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Master's Research Project Report

Digital museum transformation and its potential for renewing visitors' experience: A construal-level-theory perspective ——Take analysis among Fukui Dinosaur Museum (digital exhibition) as an example

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Abstract

The development of social media and portable equipment provided by modern technology has brought about changes in the form of the behavior of visiting which have gradually become the subject of tourism research. While existing studies have explored the attraction and potential economic value of digital applications in venues such as art museums. From a macro perspective, some researchers have explored the positive impact on the visiting experience of traditional natural science museums that have experimented with digital projects. What's more, few researchers have explored in depth the positive impact on the visitors of some traditional natural science museums that have made attempts to digitize their exhibitions, especially in terms of how the content of the exhibitions can complement and enhance existing ones. In this study, a text mining analysis, a questionnaire, and a semi-constructive interview was generated to examine the two purposes of this research.

The first chapter introduces the definition of traditional museums, the characteristics of digital museums, and a theoretical description of the construal-level theory, laying the foundation for the discussion that follows.

The introduction to traditional museums consists of two parts. The first part will focus on the special characteristics that traditional museums possess. According to the definition of museums and distinguishing them from current digital museums, the functions of museums (traditional museums) encompass many aspects, in terms of the use of exhibits, including the investigation and study of collections, preservation and display, etc. The museum, as the holder and conservator of these collections, has the obligation to respect, protect and present them to the public. Whereas natural/cultural heritage, part of which is already been protected in its current location, is threatened by weathering, war, erosion, etc. Under the purpose of better dissemination and preservation, major economies have started to take measures to record and preserve collections with digital technology.

However, with the impact of the Covid global pandemic, digital exhibits show potential of which could break through geographical and travel restrictions and transform the museum industry that continues depression in the current situation. The second part will provide a broader perspective on the dilemmas faced by traditional museums. And its relationship with society and technology, which will be discussed in Chapter 1.5.

The issues and discussions that may result from digital museums consist of two main parts, one related to technology and the other to social concerns and the updating of relevant legal regulations. Firstly, digital technology (VR for example) is used and developed as a prerequisite for more practical applications such as manufacturing, medicine, tourism, etc. through its application in virtual gaming environments. The content of natural science museums is considered suitable for digital technology development because of the special characteristics of their collections, i.e., rich knowledge storage, potential for application development, and long-term development measures or investments that can create a demonstration effect and establish the

museum brand, which is conducive to the dissemination of exhibits and the influence of the museum.

Although the maintenance of facilities on site introduces the participation of the civil partitioner when the digital museum can be an opportunity to expand the participation of the citizen participation to jointly develop the natural/cultural heritage and share it with citizens who was passionate and concerned. It is worth to study since when these applications are developed, in civil tech research indicate that people who could help handle the complex data are mostly non-professionals, which means civil participation would effectively reduce the cost and economic pressure of museum industry. Although the digital museum industry is still in the experimental stage of development and seems to have a choice between implementation and non-implementation. But without further experimentation, the results of museum-led digitization of resources may be unduly influenced by competing products developed by film and game companies to draw away the attention they deserve. In this case, the public will be more inclined to choose a higher quality finished product, and loss of trust in the brand will occur. Second, museums allow qualified developers or companies to complete development projects in their place. With no oversight mechanism, this authorization may become a representative of the caregiver's interests, resulting in a product that is not sufficiently attractive.

In conclusion, the question of whether digital exhibits in natural science and history museums could generate a positive impact on the visitor experience worth for further investigation. At the same time, the number of mature examples of such exhibits is still very limited, so much so that the traditional way of visiting museums is still the mainstream of the museum experience. As a result of this investigation into the prevalence and development of digital exhibits, it is interesting to see what barriers exist on the developer side of existing digital exhibits, and what aspects of the existing visitor experience limit visitors. Since the spread of digital museums may bring certain benefits and risks to museums, it is worth discussing whether this approach is in line with the traditional obligations of museums as institutions of public welfare. This is one of the two main questions of this paper.

Key word: Digital Museum, digital transformation, VR, Intellectual property, construal level theory

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Chapter 1

Introduction

This paper aims to represent a brand-new perspective to evaluate the representative traditional on-site museum visits under the context of digital exhibition promotion (VR exhibition) which might lead to a construal level of consciousness and knowledge acquisition. The process and attempt of examining the construal level generated by visitors could provide solutions to the current transformation and digital exhibition contents carried forward by the traditional museum during the Covid pandemic. And this research aims to propose a hypothesis analysis through construal-level-theory (CLT) to understand how existing exhibition-related methods and facilities contribute to the educational functions of museums and revisit intention as tourist destinations. The level of interactives, construal level, and expectations of visitors were analyzed for on-site museum exhibitions. At the same time, by verifying this result, this paper also tries to take the limitations and constraints of the promotion of digital museums from the perspective of socio-technical and scientific progress into consideration.

The positive impact of museum visiting behavior and activities is an important topic in tourism research. Existing studies have explored trends and development regarding the technological applications of digital museum development, but few researchers have delved into the acceptance of new display formats specifically, and the mechanisms of how digital displays act on visitor expectations are unclear.

The study was conducted through questionnaires, text mining and semi-constructive interviews, firstly, through the analysis of randomly selected texts of visitors' comments to analyze the existing visitation experience, and then through interviews at the developing and operating side of the digital project to understand the activist relationship in the context of digital development. Based on the textual analysis, the results of the interviews, and the analysis of the questionnaires, three barriers to the digital museum project were summarized: barriers based on the development of digital technology, barriers based on a change in the thinking of the operators and managers, and barriers to the acceptance of digital exhibits by visitors. It also provides ideas for subsequent research advancement. Last but not least, exploring the parallel space between existing visitor methods and digital exhibitions will help to understand the changing role of museums as they evolve and advance the development of the museum profession.

1.1 Research purpose

1. To understand the current situation and difficulties of traditional museums in the context of digital technology application and development.
2. To understand the influences of existing facilities in terms of educational functions from the visitors' perspective.

1.2 Definition

1.2.1. Traditional museum

To distinguish this new form of the museum from the digital museum, this study first explains the existing physical museums (i.e., traditional museums) to understand what social functions the existing museums perform. The ICOM (International Council of Museums) defines a museum as a non-profit, permanent facility that serves the community by investigating, collecting, preserving, interpreting, and presenting tangible and intangible heritage. It provides education, entertainment, and knowledge sharing for the public.¹

Traditional museums got an explanation from two aspects which includes the practical functional aspect that the role of “collector” and “preserver” (Stephen, 2001:297). That provides in their function which includes the preservation and collection functions as public institutions not only play a role as cultural symbols that contribute to the construction of a national cultural system (Meng, 2022:172) and the sense of conscious identity but also contribute to the solution of educational and recreational functions.

This function provides useful resources, platforms, or solutions in terms of practicality for social well-being and cultural dissemination. At the same time, museums play a role as a subject like processing preservation of historical heritage such as ancient buildings, which is a key physical indicator of the cultural diversity of a region or a country (Whelan, 2015:217). And the quality of its displays depends to a large extent on the presentation and diversity of the exhibits, as well as assuming a part of the economic function that can help cope with and adapt to the costs arising from the maintenance of collections and displays, a function that is indispensable in addressing the preservation and display of regular exhibits (Gable, 1992:79).

This function is indispensable in addressing the preservation and display of conventional exhibits. As the function of the museum continues to evolve as a multifunctional public space, it demonstrates that it encompasses both recreational and educational functions and that by virtue of this transformation it can fulfill the mission of the museum in both directions of development (Mcpherson, 2005:10). However, in the context of the development of diverse display platforms and digital technologies, there is still much potential for traditional museums to develop innovative ideas to develop new exhibitions, so it is important to explore the factors and mechanisms that influence creativity in the development of existing resources (Nafalora et al, 2022:13).

1.2.2. Digital museum

Digital museums have diverse forms of existence, serving different purposes due to the different technologies they applied. Among them are the following categories, first of all, the digital museums that act as portals to provide information retrieval and guidance services to visitors, but also content-based museums that exhibit databases of museum collections, and virtual museums that provide online content to enrich the level of exhibitions (Benhamou, 2016). In the meantime, Digital museums

¹ <https://icom.museum/en/resources/standards-guidelines/museum-definition/> (Accessed:2022/05/26)

likewise refer to public institutions that provide public services and promote experiences through the platforms or channels of digital technology. This includes the dissemination of knowledge and the popularization of educational functions. In the early stage, digital museums attempted to preserve and display their collections of artifacts and historical collections in digital form using museum exhibition platforms of computers and early information technology (Richard&Yu, 2015:4830).

And with the iteration of technology and the increasing requirements for the level of digital display, new characteristics of digital museums is required that should meet the functional requirements of museums are proposed in the following aspects (Tong, 2021:753):

1. The foundation of digital museums lies in making full use of the advantages of digital technology tools while paying attention to the impact of technological updates and iterations
2. Digital museums can solve the drawbacks of traditional museums in terms of display and preservation of physical collections
3. Digital museums should complement the functions of existing physical museums.

1.2.3. CLT (construal level theory)

The claim of the construal level theory is that the same thing or object can be expressed at different construal levels or abstraction depending on the psychological distance, i.e., the interpretation of things varies with the psychological distance (Trope& Liberman , 2010:440) While psychological distance is interpreted as the distance at which individuals perceive things, the contextual conditions of the construal level theory include spatial, hypothetical, social and temporal distances (Liberman & Förster , 2009:204).

Psychological distance is also usually evaluated through four dimensions: spatial, temporal, hypothetical level, and social. In terms of results, the construal level theory suggests that greater psychological distance is accompanied by an increase in the level of psychological abstraction, i.e., an increase in the abstraction with which things are explained (Wang. et al, 2021:203).

And objects with high or low construal levels have a significant focus effect, and this focus influences individuals' judgments and evaluations of it (Liberman & Förster, 2009:207). In related extensional studies, psychological distance and its corresponding level of construal, whether concrete or abstract, affects decision making. (Pani.et al, 2020:108) This point provides a theoretical basis for the construal level in the evaluation of the visitor's degree of perception.

1.3 Social Background

1.3.1. The limit and problems of traditional museum

The limitations of traditional museums are those cultural heritage which first and foremost the monolithic nature of preservation and exhibition, and the decline in revenue and government funding will affect the preservation and display of exhibits since the Covid pandemic (Lampthey, 2021:2).

Although traditional museums assume the role of public interest institutions as both knowledge dissemination and public entertainment, their vast storage of knowledge and the cultural context of the collections make themselves still presenting a learning threshold for the visitors (Moreno-Gil.et al,

2021:3). The visitors' experience should not be limited to an entertaining experience, but also expend to its more important mission of science popularization and education. To achieve a balance between these two functions, digitally accessible natural resource heritage is an alternative.

Current applications of digital visiting technologies can be divided into three categories: AR, VR, and MR. In the current environment and with the large number of visitors had been recorded, equipping visitors with equipment that supports all three kinds of technologies would be a financial burden on the museum at the operational level(Eisenberg. et al, 2020:11). Instinctively, it is assumed that the priority for digital exploitation could be offered to cultural collections where there are problems of preservation or restoration due to natural factors. However, this approach is not limited to these categories. Since a large number of collections in natural science museums come from excavation sites (especially dinosaur fossils), and in this category of artifacts considered natural heritage, the basic methods of preservation include the need to prevent further damage through cleaning and restoration, scanning and other auxiliary methods, although with the destruction of the natural preservation environment or damage caused by geological movements will not cause a reduction in its natural value, but from the aspect of preservation and documentation, the digital development of natural heritage has a considerable advantage over these collections.

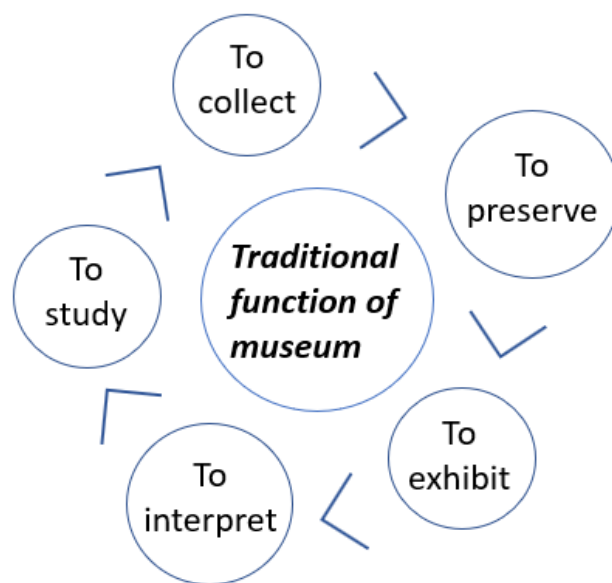


Fig.1 Five Functions of traditional museum (Trotter,1998:47)

1.3.2. Development of digital promotion

Before the development of digital museums, the digital documentation and preservation of existing collections was the basis for subsequent digital development, a trend that began to be emphasized before the global pandemic(fig.1-2), in which digital promotion project in Europe provides access to

over 58 million digitized cultural heritage records from over 3600 cultural heritage institutions and organizations.²

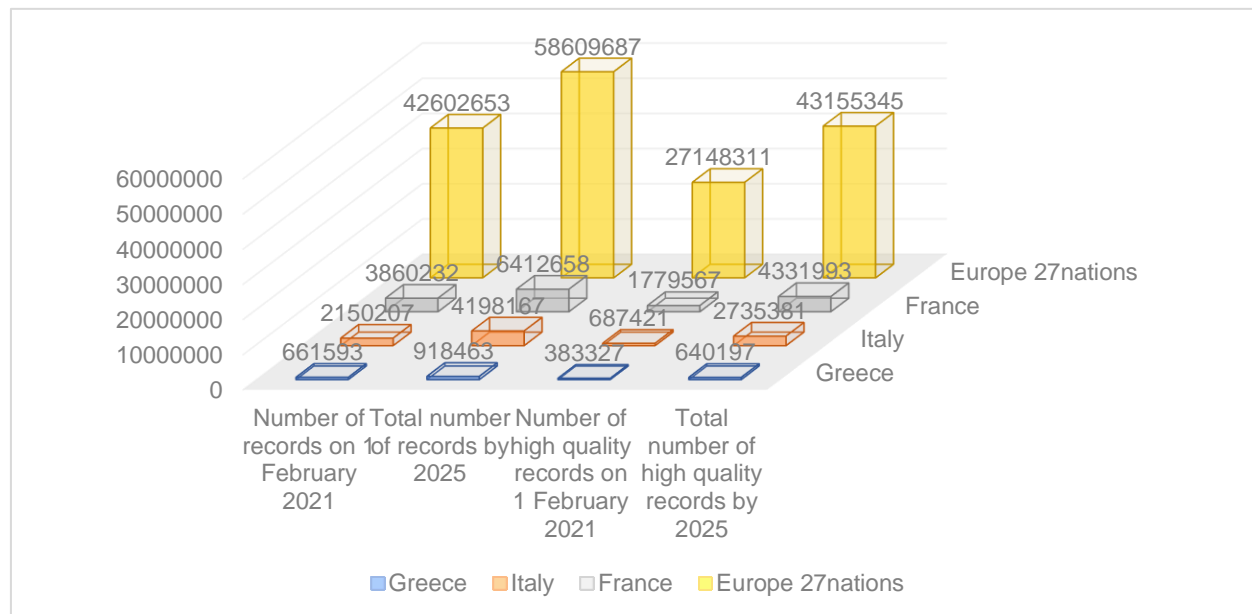


Fig.2 Digital preservation promotion in Europe ³

Meanwhile, Japan National Center for the Promotion of Cultural Properties generated Japan Search by 2020 to manage digital cultural properties in existing sites and searchable databases. ⁴The database not only includes digital collections, but also provides access to online exhibitions and interfaces, expanding the content and breadth of the collection by linking to a variety of media and media formats. ⁵

The protection and digital preservation of cultural heritage, starting from the overall environment, not only guarantees material preservation but also allows for observing the process of natural erosion of its culture's development and building material on the existing foundations. At the same time, standardized scenes (scenes of cultural heritage) are useful to deploy digital platforms for the public (different materials on the same platform), thus avoiding the loss of diffusion due to differences in digital projects.

1.3.3. Why it is crucial

The outbreak of the Covid-19 epidemic posed a significant impediment to the traditional museum industry in terms of both the decreasing number of visitors and related economic value created for public cultural institutions, but the act of cultural appreciation and visiting museums continues to have a strong appeal to people. As these industries continue to evolve into new patterns with high quality,

² Shaping Europe's digital future: The Europeana Platform. <https://digital-strategy.ec.europa.eu/en/policies/europeana>. (Accessed:2022/02/18)

³ Shaping Europe's digital future: The Europeana Platform. <https://digital-strategy.ec.europa.eu/en/policies/europeana>. (Accessed:2022/02/18)

⁴ Japan Search.<https://jpsearch.go.jp/arfy2021#t730ad1n04odt>(Accessed:2022/03/15)

⁵ National Center for the Promotion of Cultural Properties Initiative.https://cpcp.nich.go.jp/modules/r_free_page/index.php?id=25&lang=ja&lang=en. (Accessed: 2022/03/21)

cultural appreciation activities have become a common way of life, and the impact of such activities on visitors has attracted academic attention (Angela,B.et al, 2021:3) .In general, current research has focused on the immediate effects of the visiting experience on visitors' cognition, emotions, and behavior during the visiting process, and has focused on phenomena that are limited to the behavior of visiting, neglecting the distal effects of visiting activities on the visitors’ cognitive influence(Gali, 2022:27), which has objectively led to a lack of in-depth exploration of the connection between visitors and construal level in this research field.

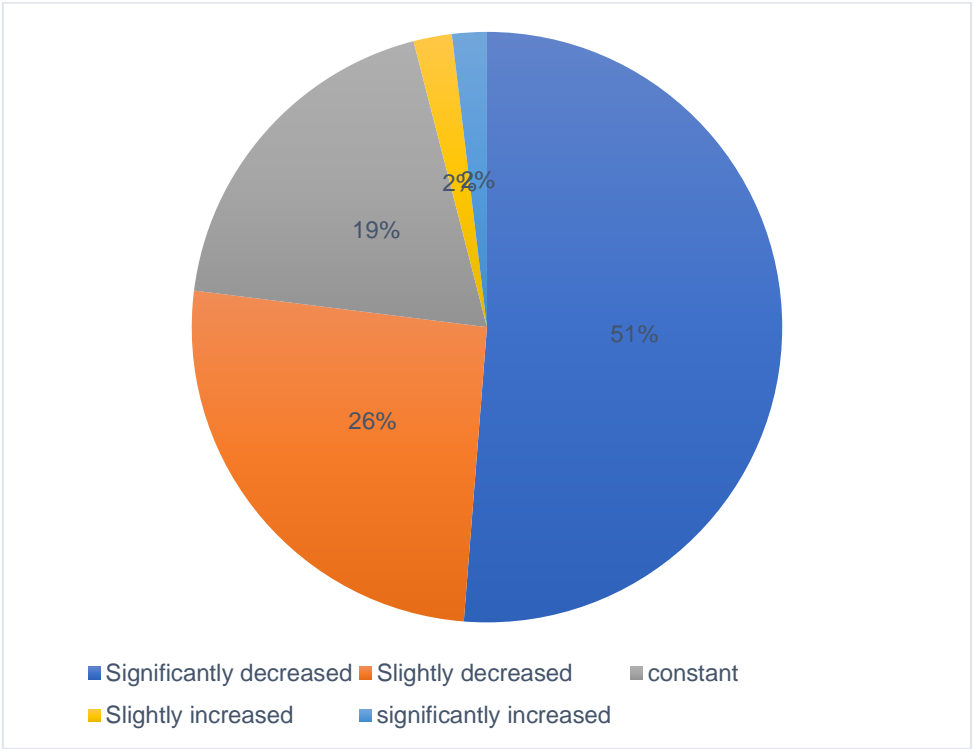


Fig.3 Cultural and artistic activities frequency (Japan Agency for Cultural Affairs, 2021)

In the 2021 Japan national survey, the frequency of direct appreciation of cultural and artistic activities declines significantly. At the same time, in the context of the significant decline in the number of people participating in cultural appreciation activities reported in this survey (The portion could be seen as fig.1-3), digital access, which has been gradually adopted as an alternative form due to the pandemic, will be effective in mitigating this situation.

From the perspective of the visitors, the spread of digital visiting experiences will provide more options for the act of visiting itself, and the application of this technology will have a representative impact on the visitors’ acceptance of new technologies in their daily lives, thus embracing the convenience of technological advances. The digital technology itself, through its multi-perspective application, can provide more detailed, personalized and highly interactive visiting content.

From the side of the museums of which provide exhibitions, the invisible value of rare cultural assets in terms of communication will be amplified with more accessible communication technologies, making digital museums more of a complement to traditional exhibitions than a new form of exhibition.

In contrary, as an emphasis on new ways of displaying existing objects and highlight the role of museums as entertainment facilities in the creative tourism market will not help this trend.

1.3.4. Limitation

Researchers have different views on the entertainment and educational functions of museums, such as whether the association of museums with tourism overemphasizes the tourism and recreational functions of museums (Daniela.P, 2019:3). This has led to some debates on whether traditional museums should focus on heritage conservation or be devoted to the development of tourist attractions.

There is some debate as to whether digital conversion of material preserved with analog preservation techniques (the text or video) to a form of presentation acceptable to the public would be more expensive, and whether analog preservation techniques can be adapted to digital presentation (Vassiliki,K.et al, 2021:4). From the existing studies, the influencing factors for developers and operators to develop digital exhibitions can be screened mainly from two perspectives, such as the limitations at the technical level and their policy support, the technology-related factors include the difficulty of applying the technology and the effect on the way of visitors' participation such as using wearable devices for visiting. And the policy factors are related to the copyright of natural resources and digital platforms was also considered, such as NFT art goods, secondary creations based on original exhibits, etc. (Wilson, 2022:28).

1.4 Research object

1.4.1. Overview

Tab 1. Profile of Fukui dinosaur museum ⁶

Structure	3 floors above ground, 1 basement floor
Site	area 29,946 m ² (leased free of charge from Katsuyama City)
Total floor space	15,000 m ² (including 4,500 m ² for permanent exhibition rooms)
Parking	Approx. 1,460 spaces (as of February 2017)
Development cost:	approx. 14.3 billion yen (construction: 9.0 billion yen, exhibitions, etc.: 5.3 billion yen)

1.4.2. Properties

First, the basic properties the type of visitors which could be described that the main type of visitors are mainly day-trippers (visitors), and because of its location and transportation mode, it is far away from large urban areas and major transportation hubs, the transportation options to the museum are limited. Family-based visitors are the main group of visitors.

⁶ Fukui dinosaur museum homepage, <https://www.dinosaur.pref.fukui.jp/museum> (Accessed:2022/06/15)

The museum is the largest museum in the prefecture and a large museum with the theme of dinosaurs. It serves as an important node for tourism promotion in the entire prefecture, and its location is close to the National Geopark, which has developed a tourism experience of experiencing the excavation site and promoting the participation of citizens (civil participation) and cultural awareness at the excavation site.

1.4.3. The existing visiting method

Limitations as a traditional educational public institution:

The exhibits in the museum are still based on traditional text-based information (traditional exhibits and signage), supplemented by audio descriptions and graphic descriptions near the exhibits' introductory text columns, which display a relatively simple amount of dinosaur-related knowledge and content, and are short enough for visitors to stay for a short period.

However, in terms of the overall content of the museum, the exhibits and the number of exhibits in the collection are very large, but for first-time visitors, the dissemination and popularization of the content are limited by the basic knowledge of the visitors, and the introduction of the text column is mainly scientific text without emphasizing the amount of information and the ultimate effect of learning.

For example, the most advanced display facility in the museum is a three-sided stereo display screen that shows some dinosaur life scenes, but from the perspective of today's technological development, its expressiveness and realism can no longer achieve the details and restored scenes of dinosaurs shown in the same type of CG animation and movies.

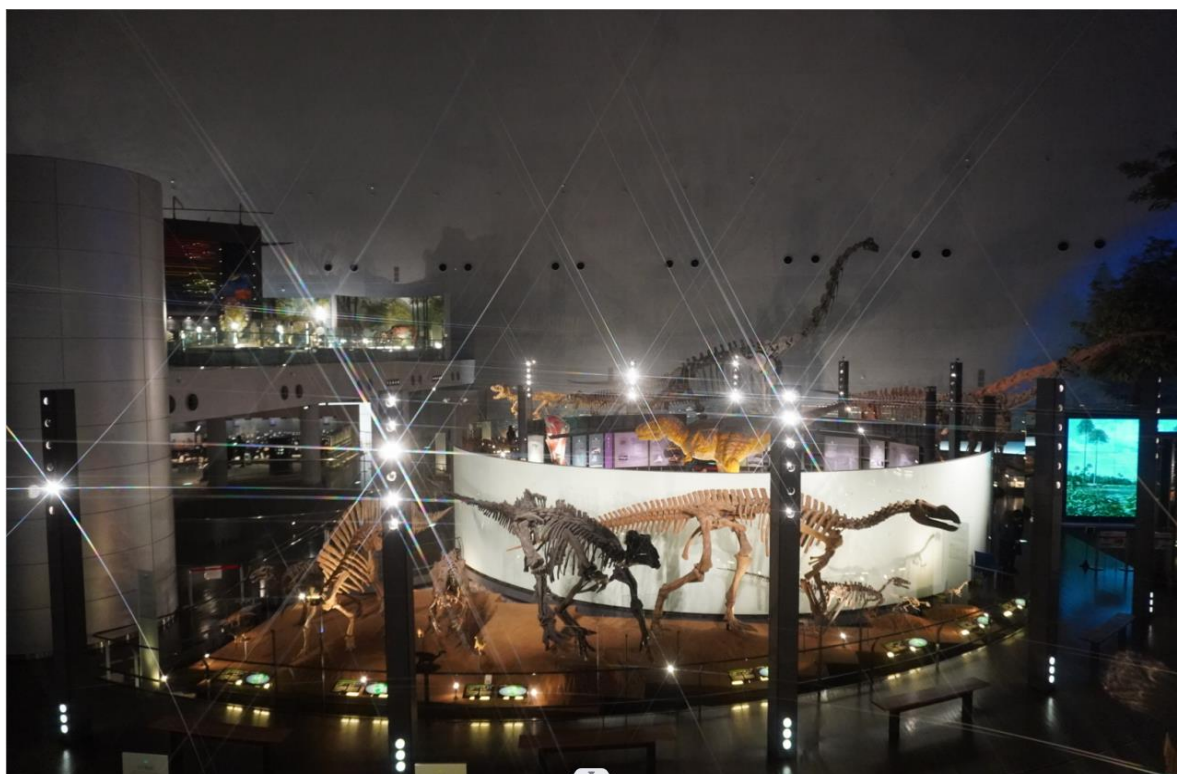


Fig.4 Main exhibit hall of dinosaur museum

1.4.4. Reason of selection

With the spread of digital technology, Fukui Dinosaur Museum tries to develop its rich dinosaur resources through VR technology in the form of special exhibitions with famous dinosaur fossils and restored models as the main objects, "Fukui Dinosaur Museum VR Exhibition" is an event led by the Dinosaur Research Institute with the theme of online tourism and education.

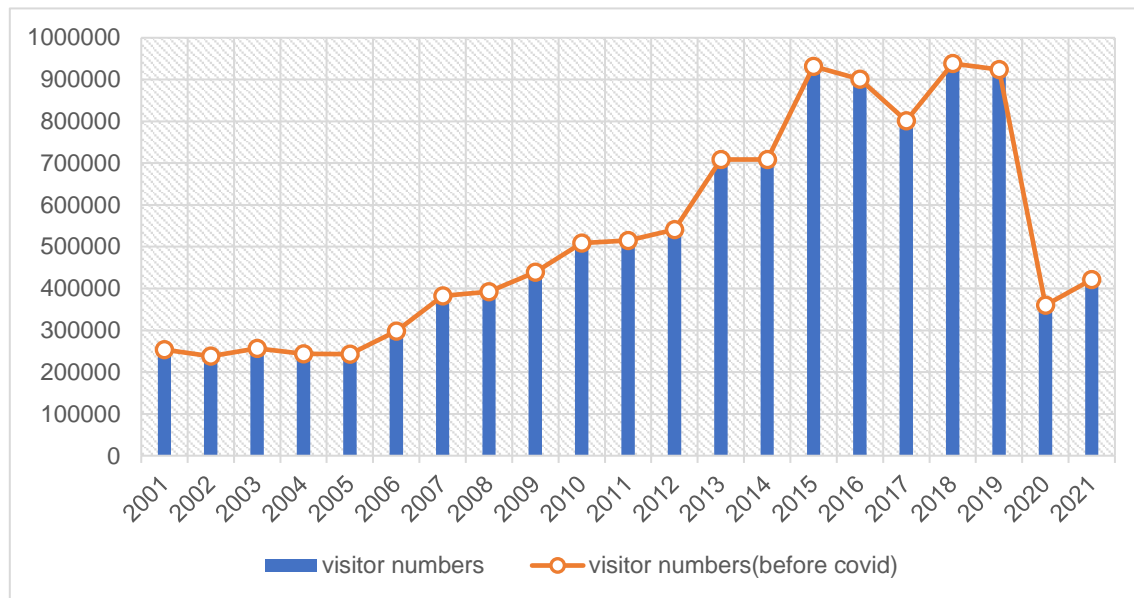


Fig. 5 Number of visitors by year⁷

First of all, the dinosaur museum as a representative of natural science museums, its characteristics of dinosaurs as the main exhibition content than other natural science museums are more able to arouse the interest of ordinary visitors to the exhibition itself, its development process and social exposure will also help the whole museum industry to learn and think, and at the same time the digital results of the dinosaur museum can be used as a reference for other museums to digitize. Secondly, as a popular tourist destination, it is worth investigating whether the educational function and the task of popularizing social science knowledge undertaken by the dinosaur museum itself are weakened from the viewpoint of the visitors, and whether the digital exhibition can improve the dissemination of dinosaur knowledge and the level of knowledge acquisition through a more flexible and richer dissemination method. These are worth analyzing through research.

From the perspective of the construal level theory, compared with the present-day cultural heritage, the image of dinosaurs and their life scenes involve millions of years ago, and without the support of professional background, the image of dinosaurs and the impression of their basic external characteristics can only come from the scientific research arguments and restoration of professionals. From the point of view of the construal level theory, the image of the dinosaur satisfies a sufficiently long psychological distance and a high degree of abstraction for the visitor to verify how to disseminate and popularize this kind of knowledge in the existing visiting methods.

⁷ Fukui dinosaur museum homepage <https://www.dinosaur.pref.fukui.jp/museum/entry.pdf> (Accessed:2022/06/15)



Fig.6 & Fig.7 location of dinosaur museum⁸

1.5 Academic background

1.5.1. Relations with Technology

While more and more museums are transformed into tourist attractions and destinations, their educational and knowledge popularization functions have been neglected (Antonenko& Khutkyi, 2021:971). Existing traditional nature museums have made many efforts to create more economic value and serve as visitor destinations while developing and promoting museum brands and programs in response to the digitalization trend (Zhang, 2014:134). With the development and advancement of digital technology, digital projects such as digital promotion projects for art museums and science museums have also started to emerge, in terms of the dissemination of works, the level of technological development, and even digital art collections based on virtual currency. In the context of the development of digital technology, it is important to explore the current situation and the problems faced by this type of development considering the preservation of cultural heritage in various countries.

Under this premise, the content of cultural and natural heritage suitable for digital preservation of cultural heritage is firstly divided into tangible and intangible heritage according to its purpose.⁹ While virtual reconstruction and visualization focus on tangible heritage, the development of virtual archaeology provides a complete path for digital museum development: including the digital development process, including excavation, restoration, validation, education, and application (Reilly, 1990:133).

⁸ white map resource from 3kaku-K Co. https://www.freemap.jp/about_us.html(Accessed:2022/06/17)

⁹ Convention Concerning the Protection of the World Cultural and Natural Heritage, the United Nations Educational Scientific and Cultural Organization (Accessed: 2022/07/18)

At the same time, the objects of digital development have expanded from static collections to dynamic collections. This expansion has opened up the scope of application of digital resource development from historical, aesthetic, ethnographic, and anthropological perspectives.

1.5.2. Transformation process

Transformation of gamified digital tools (VR)

Video games, 360-degree videos applications were known as an initial way that applied fully functioned VR applications. Although VR is described as a tool which is known primarily for its use in entertainment. And it is become emerging in industries including education, medicine, and business. What's more, VR is one of the fastest growing technologies regarding technical advancements, rate of adoption, and financial investment (Zyda, 2005:26& Boas,2013:13).

Presence describes the degree to which the individual user is more present in the virtual environment than in the real world. (Witmer & Singer, 1998) while immersion describes the technical evaluation scale of the realism of the object or environment presented in the virtual environment and its ability to be isolated from external physical contact for a short period of time. (Cummings & Bailenson, 2015:3) By examining this, it has been shown that VR enhances the presence of participants in virtual environments through immersion.

Usually, the immersion exhibited in VR environments is related to the realism of the material and the visual images applied to the virtual environment. In addition to realism, there are other external factors and technological applications that influence immersion, such as wearable devices or multisensory systems that create a higher level of immersion, and for creating a sense of presence, alongside content realism, such as interaction methods and perspective, also have an impact on immersion.

1.5.3. Relations with Society

The application of digital technology has been used in a large number of applications and games, in the same way in the study of digital tourism development, the three themes of virtual reality tourism, virtual tourism and augmented reality are the three main research topics summarized by the analysis of the database research papers (Akhtar. et al, 2021:45)

At the same time, virtual technologies are changing the tourism and hospitality industry at both technical and conceptual levels (Chiao. et al, 2018:29). Among the specific studies include advances in VR and other immersive technologies that make it possible to experience tourist destinations "virtually" and inexpensively (Belhi. et al, 2021:4) and MR technologies represented by VR (immersive and non-immersive VR) have great potential for the tourism industry and tourism resource development (Huang. et al, 2015:100)

Another study suggests that museums already use various technological tools to enhance the visiting experience (e.g., audio tours), but interactive, content-rich digital multimedia tools will become the norm combining developments in the tourism industry with new ideas for the future preservation of digital cultural heritage that are cost-effective and easy to replicate (Belhi. et al, 2017:4).

(1) Intellectual properties

The dinosaur named “Sue”

The value of the original dinosaur fossils is not part of the natural heritage and protected by national conservation laws, but is strictly defined as private property, i.e., natural/cultural resources excavated and explored on private land, which also belongs to the individual (Judy,1992).

In the case of the famous T-rex fossil "Sue", for example, the skeleton of the largest carnivore ever found on Earth, which was excavated with 90% integrity, is defined in U.S. law as "Earth's land resources" in the same way as natural resources extracted from private land. (Ronald, 1970:14)

And while it demonstrates a significant degree of scientific value, all collections and commercial trade in antiquities cannot be illegalized in the name of science.

In contrast to this example, the British approach is much closer to the way major natural/cultural heritage is treated in mainstream countries today, i.e., all natural/cultural heritage is owned by the state, and excavation and exploration requires partial government permission.

Despite the fact that natural and cultural heritage belong to the country, is there some restrict about the digital samples for preservation? In contrast to the question of preserving pre-existing cultural/natural heritage, whether the same legal restrictions apply to the digital preservation of natural and cultural heritage This issue has been discussed as follows:

In the era when text or images were the primary medium of transmission and documentation, The traditional view commonly held by owners of cultural heritage is that they only use the intellectual property (IP) of the exhibits rather than owners. In some case of preservation materials that are predominantly written or visual records, IP issues are only relevant when faced with the need to adapt, borrow, or reproduce texts from existing materials, whether it is visual records or written texts.

However, with the invention and application of new technologies (digital collections), there is a need for some conceptual changes among those who preserve and protect cultural heritage, as represented by museums. Digital collections and the intellectual property rights attached to them are equally important in terms of access, preservation, and management, while the products of these new technologies are also more accessible platform for the dissemination of knowledge. The focus of cultural heritage conservators will no longer be on the intellectual property rights to use existing collections but attempts to expand this possibility through the management of the intellectual property of existing collections and the planning and liability of potential future developers not on the museum side.

From its own natural resource properties, although digitized dinosaur fossils may not be IP rights protected assets, digitized resources can be exploited to create other assets protected by IP rights. In the same way that different uses of cultural collections can create different IP rights.¹⁰

¹⁰ Rina Elster Pantalony, Managing Intellectual Property for Museums.WIPO homepage. Chapter3. pp.20.https://www.wipo.int/edocs/pubdocs/en/copyright/1001/wipo_pub_1001.pdf (Accessed: 2022/08/28)

Thus, different uses of digital resources may create different IP rights, of which the understanding of copyright and related rights are the most relevant in this study.¹¹In the case of dinosaur fossils, for example, copyright is not a single right, but a series of related rights. These rights often need to be subdivided according to different objects, through multiple dimensions or perspectives to understand the depth and breadth of the content or expression of the works that may be protected by copyright. The most eye-catching right in this resource is the right to reproduce it, or the right to copy the work. Other relevant rights include the right to include a sample of this natural resource or associated digital preservation in a film or audiovisual work.

Possible uses of digital resources protected by copyright and related rights: for example, graphics in video games.¹²Intellectual property rights are related to both the tools used to develop the game and the content included in the game. For example, copyright protects the creative and artistic expression (code), artistic design, and sound (and music) contained in the game software."), paintings, movies, etc. (these are the assets protected by IP rights).

The IP rights are exercised in a manner corresponding to the IP asset, such as allowing films to be shown on television (the right to broadcast), allowing adaptations to be made (the right to adapt a work), and allowing the printing and publication of collections of paintings (the right to copy), as these rights can be exercised by copyright holder licenses to other.¹³IP can also be licensed by the owner to another party on terms and conditions among which the most relevant are the duration of the license, territory and purposes of the party licensing the IP¹⁴, which can create significant economic benefits while also contributing to public awareness of natural resources through dissemination.

¹¹ Rina Elster Pantalony, Managing Intellectual Property for Museums.WIPO homepage. Chapter2. pp.13.https://www.wipo.int/edocs/pubdocs/en/copyright/1001/wipo_pub_1001.pdf (Accessed: 2022/08/28)

¹² Rina Elster Pantalony, Managing Intellectual Property for Museums.WIPO homepage. Chapter2. pp.18. https://www.wipo.int/edocs/pubdocs/en/copyright/1001/wipo_pub_1001.pdf (Accessed: 2022/08/28)

¹³ Rina Elster Pantalony, Managing Intellectual Property for Museums.WIPO homepage. Chapter2. pp.18.https://www.wipo.int/edocs/pubdocs/en/copyright/1001/wipo_pub_1001.pdf (Accessed: 2022/08/28)

¹⁴ Rina Elster Pantalony, Managing Intellectual Property for Museums.WIPO homepage. Chapter2. pp.18.https://www.wipo.int/edocs/pubdocs/en/copyright/1001/wipo_pub_1001.pdf (Accessed: 2022/08/28)

Chapter 2

Research method

To scientifically test the above hypotheses, a multi-method research design consisting of a text mining analysis, a questionnaire, and a semi-constructive interview was used. Compared with studies using a single method, studies using multiple methods can provide more scientifically rigorous conclusions. (Davis. et al, 2011:467)

2.1 Text mining

2.1.1. Method

The keyword analysis of the random comments from the visitors was first used to obtain a general impression of the recent visitors' experience at the dinosaur museum, which in turn helped to understand who was visiting and the purpose of the visit, whether it was more recreational or educational in function. For the analysis of specific textual material, first a random selection of reviews (with some degree of filtering) was made, based on a sample of 897 randomly selected reviews (optimized for content validity and textual diversity) from the 9779 visiting reviews of visitors to the museum, with invalid or extremely malicious reviews also subject to pre-processing intervention.

A multi-dimensional scaling analysis, a co-occurrence networks analysis of descriptive statement and terms related to the visiting experience were conducted to examine the characteristic terms and the focus of the exhibition content around the traditional visiting method provided by the dinosaur museum.

2.1.2. Analysis

In this section, this research tried to analyze the descriptions of the visitor experience using multi-dimensional scales in the visitor evaluation, as shown in fig.2-8, the author used the ward method for text mining and the Jaccard method for distance measurement,

A total of six categories were summarized and presented on two different subscales, which can be interpreted as the horizontal and vertical axes of the coordinate system. By interpreting the results of each subgroup, the vertical axis can be summarized as follows: on the positive half-axis, as the values increase, the visitor experience tends to express more immediate emotions and impressive objects of the experience; on the negative half-axis, as the values decrease, the description of the experience focuses more on the time of the visit and more specific opportunities to visit, etc. On the horizontal axis, as the value of the positive half-axis increases, the visitor's experience tends to be more about transportation, food, and amenities, while on the negative half-axis, the description of the visitor's experience is more focused on the description of the things of interest (e.g., the diversity of the collection, the exhibition space, etc.). As for each of the clusters, Cluster 1, the central category of the system, contains several highly frequent terms that constitute the most fundamental and crucial part of the museum experience for family-based groups, such as those who accompany their families or

children on fossil excavations. Cluster 2 shows the practical considerations that some visitors give to the way they visit, including the importance they place on the infrastructure of the museum and the means of transportation. Cluster 3, 4 and 6 are more focused on the content of the exhibit, including positive comments about the exhibits and facilities, while Cluster 5 is more focused on the time of day, including what holidays or time of day to use for the visit.

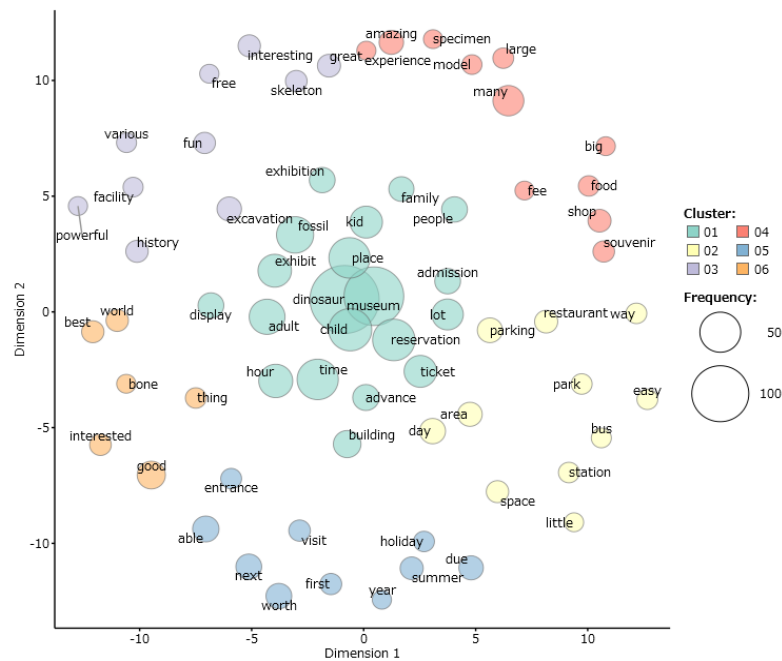


Fig.8 Multidimensional scales analysis of visitors' review

In the analysis of the co-occurrence network analysis, the visitor experience evaluation was also analyzed, using the Jaccard method for distance measurement, and the results were summarized and analyzed as shown in the fig.2-9. The analysis of centrality, frequency of use, and relatedness was used to understand the most important keywords in the visitors' evaluation. Like "time", "fee" can be considered as characteristics of the current visitor evaluation of a dinosaur-themed family visit, considering time and costs. The deficiencies in the educational function of the current visit experiences related to dinosaur museums (low frequency of terms related to knowledge acquisition) are demonstrated.

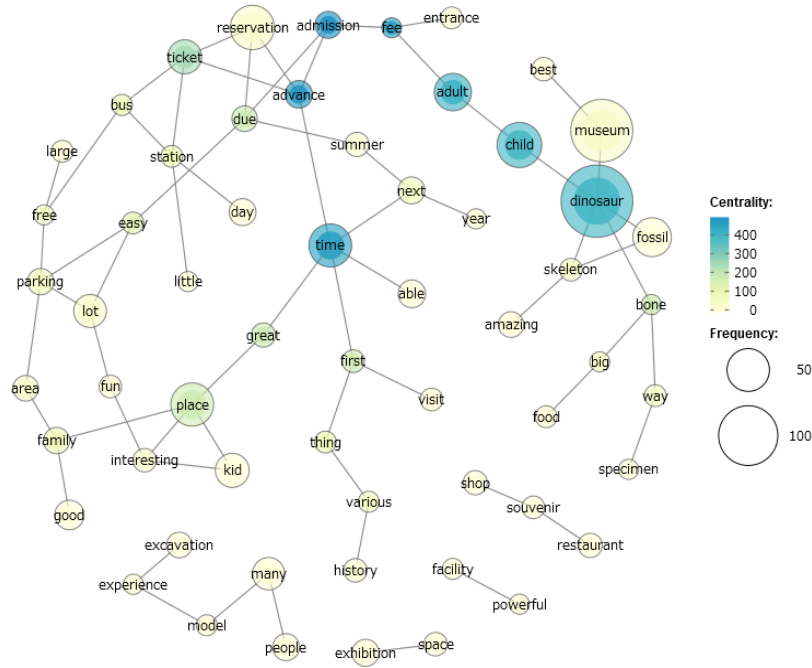


Fig.9 Co-occurrence networks analysis

2.2 Semi-constructed interviews

2.2.1. Research questions

Through a semi-structured interview, the research questions that this research tried to address are as follows. And used in-depth interviews to explore the following research question:

1. Understanding the process of digital applications in the museum. (Current state of development)
2. The collaboration of museums with private and educational institutions in digital development.
3. The reasons for not developing creative and open-source resources in terms of intellectual property development for digital development.
4. How do traditional museum practitioners understand the futures of museum?

2.2.2. Organize the content of the interview

The research design of this study was based on the main research method of in-depth interviews, and the interviewees were identified by following methods:

The interviews were completed by one interviewer in a semi-structured question-and-answer format, with the interviewer in charge of the interview and the interviewer in charge of recording and supplementing the questions. Before the interview started, we explained the purpose of the interview to the interviewees and obtained prior consent from all interviewees, and the entire interview was recorded.

The outline of the interview was divided into the following sections.

Basic information:

1. The technical platform of the current exhibition, the desired effect, the target audience
2. The status of achievement of the museum's objectives

3. The teaching process and the way and platform of displaying the results of the educational institutions related to dinosaur research.

2.2.3. Features of interview

Transcribe the audio recordings verbatim into textual data at the end of the interviews. In this research design, to make the communication record between the interviewer and the interviewee easier to understand, some of the existing answers, including oral narration and spoken words were "standardized" (the verbal phrases and insubstantial repetitive statements were removed from the interview narrative), and the text organizing process was transformed into the formal text on the basis of verbatim dictation and transcription.

The interviews were mainly one-on-one face-to-face interviews. For offline interviewees, the interview location was determined according to geographical inexpensiveness, and each interview was conducted for at least one hour in depth. The interview was conducted in a semi-structured question-and-answer format by two interviewers, one of whom asked and recorded questions, and the other who supplemented and asked additional questions.

The purpose of the interview was explained to the interviewees before the interview started, and prior consent was obtained from all interviewees, and the entire interview was recorded. Gifts was given to the interviewees at the end of the interview.

In the process of organizing the interview data, the interviewees were numbered, and for the purpose of authoring the paper and understanding the interviewees' narratives, the verbal narratives of the interviewees were "standardized" for textual transformation based on verbatim transcription, i.e., the verbiage and insubstantial repetitions of the interview narratives were removed.

Through in-depth interviews with museum practitioners, we explore their "local understanding" of the concept of digital museums and place this examination in the historical context of changes in communication technologies, changes in the way museums are viewed, and changes in the functions of traditional cultural public institutions, to grasp and theorize the development of digital museums. We attempt to grasp and theorize the characteristics of digital museum development. In other words, we attempt to explore the current situation faced by museum practitioners and the processes that drive the digitalization of museums, to describe and interpret the contradictions and dynamics of their internal development, and to examine the theoretical connections between these contradictions and dynamics.

To accomplish these goals, we interviewed the developers of the VR exhibition, professors from the Prefectural University, in a face-to-face interview from December 2021 to June 2022 (interview period).

The interviewee, who works at the Prefectural University and is also a researcher at the museum, is a researcher specializing in research, teaching, and development of dinosaur fossils, restoring their ecology, skin, and morphological details, etc. The fossils are mainly from locally excavated dinosaur fossils. Part of the work is also oriented towards media promotion and fund raising: to promote the results of the digital dinosaur development and another part of the work is oriented towards spreading

the brand awareness of the dinosaur museum: The theme is “dinosaurs excavated in Japan”, and the goal is to promote Katsuyama as a center for dinosaur themes. In terms of the degree of digitization, most of the developed contents are publicly displayed in VR format and can also be viewed through traditional media such as browsers. As a result, the museum-educational institution linkage for digitizing dinosaur resources is shown in fig.2-10.

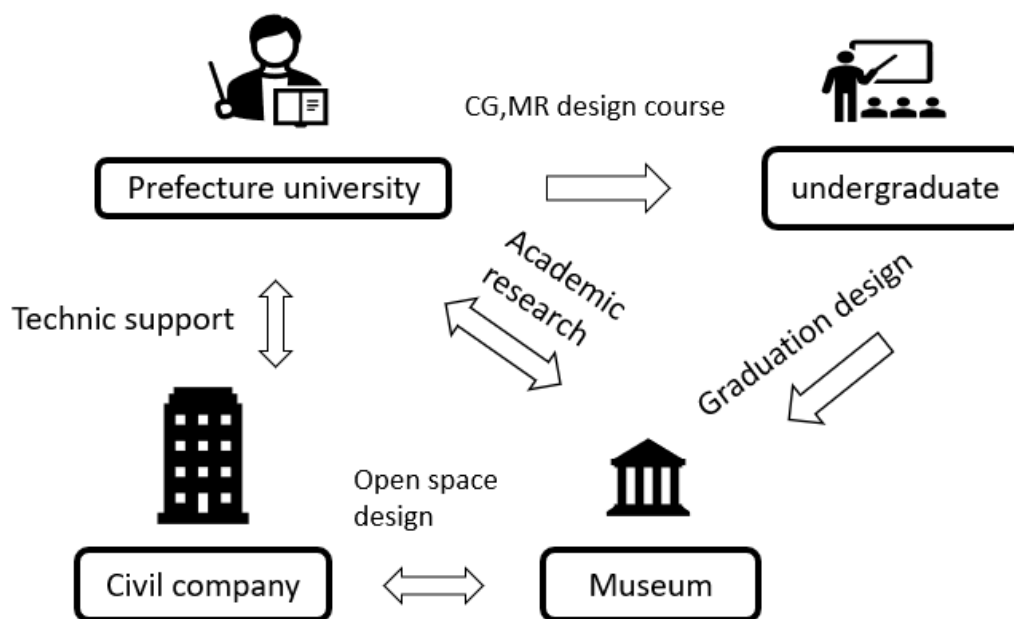


Fig.10 The Museum-Educational Institution Linkage for Digitizing Dinosaur Resources

2.2.4. Limitations of interview

There is some limitation with single interviewee, the cooperation with the partners involved in the production of the virtual space, will be a good complement to the content of this interview, and the evaluation of the development quality from the perspective of the user participants should be understood through the sampling method.

2.3 Questionnaire

2.3.1. Hypothesis

The construal level is generally defined as the degree of the description of things, and previous studies have considered the level of explanation as a core indicator of engagement cognition, as well as an important indicator for judging changes in cognition of things, and researchers generally measure the construal level through scales.

For a specific target, since people have the same knowledge base acquired in a certain period, there is a difference between high and low levels of construal level, and many researchers believe that a

distant psychological distance can be equated with a higher level of construal. (Kang,2020:255) Since this paper focuses on museum visitors, on-site visits are defined as a higher construal level, and distant participation is defined as a lower construal level. And the way individuals construe an object considerably affects their judgment and decision-making about a particular object (Brust. et al, 2021:86)

As a result, the following hypotheses were formulated.

H1: interactive visiting methods of existing facilities which could affect the construal level of visitors

In Kim's research (2019), according to the paper, the VR environment is a technology that produces a lower construal level than the PC-based scenario, and the more interactive scenario reduces the level of abstraction of the observed object. And under the context of construal level, it explained high interactivity method could help people get closer to distant places and times. The question of whether digital tours are closer to visitors than live tours and make abstract, monolithic information more concrete and easier to learn is worth exploring. Based on the above, the following two sub-hypotheses are proposed to verify the effect of interactivity on the construal level:

H1a: there is a positive association between facilities interactivities and visitors' construal level

H1b: there is a negative association between facilities interactivities and visitors' construal level

The difference in the psychological distance could be applied into service industry. Some research was presented that by examining the use of construal level in the service industry could help understanding the process of service and expectation formation and proposing the idea of providing different types of services according to the construal level (Satoshi. et al, 2011:87). It is worth exploring whether this can promote the willingness to revisit, which also has the attribute of tourism, and the following hypothesis is proposed based on the above description.

H2: the construal level of visitors could affect visitors' expectation formation

(1) Measuring variables

The questionnaire is based on the construal level theory, the interactivity of existing facilities, and the expectations of visitors to understand the shortcomings of existing traditional museum exhibitions and how they can be enhanced through digital applications.

Three questions were used to understand personal attributes of visitors, one based on gender and age, the second on the most recent museum experience and the number of actual visits, and the third asking participants to recall their reasons for choosing to visit again after two or more visits to the museum. The latter two items were phrased as "How many times have you visited a natural science museum? [a. First time b. Two or more times." "Reasons for return visits []. [fill in the blank]", where the third question asked participants to fill in a specific reason for their return visit for those who selected the two or more times option.

1) Measuring level of interaction

The evaluation of the interactivity of the existing facilities was done by method of a questionnaire. The scale of interactivity of the museum was used to obtain data, and the question was set to include five options of increasing interactivity: graphic (photo/image/graphic), audiovisual (audio/video), external URL (audio/video), participatory (interactive graphics/infographics), and interactive resource (audio/video) to find out the level of interactivity of the existing facilities in terms of the existing experience of visiting a natural science museum. (Capriotti. et al, 2016:99)

2) Measuring construal level

In measuring judgments of perceptions of museum facilities (i.e., construal level), the scale was adapted from previous research (Vallacher&Wegner,1989:666) and from the context of this study through a behavioral identification form (BIF) that included seven questions, which were phrased as one of two choices based on the scenario described in the question during the actual visit experience, including "Watching the introductory video shown on the exhibit [single-choice] a. moving fingers/touching the panels b. learning and discovering knowledge", "listening to the audio presentation on the panels [single-choice] a. following the introduction b. deepening knowledge and satisfying curiosity", "seeing restoration work in progress [single-choice] a. removing dirt from the object to restore it /Removing dirt from artifacts b. Restoring artifacts and restoring them to their original state", "Seal in with a stamp on the way to the museum [single-choice] a. Writing down the stamp in a book b. Making memories of the visit", "Seeing an artifact in an exhibition that I had seen in a documentary Artifact or exhibit [single-choice] a. Recall the plot and scenes in the film b. Evoke attention and interest in this artifact or exhibit" "Photograph the exhibit or contents of the museum [single-choice] a. Press the button b. Capture a beautiful moment"

3) Measuring extent of expectation

The questionnaire design and scale selection in this paper focus on the measurement of expectation in two directions which of knowledge acquisition and satisfaction. This paper uses the Museum Experience Expectation Scale (Sheng&Chen, 2012:58), which has been shown to have good reliability and validity in previous studies, and this paper makes appropriate modifications to the scale according to the needs of the study. The modified scale consists of five questions with the specific statements, "When visiting museums, I expect to recall some experiences related to my own experiences", "I expect to feel passionate and satisfied when visiting museums", "I want to explore abstract historical knowledge when visiting a museum.", "I want to see famous artifacts up close and see historic and famous scenes.", "I would like to collect many meaningful souvenirs and preserve memories while visiting a museum.", "I would like to be recognized, for example, by visiting a museum with people who share my interests." Museum visitor experience questions were scored using a 5-point Likert scale (1=strongly disagree, 5=strongly agree).

(2) Sample and process

Participants were recruited through Credamo, an online research platform, for the questionnaire on the evaluation of existing facilities in natural science museums. Since the focus of this paper is on the orientation and impact of existing visitor facilities on the development of digital content, and the study was conducted with visitors who had participated in a field trip to the museum, the participants were screened by using the questionnaire's response limit function so that only those who had visited the museum could complete the questionnaire. After entering the questionnaire, participants were first asked to recall their visit and answer questions about interactivity, construal level, and expectations. They then completed the Construal level Scale and the Museum Visitor Expectations Scale and provided demographic information. A total of 418 questionnaires were collected, and after collating the questionnaire data, 18 abnormal data were found, so 400-questionnaire data were included in the follow-up analysis.

2.3.2. Results and discussion

By analyzing the total number of participants, 138 males accounted for 34.5% and 262 females accounted for 65.5% (see Tab.2-2 for detailed participant demographic characteristics). In terms of the number of museum visits in recent years, the frequency of visits answered by participants ranged from single to multiple visits.

Tab. 2 Profile of participants

Items	n	100%	Items	N	100%
Gender			Age		
Male	138	34.5	10-20	14	3.50
Female	262	65.5	20-30	230	57.50
			30-40	118	29.50
			40-50	24	6.00
			50-60	13	3.25
Interactivity			60 and	1	0.25
Graphic	199	49.75			
Audiovisual	64	16.00	Time of		
External URL	13	3.25	Once	53	13.25
Interactive resource	44	11.00	Twice	347	86.75
Interactive application	80	25.00			

As for the visitors' interactivity with the museum's existing facilities, a total of 199 visitors (49.75% of the total) chose the a. graphic content (photos/images/pictures) option, 64 visitors (16.00% of the total) chose the b. audiovisual content (audio/video inside the venue) option, and 16.00% chose the c. extended content (audio/video outside the venue) option for the external website 13 visitors (3.25% of the total), 44 visitors (11.00% of the total) chose the option d. Participatory interactive content (interactive images), and finally 80 visitors (20% of the total) chose the option e. Digital interactive resource content (VR applications), the option of option c, i.e. extended content on external sites (audio/video outside the venue), is the median option in the scale, i.e. 263 respondents rated lower levels of interactive display content (option a and option b) in their museum visit experience in recent years, with 199 of them choosing option a, the highest percentage of this group, indicating that to

some extent the existing methods of museum visit and the current display provided by museum still remains low interactivities(Fig.2-11).

scores for construal level

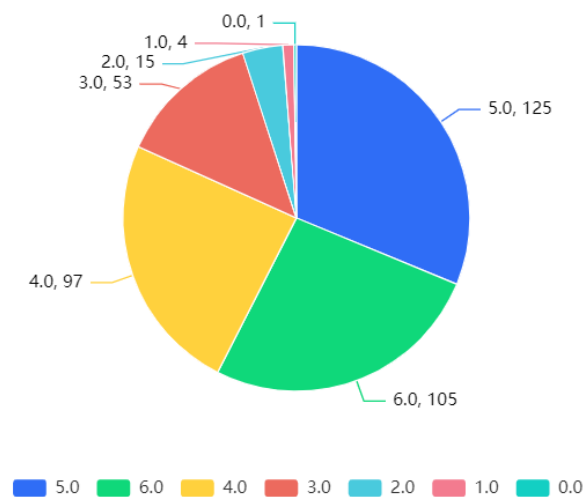


Fig.11 scores for construal level

The overall data on the evaluation of the museum experience from the respondents of option a. & b. shows that the evaluation of the museum experience from the visitors' responses is concentrated in the less interactive content.

Firstly, in the case of low-interactive content, access to information and understanding of exhibit content would remain at a lower construal level more specific and direct than in the case of visual and auditory-based approaches, and these findings are consistent with the findings of existing studies on the museum visit experience, providing a concrete and realistic basis for the proof of hypothesis 1.

According to the analysis of the respondents' choices, according to the definition of interactivity of the five museum displays in the scale, the scores from option. A to option. E were recorded as 1 to 5 as shown in Tab.2-3. To understand the respondents' overall impression of the museum visit experience, where the mean value was 2.36 and the standard deviation was 1.63. According to the analysis of the overall scores, the respondents' interactivity of the facilities provided by the museum during the visit experience was at a low level. The overall scores were analyzed to show that the respondents' level of interaction with the facilities provided by the museum was low and satisfied the hypothesis.

Tab. 3 Profile of interactivity score

N	Mean	Sample standard deviation	Variance of sample standard deviation	Overall standard deviation	Variance of the overall standard deviation
400	2.36	1.63	2.65	1.63	2.64

To verify the internal consistency of the scales, this paper conducted reliability analysis on the Explanation Level Scale and the Museum Experience Expectation Scale. The overall Cronbach's alpha coefficient for the Cronbach's alpha of the Explanation Level Scale was 0.6711, which indicates that the internal consistency of the question items was average, and the data reliability was acceptable, indicating that the scale has some extent of internal consistency (Eisinga. et al, 2013:638). However, the third option of the questionnaire "Restoration work in progress [single-choice] a. Removing dirt from the object to restore it /Removing dirt from artifacts b. Restoring artifacts and restoring them to their original state" The CITC value of is 0.2794, which is less than 0.3, indicating that the correlation between the corresponding item and other items is poor and there is room for correction or elimination. (Eisinga. et al, 2013:638).

Tab.4 Statistics of construal level scores

number	medians	average	95% confidence interval	Standard deviation	Minimum value	Maximum value
400	5	4.59	[2.00,6.00]	1.19	0	6

In the table for the analysis of the construal level, this was also measured by response scores, where a response option demonstrating a higher construal level was scored with 1 point, and a response with a lower construal level was not scored.

In the overall response scores (Figures 2-4), it is noteworthy that although the distribution of participants' responses to the interactivity of museum facilities was more concentrated on the low interactivity options, the overall mean and median responses showed higher construal level. In other words, the facility under the premise of limited interactivity, visitors will be associated with further psychological distance and more abstract things, their interpretation of things in the interactive limited facilities, visitors to the average and median show a higher construal level, the visitors will be associated with the more distant and abstract things, their attention or expectation will favor the longer term of choice, which satisfies hypothesis H1b.

The results showed that although the responses to the existing visit facilities focused on lower interactivity, the current visit experience generated a stronger level of deconstruction based on the results of the questionnaire, leading to a discussion about the meaning of the continued implementation of digital exhibitions.

From another perspective, do the above visiting measures cause visitors to show a higher construal level in the existing visiting experience due to the simplification of the displayed content or form, in another word, does the low interactivity of the existing visiting facilities helped increasing the expectation of visitors to a higher level of more complex content? The proof of this point of view will effectively address the future direction of digital museum content development.

Further discussions include whether digital exhibitions can facilitate the process of knowledge transfer: whether existing exhibits can be introduced and popularized in a way that is easier to understand and learn from, and that is worthy of application in the relevant evaluation and testing of

the effectiveness of digital exhibitions. It is worth noting that, due to external factors such as the technical limitations of the developer, it has not been verified whether the highly interactive visit, which is attended by 25% of the participants, is more intuitive and clearer than the traditional on-site visit. It would be helpful to continue the discussion of this result to verify the effect of digital presentation with control variables.

And in the expectation of museum experience scale, the overall Cronbach' α coefficient for the question and answer on the options of expectation of museum experience was 0.4577, indicating that the internal consistency of the question items was not convincing, and the data reliability was unacceptable. The CITC values for the entire total of six questions were 0.2707, 0.2038, 0.2401, 0.1744, 0.2559, and 0.2081, all of which were less than 0.3, indicating that the correlation between the corresponding question items and the other items was poor and there was a need for correction or elimination.

In summary, the overall data reliability of the questions and answers about the construal level met the standard and could be used for the subsequent analysis, while the overall data reliability in the expectation question of museum experience did not meet the standard and could not be used for the subsequent analysis.

Several limitations were identified in the expected questionnaire design, which could also explain why the study results did not support the hypotheses of this paper. First, the reliability of the results may be affected by the lack of differentiation of basic attributes such as education and region, incorrectly set question items, and a small sample size of questions.

At the same time, all participants were recruited through the same online platform, and future studies should target more diverse samples and groups. As a result, the results generated may not be representative of the general population of visitors.

At the end of the questionnaire, a total of 342 respondents selected two or more visit experiences, of which 11 were screened out for information that could not be textually analyzed, and a textual analysis of the respondents' reasons for visiting was conducted. This study attempted a multidimensional scale to analyze the respondents' reasons for choosing to revisit.

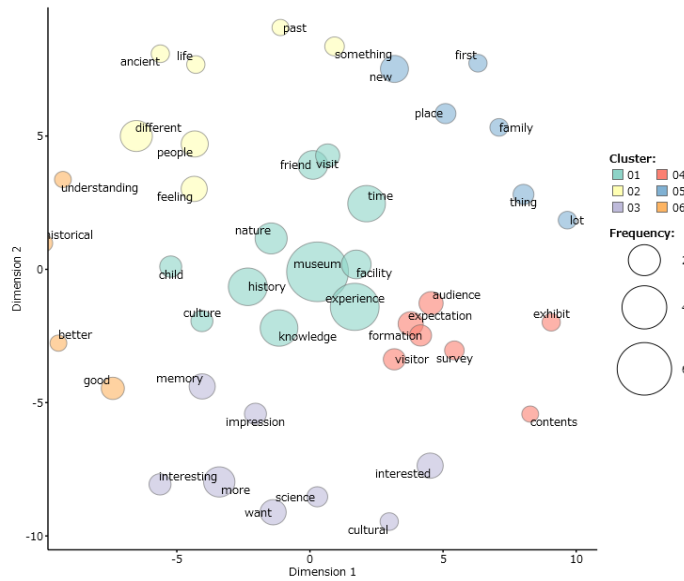


Fig.12 Multidimensional scales analysis of revisit reasons

As shown in Figure 2-12, the authors used the Ward method for text mining and the Jaccard method for distance measurement. A total of five clusters were summarized and presented on two different subscales, which can be interpreted as the horizontal and vertical axes of the coordinate system in the figure.

By interpreting the results for each cluster, the vertical axis can be summarized as follows: on the positive half axis, as the values increase, the reasons for revisiting tend to value past impressions and memories of the visit; on the negative half-axis, as the values decrease, the description of the experience focuses more on reasonable expectations and anticipation of the content of the visit.

On the horizontal axis, as the values on the positive half-axis increase, the reasons for revisiting the visit tend to focus more on specific furnishings and exhibitions; while on the negative half-axis, the reasons for revisiting the visit tend to focus more on the emotional description of the visit experience. As for each cluster, Cluster 1, the central category of the system, contains several terms with high frequency that are similar to the clustering results of the textual analysis of the visit evaluations. Similarly, the time spent with family or friends is the most basic and critical part of the museum experience. Clusters 2 and 5 show some of the points that visitors remember and are impressed by as a result of their visit experience including their choice to revisit based on a good rating of their first visit. Clusters 3 and 6 focused more on the content of the exhibits, including positive evaluations of exhibits and facilities, while Cluster 4 was more purposeful, such as conducting research etc.

Chapter 3

Conclusions

While the digital visiting experience has the potential for new technology adaptation and development, there is still controversy over whether the traditional visiting method retains the advantages of providing the conservation of valuable collections. The benefits and risks of opening and advancing digital museums provide rationale and objections to support or prevent these projects from moving forward.

The current impediments to digital museum advancement programs could be summarized into 3 parts: impediments based on the development of digital technology, impediments based on a transformation of operators' thinking, and impediments to visitor acceptance of digital exhibits.

The first kind of impediment is the investment of public funds in the digital protection of existing natural/cultural heritage based on the development of digital technologies. At present, public expenditure on the protection and restoration of the collections themselves is balanced in the form of income from exhibitions and entrance fees, while public expenditure on digital storage fails to reach a satisfactory input-output ratio for some projects (digital recording projects, etc.) that have been implemented for many years. It is necessary and reasonable for every citizen to protect these collections and cultural property first and foremost in itself, but it is also a cause for concern in terms of digital content derived from new technologies. The impact of this barrier is not only reflected in the formation and dissemination of public awareness of cultural/natural heritage but also ultimately leads to insufficient attention and financial support attracted by the project itself, where financial and technological constraints will determine the scale and quality of digital museum development.

Based on the second type of impediment is the transformation process in operators' and managers' consideration. Firstly, digital museums are also objects for all citizens, and public institutions such as museums need to make decisions in their best interests regarding the use of cultural resources and the well-being of citizens. Arguments against this development at the operator level include the possible impact of virtual museums on actual museum attendance and revenue, namely a reduction in physical attendance due to differences between digital exhibitions and traditional approaches. But instinctually, on the contrary, different from the traditional way of visiting, it can be used to meet the deficiencies of the existing museums in terms of educational function, and to supplement the existing museums by displaying knowledge in more diverse ways.

While understanding these conflicts of view, it is necessary to gradually introduce a definition process for developing relevant digital resources and to explain and define digital resources reasonably according to this process. The appropriate and feasible approach is to interpret and develop these digital resources in the form of licenses for qualified individuals or institutions in the form of collaborative or secondary creations. The actual interpretation of digital resources is related to the authorization of intellectual property development.

The impediments for visitors to accept digital exhibits, and how to achieve a balance between educational and entertainment functions, should be the essence of the development of digital museums. Therefore, new ways of better science education and learning will be the core element of digital development. Therefore, a pan-entertainment digital visit experience or even a game scenario application should not be the focus of these precious digital development content.

From the analysis of visitor experience in this study, it can be seen that the traditional way of visiting has limitations: including the limitations of place or time, other people around and the public environment, as well as the resources and content provided by the museum, etc. When the target people of the educational function of the museum lack the ability to learn actively, leading the related displays and facilities of the museum can only provide a pure entertainment and tourism experience.

Therefore, the development of a digital museum should first conform to its function of education and knowledge dissemination, and at the same time, it can adapt to social changes to a certain extent to enhance its internal motivation for transformation. Through the application of new methods and technologies to ensure that it retains the range of functions undertaken by the museum while expanding its influence and brand. In the context of rapid digital development, multi-sensory and multi-angle learning approaches are considered reasonable and effective, which will become the core of the future digital museum. However, according to the existing developers, the existing projects led by natural science museums do not meet the relevant elements for now.

3.1 Limitations

By examining the construal level of the on-site visit, hypothesis 1 could support the discussion about how a virtual visit could help enhance the experience, but it also has its limitations. First, this study only focuses on the development side of the digital exhibition planning and design and theoretical support of the museum, it does not investigate the threshold and difficulties of using these methods of visiting from the visitors' perspective and whether they can accept in opposite such a visiting method, etc. However, from the questionnaire, visitors are affected by the different ways of traditional museum visiting. Future researchers had the opportunity to refine this classification for specific exhibition formats and special exhibition equipment, and to observe all values in this refined range.

As mentioned above, this study has not conducted a controlled experiment based on the construal level theory in a laboratory setting to compare the interrelationship between traditional visiting methods and digital online exhibitions in terms of factors such as cognition, knowledge acquisition, satisfaction, and expectation. And these components need to be further explored in future studies.

In the subsequent study, the hypothesis could be tested by a one-way ANOVA with a modified questionnaire, and the test statistic F-value could be calculated and generated the p-value to help determine and infer from the results.

At the same time, it might be promising to have some test on the construal level, whether other activities of people during non-visiting time could affect their evaluation of learning-related content in visiting behavior. In addition, such as general visiting activities that do not require a complete

disengagement from the usual environment (i.e., visiting behavior dominated by traditional visiting methods). Some features which are mostly offered in digital exhibitions, may also affect the efficiency of knowledge transmission in digital conditions, then the impact of such participation in visiting activities could be measured. It is worth to have some further research on whether there are differences between the digital forms of visiting activities on knowledge acquisition and traditional visiting activities on knowledge acquisition. Second, there might be more variables that play a role in the visiting process in real life that is worth exploring.

From the side of public entertainment, the effects of the type of visitation activity, time of stay, travel companions, and extent on knowledge acquisition could be explored; from the educational side of museums, the mechanisms of action of the form of visitation other than knowledge acquisition, such as on daily life and creativity could be explored in future research.

3.2 Acknowledgement

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Appendix

1. Interview

1) Features and details about the VR exhibition

Q: the virtual exhibition on the website along with the previous photo is now being held in December, right?

A: For that, there are no specific details on the web page homepage right now, but I would like to hear from the doctor about the specifics of that.

We have six kinds of dinosaurs that we are using for the Fukui Dinosaur Expo, and we have asked a 3D artist to reconstruct them as they were when they were alive, rather than as fossils. The product is exhibited in the exhibition space, and the visitor can see it virtually using a browser or VR goggles.

I was also listening to a video library today, where there is an exhibition of over 1,000 videos, but it is not the same type of exhibition. The museum exhibits are all made in 3d applications, so the exhibits can be visited freely as if they were in a real museum, with captioned explanatory text and videos inserted in between, so that the dinosaur skeletons, 3D models, and explanatory text used by our experts can be exhibited together in a truly virtual space. The museum is a virtual space where dinosaur skeletons, 3D models, and explanatory text generated by our experts are exhibited together.

Q: Is the user's point of view the first view? And would you mind telling me about what is the size of the VR exhibition hall?

A: First, the first-view point is used. The dinosaurs will be about 10 meters long and 34 centimeters long, so the total size is 600.

Q: Does digital content demand the age of the visitor?

A: We are not limiting the age range of the visitors, but we are thinking of people who come to the museum. We send a variety of items so that anyone who really likes dinosaurs can get them. The explanatory text is designed for people in the upper grades of elementary school and lower grades of junior high school so that even adults can enjoy reading it and children can understand it to a certain extent.

For example, the explanation part, for example, what type of dinosaur shows the “Fukui value,” and how to display it, for example, by placing a clickable spot in the virtual space, and when you click on it with a plus button, the text will appear.

Q: The project that you just did, you do it online, right?

A: It's the same. Yes, there is no device requirement.

Q: To be more specific, is it required to have a VR device or not?

A: It's possible to do it just with a browser on a PC, yes. And I don't know if I can say that much about VR device compatibility on the first exhibition in December.

Q: Are dinosaurs and other natural objects could be potential objects in the Metaverse? But we are using only virtual ones. I'm talking about a virtual space that doesn't really exist in the real world.

A: Of course, there are virtual museums that convert real-life exhibits into 3D and exchange them online, but what I am doing is different from that. It is a complete Metaverse. The definition of "metaverse" is a bit broad, so I guess I'm just going to define it as it is: copying a real-life exhibition and putting it online.

If we are to divide the space into VR and non-VR, the virtual dinosaurs I am working on are completely existing. I create spaces by imagining them. And what's more, I am working on the latter as well, but what I want to do is to create a museum exhibition as an educational tool.

If museum exhibits are in Metaverse and converted into online content, how can we make what is not possible? I am trying to explore the advantages that can only be achieved in a virtual space, such as the ability to provide access to things that are normally inaccessible from distant islands, and I want to create a virtual exhibition. I want to create a virtual museum as a place of education and dissemination, not as a fantasy of the world of the past, but as a virtual space.

Q: However, of course, the Jurassic Park-like exhibits are also interesting and could be the subject of interest, so I am working on those at the same time, but they cost a lot of money, so I can't create all the vegetation and the natural environment. So, we have not made that much progress yet.

So, I don't mean to be lenient on that side, but that side is already being sent out ahead of time. I know a bit about museum curation, and I have experience in that area. I'm going to put it all together at the meeting and write it up as if it's ineligible.

I have a virtual dinosaur exhibition that is open to the public and anyone can enter, and I think the point is the same as the virtual dinosaur exhibition. We have a symposium once every few months or so, but the photos appear regularly, and we have a symposium in the Kansai region, where we discuss with those who come, for example, the current digital issues and future challenges, and what fun about that.

I went to Laos once to see the number of dinosaurs, and I had a chance to visit a museum there. I'm using Unity 5, the latest version, from a project I've been working on.

2) How to treat the problem the competition might happen two choices?

Q: Do you have any idea if this might happen in the future that such kind of exhibition will allow us to see the distance that the dinosaur is living, not just the feelings of living, the realism, and not just the museum, for example, the researcher's recommended course of action?

Not only that VR but something that feeds it back into the real space.

A: For example, if you go to the Fukui Dinosaur Museum, you can see the traditional life of dinosaurs in VR, but if you go to the museum in person, you can also see the real life of the dinosaurs online.

The Dinosaur Museum and the Virtual Dinosaur Exhibition are operated separately, so there are no plans for direct collaboration between the museums at this time. In the future, for example, the museum will be virtualized, and the 3D model of the Fukui version will be used in the virtualized museum. We would like to increase the number of exhibits and enrich the contents by adding a 3D model of the dinosaurs as they were when they were alive.

Q: Next, we saw the wall-like devices in the museum today, and I would like to add more realism to these devices, for example, there are two screens that are not being expressed. The reality or immersive experiences that Dr. Imai has achieved online this time, compared to existing facilities, for another word what is the prospect and goal for the special VR exhibition?

A: That's true. Some of the exhibits that exhibiting nowadays, the things that could not be described as "can be expressed." But the future we want to achieve is different. First of all, in VR space, you are not allowed to touch the exhibits, so the exhibits must be put in close proximity to the visitors, and you have to be able to see and touch the exhibits. There are also restrictions that prevent visitors from looking at something up close or from various angles in any direction they like. However, if the exhibits are displayed virtually, the visitor can see the details of his or her question, and the interaction between the exhibits and the visitor can be increased.

In addition, it is very easy to update virtual exhibits. And especially in the case of dinosaur research, if research progresses in a few years and the exhibit needs to be changed, the virtual model can be changed immediately without spending a lot of money. If you go to the wall and replace those images, it will cost a lot of money, but with virtual screens, all you have to do is leave the data as it is and insert the data for the commentary.

But with virtual data, all you have to do is just leave the data as it is and insert the data in the commentary. Next, if you go to a museum and you see a documentary that shows the process, for example, the how reservation process will be changed immediately, won't it? That is why the museum

industry has the necessity to engage in 3D virtual and 3D programming, not only the dinosaur museum, or customer service.

3) Questions about digital museums in Japan

Q: Now the dinosaur museum has the goal of turning into a digital museum.

A: That's what we are aiming for. First, the Museum has recently been scanning the excavations and making them accessible to the public. The first purpose of this is that once a fossil is excavated, the information about the time like when it was excavated and scanned. As a leader in this field and being the information director at the time, I am looking forward to these projects which aim at that information.

I think there are an increasing number of museums around the world that are willing to release them into the public domain and allow anyone to use them in any way they like. But, at least in Japan, museums are not going in that direction, because they have rights to the stores, copyrights, and other property rights, and we are still trying to sort that out legally. We have data, but we are not in agreement on whether it should be made public or not. I personally would like to do so, and I would like to make it available to the public, but we are still in the discussion stage, and it is a little unclear whether it will happen or not. I know what I can do, but I just don't know how to do it.

Q: What's your opinion about the intention of visitors in the context of the digital museum?

A: I think that the number of visitors to the museum on-site will decrease because there might be a trend that everyone is looking at the 3D data that has been released. Considering those I've mentioned, there are some people who don't want to release the museum's dinosaur exhibit data, which is a regretful result.

In addition, customers simply stopped coming to the museum, and the point is that if they could see everything, they would not come anymore.

Q: But now, the flow or trend of visitors to museums has been returning since there is no more travel restriction, and for today's situation, there may be a bad situation with the development of VR technology.

A: In that case, I'm sorry to say that since the announcement of the VR exhibition that will be held in December, we have already decided on the contents of the exhibition that are expected, for example, from other people, such as tourists, researchers, and other people.

Q: There is some feedback or request from those fans or supporters during the process?

A: Actually, somehow it arouses some attention of the public. And there are people who are particularly interested in the VR project, who have sent me an e-mail, there is a situation where, you know, I'm just trying to get some coverage, because I don't have anything specific (financial support). I'm currently on social networking sites, so I've received some requests for interviews from the media, and I've received replies on Twitter and other forms of social networking sites saying, "Please do your best and I'm looking forward to seeing what you do."

I wondered if there would be any specific requests, such as "I would like to see a Tyrannosaurus," or "I would like to see a major exhibition of famous dinosaurs," but surprisingly, there were not.

Q: Dr. Imai, how many times would you hold the VR exhibition in the future like you just held in December?

A: There is no certain answer about it because the preparation of virtual exhibitions is difficult, this is the first time we have had to spend money to create a full-scale Fukui Virtual Dinosaur Exhibit of high quality.

Q: How these could be related to the educational field?

A: Also, as I mentioned earlier, I think this could be very useful for some undergraduate training. Our museum often shows existing exhibits and special exhibitions, so we can show them and do something new with them. If anyone can actually make what I am making in a virtual space, then I will give you a few more examples of how I am doing it, so you can create your own original exhibits. I think it would be more useful in terms of location-based training.

I don't know how it can be put to practical use, but I think it's going to change gradually. I am also a bit prejudiced against people in their teens and older, but I think people in their 50s and older may not have enough knowledge about this kind of thing or maybe a bit prejudiced. I think we will be in a situation where people like us will be able to join the ranks and change some mindsets.

At the dinosaur museum, one thing that I think is particularly difficult is intellectual property rights, and the prefectural government is going to change. To obtain the rest of the skeleton, a replica is made from a fossil found in the past, and the replica is used to make up the rest of the skeleton. Then the replica is copyrighted by someone on the ground, and it's another matter to make use of it and publish it online.

If we are very strict about this, we cannot release the replicas to the public until only a considerable number of them have been numbered. If we are going to be really strict about this, we would like to have a large number of items as the result of our research.

Recently, in the contracts that we have signed when we are asked to make replicas, we are told that we must not scan all the replicas and that we must inform the museum of each policy when we release the replicas to the public, so that part is relatively clear. The old one, about 3 years ago, is not supposed to do that, so they are trying to sort out how to do that.

Q: Can I ask you two questions about your work? The copyright part, yes.

A: I am very deeply involved in this project, and I appreciate the fact that Creative Commons is very clear about this. I'm reading the 3D data in the papers, or the photos, etc., which are published in the Creative Commons, or the data that researchers are using for their own research, and I'm having a lot of trouble.

But for museums, we have to talk about whether to create the data in the first place with the help of cooperating companies who basically tell us that the data will be given to us by Japanese museums. I think it's a good thing that they're sorting out these rights, but at the moment, the cleat commons issue is changing a lot, and not many people are aware of it. The researcher's rights are included. But if the person who made the copy or the organization to which the person belongs makes a decision and does something, then yes, it is in the public domain.

Incidentally, there is, however, another problem with this, which is, of course, if it comes out, that's fine, but it breaks up into pieces. It is the researcher who restores it. The question is whether the restored object is a natural object or a work of art. But the problem is that there are countless museums around the world plus private companies that make these replicas, and yes, there are. Then perhaps in the contract, it doesn't say who the rights belong to for the replicas that have been made. If it is a commissioned project, it is usually interpreted as the property of the museum, but there are cases where it is not clearly stated.

Also, it is still fine to have one consignee, but if several consignees are involved in a project in which they separately make replicas of various objects and combine them, or if they make a new replica based on an old one and use it, it is difficult to know who has the rights to it.

I don't want to investigate museums at all, at least not by the proper means, and I don't want to know who owns what in a museum, who has the right to display it in a museum, who has the right to display it in a museum, who has the right to display it in a museum, who has the right to display it in a museum, and who has the right to display it in a museum.

If it is not, there should at least be a guideline to prevent it legally or at least a guideline that says, "Let's go back to the past and look at it this way". Ideally, there should be clear rules for each individual specimen. So, in order to unify all the specimens, we need to have the copyrights and policies in the catalog.

We will start with two types of exhibits, which will be open to the public completely free of charge, and then we will find out the response of our customers. We will eventually have 6 types of exhibits and charge a fee for them. We will also continue to update the exhibits while receiving a certain amount of money, and we will also consider a registration system.

In the case of Japan, the term "heritage manager" is often used to refer to a square of cultural properties and buildings, but in a broader sense, if we are talking about intangible items, they should also be included in the list. Heritage management is not just about contributing buildings, yes.

Q: From the observation, it seems that the museum is playing a role in recreational functions.

A: Yes, I think that is because there is no demand for it. In the U.S., museums are places to learn, but in Japan, they are more like places for fun and sightseeing. I think there is one solution to the problem of sharing educational material tasks, although there may be problems with copyrights in the future. But in the end, they are animals, so the point is, what is it?

But, as a fossil, it is not good to copy it, but since it is an ancient creature, it is possible to clear the copyright if the CG data of a craft that does not exist in any museum is created and used as educational material, and if the person who created the CG data does not tell anyone, it is possible to clear the copyright if it is registered. If the person who created the CG data does not tell anyone, the copyright can be cleared. I don't know.

Strictly speaking, it's not that far off, so as long as we can't clear up the copyright issue for educational materials, I think we have no choice but to make them. Fukui has been awarded the title of "Dinosaur Prefecture," and although science education using dinosaurs is exceedingly popular, there are people who find it difficult to visit museums, especially in the other region, which is far away from this city. So, I am making this project with the aim of making it possible for people in Fukui to participate in cooperative projects since they are so unique to Fukui.

4) The details about designing process

Q: What about the current state of virtual space designing and the engine which was used?

A: Now that I know what Unity is, I will be able to see the UD software and its software on Unity, and I will be able to see its skeleton and the processing of Unity. I created the exhibit in Unity space for free and made it available to the public. However, I think that the part I just did may have been transferred into a similar game or something like that, that is what I've been worried about.

But from another point of view, I am using it simply for that purpose, from the point of view of being able to design my own 3D space to see what I can do with it. I am not releasing the Unity data to the public, but only the space created on the virtual SNSCluster, so it is not possible for someone to use my data to create a game. By the way, I don't want to simply make a game, but I can make a museum exhibit that I can make by myself.

Q: Since unity is a popular engine for virtual content, would it be disordered?

A: What I think is good about that is that I don't have any knowledge of software and I only have knowledge as a curator, so what I am doing with Unity is basic stuff. People who like dinosaurs can enjoy making their own original exhibits, and people who are trying to become curators can use the Unity system. It would also be a great opportunity for those who are trying to get a curatorial license to use the Unity system to create their own exhibits and practice creating exhibits with each other.

I'd like to do this, but I'd like to have a deeper conversation with the people who are involved in the promotion of tourism, and with special museums. In addition, the public data is not yet well developed in Japan, and there are no museums that are willing to take the initiative in this area.

If the Agency for Cultural Affairs or some other organizations were to push for such a move but there are probably no museums in Fukui Prefecture or other local governments that are willing to make such a move to open data on their own.

So, if this museum handles fossils, I'd like to try it, and even if it doesn't, I'd like to know what kind of display measures they are taking as a museum. However, a museum can't do something experimental and one step ahead like this, because it doesn't have the budget or the actors to do such a thing. So, I think it would be better for the museum to take on this kind of challenge once at the university.

Q: Maybe I would like to mention some of the open-source issues that Mr. Arai was adding earlier. Now I have a question about something that was offered to the students in the VR space creating.

A: There is a class about the VR building, and there is also a computer service there. I would like to introduce you to what kind of content was included in the VR Center, and what kind of design system

was provided for the students. First, the Fukui Virtual Sharing, which I mentioned the other day, can be used in public lectures and general education courses for students.

Q: But how do you show it on the screen in the university and give an online tour?

A: One of the things we are developing now is a virtual tour of dinosaurs, and another is a symposium on understanding virtual paleontology, which I think could be introduced at the symposium. The students can compare the skeletons of dinosaurs with each other and learn about living creatures, including dinosaurs, of which there are many different types and names. For example, there are many different types of dinosaurs that cooperate with each other, and they have different names, but why are these dinosaurs different, and why are they different? However, the bones are large, and it is not possible to do this anywhere, so the concept of healing them in a virtual space was created to repeat the process on the spot.

Q: By implementing these items, do you aim to utilize them for academic purposes or for the Dinosaur Excavation Museum?

Yes, the project can be used for joint museum seminars and seminars for the public, but the museum already has the real thing, so yes, it can be used for that. But museums already have the real thing, so, yes, they can be used. Some of the visitors do not have such a large budget for tours to museums, and of course, there are not many countries that have dinosaur skeletons for junior high schools and high schools. We can provide one or two real dinosaur skeletons, of course, but the rest can be used for general training.

Q: Is there something that you are not able to receive, something that you are cognitively manipulated, something like open-source open space that is provided to you?

A: I don't think there is anything that students can do spontaneously. I don't think so. As far as I know, the development of digital data for teaching materials and academic purposes has just started among faculty members, and there is no movement among students to voluntarily do something about it. One of the reasons is that we are in the natural sciences, such as dinosaurs and life sciences, and we do not work so much with virtual technology, which is more engineering-oriented, so there is a gap between the two. We can approach people in the engineering field and say, "This is what we are doing.

I am not very familiar with or good at dinosaurs as living creatures, but if there are people in the field of CG design or art who would like to try their hand, I would be more than happy to help. I was hoping to be able to do such things in the future, especially in museums, where knowledge of spatial design, architecture, and various engineering aptitudes is essential. We curators and researchers don't have such knowledge, so we are hoping to find someone who can act as a bridge between the two.

I know how to show them in a way that is easy to see and, conversely, I know that it would be nice to do something that cannot be done in reality, so I can realize it virtually, but I can only do it if, for example, the entire exhibition, which is still on the screen, is immersive with a space and VR goggles on.

But, for example, this is a space with VR goggles on, so you feel immersed, and when you are alone, you can concentrate in a space where you can calm down. I was asked what the point is of having a VR space, and I said, "It has to be a museum or a private company that can design a museum. There are about 3 companies which are 3 private companies that can join the design project of the museums.

What we would like to do is to work with students, rather than private companies, who specialize in technical fields such as space design, and have them create a version of the ideal museum they would like to create. That kind of graduation project. If we do this, they will learn a lot, and we will also be able to get into the character of the museum and see if we can make it look like a museum.

Q: Lastly, there is something I would like to confirm in terms of reality. Can the MetaQuest 2 device be used?

I'm uploading a virtual education system called Cluster, which is like a virtual SNS Cluster chat room. it's the same service, yes. I can use the same service without any advice from the user. If you have that, you can use MetaQuest to make online calls. Anyone can use MetaQuest or something like that to get in there, and the cluster is standard support, so yes, I'm not doing anything special. There are some platforms for VR chatting.

5) The recreational functions of museum that related to tourism industry

Q: The next question is about tourism for example, do you want the part Dr. Imai just did, to be a recommendation by that representative to others, or do you want it to be a share? I would like to make it the former, but what I would like to see is the introduction of Fukui's dinosaurs to people all over the country and the world.

A: I understand that this is because we want to introduce Fukui's dinosaurs to people all over the country and the world, and we want people to come to the museum to see the real skeletons and fossils that have been found.

Q: Now, with the project of Dr. Imai, which part is putting the most attention?

A: I would like to put more effort into it because, for example, I am a researcher and a curator, and I want people to go back here and have a revisit just because they were impressed by the experience. I

don't want people to visit the museum just because they were impressed by the curator or the researcher, but I want them to learn something about what was amazing about the exhibit, or how many dinosaurs there were, or something like that.

Q: What was interesting to me was that the museum was still struggling with the issue. One thing that was interesting to me was that museums are still struggling with the question of whether to actively develop virtual museums, and I think it is the same for all museums in Japan.

A: Yes, that's true, first is that legally, there are no copyrights about this cultural or natural heritage yet, and the objects are not in accordance with the original legal materials, so they are still being put together as they were in the olden days.

Q: Would you mind please introducing some extreme examples about how normal you think that by showing more content, more people will come to the museum?

A: That part is also true. One of the reasons why people don't come to museums is that they don't know about them. Even if we vaguely tell them that a dinosaur skeleton is big and amazing, many of them say that it is not that big.

The most important thing is that they don't understand the appeal of robots and living creatures, or they don't understand how powerful they are and how many interesting things there are. I think it is a great way to communicate that the place is interesting and that it is like this, so I think it would be strong to use virtual technology to convey that kind of information in advance. It would be a great opportunity to raise expectations before coming, to learn in advance, and to see the real thing when you go there.

Q: If the two are mutually reinforcing, it would be a mutual complementation, wouldn't it?

A: In other words, the virtual content can be used in a variety of ways, and it can be used as a virtual exhibition of dinosaurs. But if you put a touchpad on it, for example, and put a model of the same fossil there that you can click on interactively, you can zoom in on what you want to see, and people all over the world can see it more comfortably. In this sense, it is possible to use the data that should not be created as a single piece of data, so that, for example, just because you have created a virtual model, it is not the end of the story. It can also be used before and after an exhibition and can also be used in places where there is no exhibition.

Q: How about the communication with the operating side?

A: In terms of being used in various places, I think it has tremendous value for museum management, or even just in terms of simply letting people experience it. The Fukui Virtual Dinosaur Exhibition is organized as a committee separate from the museum.

I am also affiliated with the museum, but in a sense, I am also a member of the museum, but in a dual capacity, so in that sense, the museum staff is also talking to me, and of course, I am talking to them about what we are going to do. But, you know, it's a public facility. The museum is a university, and as a corporation, we are not exhibiting the skeletons. We will display only a biological model of the living creatures, but even that will not be very colorful, so in that sense, it is still difficult for a museum to do something on this scale, at least at the dinosaur museum.

So, when the lead professor said, "We are going to do it," he was a bit forceful, so I thought, "What happened at that time was that it was difficult for people to visit the museum in person. I think it is something that should be welcomed by the museum as well, but it took a lot of effort and rooting around at that time for everyone to think about it. As I mentioned earlier, if you say the word "virtual", people will stop coming to your on-site visit. If I show them the virtual content first, they may not come even if they look satisfied after that.

There were some people who said, "Well, if we show them the virtual exhibition, they will never come again, even though they may look satisfied with it. As a researcher, I think it is important for us to provide information to visitors and children as far away as possible.

We want the visitors and their children to enjoy the simple fact that they are bored by the Corona disaster, such as science education and other such activities. However, if we consider the various aspects of tourism, it is difficult to make progress on that basis alone, so it is difficult to make adjustments.

Q: I was a little concerned about how the museum would return to its original state after the Corona recovery. However, the number of live performances is increasing, especially in the field of music, and of course, the charging of fees is progressing, etc.

A: Yeah, but when that happens, it may be good for the organization, but for the local economy of the main hall and the surrounding area, it is not necessary for people to come to the hall. If it is all done online, I wonder what will happen to the transportation system, but I think it is a good thing that people have more choices.

Q: Do you think online concerts or presentations have an impact on the museum's digital exhibition format?

A: In fact, people who are elderly or have disabilities can enjoy the convenience of a PC or smartphone. I am not an expert in this field, so this is simply my own feeling, but I used to enjoy going to places where music was performed, so I think it would be great if people who enjoy music could also enjoy it. So, I don't know why it is that concerts like that are held in the name of a museum, but recently, with the advent of virtual or online distribution, the funding has gone down, for better or worse, and the cost has gone down. The money has gone down, and especially in the case of parks, you can enter the parks for free, or you can do professional concerts for as little as 1,000 yen for 10 days, which of course is very important for the money. But for me personally, the space is impossible for professionals to do it.

So, personally, I think it would be good if the online content could be taken away a little earlier, and if not in terms of cost, then maybe a usage fee would be acceptable. I think it is important for both parties to have a fee for the content, but I think it is important for both parties to have a fee for the content so that they can continue to work together.

I have already done it many times myself, but how I do it is not by creating a virtual dinosaur from scratch like this one, but by using online skeletal data of dinosaurs that are available under Creative Commons. I downloaded some skeletal data of dinosaurs that are available online under Creative Commons, which is copyright free. Also, something more and more, the same, but tourism, the promotion of foreign countries that are receiving this training, the ideals of the staff members and their advancement, and the promotion of local tourism through public-private partnerships, like the Hachiko statue, is progressing.

Q: In order to show the public why is emerging what content should be involved in promotion?

A: We would talk about the sharing of the data as mentioned earlier, and finally, we talked about the problems and future issues that need to be addressed, such as the discovery of fossils and the use of the data for educational purposes. Dinosaurs are still very popular among a wide range of people, from young children to the elderly, so people wanted to see them.

Q: However, the current virtual technology is not so friendly to such people.

A: I would like to introduce that part by talking about some of the issues that need to be addressed in the future and some of the challenges that lie ahead, and I'm sure we can find something else to talk about.

It may be easier for the prefecture to move forward with such a form of challenge for the museum, especially since our museum is a part of the tourism department, which makes it difficult to brand the museum. When it comes to educational dissemination, it is easier for the universities here to take

action on the space issue. The museum is a tourist department, so it is not a tourist attraction. Museums are the tourism sector, so they are often attached to tourism, but other places can be more open to the public.

The museum is connected to what kind of department, and it depends on the individual museum and the municipality. The governor is not directly under the education board and the governor is not directly under the education board and the governor is not directly under the education board and the governor is not directly under the education board and the governor is not directly under the governor.

6) How can we sustain the cultural industry?

A: It is true that the policy is to digitize and monetize more, but it is not that simple to say that if you digitize, you can monetize anything. However, the people who are involved in this project need to do something about it. It is not just a matter of making it cheaper and how to lower the barriers to entry.

Recently, I have been giving online lectures, and some customers sometimes ask me, "Is it OK that it's so inexpensive? As you can see, a fan told me that his talk was very interesting and that he really appreciated that it was free and that he went to a lecture like this one the other day and honestly, the discussion was not interesting and not good at all, but he got paid.

The point is that normally, people pay a certain amount of money for lectures, so they can choose the lecturers they want to attend. So now, with the online distribution, the threshold has been lowered, so the people who do the lectures are more careful, even if they are not satisfied with the quality, they are paying for it. But now I realize that I can listen to them even though I don't pay them and that I can't work for money.

Q: Is there some consideration about portable devices that changed the method of visiting?

A: I understand that our generation can do anything on their smartphones, so they can look things up on their phones and do things like this, but for children and people in their 60s and older, asking them to say something on their smartphones is a hurdle. It's hard to make the transition to digital, but it's not easy.

Especially at our large scale, we used to have about 15,000 visitors at the most. It's too risky to say, "I'm watching various contents while holding my phone and clicking away," but it's too risky to be fooled. Another thing is that I have recently been there, and I think it will change from young to old, from grandparents to children, but the virtual hurdle is still high.

So, it is difficult to introduce such a system unless we can make it so that people can easily see something like a newspaper or other digital content without using their phones or other portable devices and without having to stop walking.

I also realized that it could not work for money, so it was the same thing. I think that people in the psychology department will investigate this, but I think that the level of understanding will change depending on that. I am sure that people in the psychology department will investigate this issue in the future, but I think the level of understanding will change accordingly.

Q: How were the content and its exhibit method decided?

A: At first, I was thinking of the next stage of development, but when I talked to people in this field, they said it would be too expensive, so I decided to reduce the quality a little and make it smaller so that people can just view it on a computer with a browser.

We need to make a more robust application, and then we can make a large number of applications, for example, and then we can monetize them, or we can have a larger, higher-quality application.

I have been working with a person who has his own company in Tsukuba and who is an assistant professor at our university. He is a visiting professor at our university, and I worked with him to set up a dinosaur laboratory within his venture company.

The point is that our intention was to use digital technology to promote dinosaur research and dinosaur education, but now that we live in such a world, the first thing to do was to ask what a bar is and how to convey the appeal of dinosaurs without leaving home. This project itself was started with the idea of communicating the appeal of dinosaurs without having to leave home.

Before that, I especially myself had no resistance to the virtual world because I was a creator, but it wasn't until recently that I started to use it to my full advantage. However, the idea of creating a virtual space and making a new version of Metaverse from scratch would not have emerged without this kind of situation.

Q: I am not familiar with such technology, but was it used for archiving purposes as well?

A: I suppose the purpose is different, but the current trend in Japan and around the world is to make things virtual, do you think that this technology was originally used for this purpose?

As far as I know, the American Museum of Natural History and the other Museum had been exhibiting 3D models of the 3D military technique to some extent before the museum was temperately shut down

because of the Corona pandemic, and the key to the individuality and engineering that deals with fossils are that it is a discipline that cannot be established without foreign objects. The key to engineering is that it is a discipline that cannot be established without foreign materials, so there was a problem with how to preserve the good things, how to share them, and how to study them together after all.

In the past 10 years or so, with the spread of scanners and CT scans, there has been tremendous progress in this area, so yes. I think it was a natural progression for people to think that since they had spent a few days with the object, they should share it with the public, or virtualize it and share it with others.

Q: The real advantages that facing with the designing process and how has it helped change people's opinions?

A: I think the reason why there was such a wave of people saying that objects exhibited in museums were too large, too fragile, or not to be touched easily was because they solved the problem of seemingly minor scratches.

For example, if you have a mathematical formula, or if you have to write something, or if you have a document model that is so small that you don't need to carry it, you probably don't have this much 3D technology, but for a skeleton or another thing, you really need to have something at hand. In that sense, the demand was great.

I think it would be good if such things were shared more publicly. I hope that this kind of thing will become more shared and publicized. I'm of that school of thought, too, but I think it would be good if children could easily create a space like that and make it their own favorite. I think it will be a good way for children to learn more about the museum.

And museums and art galleries are no exception, but they are still far away from us. I think that museums for tourists, where people go to study and visit to see things, are very much in tandem with tourism.

Basically, museums have a formal image and are not very close to people, so if we can find something we like, by combining and exhibiting it, and if play can be used for education, the fun and enjoyment will increase. I think the use of such technology as an educational tool for spreading the use of technology should increase.

Therefore, I think it is important to create a space where people can show what they want to show by creating their own exhibits and to create a space where people who love making things and who are not familiar with such things can enjoy making things.

Q: Since it is a great symbol of Fukui Prefecture how VR exhibits would generate pride or awareness for local people?

A: It's not about restoration, but more about the idea of how to present and create a system to continue the intangible and tangible heritage in society. I am concerned about the theme of "currents" because it is easy to understand and popular on a large scale, and it is not unreasonable for me to think that I am not very interested in this theme. I am not sure if the local people's awareness of this issue and whether they really care about it is small, but I am glad that it is getting so much attention. I am happy when people pay attention to the fact that they don't really value it, and I think that's exactly the case.

I think this is exactly the case. I am happy that Fukui is known for dinosaurs, and I think it is a good thing that Fukui is famous for dinosaurs. The Dinosaur Museum is a wonderful museum, and if people from outside the prefecture tell people of the generation with children and people from outside the prefecture that they often visit the Dinosaur Museum, they will say, "That's a great museum."

If people from outside the prefecture say that they often visit the dinosaur Museum with their children, they will say how wonderful it is, and it will make them proud. But it is true that people in Fukui do not have that kind of awareness.

If the people of Fukui had that kind of awareness, I think they would have been shaken by the local tourism. I think that's the kind of feeling. I wonder how many people are proud of the teachings of Fukui Prefecture and their own hometowns, and how powerful they are.

Recently, when the contract is signed, it is often accompanied by a contract that prohibits the acquisition of any data, such as training in making replicas based on the original.

There is no prohibition on replication that must be removed, but rather replication.

However, when we receive evaluations from overseas, we cannot find any indication that overseas people are willing to take care of such a large amount of data.

I think there is a difference between the Ministry of Economy, Trade, and Industry (METI) and the Ministry of Education, Culture, Sports, Science and Technology (MEXT), but I have the impression that even the national government is not aligned with the National Museum of Nature and Science, which is the rightmost organization.

2. Questionnaire

Questionnaire for on-site visits(Dinosaur museum)

Request for Questionnaire on Visitor Experience and Expectation Formation by Museum Facilities

Thank you for taking the time to complete this survey about existing facilities for visitors. Please allow 8 minutes of your time for this questionnaire

Which of the following applies to the content displayed in the museum building?

- a. graphic (photo/image/graphic) [☐].
- b. audiovisual (audio/video) [☐].
- c. external URL (audio/video) [☐]
- d. participatory interactive (interactive graphics/infographics) [☐]
- e. interactive resource (audio/video) [☐]

1. watching the gestures of the dinosaur robot

- Seeing moving claws and tails [☐].
- Thinking paleontology is back [☐].

2. Watch the introductory video of the exhibit panels

- Moving fingers, touching panels [☐]
- Learning and discovering for knowledge [☐]

3. Listening to the audio guide on the display

- Following the introduction [☐]
- Deepening knowledge, satisfying curiosity [☐]

4. Dinosaur prey scene

- Chewing and swallowing [☐]
- Taking nourishment [☐]

5. Dino cleaning operator at work

- Removing dirt from fossils [☐].
- Restoring fossils and preventing decay [☐].

6. Signing with the stamp mark at the Dinosaur Museum

- Writing down in a stamp book [☐].
- Making memories and memories [☐].

7. Seeing the dinosaurs from the movie "Jurassic World 3" at a special exhibition

- To memorize the plot and scenes from the movie [☐].
- To arouse interest in dinosaurs [☐].

8. Taking pictures of fossils and reconstructed models

- To press a button [☐]
- Capturing a good moment [☐].

1. while visiting the museum, I expect to be reminded of some experience related to my experience.

a. Totally disagree b. Disagree c. Neither agree nor disagree d. Agree e. Very much agree

2. I expect to have positive feelings of passion and satisfaction while visiting the museum.

a. Totally disagree b. Disagree c. Neither agree nor disagree d. Agree e. Very much agree

3. I expect to explore abstract and historical knowledge while visiting the museum.

a. Totally disagree b. Disagree c. Neither agree nor disagree d. Agree e. Very much agree

4. I expect to see famous fossils up close and see legendary scenes.

a. Totally disagree b. Disagree c. Neither agree nor disagree d. Agree e. Very much agree

5. I expect to collect many meaningful mementos and preserve memories while visiting the museum.

- a. Totally disagree b. Disagree c. Neither agree nor disagree d. Agree e. Very much agree
6. I expect to be identified with, for example, visiting a museum with others who share my interests.
a. Totally disagree b. Disagree c. Neither agree nor disagree d. Agree e. Very much agree
1. [Age] a. Under 20 b. In their 20s c. In their 30s d. In their 40s e. In their 50s f. In their 60s or older
2. gender a. male b. female
3. Where do you live? a. Outside the prefecture...prefecture [] b. In the prefecture...city [] 4.
4. Who or what group of people came with you to see the exhibition?
a. Solo traveler b. Couple c. Family [] person d. Alumni association, etc. [] person e. Club activities, etc. [] person f. Other group, organization, etc. [] person
- How many times have you visited the Dinosaur Museum?
a. First time b. Two or more times → Reason for return visit [].

Thank you for your cooperation!

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