

Pilot Study of Applying Creative Computing for the Activation of Intangible Cultural Heritage

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Abstract

The activation of intangible cultural heritage has received much attention in recent years. Especially in tourism, there have been different activation forms for intangible cultural heritage, such as museum display, time-honoured brand, festivals, interaction activities, tourism products, and so on. Compared with other forms, the design of tourism products is more preferable, as the core idea of the activation is to associate the traditional culture with the modern time. However, the inheritors have various kinds of limitations (e.g., lack of education) to meet the requirements nowadays. It is particularly difficult for inheritors to achieve some kind of innovation for the activation of intangible cultural heritage. Various kinds of computing technologies have been widely utilised in different fields. Even artistic fields benefit greatly from them. In the meantime, due to the deep utilisation, the creative elements within artistic fields also influence the computing dramatically, which generates a variety of new concepts in the computing field. Creative computing, which is one of them, aims to improve human creativity by computing through creative ways. Therefore, in this paper, the study focuses on trying to apply the ideas of creative computing to facilitate the innovation of inheritors for the activation of intangible cultural heritage.

Keywords: intangible cultural heritage; activation; creative computing; creativity

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1. Introduction

Intangible cultural heritage has great significance to the diversity and sustainable development of human culture. Through its inheritance from generation to generation, it has been developed in various forms and bears the cultural gene and national memory all over the world. Over time, the activation of intangible cultural heritage has been an important way to protect and inherit it. Being created from long-term production practice, intangible cultural heritage is closely related to human lives. Therefore, a promising way to activate intangible cultural heritage is to associate the traditional contents with people's modern lives (see Figure 1). The combination between the "old" and the "new" may be able to generate an unprecedented power of creation.

Tourism has been the main context for intangible cultural heritage activation. On the one hand, due to the fast development of human society, competition in various fields has been increasingly dramatic and has drawn many people's attention. On the other hand, tourism offers a relatively relaxed environment. While travelling, people are more willing to explore and discover interesting things. Especially in recent years, new features have been shown in tourism. People have begun to seek more spiritual satisfaction rather than solely physical relaxation. The relationship between culture and tourism has never been so close.

For now, within the domain of tourism, there have been many approaches to activating intangible cultural heritage, such as museum display, time-honoured brand, festivals, interaction activities, tourism products, and so on. Compared with other approaches, tourism products are more preferred for the activation in tourism. It may not be very often that people go to a

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museum. However, by integrating the essential elements of a certain type of intangible cultural heritage into people's daily necessities, the influence could be imperceptible. For example, a mobile phone accessory (see Figure 2) may be able to trigger people's interests in Chinese traditional painting. Therefore, within this paper, we particularly focus on activating intangible cultural heritage by facilitating the design of tourism products.



Figure 1. Chinese actress fan bingbing wearing the evening dress of imperial robe at cannes film festival (https://www.sohu.com/a/153313674_99910301)



Figure 2. Mobile phone accessory of the chinese painting of flowers and birds (<https://palacemuseum.world.tmall.com/>)

New ideas are urgently needed for the activation of intangible cultural heritage in tourism, especially the design of tourism products. Most of the intangible cultural heritage in China is inherited through certain inheritors. Nowadays, there are many limitations of the inheritors. Some inheritors are already very old, but the young generation is not interested in the inheritance of intangible cultural heritage. Some inheritors are still living in small villages, and few of them receive higher education. Due to the various limitations, most of them still focus on the conventional forms of intangible cultural heritage. It is difficult for the inheritors to innovate and create new activation forms of the heritage to meet people's requirements in contemporary society.

However, due to the fast development and pervasive utilisation of computing technologies, there may be a promising approach, known as creative computing, that could help inheritors innovate and create new forms of activating intangible cultural heritage. The aim of creative computing is to improve human creativity [1]. Depending on the creative algorithms, creative computing is devoted to generating unexpected but valuable results to stimulate people's creativity, which is urgently needed by inheritors. To deploy creative computing for the activation of intangible cultural heritage, a system of creative computing may be useful to help inheritors come up with new ideas of activation.

The purpose of this paper is to try to apply creative computing to the activation of intangible cultural heritage. This paper is divided into three parts. In Section II, the current problem of the activation of intangible cultural heritage is described in detail. Then, a solution proposed by creative computing is elaborated on. The related knowledge of creative computing is introduced firstly. Secondly, two activating approaches illuminated by creative computing are indicated in Section III. Finally, in Section IV, based on the proposed approaches, some suggestions are raised by creative computing for the activation of intangible cultural heritage.

2. The Problem

Nowadays in China, intangible cultural heritage can take various forms, such as oral history, performance art, social customs, etiquette, festivals, practice and knowledge about nature, traditional painting, traditional medicine, and traditional craftsmanship [2]. Compared with other forms, traditional craftsmanship (e.g., embroidered art) is paid more attention. The main advantage of the craftsmanship is that it can be represented through tangible carriers, such as tourism products, which not only congeals the essence of intangible cultural heritage, but also offers various possibilities to perform the activation. Therefore, within this paper, we start with the study of the facilitation of traditional craftsmanship activation.

The creativity of traditional craftsmanship inheritors should be facilitated through the activation process. As mentioned above, this paper particularly focuses on the design of tourism products. Therefore, the activation process of the traditional craftsmanship is the creation process of tourism products. Generally, the first step of the activation process is the extraction of the essential elements of intangible cultural heritage. Then, a type of daily necessity would be selected. Through the combination of the two, there would be a prototype of the tourism product (see Figure 3). Accordingly, to facilitate people's creativity during the activation process, we could refer to the theories of the creation process. Based on our study, there are four stages of a creation process, including preparation, incubation, illumination, and verification, which is widely used in artistic fields. During each stage, people are required to follow certain rules. In particular, during the first stage of preparation, people are often encouraged to learn about information and knowledge from various aspects to broaden their horizons, which is very good for the creativity outbreak afterward. Therefore, the problem discussed in this paper is how to generate inspirations with great diversity to truly stimulate inheritors' creativity for the activation of the intangible cultural heritage of traditional craftsmanship.



Figure 3. Activation process of intangible cultural heritage of traditional craftsmanship

3. A Solution

A possible solution comes from creative computing, which aims to improve human creativity by computing in creative ways. There is no doubt that human creativity needs to be facilitated nowadays [3]. For now, various kinds of computing technologies have been widely applied to support people's creativity, from offline creativity educations to online training courses, from relatively simple portal websites to extremely complicated innovation platforms, and from research tools like FMRI and EEG [4] from cognitive science to the so-called new generation of information technology like virtual reality and artificial intelligence. Due to the fast development of computing technologies and their pervasive utilisation in creativity world, creative elements have begun to have a great influence on the way of computing. Therefore, new concepts are being continuously proposed. Take creative coding as an example. Inspired by the creation of works of art, instead of focusing on programs' functions, people using creative coding tend to pay more attention to the expressiveness aspect of programs, which is always utilised in the artistic world to show artists' emotions. One of them is known as creative computing. By approaching computing in creative ways, unexpected but valuable results may be generated to stimulate people's creativity.

The next key question would be how to understand the "creative" way of computing. Accordingly, there are three core elements of being creative, that is new, surprising, and valuable [5]. Compared with the other two, the surprising element is seemingly more difficult to define. According to Professor Margret Boden, there are several types of creativity associated with different levels of surprising, that is, combinational creativity, exploratory creativity, and transformational creativity [5]. Combinational creativity is the ability to make unfamiliar combinations with familiar things. For example, Google Glass, a typical instance of combinational creativity, is the combination of glasses and computing. As for the other two types of creativity, the term "conceptual space" needs to be accounted for in the first place. It is like a kind of knowledge system that includes various associations of concepts. Exploratory creativity is devoted to discovering possibilities within one conceptual space. It is widely applied in studies of disciplines like biology and chemistry. As for transformational creativity, instead of digging in only one conceptual space, it aims to make a new conceptual space by altering the conditions of an old one. Take the proof of Fermat's Last Theorem as an example. By redefining the pure algebraic problem in a new conceptual space known as elliptic curves, Professor Andrew Wiles finally could prove Fermat's conjecture, which



Figure 6. Interactive games (<https://young.dpm.org.cn/damaoxian#gamezone>)

For example, among the various kinds of tourism products of the Forbidden City, a particular series has drawn many people's attention and is known as the cat of the Forbidden City (see Figure 7). Instead of using various conventional patterns, the series is based on a cat figure, which originates from the cats living in the Forbidden City. In the past, cats have very auspicious meanings of longevity and luck. Back in the Ming Dynasty, some cats living in the Forbidden City were taken care of by professional people. Some cats loved by the emperors, queens, and concubines were even honoured with official titles. Raising cats has become a tradition in the Forbidden City. As time has passed, the cats have been a particular scenery of the Forbidden City. Even nowadays, they are still very popular and important enough to be mentioned in various documentaries about the Forbidden City, such as *Masters in Forbidden City* and *The Forbidden City 100*. Because of its creativity, the series of the Forbidden City cat won the gold medal of the 2016 China Tourism Commodities Competition.



Figure 7. The cat of the forbidden city
(<https://baijiahao.baidu.com/s?id=1601853579796809389&wfr=spider&for=pc>)

3.2. Exploratory Approach

As mentioned above, the core idea of exploratory creativity is to discover innovation possibilities in one conceptual space. However, there are still some limitations. For example, it may be difficult for people to break their fixed minds. Various theories of creativity have discussed this; for example, the aim of lateral thinking is to encourage people to think out of the box. To facilitate people's exploratory creativity, new perspectives should be imported. By seeing things from a different angle, somebody may be able to think something unthinkable and see something overlooked before. The Forbidden City is very good at this.

By importing a kind of technology-driven perspective, the Forbidden City, with more than 600 years of history, has become an icon within tourism informatisation. Nowadays, various kinds of technologies have been widely used in tourism, which finally leads to a new domain known as tourism informatisation. However, most of the people are still focusing on how to use technologies to analyse and solve problems in tourism. The technology-driven perspective considers what information technologies could inspire us to find something new for the activation of intangible cultural heritage, rather than thinking about what we need technologies to do.

In recent years, there have been many types of new technologies, including virtual reality, mobile technology, Internet of things, cloud computing, big data, and artificial intelligence, which are commonly known as the new generation of information technology. Illuminated by the new technologies, the Forbidden City has achieved a great number of innovations and displayed them in a digital gallery located at Duanmen Gate. The gallery hall features screens known as digital cabinet of curiosities displaying and explaining architectural features and cultural relics, some of which are too old and fragile for real display. Visitors can even access the Forbidden City's treasures through virtual reality display (see Figure 8). In one of the AI features, visitors can chat with one of the “emperor's old ministers,” who will give them eloquent replies in classical Chinese. Being told “I have gained weight,” the “old minister” would reply, “If a superior man is not ‘heavy,’ no one will respect him.” This is a quote from the teachings of Confucius. The Chinese character for “heavy” also means “serious” (see Figure 9).



Figure 8. Digital gallery of the forbidden city: digital cabinet of curiosities (left) and VR (right) (<http://www.dpm.org.cn/show/246075.html>)



Figure 9. AI in digital gallery of the forbidden city (<http://www.dpm.org.cn/show/246075.html>)

The Forbidden City also benefits greatly from the fast development and pervasive utilisation of mobile technologies. The Forbidden City developed several apps to show its treasures from various aspects (see Figure 10). A typical example representing the technology inspirations to the Forbidden City is named “One Day in the Life of the Emperor.” It is a game app specifically developed for children. Various kinds of animation figures are designed for this app, such as a cartoon emperor and an auspicious lion to attract children's interests. There are more than 200 interactions within the app. While playing games, children can not only learn about different architectures of the Forbidden City, but also comprehend the royal culture imperceptibly. For example, by playing the game of helping the emperor change costumes, children can learn about the special meanings behind each royal costume. Children can also play a cooking game to learn about the cultures about royal food, like how the servant will try the royal food before the emperor to test whether the food has been poisoned. The emperor is not allowed to eat too much, as it would be harmful to his health.

Another typical example worth mentioning is known as the “Twelve Beauties of Yinzhen” (see Figure 11). Yinzhen is the name of the famous emperor Yongzheng of the Qing Dynasty. By utilising various technologies, the app could show Yongzheng's twelve beauties from various aspects. For example, there is a virtual lens that can enable us to see more details of the paintings. The relics and antiques of the paintings can be displayed in 360 degrees through 3D. Even the candlelight and charcoal fire of the paintings can be shown dynamically to mimic the real world. In just two weeks after its launch online on the App Store, it was downloaded more than 200,000 times.



Figure 10. Apps of the forbidden city



Figure 11. Twelve beauties of Yongzheng

Due to the great success of its attempt on informatisation, the Forbidden City has seen the tremendous value of applying technologies in culture activation. To explore more possibilities, the Forbidden City has embarked cooperation with one of the five Internet giants in China – Tencent. Due to the abundant technology resources of Tencent, the Forbidden City is devoted to building the Palace Museum without walls. Through using scientific and technological methods, Tencent also takes the continuation of traditional culture as its own responsibility. During this cooperation, it aims to explore the application paradigm of advanced digital technology in the field of cultural heritage protection, research, and exhibition and develop and create forward-looking and demonstration examples of digital technology application. In order to collect more creative ideas, a competition named “The Next Idea” was held by the Forbidden City and Tencent. During the competition, the Forbidden City opened a series of classic IP (e.g., Twelve Beauties of Yinzhen) for attenders to innovate.

The digital invitations of the competition are particularly worth mentioning. To illuminate people’s creative ideas, the invitations were made by HTML 5 (abbr. H5). H5 is kind of advanced web page technology. Compared with other ones, H5 offers more interactivities for people to innovate. Baidu even built a platform of H5 specifically for stimulating people’s creativity. One of the invitations was made from the painting of the Twelve Beauties of Yinzhen (see Figure 12). By using H5, things from modern times could be coalesced into traditional paintings. How can you imagine that a beautiful lady from ancient times could use VR gears? The effect of the combination between the “new” and the “old” is beyond imagination.



Figure 12. H5 invitation of the next idea competition

4. Some Suggestions

Based on the solution raised from creative computing, a computing system is planned to be built for the activation of intangible cultural heritage. Extended from the two approaches discussed above, some suggestions for the design of the system are proposed in this paper.

4.1. For the Form Innovation of Intangible Cultural Heritage Activation

A concept of “Clinamen” meaning deviating from a conventional way of doing something was proposed in creative computing. The ideas of deviation could be used to form both innovation and content innovation of the activation of intangible cultural heritage. Take embroidered art as an example. For the form innovation, most of the time, people always think that the conventional way of creating embroidered art is based on cloth. Is it possible to deviate from the conventional materials to something new? In recent years, due to the popularity of a school of embroidered art known as cross-stitch, embroidered art not only could be created with plastic objects but also could be made on metal things (see Figure 13). In particular, for traditional craftsmanship like embroidered art, a common way of performing the activation is by designing clothes. The material is also one of the main issues studied in the field of fashion design. Therefore, for a computing system devoted to facilitating the activation of intangible cultural heritage, a variety of material models may be useful.



Figure 13. Embroidered art on a pan (http://www.sohu.com/a/71182228_358228)

4.2. For the Content Innovation of Intangible Cultural Heritage Activation

As discussed above, another promising way of activating the intangible cultural heritage of craftsmanship is to extract familiar but unexpected elements for the design of tourism products. The crucial question is how to achieve creative extraction. It could also be inspired by the ideas of deviation proposed in creative computing. Based on our study, there are several ways to achieve the deviation. They are all based on the ideas of ambiguity.

Ambiguity is a useful technique to facilitate people’s creativity. It has been widely used in artistic fields like painting and poetry to stimulate people’s creative thinking. To use it in paintings, artists tend to attract people’s attention by creating visual illusions (see Figure 14). Within fields like poetry, ambiguity is one of the major sources of linguistic creativity [8-9]. Although ambiguity is considered a flaw in writing, many writers use this technique to allow readers to understand their works in a variety of ways, giving them depth and complexity. For example, *The Sick Rose*, a short lyric written by William Blake, is full of ambiguities:

*O Rose thou art sick.
The invisible worm,
That flies in the night
In the howling storm:*

*Has found out thy bed
Of crimson joy:
And his dark secret love
Does thy life destroy.*

Many of the words in the above lines show ambiguity. We cannot say for sure what “bed of crimson joy” means, nor can we be exact about the interpretation of “dark secret love.” The ambiguous nature of such phrases allows readers to explore deeper meanings of the poem. In Chinese traditional culture, there are also many phenomena of ambiguity. Two of them, phonetic ambiguity and semantic ambiguity, will be discussed in this paper.



Figure 14. Ambiguity painting (http://blog.sina.com.cn/s/blog_4dbd138701000clw.html)

Phonetic Ambiguity It is believed that inheritors' creativity can be stimulated by the ideas of phonetic ambiguity like homophonic phenomena for the activation of intangible cultural heritage. As discussed above, to make creative combinations, it is crucial to discover familiar but unexpected elements (e.g., embroidered patterns) of intangible cultural heritage. Take embroidered art as an example. The extraction of patterns is vital for tourism product design. Due to various limitations (e.g., lack of education), most inheritors are used to conventional patterns, which are often deemed as the classic patterns within schools of embroidered art. As there is relatively limited space to extract the classic pattern creatively, the computing system could inspire inheritors to create new patterns by developing algorithms of phonetic ambiguity (e.g., homophonic algorithms).

The homophonic phenomena are often discussed in phonetic ambiguity and widely used in Chinese traditional culture. For example, a Chinese character “生” is pronounced “sheng.” If it is interpreted as an adjective word, it commonly means the food is not well cooked. If it is understood as a verb, it could stand for giving birth to a child. Therefore, during ancient times in China, when two people got married, on the wedding day, the bride would be given something raw to eat and be asked whether the food is “sheng,” meaning not well cooked. If the bride said “sheng,” the answer would be interpreted as the bride wants to have a baby, which is a beautiful expectation of a good marriage. Furthermore, the character “生”, when combined with another character “花”, could compose a new word “花生”, which, in English, means peanut. Therefore, in Chinese culture, the peanut often stands for fertility.

In particular, besides commonly used homophonic associations (e.g., in Chinese culture, magpie always means auspicious significance as there is a Chinese character in its name whose pronunciation stands for happy things), there is also a variety of modern usage of the homophonic phenomena. For example, a class of pear in Chinese is pronounced “Ya Li,” which has the same pronunciation as the word meaning pressure. Therefore, nowadays, people often use “pear” to refer to big pressure. It might be a better way of performing activation to meet modern requirements.

Semantic Ambiguity As for semantic ambiguity, a typical example is metaphor, which is a figure of speech that directly refers to one thing by mentioning another. It is another important source of linguistic creativity in Chinese culture. An endearing and approachable work of art named “Jadeite Cabbage with Insects” is a typical example of metaphorical associations. This piece is almost completely identical to a piece of bokchoy cabbage (see Figure 15), which, in Chinese culture, always represents the purity of a girl. It is carved from verdant jadeite and consists of the pure white vegetable body and brilliant green leaves. It is even more surprising that there are two insects alighted on the vegetable leaves. They are locust and katydid, which are traditional metaphors for having numerous children. This work originally was placed in the Forbidden City's Yonghe Palace, which was the residence of the Emperor Guangxu's Concubine Jin. For this reason, some have surmised that this piece was a dowry gift for Concubine Jin to symbolise her purity and offer blessings for bearing many children. Therefore, for a computing system used to help the activation of intangible cultural heritage, algorithms of semantic ambiguity (e.g., metaphor algorithms) also should be considered to stimulate inheritors' creativity. Especially in modern times, there have been various kinds of metaphor resources that could be utilised for innovation.



Figure 15. Jadeite cabbage with insects (http://www.sohu.com/a/243661787_100110703)

4.3. For the Importing of New Perspective of Intangible Cultural Heritage Activation

As discussed before, the Forbidden City benefits greatly from the technology-driven perspective. By considering what advanced technologies can inspire people to innovate and think outside of the tourism field, something previously unthinkable could be discovered. Therefore, it is demonstrated that the importing of a new point of view can be helpful for intangible cultural heritage activation. However, besides the technology-driven perspective, is there any other aspect of intangible cultural heritage that can be considered? Due to the cultural and artistic features of intangible cultural heritage, in this paper, an artistic perspective is also discussed.

The Perspective of Art A product of intangible cultural heritage is like a work of art that embodies people's wisdom and efforts. A work of art can be appreciated in various aspects, including concrete things like colour, shape, light, and structure and complicated issues like the creator's story and social context. It is believed that the various aspects could be the main resources for activation. An interesting example is from the Classic of Mountains and Seas, which is a Chinese classic text and a compilation of mythic geography and myths. Many magical creatures are described in this book, including various kinds of ancient fish (see Figure 16). By extracting the shapes of the ancient fish in a variety of ways, products like lamps and lanterns (see Figure 17) may be developed, which is good for the activation of Chinese traditional culture.



Figure 16. Ancient fish from the classic of mountains and seas



Figure 17. Products developed from the ancient fish

In this paper, the perspective of colour is used to exemplify the use of the perspective of art for the activation of intangible cultural heritage. Embroidered art is taken as an example. In Chinese traditional culture, besides patterns, colour matching is also one of the major issues of embroidered art. The colours extracted from the products of embroidered art often can remind people of a particular category of colour known as Chinese traditional colour (see Figure 18). In recent years, Chinese traditional colours have received much attention, triggering a new trend in fashion design (see Figure 19). Therefore, it can be seen that the importing of the artistic perspective may be a very promising way to activate intangible cultural heritage.

The Perspective of Technology As discussed above, the Forbidden City is very good at using technologies to find possibilities for innovation. Various kinds of so-called new generation of information technologies have been utilised. There is even a digital gallery located at the Duanmen Gate of the Forbidden City [10]. Due to its great success, it has even launched full cooperation with the big technology company Tencent and aims to utilise its huge amount of technology resources for the activation of Chinese traditional culture.

Therefore, for a computing system that is dedicated to facilitating the activation of intangible cultural heritage, models of advanced technology may be helpful. There are various kinds of aspects that could be considered, such as starting from the new generation of information technologies (see Figure 20). Through the perspective of technology, there may be interesting ways of achieving activation. Displayed in the digital gallery of the Forbidden City, there are many interactive installations. Some could enable people to be able to draw Chinese traditional paintings, and others could offer an opportunity for people to try royal costumes (see Figure 21). By doing so, there could be a variety of forms for inheritors to perform the activation of intangible cultural heritage, which may be able to provide more experiences to people.



Figure 18. Chinese traditional colour (<http://zhongguose.opentutorial.info/>)



Figure 19. Fashion design inspired by the embroidered art (http://www.sohu.com/a/245149899_348900)

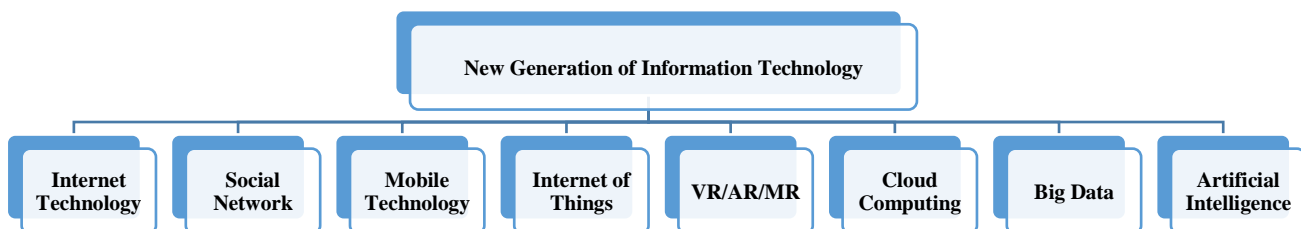


Figure 20. New generation of information technology



Figure 21. Interactive installations displayed in the digital gallery (<http://www.szzs360.com/topic/2016/gg/>)

5. Conclusions

By associating the activation process of intangible cultural heritage with the creation process studied in the creative field, the inheritors' preparation stage has drawn many people's attention. It is believed that through simulation with ideas from various aspects, inheritors' horizons can be broadened for innovation. By studying the ideas of creative computing, a

solution has been proposed to help inheritors “think out of the box,” including the combinational approach and exploratory approach. In terms of the combinational approach, suggestions based on a creativity phenomenon known as ambiguity (e.g., phonetic ambiguity and semantic ambiguity) are proposed to help inheritors make unfamiliar combinations with familiar things. As for the exploratory approach, advice about importing new perspectives (e.g., artistic and technology perspective) is given to assist people to explore new possibilities for innovation within an old conceptual space. It is believed that creative computing may be a promising way to inspire inheritors’ creativity for the activation of intangible cultural heritage.

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