore, the Enforcement Decree of Welfare Act of Persons with Disabilities classifies disabled persons into 15 types of physical and mental disabilities. In South Korea, the disability registration system is operated to diagnose disabilities and support what is needed for persons with disabilities (Korea Differently Abled Federation, 2022). As of the end of 2021, the number of registered persons with disabilities is 2,645,000, or 5.1% of the total population. The proportion of registered persons with disabilities has steadily increased since 2003 due to the expansion of services for disabled persons and increased understanding of the disability registration system, but the proportion has been maintained at about 5% since 2010. Among the 15 types of disabilities, the most common type was retardation (45.1%), hearing (15.6%), sight (9.5%), and brain lesion (9.4%), and the least common type was facial (0.1%) and heart (0.2%), and epilepsy (0.3%) (Ministry of Health and Welfare, 2022).

Immersive content refers to content that maximizes five human senses by utilizing sensory technologies represented by virtual reality (VR), augmented reality (AR), mixed reality (MR), and eXtended reality (XR) and interacts with the user (Korea Creative Content Agency, 2021). VR refers to a technology that uses artificial technology to stimulate the human senses to experience a reality that does not exist in reality as if it were real. AR refers to a technology synthesizing virtual objects or information in the real environment to make them look like objects existing in the original environment (Kang and Lee, 2020). MR is a fusion of the balance between reality and virtual reality by combining the strong immersion provided by VR and the information delivery power of AR, and XR is a concept of ultra-realistic technology and services that encompass VR, AR, and MR (Kim, 2022; Shin and Lee, 2020). The possibility of applying and utilizing existing immersive content for disabled persons may vary depending on the subject's condition. It is possible to enhance usability by complementing with assistive devices and technologies for each type of disability. Furthermore, there exist many examples of using immersive content in consideration of the characteristics of disability and the degree of disability in the medical, education, transportation, and public fields (Korea Creative Content Agency, 2020).

As such, the definitions and types have been established for disabled persons and immersive content, respectively. However, the definition of immersive content for disabled persons has not yet been established; it is considered to differ from the existing definition of immersive content in that the components of immersive content such as VR, AR, MR, and XR can be tailored to the specific target of disabled persons.

A Review of Literature on Immersive Content for Persons with Disabilities

The literature can be divided into three categories: disabled persons and immersive content, island areas and immersive content, and disabled persons and island areas. First, research on disabled persons and immersive content has been published mainly in academic journals that prioritize academic values in this field rather than in reports for policy application. The survey report on the dissemination of immersive content for persons with disabilities published by the Korea Creative Content Agency (2020) is considered a typical research report; this report is meaningful in that it is a study that attempted to practically investigate the current status, legal basis, different cases, and demand for dissemination of immersive content for disabled persons. Meanwhile, journal articles cover types and degrees of disability, encompassing intellectual disability, attention deficit hyperactivity disorder (ADHD), panic disorder, and post-traumatic stress; the articles cover the linkage of immersive content with the type of disability and age (infant or adolescent, etc.), or the development and effectiveness of new technologies.

Here are a few examples of studies that focused on education and rehabilitation: utilization of AR for educational activity targeting children with disabilities by Chien-Yu Lin et al, 2016, methods of teaching mathematics targeting students with disabilities in middle school using AR technology by Ryan O. Kellems et al, 2019, and rehabilitation for disabled people using VR technology as well.

However, there is no study linking island areas with immersive content; the only study is one that analyzed islands and marine content technology in the game, not in actual island areas. Lastly, research on the linkage between disabled persons and island areas has been conducted to study the low welfare level of disabled persons who live in island areas; the primary purpose of the study is to improve the mobility of disabled persons to the island area.

Study Method

Data Collection

The subjects of this study are disabled persons who have used immersive content facilities in South Korea. A total of 12 immersive contents facilities targeting disabled persons are currently situated in S. Korea, especially downtown area. A survey method was employed; the purpose of the survey was fully explained to the participants before asking them to participate. If the participants were mentally and developmentally disabled, their legal guardians (e.g., parents) were asked to respond to the survey. The survey was conducted from July 1 to July 31, 2022; a total of 82 surveys were collected, and after filtering out 10 with insincere responses, 72 were used for data analysis.

Data Analysis

SPSS 26.0 and Smart PLS 3.0 were used to analyze the collected data. Smart PLS is a statistical tool to perform partial least squares structural equation modeling (PLS-SEM), which was first used in the field of management (Hair et al., 2013). Unlike covariance-based structural equation modeling (CB-SEM), PLS-SEM does not require the normal distribution of sample data. Furthermore, PLS-SEM is known to be useful when the study entails a small sample size and an exploratory approach (due to few previous studies) to develop new theories for the first time (Hair et al., 2019)

This study involved all these conditions or situations (i.e., small sample size, exploratory study), and thus PLS-SEM was employed for data analysis to test hypotheses in this study. SPSS was used to conduct frequency analysis to examine the demographic characteristics of the participants, and Smart PLS was used to investigate the validity and reliability of the measurement model and the relationships among the constructs in the research model. The research model is developed to empirically analyze the structural relationships among user satisfaction, positive affect, self-esteem, and psychological happiness of disabled persons who use immersive content.

Measurement

Measurement items in this study are thoroughly based on previous studies. This study defined immersive content user satisfaction as overall psychological satisfaction after using immersive content. Eight items from Oliver's (1993) were adapted to the context of this study and used to measure user satisfaction. A 5-point Likert scale was used (1=not satisfied at all, 3=average, and 5=very satisfied). Positive affect was defined as a subjective mood state such as confidence, joy, and pleasure. A scale developed in the study of Lee and Lee (1990) and used in the study of Lee (1994) was slightly modified to fit the context of this to measure positive affect, based on a 5-point Likert scale (1=not agree, 5=strongly agree). Self-esteem was defined as an evaluative emotion about one's worth, including positive or negative evaluations. A scale developed by Harter and Pike (1984) was adapted and used to measure self-esteem in this study based on a 5-point Likert scale (1=not agree, 5=strongly agree). Psychological happiness was defined as a cognitive-emotional state that can integrate people's feelings of pleasure, euphoria, and satisfaction. A scale developed by Yang (1998) was adapted and used to measure the construct of psychological happiness in this study; the scale is composed of 20 items in 4 sub-factors (pleasure, immersion, self-actualization, self-confidence) and measured on a 5-point Likert scale (1=not agree, 5=strongly agree).

Results

General Characteristics of Respondents

The demographic characteristics of the participants in this study are as follows: by sex, 40 males (55.6%) and 32 females (44.4%); by age, 17 participants in their 20s or younger (23.6%), 23 participants in their 30s (31.9%), and 32 participants in their 40s or older (44.4%); by education, 25 participants with equal to or less than high school education (34.7%) and 47 participants with equal to or more than college education (65.3%); by disability level, 40 participants with level 3 or lower (55.6%) and 32 from level 4 to level 5 (44.4%); by basic livelihood support, seven beneficiaries (9.7%) and 65 non-beneficiaries (90.3%); and lastly by disability type, 42 participants with a developmental and mental disorder (58.3%) and 30 with a physical disability (41.7%), as presented in Table 1.

Table 1. Demographic Characteristics of the Research Participants

Variable	Category	Frequency (n)	Percentage (%)
Sex	Male	40	55.6
	Female	32	44.4
Age	≤ 20s	17	23.6
	30s	23	31.9
	≥ 40s	32	44.4
Education	≤ High school	25	34.7
	≥ College	47	65.3
Disability Level	≤ Level 2	40	55.6
	Level 4 ~ Level 6	32	44.4
Basic Livelihood Beneficiary	Yes	7	9.7
	No	65	90.3
Disability Type	Mental Disorder	42	58.3
	Physical Disability	30	41.7
Sum		**72**	**100.0**

Measurement Model

The reliability and validity of the constructs of immersive content user satisfaction, positive affect, self-esteem, and psychological happiness were examined. The Cronbach’s alpha value (0.6 or larger) and rho_A value (0.7 or larger) can be used to examine the internal consistency of a construct (Hair et al., 2017). The Cronbach’s alpha value was found to be 0.973 for the construct of immersive content user satisfaction, 0.971 for positive affect, 0.949 for self-esteem, and 0.986 for psychological happiness, demonstrating a solid internal consistency (reliability). The rho_A (a.k.a. Dijkstra-Henseler's rho) values were 0.973 for immersive content use satisfaction, 0.972 for positive affect, 0.951 for self-esteem, and 0.987 for psychological happiness, all being much larger than the cut-off value of 0.7, as shown in Table 2.

Meanwhile, convergent validity was examined with composite reliability (CR: 0.7 or larger), average variance extracted (AVE: 0.5 or larger), and factor loading (0.6 or larger) (Chin et al., 2008). The results show that the CR values for all constructs are larger than 0.9, and all AVE values are larger than 0.8, securing the convergent validity of the study.

Table 2. Results of Measurement Model

Construct	Measurement		Cronbach's α	rho_A	AVE	CR
	Item	Loading				
Use Satisfaction (US)	US1	.915	.973	.973	.842	.977
	US2	.902				
	US3	.913				
	US4	.936				
	US5	.883				
	US6	.899				
	US7	.942				
	US8	.948				
Positive Affect (PA)	PA1	.932	.971	.972	.898	.978
	PA2	.977				
	PA3	.935				
	PA4	.962				
	V5	.930				
Self-Esteem (SE)	SE1	.855	.949	.951	.831	.961
	SE2	.895				
	SE3	.939				
	SE4	.951				
	SE5	.916				
Psychological Happiness	Pleasure	.977	.986	.987	.960	.990
	Immersion	.977				
	Self-actualization	.990				
	Self-confidence	.976				

Discrimination Validity

Discriminant validity is used to determine whether the concept of each construct is independently well constructed without reflecting the concept of other constructs. The HTMT ratio derived from Smart PLS can be used as a criterion to determine discriminant validity (ideally 0.85 or larger) (Henseler et al., 2015). As a result of the analysis, the correlation coefficient values between all variables were 0.85 or less, indicating that discriminant validity was also secured. Disabled persons who have used immersive contents facilities feel satisfied, pleasant, respectful for themselves, and psychologically happy from using facilities and above-mentioned emotions are associated with each other.

Table 3. Heterotrait-monotrait (HTMT) ratio

Construct	User Satisfaction	Positive Affect	Self-esteem	Psychological Happiness
User Satisfaction	.842			
Positive Affect	.819	.898		
Self-esteem	.730	.687	.831	
Psychological Happiness	.802	.819	.673	.960

Structural Model: Results of Hypothesis Testing

The coefficient of determination (R^2) and the effect size (f^2) are the primary indicators to be considered in PLS-SEM (Hair et al., 2013). The coefficient of determination (R^2) represents explanatory power, which is defined as the degree to which the independent variable(s) explain(s) the variance of the dependent variable (ideally 0.25 or larger). Meanwhile, the effect size (f^2) is a criterion to judge the strength of the association between two variables (e.g., independent and dependent variables). A value of 0.02, 0.15, and 0.35 were used as a cut-off to judge effect size to be small (<0.02), medium (>0.15), and large (0.35) (Cohen, 1988). P-value, which is generally used to show the significance of the relationship between two constructs in the structural model, does not explain the relationship's strength level. However, the effect size (f^2) from Smart PLS can be used to determine the strength of the relationship between constructs in the structural model (Ali et al., 2016).

The results of hypothesis testing through the structural model are presented in Table 5. First, immersive content user satisfaction was found to have a significant and positive relationship with positive affect (t=35.875, p=.000), supporting Hypothesis 1. The result shows that the higher disabled persons' satisfaction with immersive content, the higher their positive affect is. Second, immersive content user satisfaction was found to have a significant and positive relationship with self-esteem (t=2.230, p=.026), supporting Hypothesis 2. This means that when disabled persons' satisfaction with immersive content increases, their self-esteem also increases. However, positive affect did not have a significant relationship with self-esteem (t=.424, p=.672), leading to a rejection of Hypothesis 3. Third, immersive content user satisfaction (t=2.820, p=.005) and positive affect(t=4.519, p=.000) were found to have a significant association with psychological happiness, resulting in an adoption of Hypothesis 4 and Hypothesis 5. Hence, it can be said that if disabled persons' satisfaction with immersive content increases, their psychological happiness also increases and that an increase in positive affect after using immersive content would lead to an increase in psychological happiness. Meanwhile, self-esteem was not significantly associated with psychological happiness (t=.081, p=.936), leading to a rejection of Hypothesis 6.

Meanwhile, the effect sizes (f^2) of the four pathways that turned out to be significant are as follows. First, the effect size of the path from immersive content user satisfaction to positive affect was 5.621, which is considered large; the pathway from user satisfaction to self-esteem had a medium effect size (0.127). Second, the path from immersive content user satisfaction to psychological happiness was found to have a medium effect size of 0.132. Third, the pathway from positive affect to psychological happiness turned out to have a large effect size (0.387). Lastly, the coefficient of determination (R^2) of immersive content user satisfaction on positive affect was 0.849, which is considered to be strong explanation power; the coefficient of determination of the constructs of immersive content user satisfaction and positive affect on self-esteem turned out to be 0.542; and the coefficient of determination of the constructs of immersive content user satisfaction, positive affect, and self-esteem on psychological happiness was 0.868.

Table 4. Hypothesis Test Results

Construct				β	t	f^2	ρ	R^2
(H1)	User Satisfaction	➡	Positive Affect	.921	35.875	5.621	$.000^{**}$	.849
(H2)	User Satisfaction	➡	Self-esteem	.621	2.230	.127	$.026^{*}$	.542
(H3)	Positive Affect	➡	Self-esteem	.123	.424	.005	.672	
(H4)	User Satisfaction	➡	Psychological Happiness	.361	2.820	.132	$.005^{**}$	.868
(H5)	Positive Affect	➡	Psychological Happiness	.583	4.519	.387	$.000^{**}$	
(H6)	Self-esteem	➡	Psychological Happiness	.008	.081	.000	.936	

$^{*}\rho<0.05$, $^{**}\rho<0.01$

Indirect Effects

The results of examining indirect effects posed in the structural model of this study are as follows. First, the indirect effect of immersive content user satisfaction on self-esteem through positive affect was insignificant (β=.114, p=.674), leading to a rejection of Hypothesis 7. Second, the indirect effect of immersive content user satisfaction on psychological happiness through positive affect and self-esteem was found to be significant (β=.543, p=.000), leading to adopting Hypothesis 8. Hence, it can be said that a high level of satisfaction of disabled persons with immersive content leads to a high level of positive affect and self-esteem, leading to a high level of psychological happiness. Third, the indirect effect of positive affect on psychological happiness through self-esteem was insignificant (β=.001, p=.978), rejecting Hypothesis 9.

Table 5. Indirect Effects

						β	t	ρ
(H7)	use satisfaction	➡	positive affect	➡	self-esteem	.114	.421	.674
(H8)	use satisfaction	➡	positive affect	➡	psychological happiness	.543	4.458	$.000^{**}$
			self-esteem					
(H9)	positive affect	➡	self-esteem	➡	psychological happiness	.001	.028	.978

$^{**}\rho<0.05$, $^{***}\rho<0.01$

Results from Professional Conference

In-depth interview with specialists in the field of disabled persons immersive contents, social welfare, law, culture, and sports has reached conclusion as follows, based on findings from quantitative analysis in this paper.

A narrative survey was carried out with structured questionnaire, focusing on what to be emphasized when developing the policy to install immersive contents facilities in island areas.

First, those specialists put forth their opinions as follows: it’s required to 1) study demand by cultural field, 2) set priority by region, 3) investigate distribution of tourism resources by cultual field, 4) and accessibility including distance and information access to ensure equity and balance while selecting island areas.

Second, they insisted to use water transport that run during the week or in the weekend to carry disabled people including their guardians or persons interested and take them to city so that they could use immersive contents.

Third, it's necessary to formulate policy to allow disabled persons to use public transportations and go on tour in the island and vulnerable areas, given that they're wheelchair-bound. And there was opinion to establish policy to allow the weak who are not disabled to use such facilities.

Fourth, elderly people have been distributed in the most of island areas in S. Korea where faces shortage of professional manpower who could run and manage immersive contents. Therefore, some argued it's necessary to take mobile immersive content equipment so as to meet demand.

Lastly, many specialists put forward opinions to have platform to communicate with local residents in the island, not to provide one-way experience so as to strengthen communication with them including elderly people. And they claimed that it's required to combine business models including telemedicine, education contents different from disabled persons immersive contents in the island areas to facilitate distribution.

Conclusion and Recommendation

This study analyzed the structural relationships among immersive content user satisfaction, positive affect, self-esteem, and psychological happiness to investigate the effect of immersive content experience on disabled persons who long for immersive content facilities in island areas. A survey was administered to physically and mentally disabled persons with experience using immersive content facilities located nationwide in South Korea; a total of 72 surveys were entered into data analysis. The collected data were analyzed using the SPSS 26.0 and Smart PLS 3.0 statistical packages; frequency analysis was performed to investigate the demographic characteristics of the participants in this study using the SPSS; the validity and reliability of the measurement model and the hypotheses posed in the structural model were tested using the Smart PLS.

A summary of the results from this study is as follows. First, the higher disabled persons' satisfaction with immersive content, the higher their positive affect; second, the higher disabled persons' satisfaction with immersive content, the higher their self-esteem; third, the higher disabled persons' satisfaction with immersive content, the higher their psychological happiness; fourth, the higher the positive affect after using immersive content, the higher the psychological happiness; lastly, the higher disabled persons' satisfaction with immersive content, the higher the positive affect and self-esteem, leading to increased psychological happiness.

Implications from the findings of this study are as follows. First, this is the first study to investigate how immersive content facilities work on disabled persons. Second, persons with physical disabilities and developmental/mental disorders are characterized by limited experiences due to restricted mobility compared to normal persons. The findings from this empirical study show that the quality of life of disabled persons would improve if they could use immersive content that simulates various real-life programs, which are not accessible to disabled persons in real life. In particular, the strong power of immersive content user satisfaction, positive affect, and self-esteem in explaining the psychological happiness of disabled persons (R^2=0.868) indicates a high likelihood that immersive content would significantly affect the happiness of disabled persons. Third, it was found that disabled persons' satisfaction with immersive content could be an important antecedent variable to the positive affect and self-esteem of disabled persons. In particular, immersive content user satisfaction exerted a high power of explanation (R^2=0.849) on the positive affect of disabled persons, and the pathway from immersive content user satisfaction to positive affect was also found to have a large effect size (0.561). Furthermore, the self-esteem of disabled persons explained 54.2 percent of the variance in their psychological happiness, and the pathway from self-esteem to psychological happiness was found to have a moderate effect size of 0.127. These results demonstrate that disabled persons' satisfaction with immersive content positively affects their psychological factors. Therefore, if various real-world situations that are difficult for disabled persons to access and experience are produced with immersive content, and immersive content facilities are provided in island areas, it would contribute to overcoming various psychological problems that disabled persons may have and revitalizing island tourism as well.

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