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A Study of Local Culture Redesign and Digital Sharing Model

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***Abstract*—One of the most important assets of a town or city is its local culture. With the technological advances and the influence of the open source concept, the pattern and responsibility of culture digitalization need to keep pace with the times in order to meet the demand of different generations. In the past, the digitalization of cultural contents mostly focused on preservation and repository. Original antiquities, writing arts, photographs and image, audio/video, navigation websites are preserved in a passive way. Due to the fact that 3D prototyping techniques are getting more mature and popular, the purpose of this study is to extend the concept of digitalized cultural contents and to proposed the design applications and digital sharing models that are based on the local culture. Firstly, local elements are extracted for design creations and then 3D models are aggregated into digital works. Several new curtain rod end caps and tiebacks that are equipped with the Taitung elements are developed by this model. A database that has dedicated Taitung culture elements is also established on a globally well-known 3D model open source platform. With the Internet's characteristics of no boundary, those people who are not able to visit Taitung by themselves can see Taitung culture and antiquities. They are able to get three-dimensional perception of the external details and cultural implication of antiquities. They can also download to print the antiquities so that they can freely apply to the layout and decorations of their houses.**

This study extends the open source and sharing concept from the engineering field to the cultural scope. This new way of thinking allows more people to see and apply local cultural contents. The value of a land can be rediscovered in order to construct the unique "digital experience of local culture" that breaks the divide between existing urban and rural regions and flips local cultural industry.

***Keywords*—Local Culture, Open Source and Sharing, 3D Printing, Taitung, Curtain Decoration**

I. INTRODUCTION

Introduction section should present the background and the aim of the study. Please explain why this Article is important and/or interesting.

The coming of the digital era has already changed people's living style. The way how local culture is preserved and its meaning are affected as well. Cultural assets can be preserved and exchanged by digitalized techniques and the digitalization of local culture has become one of the main studies for this era.

Since the last decade, the ethos of "digital fabrication tool" and "open source and sharing" has become the new trend in this industry. Corresponding to the advances in the digital tool and technique and the concept of open source sharing, cultural contents need to keep pace with the times and press close to the common people life so that life is culture and culture is life. Nowadays digital fabrication tools have evolved to be more downsizing, affordable, and popular. Users are allowed to download files freely and 3D model open source platform that allow free printing are also rising and flourishing. It gets more common for users to download an object in order to print by themselves. To this day, there are already dozens of 3D model open source platform domestically and overseas. However, those files are nothing else but figures, mechanical parts, living tools, etc. The scope of application is beyond those in the past. Nonetheless, the content of local culture is seldom used as the target for digital fabrication printing.

Taitung has abundant natural products and diversified humanism. However, its geographical location is remote so that it lacks the digital resource and information as compared to other cities. Therefore, the cultural content of Taitung is selected as the case study with an attempt to investigate the implication of the characteristic culture of Taitung, build up an open source database for Taitung culture so that more people can see the uniqueness of the cultural content of Taitung in a digital and innovative pattern. This approach can also highlight the characteristics of knowledge as boundless under the trend of open source and sharing.

II. LITERATURE REVIEW

A. Contents of local culture

The trend of globalization is progressing around us and the exchange between different types of culture is more frequently. From a general viewpoint, the global culture seems to be pushed toward "cultural convergence". As a matter of fact, while globalization is progressing, the burst of upsurge of respect for

diversified culture and emphasis of local culture does not get weakened.

In essence, local culture is the demonstration of the local living culture. It starts from the thinking of the local area itself and the goal is to utilize local resource, talents, and condition to construct the unique attractiveness of the local area. It deals with the re-construction of the local area with inward generated and autonomous innovation (Chiang, 2006). Item 1, Article 3 of the Heritage Preservation Act in Taiwan indicated that an asset that has been specified or registered to have historical, cultural, artistic, and scientific values can be viewed as a cultural asset. Cultural assets can be classified into seven categories which include ancient monument, historical building, settlement; ruins; cultural landscape, traditional arts, folk-related antiquities, ancient curios or remains, and natural landscape.

For the classification of the assets of local culture implications, several scholars follow the five categories that are proposed by Japanese scholar, Sei Miyazaki. These five categories include people, culture, land, product, and landscape and can be used for the classification of local cultural resources as follows. (1) People: This deals with the human resource, which covers the satisfaction of local residents' common needs, management of interpersonal relationship, and the creation of living well-being. (2) Culture: It deals with the cultural resource, which covers the continuation of local common historic culture, management of arts and cultural activities, lifelong learning, etc. (3) Land: It deals with the natural resource, which covers the maintenance and promotion of geographical features of the local area. (4) Product: It deals with the product resource, which covers the creation and marketing of local products, collective promotion of local economic activities, etc. (5) Landscape: It deals with the landscape resource, which covers the creation of local unique landscape, sustained management of living environment, local construction with the devotion of local residents, etc.

For the practical design in this industry, Cherng (2016) concluded a local cultural content into five aspects which include local culture and history, ecology, nature, legend, and craft based on her years of practical experience of local culture and creative design. A checklist of local cultural contents is proposed in this study by integrating both academic and practical aspects as shown in Table 1.

TABLE 1. CHECKLIST OF LOCAL CULTURAL CONTENTS.

Local culture and history	**Ecology**	**Landscape**	**Craft**	**Folks**
Ancient monument and architecture	Agricultural products and specialty	Mountain	Traditional arts and crafts	Religious story
Temple	Primitive/featured plant	River and sea	Totem and code	Holiday and celebration
Featured architecture	Primitive/featured animal	Land		Folk story
Museum		Sightseeing landscape		

B. Cultural content of Taitung

Taitung is located at southeastern Taiwan and it accounts for 9.8% of total area of the Taiwan Island. It is the third largest county in Taiwan. The Pacific Ocean is to the east of Taitung. It is located in the tropical region with mountains and seas by its side. It has a coastline of 176 km which is the longest in Taiwan. The administration districts include one city, two towns, and 13 townships.

From the aspect of natural ecosystem, Taitung has abundant natural resource. It not only has several natural and cultural preservation areas, but also has not industrial pollution. It has all types of specialty include small abalone, lobster, and bonito in the sea; rice, sugar apple, tea tree, pineapple, daylily, and roselle in the mountain. These products are well-known in Taiwan. Since the development of Taitung is comparatively later in history, Taitung still preserves abundant aboriginal cultures. The population of Amis, Pnyumas, Drekays, Bununs, Paiwans, and Yamis accounts for more than 30% of Taitung population, which is the highest percentage among all cities and counties in Taiwan. The number of prehistoric runs is also the highest in Taiwan. The most well-known cultural activities include Firecrackers at Master Han Dan in Lantern Festival and the harvest festival of the aboriginal people. According to the statistics by Taitung County on its cultural assets, there are 47 historical architectures in Taitung County which include Chong Wa Benevolent, Taitung Tianhou Temple, Baoting Art and Culture Center, Guanshan Old Station, Guoben Farm, Yiwan Presbyterian Church, Ludao Lighthouse, Lanyu Weather Station, Gongdong Church as the historical resources. There are five historical ruins including Baxian Caves Historical Site, Beinan Cultural Park, Dulan Historical Site, Jiuxianglan Archaeological Site, and Balan Historical Site. There are three cultural landscapes including Rang, Orchid Island, Green Island White Terror Memorial Park, and Brown Avenue. There are three traditional arts including Polyphonic Songs of Malan Amis Tribe, miwalathini of Yami Tribe, and Millet Festival of Beinan Tribe. There

are five folk festivals including Master Han Dan activities in Lantern Festival, Maljeveq of Paiwans Tribe, mangayau, Simangavang of Yami Tribe, and Flying fish festival of Yamis Tribe. There are 18 groups of 24 ancient curios (Wikipedia: Taitung County Government, Taitung County Cultural Assets, 2018).

C. 3D model open source platform

The original purpose of open source is to provide a mechanism so that a design can be open to allow all users to modify for free. It is mostly applied to the process of software development. Nowadays, this mechanism has gradually transformed into a concept or even upgraded into an attitude in life. It is widely applied to products, schemes, and projects that allow the public to participate, discuss, and modify. The purpose is to facilitate its development, enhance its transparency, and the well-being of the common people. Examples include hacker culture and free software movement, which can be viewed as part of the advances even if it fails.

The most iconic growth in various industries is the development of 3D printing techniques. The 3D printing industry has developed into a market that can generate billion dollars of revenue. It shows a trend of continuous growth around the globe. There are many 3D model open source platforms domestically and overseas. In Taiwan, National Museum of Prehistory provides the first 3D model platform for antiquities (http://3d.nmp.gov.tw). People visit their website or use their APP to browse through 3D models of antiquities. This approach allows people to view antiquities from any angle. However, this 3D model platform of antiquities offers the functions of viewing and browsing through instead of open source downloading and printing. There are already several open source platforms that offer 3D model files domestically and overseas. It can be found from these 3D model platforms that domestic and overseas 3D open source platforms mainly offer figures, mechanical parts, and tools. Few platforms offer 3D models that feature cultural contents except for ThreeDScans (http://threedscans.com/) which provides 3D models of the statues in Kunsthistorisches Museum Wien, Paris Museum, etc. for the public to download and print for free.

D. Creative Commons (CC) License

The wave of digital technology development has changed the traditional way of distributing copyrights. A variety of copyright exchanging ways are created so distributing various types of digital contents. This approach further affects people's habit of using copyrights. For the problem of digital authorization, the concept of creative commons (CC) license has been promoted worldwide (Taiwan Creative Commons Project, 2005). The CC project was proposed by law scholar Lawrence Lessig in the US in 2001. He founded the Creative Commons organization in US and the goal is to establish a reasonable and flexible copyright mechanism for the growing limit on creations by the copyright system. It is expected that creations can be exchanged more easily by the flexible authorization of keeping part of the rights. The creative commons (CC) is a simple and flexible open copyrights authorization agreement. For typical users, they simply follow the condition that is set by the copyrighter and they can use the creation securely without any cost. For a copyrighter, he/she can obtain greater awareness and business opportunity by sharing his/her works conditionally (Yan, Wu & Cheng, 2008).

The creative common (CC) license is to provide a combination of four authorization elements including Attibution (BY), Noncommerical (NC), No Derivatives (ND), and Share Alike (SA) via modularized simple conditions to supply six public authorization articles for convenient usage such as BY, BY-ND, BY-SA, BY-NC, BY-NC-ND, and BY-NC-SA. A creator can pick the authorization article that is most suitable for his/her work. After tagging his/her work, it can be released to the public for use. Via this approach of volunteer sharing, people can create works with abundant contents and clarified copyrights and this approach is beneficial for the creator himself/herself and many other users.

III. INVESTIGATION OF LOCAL CULTURE REDESIGN AND DIGITAL SHARING MODEL

To assist creators in designing the local cultural contents of a creation and to facilitate the open source and sharing of the creation, a "local culture redesign and digital sharing model" is proposed in this study. The procedure of this approach is described as follows.

- Step 1: Culture investigation: Via literature review, field research, and expert interviewing, the content of local culture is collected for summarizing the characteristics of local culture. The local culture resource is investigated from five aspects which include culture and history, ecology, landscape, craft, and folks as follows. (1) Culture and history investigation: ancient monument, temple, and featured architecture. (2) Ecology investigation: agricultural products and specialty, featured or primitive plants, featured or primitive animals; (3) Landscape investigation: mountain, river, sea, harbor, plain lands, sightseeing landscapes; (4) Craft investigation: traditional arts and crafts, totem codes; (5) Folks investigation: religion, holidays and celebrations, folk story, etc.
- Step 2: Element extraction: Elements are extracted from the above-mentioned aspects in Step 1.This study refers to the approach that is proposed by Hsu (2001) with minor modifications which include direct perception and name of spoken language of form and appearance, totem, texture, constituent statute. Other elements such as color and material that are commonly used are less extracted due to the limit on the color scheme and material for 3D printing.

- Step 3: Design transformation: The local culture elements that are extracted from Step 2 are transformed by further design thinking. By referring to the study by Lin (2007), the commonly used design transformation approaches include simile, metaphor, metonymy, analogy, allegory, etc. The first four approaches are recommended in this study for the consideration of respecting the content of local culture.
- Step 4: Digital modeling: With the population of 3D printing, there are more and more modeling software. In addition to the professional oriented 3D modeling software, software vendors also released open source 3D modeling software for 3D makers to use for free. A creator can draw a digital model according to the design drawings and further modify the surface details and texture. The commonly used modeling software include Rhinoceros, Solidworks, Cinema 4D, Autodesk 3D, and Maya. After that, the models will be saved in .STL or .OBJ format.
- Step 5: Printing test: After the completion of 3D modeling, slicer software is required to generate slices of the 3D model. Parameters of the printing commends are saved as the G-code file so that 3D printers can carry out with the printing. The commonly used slicer software includes the basic Cura and the advanced Kisslicer. In this study, the Kisslicer software is used for analyzing the model by slicer software and for calculating the external supporting structure. The 3D model file is transformed into a slicer file. The relevant parameters are adjusted so that the model will not fall apart during printing. The printing parameters include platform temperature, nozzle temperature, printing velocity, printing layers, external wall thickness, density fill, substrate, tieback material for calculation. These can be listed into the content of information catalog in Step 2.
- Step 6: Information catalog: By referring to the metadata of the digital repository database and museums, the information are adjusted and modified according to four information catalog principles as follows. (1) Using the "abstract description" to describe object type, dimension, cultural implication, and creation concept in order to meet people's expectation of information. (2) Supplying at least 5 keywords so that a user can quickly find out the cultural content and relevant work that he/she requires. (3) Supplying derivative parameters from the digital model for 3D printing for the reference of users to reduce the chance of printing failure. (4) Adopting the six creative commons (CC) authorization articles that are promoted worldwide for creators to choose from. A creator can get more chance of obtaining awareness and business opportunity by sharing his/her work conditionally. For the public users, they can use the creation securely for free as long as they follow the conditions set by the creator.
- Step 7: Upload management: Nowadays, there are a number of 3Dopen source platforms. The selection consideration includes usage, object number, and interface operability. The built-in analyzing function is also one of the selection considerations. Digital models with the CC copyrights mark can be uploaded to 3D model sharing platform for worldwide users to browse and use. A dedicated zone can be set up for file management and further update and analysis. After downloading a file by the authorization articles, a user can print the work and apply it to his/her daily life. More people can see and understand the local culture and this approach increases the opportunity for people to know the culture of this land.

IV. EXAMPLE OPERATIONS

To meet the requirement of local culture dissemination and the practical value of an object, the creation target is set to be the curtain decoration that is used in every house. It is the curtain rod end cap and the curtain tieback for holding the curtain. The schematic is shown in Figure 1. The purpose of the curtain tieback is to hold the strip that ties the curtain. The example operations are described as follows.

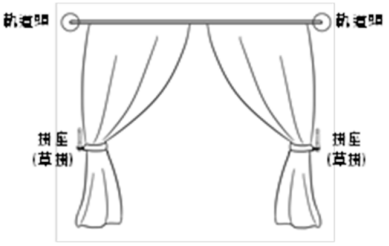

Fig. 1. Schematic of creation target: curtain rod end cap and tieback. (軌道頭: curtain rod end cap; 掛座(草掛): curtain tieback)

- Step 1: Cultural investigation: To assist creators in understanding the implication of Taitung culture, creators are asked to investigate Taitung according to the local culture contents checklist that is shown in Figure 1. The results of the creators' cultural investigation are described as follows. (1) From the aspect of culture and history, the first one is the Tianhou Temple, which is the most historical temple in urban Taitung and is also the belief center for people in Taitung. The second one is the Cave House, which is built by the deceased local self-learning architecture in Taitung. (2) From the aspect of ecology, they are invited to observe the featured plants in Taitung such as sugar apples and roselles, and featured animals such as Orchid island flying fishes. (3) From the aspect of landscape, the coastline

of Taitung reaches 176kmand is close to the Pacific Ocean. It is the city that has the longest coastline in Taiwan. Besides, Taitung is also famous for the beautiful sunrise aurora in Taiwan. (4) From the aspect of crafts, Taitung presents the colored glaze, wood carving arts and crafts of the Paiwans Tribe and the Human-Animal-shaped Jade Jue, which is the most import jade artworks of the Beinan prehistoric cultural heritage. (5) From the aspect of folks, the population of aboriginal people account for more than 30% of the total population in Taitung and this is the highest percentage in Taiwan. As a result, there are many aboriginal stories and symbolic objects such as the clay pots and male falcon furs that symbolize the authority and social status in the Paiwans and Drekays tribes. Moreover, wild boar teeth symbolize the brevity of a warrior. A Chinese Moccasin symbolizes the ancestral spirits and the ancestors will safeguard families and descendants. A lily represents the order and ethics of the society of a tribe (Information Resource of Council of Indigenous Peoples, 2015). Different creators had different types of discoveries. However, they are advised to take at least one item for each dimension.

- Step 2: Element extraction: A creator can extract one or two of the above-mentioned elements for design creation. Taking one of the creators for example, this creator chose lily and Chinese Moccasin as the pattern of the appearance, texture, and spiritual implication. For Paiwans and Drekays tribes, a lily flower symbolizes purity, holiness, and grace. A Chinese Moccasin pattern is also the decorative striation that belongs only to aristocrats and it symbolizes glory and power. The characteristics of a Chinese Moccasin include sharp head, upward mouth, wide cheek, and triangular patterns on the back are the emphasis of pattern sampling. The curved pattern of the snake body is also applied for variation. A Chinese Moccasin is viewed as independent, stable, and peaceful but doesn't attack each other. However, it presents an image of striking back if being attacked.
- Step 3: Design transformation: Creators extracted the appearance and patterns of the Chinese Moccasin and lily for their creation by simile approach. The purpose is to convey the spirit of having the ancestors safeguard families and emphasizing the family ethics. On the tieback, the hook resembles the curved snake body. By mounting the tieback on a wall inside a house, it represents the meaning of having ancestors safeguard every family member. The design draft is shown in Figure 2.

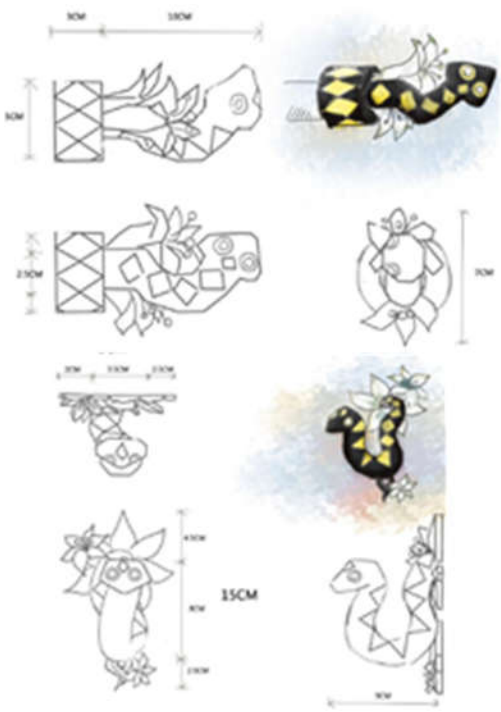

Fig. 2. Curtain rod end cap (left) and curtain tieback (right).

- Step 4: Digital modeling: There is no limitation on the type of modeling software. A creator can use any software that he/she is familiar with. The 3D models in this study are built by MAYA and Z Brush for detailed modification. Finally, the files are saved in the format of .stl or obj which are commonly used in 3D printing.

Fig. 3. 3D modeled curtain rod end cap and curtain tieback.

- Step 5: Printing test: In order to ensure the printing quality when the files are downloaded by our users, all of the 3D models are tested by real printing. In this study, the slicer software Kisslicer is used to examine whether a model file has broken surface or insufficient supporting rods so that the model might possibly collapse. The available printing parameters are recorded for use by the data catalog. The resulting printed models are shown in Figure 4.

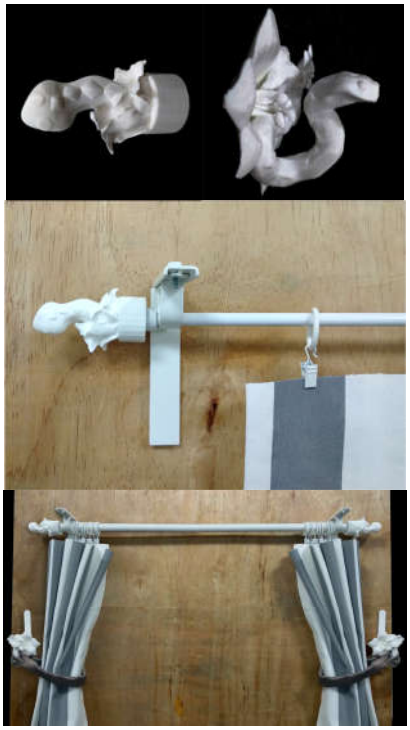

Fig. 4. Resulting 3D printed curtain rod end cap and curtain tieback with a schematic of their usage.

- Step 6: Information catalog: The data catalog of the case study which includes the object name, 3D modeling drawing, photo of printed real part, and several keywords for a user to carry out a quick and easy search. Since the search is easy, the chance of an object being browsed is increased. The "abstract description" is to describe the object's actual dimensions, cultural implication elements, and the creator's design concept within the scope of understanding by the common people. The test printing information in Step 5 is also listed in the "printing parameters" which include Format, Printer, Rafts, Supports, Resolution, and Infill so the users' reference when printing. Finally, the creative common (CC) license articles are generated by the Attibution (BY) - Noncommerical (NC) - Share Alike (SA), which is the optimal one among the six public authorization articles since it complies with the open source and sharing concept of this study. That is, a user is allowed to modify the models freely according to his/her creation requirements and environmental demands.
- Step 7: Upload management: Depending on the considerations of usage, object number, and interface operability, the finished works are uploaded to one of the two largest 3D model sharing platforms: Thinkgiver and Myminifactory to be browsed and used by global users. A dedicated zone of Taitung cultural contents (Account ID: NTTUEIDM) is created for file management, update, and analysis. Based on the proposed model, the creators have created a total of 10 sets of works (10 curtain rod end caps and 10 curtain tiebacks). All of them are uploaded to the 3D model sharing platforms as shown in Figure 5.

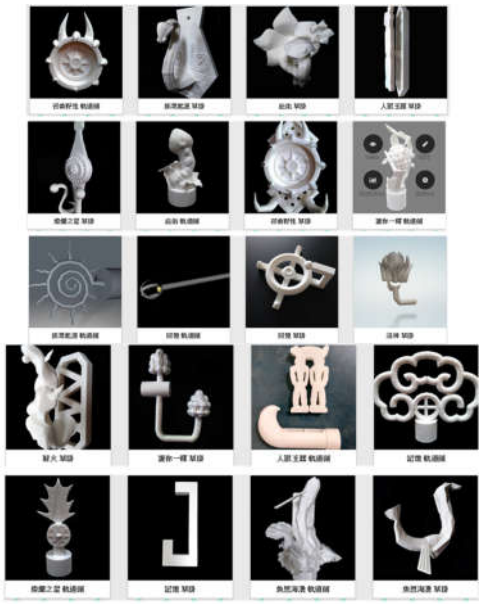

Fig. 5. Design works that are equipped with Taitung cultural elements (Supplied by this study).

Starting from March 2019, the works that are created in this study are uploaded to Thinkgiver and Myminifactorysharing platforms. It is known from the built-in analyzing tools in these platforms that the view counts reached 1140 in Thinkgiver and 2115 in Myminifactory with an accumulated count of 3225 by May 2019. The download counts reached 178 in Thinkgiver and 28 in Myminifactory with a total of 206 download count. This result implies that somewhere around the globe, there are already peoples who enjoy the Taitung culture and already applied the works that are based on Taitung culture to their daily life. The Taitung spirit has transcended the space and time limits and transmitted overseas.

V. Conclusion and Follow-up Study

The "model of design application and open source and sharing of local culture contents" that is proposed in this study is proved to be viable. The further step is to

realize the value-added utilization of the digitalized results. Anyone around the world can simply download the cultural content of each location at any time for printing as long as he/she has a 3D printer. This approach increases the chance of knowing each land in a better way. The common people can utilize the local culture to build a unique "local culture digital experience", which can realistically break the urban-rural gap. The "object information catalog format table" that is built in this study is beneficial of the understanding of an object's cultural implication and its printing information. After a total of ten 3D models of curtain decoration sets with Taitung elements, the results are aggregated together to form a brand new open source database which is dedicated to Taitung cultural contents. The concepts of "digital fabrication" and "open source and sharing" in the engineering field is extended to the cultural scope so that the range of local culture investigation can be extended as well. This approach introduces new research perspective to the field of "cultural industry".

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