

## Animation Technology to Enhance Communication of Cultural Heritage: A Systematic Review

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### ABSTRACT

Cultural heritage is the wealth of people all over the world. The question of how to effectively improve the preservation and communication of cultural heritage has become an important research hot-spot. The available research results show that animation technology is an exciting avenue for preservation and communication. This systematic review examines how animation technology can be used to protect and disseminate cultural heritage, whether it has a positive impact on cultural heritage as a whole, and identifies the factors that influence the communication effect. This study conducts the systematic analysis by integrating the quantitative results of a total of 36 papers that measure the impact of animation technology on cultural heritage. The research results confirm that animation technology (VR, 3D, 2D, and interactive technology) has a moderate impact on the effectiveness of audience perception and attitude. In addition, this study analyzes the role of moderating variables such as technology type, personal factors, and environmental factors. Ultimately, this study reveals a gap in the empirical comparative study of the effectiveness of different animation techniques in the field of cultural heritage.

**Contribution/Originality:** This study contributed to filling a gap in the existing literature reviewing Animation Technology in Cultural Heritage (ATiCH), identifying and examining the main concerns of how different moderating variables influence audience cognitions, emotions, and behaviors toward CH, and providing new ideas for the study of ATiCH.

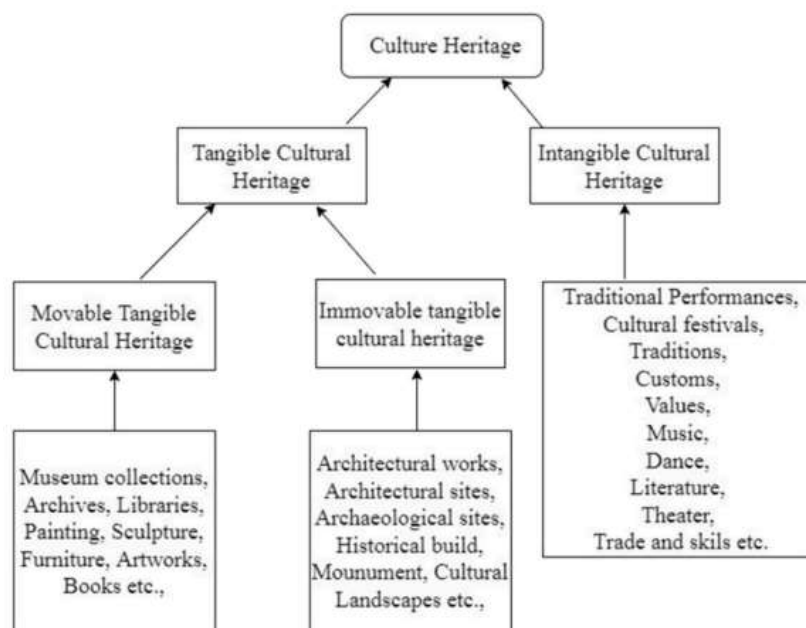
## 1. Introduction

Animation, with its freed visual expression of information and meanings, easy cross-media dissemination and rich audiovisual experience, has created a new dynamic in various industries (Wang, 2012), which can raise the consciousness of the younger generation (Luo, 2022). It is not only a form of early education and entertainment for

young people, but also an important medium for cultural dissemination to a wide audience (Tan & Tan, 2020). One of the reasons why animation is so popular is that many people believe that animation can help learners understand complex ideas more easily (Shaaron, 2008). Similarly, animation, a creative art medium, animation is also an effective means of preserving and disseminating cultural heritage (CH) (Zhang & Liu, 2015).

CH conservation includes comprises both tangible and intangible resources (Reshma et al., 2023). Figure 1 shows the different types of CH. In the field of CH, animation techniques can take various forms, including but not limited to 3D animated agents (Wu et al., 2022), spiritual themes (Li, 2012), animated images (Wang, 2020), animated stories, animated scenes and even animated props, to create an active learning environment for the audience, including the Dong people's wooden architecture construction skills (Xu, 2018), bronze drum culture (Cheng, 2022), Zhong Kui culture (Cheng, 2017), and Tibetan culture (Zhou & Liu, 2022). Because animations can provide unusual and entertaining activities (Konstadina, 2011) and incentives (Rieber, 1991), they are more likely to hold children's attention and improve their knowledge and understanding of specific concepts (Dalacosta, 2009), and the information children receive through animations is retained longer than traditional learning, which promotes student learning and engagement (Konstadina et al., 2011). Dissemination affects the cognitive, mental attitudes, values, and behavioral dimensions of CH (Zhang, 2021), which is especially true for children. Researchers clearly indicated that 76% of elementary school students enjoy verbal imitation and imitation of actions of their favorite cartoon characters (Yang, 2009), and animation technology, as a digital means, can record and preserve the essence of intangible heritage for a long time (Tan & Tan, 2020).

Figure 1: Types of CH



Source: Reshma et al. (2023)

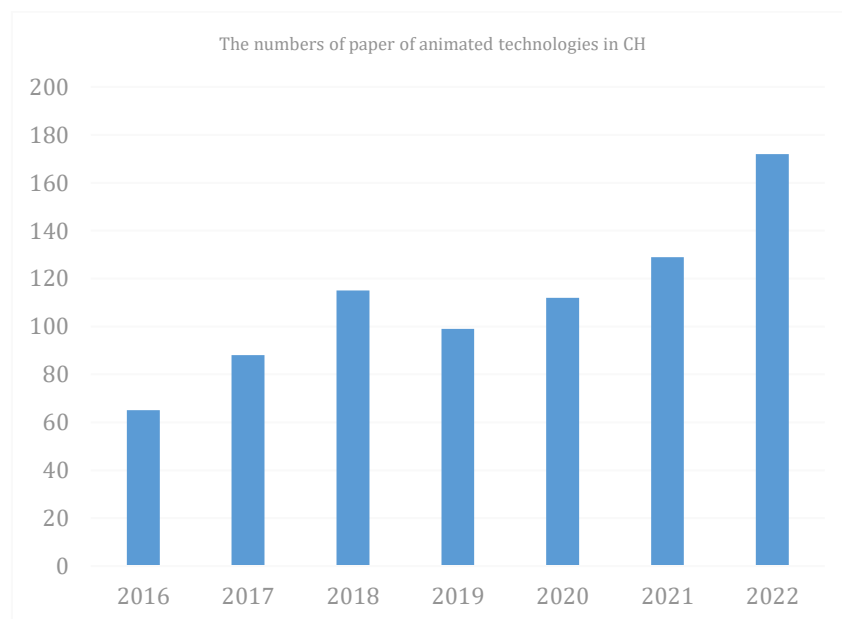
As a result, researchers proposed a variety of ways to integrate animation technology with CH, and explored the applications and implications of influencing the use of

animation technology in the field CH. "For example, the animation of Tibetan Museum Children's Gallery, *Jiji* (Zhou & Liu, 2022), the documentary animation of non-genetic heritage based on VR and SPAR Modi, *Xian Niang* (Pan, 2021), the TV animation series *The Legend of Bronze Drum*, and the 3D animation *The Eighteen Tombs of Guanzhong*, among others. Nevertheless, successful CH animation serves not only to entertain and performance for children, which is an important means of CH preservation, and transmission is the ultimate goal of non-heritage animation (Chen, 2014).

Furthermore, in the field of communication, the communication effect is the purpose of communication (Lasswell, 1948). The term "communication effect", which is currently most commonly used, refers to the psychological changes, attitudes and behaviors induced by dissemination activities with persuasion motivation, as well as the sum of all the effects and outcomes induced on recipients and in society by dissemination activities, especially through mass communication media such as the press, radio and television (Guo, 2011). CH influences or changes the audience's perception, attitudes and behaviors towards CH through animation techniques to truly achieve communication effect.

With the growth of CH, there has been a significant increase in the number of research papers addressing the role, application and effectiveness of Animation Technology in CH (ATiCH). Figure 2 shows the numbers of paper of ATiCH. These papers represent a large group of unexplored studies that are systematically analyzed. Systematic analysis examines the quantitative and qualitative findings of a large number of empirical and qualitative studies, and provides important insights. It is a rigorous alternative to literature reviews based on quantitative and qualitative analyses, and is therefore welcomed by leading journals in the social and behavioral sciences (Eden, 2002; King & He, 2006).

Figure 2: The numbers of paper of ATiCH



## 1.2. Purposes of the Systematic Analysis

Considering several factors that have been identified or are expected to have an influence on the potential impact of animation technology on the conservation and dissemination of CH (Zong, 2018). Despite an increasing number of applications of animation technology found in research, conservation, communication, preservation and restoration, previous literature has highlighted the critical role of VR technology, and 3D technology in the preservation and dissemination of CH, but researchers' opinions, experiences and impacts on the application of animation technology in their work are not explicit. Therefore, this paper systematically examines 36 papers to identify the current status, key technologies, typical applications, impacts, and communication effects of ATiCH from 2015 to 2023. The specific moderating variables that influence audience cognition, emotion, and behavior towards CH are summarised to provide systematic opinions and ideas for the development of ATiCH.

To provide a state-of-the-art and further introduction to the knowledge and application of ATiCH conservation and communication projects, the following research objectives have been defined:

- i. To map the state of ATiCH, especially for application effects and communication effects;
- ii. To survey the opinions of (prospective/academic/professional) scholars on animation technology for CH conservation and communication and to identify the main concerns;
- iii. To record the documented the use of projects using ATiCH;
- iv. To identify how different moderating variables (i.e., types of application, intervention practices, personal factors and environmental factors) influence audience perceptions, emotions, and behaviors towards CH.
- v. To provide an initial set of responses to the concerns identified in the systematic analysis, and define the knowledge gaps in future research.

This study systematically analyses the research methods to achieve these research objectives by providing a comprehensive picture of the authoritative journals and high-level papers. A total of 36 different studies are systematically analysed, including qualitative and quantitative, descriptive and applied studies. This paper consists of the following sections. Section 2 outlines the methodology. Section 3 presents the results of the review. Section 4 provides concluding remarks, implications for theory and practise, limitations of this study, and suggestions for future research.

## 2. Methodology

This paper aims to summarise and analyse the functions, technical types, typical use cases and communication effect of ATiCH. In a systematic review, data from published studies on the subject are extracted and interpreted. The interpretations are, then analysed, described, and summarised in a refined conclusion. In this study, the review follows the guidelines suggested by Kitchenham and Charters (2007), i.e. planning, conducting, and reporting the study.

### 2.1. Planning the Review

During the review process, this paper sets out the overall programme, questions and objectives of the literature review. The corresponding review process is as follows:

## 2.2. Review of the Research Questions

- i. RQ1: What are the current status and trends of animation technology research in CH?
- ii. RQ2: Can animation technology improve CH protection and communication?
- iii. RQ3: What are the moderating factors that influence communication?

Based on the research questions, the research objectives are set according to the PICO principle. [Table 1](#) shows the means of PICO in the paper.

Table 1: PICO in the paper

Types	Content	Means	Means in Paper
P	Population	The investigated object	Animation Technology in Cultural Heritage (ATiCH)
I	Intervention	The way of research	Systematic review
C	Comparison	The comparative objective	Different scholars' research on ATiCH
O	Outcomes	The expected outcomes of the review	Sort out the research status and trends on ATiCH ; Determine the impact of communication on ATiCH; Identify the moderating factors that influence the communication effect on ATiCH; Find out the research gap and give suggestions and strategies.

## 2.3. Inclusion and Exclusion Criteria

With the aim of finding a more specific research topic, reviewing literature and answering the research questions, this thesis conducted a screening. To determine the eligibility criteria, [Table 2](#) shows the criteria for systematic review.

Table 2: Criteria for systematic review

Criteria	Inclusion	Exclusion
Scientific, peer reviewed journal and conference proceedings	√	
Quantitative and qualitative study	√	
The dissemination effectiveness of ATiCH are main discussed	√	
Studies whose full text was available.	√	
High-level papers in SCI, CSSCI, PKU, and CA that have been cited more than once.	√	
ATiCH is just a part of research, not all		√
Studies for which the full text was not available		√
Duplicate papers		√

The research is eligible for inclusion if the main subject of the study is tangible and intangible cultural heritage and the research method involves use of animation technology. All types of animation technologies are eligible, including 2D, 3D, VR, AR, H5, motion capture, interaction and so on. Animation is eligible if it is part of all components and can be studied separately. This study examines the variation in participants before and after watching the intangible cultural heritage animation. The most important

outcome is knowledge, followed by attitudes and perceptions (such as satisfaction with the information, self-confidence) and behaviors (protection behaviors, learning behaviors, sharing behaviors and dissemination behaviors).

#### 2.4. Terms of the Search

The terms of this literature search can be divided into several keywords including an animation evaluation. This work searches well-known online databases, such as Scopus, Science Direct, CNKI, Web of Science (WOS), and IEE Explore. To ensure the quality of the literature, only high-level papers with SCI, CSSCI, PKU, Master's degree, or above are selected from the CNKI database. The terms used for animation are:

(Animation OR Cartoons)

The following terms are added to narrow the scope of the search in terms of user understanding.

AND (Cultural Heritage OR Intangible Cultural Heritage)

AND (Effects OR Communication effects OR Effectiveness)

In addition, the results are refined by classification, i.e., the limited year range from 2015 to 2023, and document types including journals, and conference paper in English language, and the search area related to animation in CH is narrowed down.

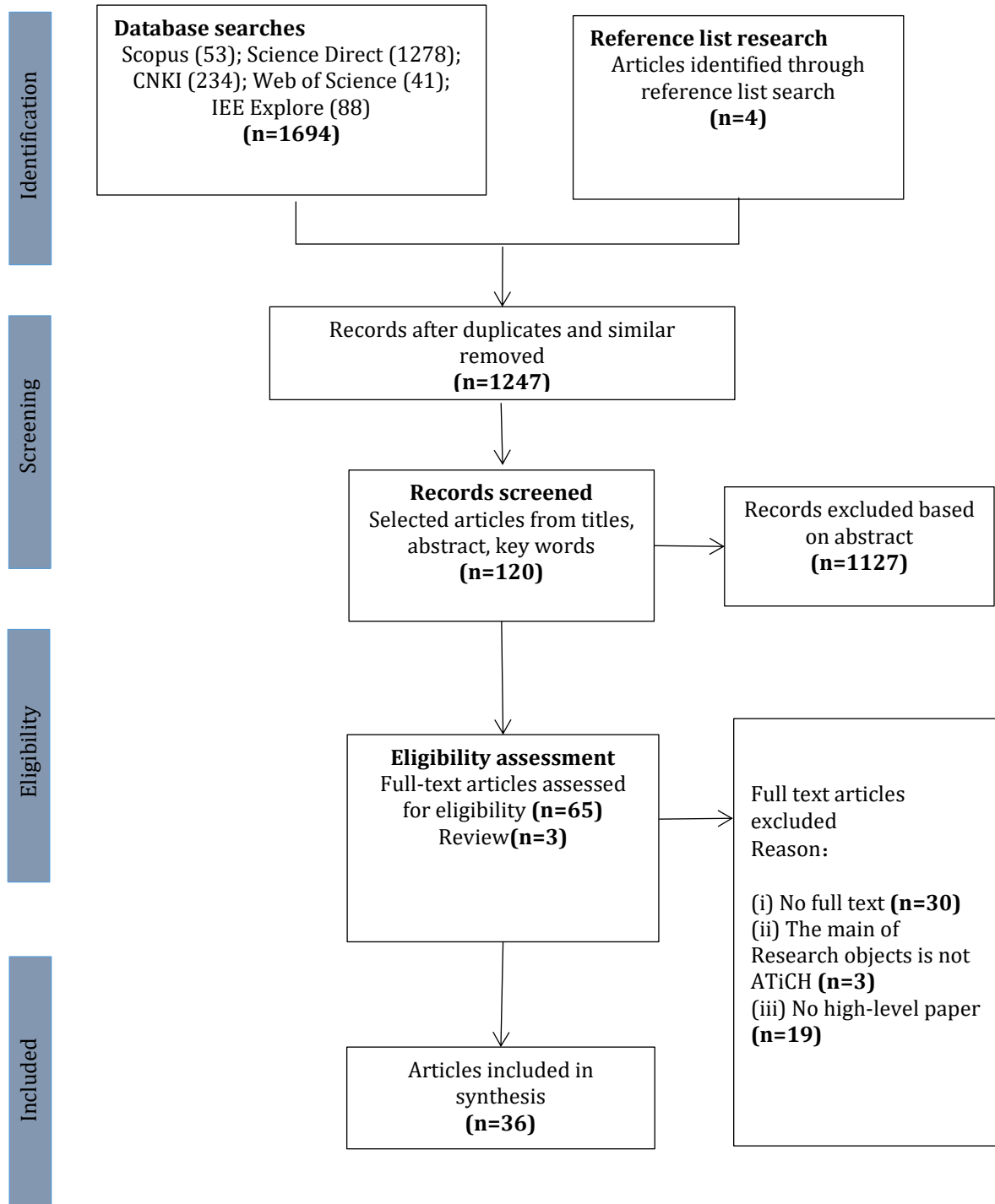
Returning to the purpose of this article, this review plays a role in ATiCH. According to the screening criteria, 1,698 papers on animation and CH were selected from 5 databases and references, and imported into Note Express and E-study software to produce a ranked list. The duplicate papers were removed and finally 1,247 papers were found. Then, by reading the titles, abstracts and keywords, those that do not match the content of the study are excluded, and 120 papers that match the research purpose are further screened out. Thirdly, general journals are excluded in chronological order, 19 insignificant and incomplete papers, 30 papers that could not be downloaded completely, 3 papers whose research content is different from the purpose of this paper, 2 conference papers that contain only table of contents and abstract, and thus the 68 papers are read through completely. Based on the general reading, articles with research value are selected, and finally 36 papers are identified for inclusion in the study.

After a general reading, this paper is excluded for the following reasons:

- i. The purpose and problems of the research are not clearly stated in the paper.
- ii. The paper does not take animation technology as the main research subject, but only as an example of digital medium.
- iii. The paper is not about CH (tangible and intangible CH), which is only an incidental example.
- iv. The content and main viewpoints of the paper are similar to those of other papers, and there are no innovative opinions or proposals. For example, the same animation technology is used in application research, only the objects of CH are presented in different ways.

Figure 3 shows the flow chart for systematic literature review. Based on the criteria in Table 2, 36 papers meet the criteria mentioned in this paper and are considered important, i.e. papers that explain and evaluate the role of ATiCH.

Figure 3: Flow chart for systematic literature review



### 2.4.1. Variable codes in studies

For each available experiment, the following five variables are extracted:

- i. Authors, databases and year of publication.
- ii. Projects area as indicated by the authors (TCH, ICH).
- iii. Approach, research design, and objectives of the work (qualitative, quantitative, mixed, and applied).
- iv. The use cases in animation technology by the author.
- v. The results of the research.

## 3. Results and Analysis

In the 36 papers reviewed, this study focuses on the following topics: the importance and role of animation technology in the preserving and communicating of CH, the application of ATiCH, the impact of the application of animation technology and the communication effectiveness of narrative animation.

### 3.1. Papers on the Role and Strategy of Animation Technology for the Conservation and Communication of CH

In the literature review, 32.35% (11 articles) applied qualitative research and descriptive analysis to propose the role of animation and ATiCH, analyse the current problems of ATiCH, and develop appropriate strategies. A total of eight articles (72.72%) came from the CNKI database, one article (9%) from Science Direct, and two articles (18.18%) came from IEEE. From the above percentages, it can be seen that both domestic and foreign scholars have studied the role of ATiCH with qualitative and descriptive analyses with relatively more scholars from China.

Animation in particular, with its humour, exaggeration, audiovisual effects and technical diversity, synthesis and ability to create a relaxed atmosphere, has a great conserving and communicative role in CH, which was affirmed by most of the scholars in these 36 contributions. Among them, 27.27% of scholars consider it particularly useful for children (Zhang & Liu, 2015; Ruben et al., 2017). One of the scholars argues that the preservation of CH should start with children and that it is necessary for children to know, recognise and enjoy ICH (Zong, 2018). Animations depict the connotation of CH through storytelling (Saptarshi, 2016), not only to entertain, humor and create a light-hearted atmosphere for the audience, but also to provide visual information and convey abstract content through animation technology (Jiang, 2021) and discover applications in new scientific fields through animation techniques. The new technologies constitute a privileged resource for the enhancement of cultural heritage by the socio-cultural animator (Ruben et al., 2017).

In recent years, animation technology has become a research focus in CH in the form of AR, VR, interactive technology, motion capture technology, animation narrative stories, and animated characters to preserve and communicate of CH that is in danger of disappearing. Summarising these studies, it is concluded that there are different types of strategies for using animation technology to protect and disseminate ICH. These include the creation of narrative, storytelling animations, based on CH, using virtual simulation technology to create immersive animation, interactive animation technology to create roaming animation, and the use of 3D and interactive fusion mode to create serious games for CH. On the one hand, animation technology is only used as a part of ICH to

recreate history, visualize abstract contents, and make CH more vivid, comprehensive, and concrete (Wang & Meng, 2018); on the other hand, the integration of animation technology and art, which uses narrative mode to tell stories and convey emotions about CH, is a second creation of CH (Zong, 2018), which improves the quality of ICH. Luo (2022) suggested improving the quality and taking full advantage of new media platforms and social networks to achieve favorable communication effects.

### 3.2. Papers on the Application of Animation technology for Conservation and Communication of CH

There are more scholars working on the application of ATiCH, accounting for 41.18% (14). Among them, there are 9 articles from CNKI database, accounting for 64.28%, 2 articles from Scopus, accounting for 14.29%, 2 articles from IEEE, accounting for 14.29%, and 1 article from Science Direct, accounting for 7.1%. There are also 3 Dunhuang murals, 3 folklore stories, 4 historical sites and 1 traditional handicrafts, shadow culture, ritual culture, and Shizhuzhai paper culture. From the analysis of the literature mentioned above, animation technology is most commonly used in CH sites, folklore and murals, while folk culture is relatively less studied due to its greater diversity, but has a wider scope.

Figure 4 shows different animation technologies. Animation technology includes VR (see Figure 4 (a)), 3D animation (see Figure 4 (b)), 2D animation (see Figure 4 (c)), holographic projection, virtual simulation animation, motion capture (see Figure 4 (d)) (Partarakis, et al., 2020), and interactive computer animation. In most cases, these techniques are not used individually, but in combination with two or more other techniques. these technologies are not used individually, but in combination with two or more other technologies. For example, "Hunan Shadow Digital Interaction Design" (see Figure 4 (e)) uses 3D animation and interaction technology (Wei, 2020); "Deer King Benshu" (see Figure 4 (f)) uses 2D animation and interaction technology (Cao, 2022), and "Dance - Dream" uses 3D animation, interaction, and holographic projection (Li, 2021). However, these applications are only attempts to apply animation technology to a specific domain, and few researchers have included both applications and effects in their studies. The review in this article also includes only 7 impact studies, all of which are superficial and not in-depth.

There are 21 articles on the application and impacts of animation technology, 12 (57.14%) use VR technology and 6 (28.57%) use 2D animation technology, and 4 of them are narrative animation. In fact, interaction technology is used in both 3D and 2D technology. The VR technology contains 3D technology and interaction technology, and there are some interactions in 2D technology as well. 3D animated characters and behaviors are the basis of VR technology, and 3D animated scenes can also be used for 2D animation. It can be seen that the animation technology currently used in CH consists mainly of VR technology and 3D technology, followed by 2D animation technology.

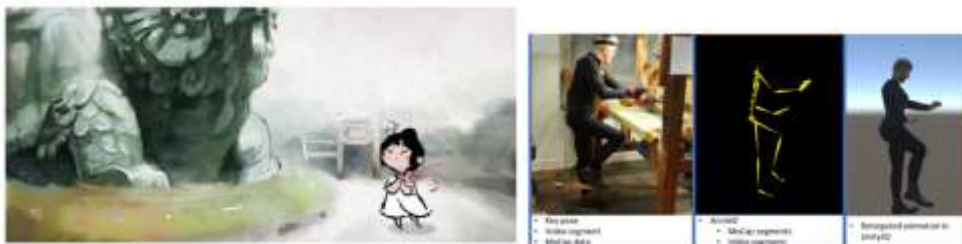
The software needed for 2D animation techniques includes Flash, Comic Studio Paint, TVpainter, Moho, After Effect, Photoshop, Premiere and other software tools that cover the whole animation process, such as animated characters and animated behaviors. 3D animation technology is mainly used in software tools, such as Cinema 4D, Maya, Blander, 3D max, UE4, Unity 3D. Other tools such as CT Scanning are also employed to assist the implementation of VR animation. Despite the fact that 3D and VR technologies are hot topics of research, 3D animation, VR animation, and interactive animation have

many complex tools and a large amount of technology. In January 2018, international law firm Perkins Coie conducted a reproduction survey of 140 US VR/AR professionals. The results show that the biggest barrier to the popularization of VR is still the user experience. Therefore, from the point of view of wide distribution, 2D animation is easier to spread and popularise than VR, because the means of production and the equipment are simpler. The high demand for VR technical aids and viewing equipment makes it impossible for viewers to reach every family. However, there is no research evidence that using 2D animation technology to distribute animation is more effective than 3D. Using digital visualisation technologies, it is possible to create access that is closer to the reality of the place by enhancing the immersive and sensory aspects of the presentation (Jouan et al., 2021). With the addition of virtual reality interactive technology, the audience will be more active and interested (Wei, 2020).

Figure 4: Different animation technologies



(a) VR with animated characters and (b) 3D Animation “the Eighteen behaviors “In a historical simulation of the Tombs in Guanzhong” (Liang, 2019) medieval city of M’ertola” (Antunes & Correia, 2022)



(c) 2D Animation “Tour by the wind” (d) Motion Capture “Mingei Project” (Zhou, 2021; Partarakis et al., 2020)



(e) 3D Animation and Interaction (f) 2D Animation and Interaction “Hunan Shadow Puppet” (Wei, 2020) “The Deer King’s life” (Cao, 2022)

### 3.3. Papers on Effects of Animation Technology for Conservation and Communication of CH

There are relatively few studies on the application effect of animation technology, and they are mainly post-application studies to test the effects. The literature mainly stems from 3 articles of Science Direct, accounting for 42.86%, among which 1 comes from

Scopus, 2 comes from CNKI and 1 comes from IEEE. There are 4 articles studying on the application effect of VR technology, 2 articles on the effect of 2D animation technology, and 1 article on the effect of interactive technology. The data of the literature review above illustrates that scholars who apply the effect research mainly focus on the effect of animation in VR technology, but pay little attention to other types of research.

The results of the review show that the majority of audiences have a positive attitude towards the use of ATiCH (Gaugne, et al., 2022; Pan, 2021; Kathryn, et al., 2020). However, there are other factors that need to be taken into account to achieve greater audience recognition, especially to increase audience knowledge and communication, purchase, and sharing behavior of CH. Interaction and narration would be an interesting avenue to explore in future research (Antunes & Correia, 2022) and it is also a general positive acceptance of 3D technology, more specifically, an active acceptance of animated characters. Some scholars reported that the characters, narratives, aesthetics, culture and traditions depicted in animated films can motivate audiences to visit theme parks, which in turn positively influences their attitudes and behavioral intentions to visit the parks in the future (Oha & Ki, 2020).

Most people have seen a real interest in the different animation techniques (Gaugne et al., 2022). Some scholars reconstructed a mummy's face 2,700 years ago by a touch-object as well as digital animation (Kathryn et al., 2020). After 236 responses to the questionnaire, they state that children under 10 years tend to be attracted to interactive digital games adjacent to 3D printing (displayed on a separate display, separate from Ta-Kush and visible videos) at first. Older children and adolescents move first to the 3D print and then to the monitor with the digital animations of Ta-Kush; while adults watch the animations and then touch the 3D print (see Figure 5). Therefore, it is also important for researchers to use animation technology suitable for the audience, further illustrating the necessity of determining the factors that influence the audience's perceptions, attitudes and behaviors.

Figure 5: A touch-object as well as digital animation (A full-colour CGI animation) for rebuilding a 2700-year-old mummy's face "Ta-Kush" (Kathryn et al., 2020)



### 3.4. Papers on dissemination effectiveness of animation technology for conservation and communication of CH

There is even less empirical research on the communication effect of ATiCH, and it is mainly narrative animation with 3D animation technology and 2D animation technology, and VR animation is almost non-existent. The author believes that this is related to the lack of animation in VR technology, the difficulty in popularizing technology and the small audience.

Base on the literature review, 4 articles empirically studied the effects of narrative animation on Chinese mythology, 'righteous' culture and minority cultures, as well as in Ancient Iranian culture. The examples of animation techniques used in these studies are mainly 3D and 2D narrative animation. Animation is closely relevant to children's early understanding of ICH, as watching stories is easier to remember and can improve children's reading behavior.

This research confirms the positive role of animation in CH, but does not clearly identify the specific factors that influence children's knowledge, emotions, and behavior towards CH. [Bandura \(2001\)](#) argued that a 'Tripartite Reciprocal Interaction' of individual factors, behavioral factors, and environmental practices influences human behavior.

As mentioned in the previous subsection, age may affect the effectiveness of animation techniques in the communication of CH. [Zheng \(2020\)](#) verified that there is no correlation between the content of animated stories and the dissemination of 'righteousness' culture based on Stuart's coding and decoding theory, nor between gender and age. The correlation between educational attainment and the dissemination of 'righteousness' culture provides a reference for studying the effect of personal factors on the communication of animation technology.

In addition to personal characteristics, environmental factors are also influential factors worthy of considering. [Zhang \(2019\)](#) empirically found that technological factors, cultural factors, and the audience's sense of expectation are the three major antecedents influencing audience dissemination behavior through the information quality framework and the expectation confirmation model empirically, which influences the audience's perception factors and satisfaction and thus dissemination behavior. Expectation confirmation is the most important behavioral driving factor, which affects the perception of dissemination effectiveness and emotional attitude of the audience. Finally, it is also noted that mythological elements are indeed or meaninglessly piled up in the animation, and that the production quality is uneven, leading to a disconnection from the audience, for example, affecting communication effectiveness.

In order to promote the effectiveness of animation in the field of cultural genetics, scholars put forward the following 4 steps: 1. Creating attractive animation, introducing fashion with cultural values, 2. Improving quality 3. Adding special video effects 4. Borrowing best practices from other industries ([Sun, 2022](#)).

#### 4. Discussion

This review is focused on ATiCH, including TCH and ICH by 4 parts. [Table 3](#) shows the number of papers covering each topic and research approach. Such as role of ATiCH, application of ATiCH, effects of ATiCH, and the last one describing some papers about dissemination effects of ATiCH. Using the PICO principles, 36 relevant papers are finally screened. According to the research methods studied, there are 25 qualitative methods and 11 quantitative and the qualitative-quantitative methods (See [Table 3](#)). The quantitative approaches make it easier to identify the influencing factors when studying the effects of animation techniques in CH. Next, this paper returns to the research question for discussion.

Table 3: Number of papers covering each topic and research approach

Paper's Kind Elements	Amount of papers	Qualitative	Quantitative	Mix
Role of ATiCH	11	√		
Application of ATiCH	14	√		
Effects of ATiCH	7		√	√
Communication effects of ATiCH	4		√	√
Total	36			

#### 4.1. What is the current state of research and trends in ATiCH?

The author's analysis of 11 out of 36 qualitative articles by 21 scholars reveals that domestic and foreign scholars are very positive about the role of ATiCH, and that VR interactive technology has become a major research hot-spot, but it does not mean that 3D animation technology and 2D animation technology are not recognized. In fact, 54.55% of these 11 articles suggest that VR and AR technologies should be combined with interactive functions to attract and encourage a wider audience (Jiang, 2021; Wang & Meng, 2019; Zong, 2018; Saptarshi, 2016; Ruben et al., 2017).

However, 18.18% of scholars believe that short and concise 2D micro-animation is more capable of creating a relaxed atmosphere and engaging audiences (Geng & Liu, 2021). 27.27% of scholars also insist that 3D animation technology is closer to the aesthetic needs of children's audiences, gaining appreciation and empathy from CH native audiences (Zhang & Liu, 2015). Zong (2018) also argue that both VR interactive technology animation, 3D, and 2D animation technology can make children aware and knowledgeable about CH, thus preserving it.

Animation technology takes many forms in CH, either as a complement or as a narrative character. Regardless of the animation technique, there is one thing in common. Scholars have mentioned the need to combine it with narrative for better preservation and communication of CH (Luo, 2022; Ruben et al., 2017). Since animation is highly open, inclusive and diverse, it enhances the depth and breadth of children's perception of animation (Wang & Meng, 2018) and interest (Saptarshi, 2016; Ruben et al., 2017) through an exaggerated and novel audio-visual sensation.

Animation technology mainly includes VR technology, AR technology, interactive animation, 3D animation, and 2D animation. VR technology, AR technology, and interactive technology are interlinked, and 3D and 2D animated characters and movements are integrated into the animation interactive technology. Even though VR technology is currently a research hot-spot in CH, it hasn't been popular among a large number of audiences due to its technical difficulty and high equipment costs. The combination of 3D animation and 2D animation technology and narration is still the mainstream at present, breaking through the integration of VR animation technology and narrative, improving VR animation content, and visual quality is a possible trend for the future development of ATiCH.

#### 4.2. Can animation technology enhance the preservation and dissemination of CH?

VR and interactive technologies are the focus of current research. Among the 21 application and effectiveness studies in the literature, 11 articles are the application studies of VR technology. Among them, three effects articles use quantitative analysis to

demonstrate that VR technology is highly appealing to audiences in CH (Gaugne et al., 2022), especially animated characters are popular with audiences. However, among those who are interested in the cultural content presented by VR technology, only 50% feel that they have a better understanding of the culture of the website than before (Antunes & Correia, 2022).

This suggests that the impact of VR technology on audience perceptions is not as great as many scholars predicted. The main reasons may be the quality of the animations generated by tools and the fidelity of simulated products. However, Soltani and Khedmati (2012) used Iranian animated stories to demonstrate that the most effective way for children to understand stories is to watch the animation.

Chinese scholars used VR technology and narrative methods to create the VR documentary animation. The Ritual, which portrays a message of authenticity and objectivity, has been affirmed and technically approved by the audiences, but it is still lacking in terms of humanistic landscapes, and cultural beliefs (Pan, 2021). In addition, VR technology with realistic content should enhance the humanistic landscape and cultural beliefs, and promote the spread of culture. Excellent animated characters are able to promote the purchase behaviour of the audience. Jianni et al. (2021) practiced 2D animated characters on the characters in "The Legend of the White Snake", and verified that 63.93% of the audience who liked this animated character were willing to buy culture-related products.

Then, after Meng (2019) used H5 animation and interactive technology to apply the study to Yangjiabu wood-paneled New Year paintings, only 70% of the viewers expressed some interest or awareness of Yangjiabu wood-paneled New Year paintings. But, only about 10% of the viewers showed a desire to purchase. Different animation techniques have different effects on the audience's perception and behavior.

It is therefore quite certain that animation technology has preserved CH permanently by digital means. From media communication point of views, although animation technology is capable of arousing the interest of most audiences in CH, its effectiveness, especially in terms of audience's perception and behavior towards CH, it needs further study and determination. What's more, it is necessary to further study the advantageous features of different technologies according to the needs of various audiences, and to pinpoint the audience so that CH can be disseminated more effectively.

#### **4.3. What are the moderator factors affecting the dissemination?**

There are many factors that impact the effect of animation communication. According to Bandura (2001) social cognitive theory of 'Triadic Reciprocity' personal, environmental, and behavioral factors can all influence each other. In terms of personal cognition, self-efficacy, and outcome expectations have a significant positive impact on audience behavior, while individual behavior is mainly influenced by subjective factors, and environmental factors have no significant impact on behavior. However, some people think that technical factors, cultural factors and audience's expectation are the three main antecedents that affect audience's dissemination behavior, and expectation proves that it is an important driving force of knowledge dissemination and has an impact on audience's cognition and emotional attitude (Zhang, 2019).

In recent years, the overall improvement of China's animation level is particularly obvious at the technical level, and many works have convincing visual effects (Xu, 2014). However, there is no empirical evidence from scholars as to whether these techniques can facilitate changes in audiences' knowledge, emotions, and behavior toward CH presented in animation.

## 5. Conclusion

Through a systematic literature review of 36 papers, this article discussed the following issues: the role of ATiCH and strategies for its preservation and dissemination, the current situation and effects of the application of ATiCH, and the communication effect of ATiCH. Based on the author's analysis and discussion, the following conclusions are preliminarily drawn.

Animation technology plays an active and important role in all kinds of CH. However, it is undesirable to rely solely on technical improvements to the detriment of the quality of content and narrative in the preservation and communication of CH. At present, there are still many ICH in animations that do not have good communication effect. The hollowing out of animation content is one of the problems of animated cultural communication (Deng, 2020). The characters, narratives, aesthetics, cultures, and traditions depicted in the animations have shown a strong motivation, thus affecting the audience's attitude and behavior (Oha & Ki, 2020). The ultimate goal of ATiCH is to achieve the preservation and inheritance of CH, especially ICH so that more ICH that is on the verge of extinction can be passed on. Different audiences have different needs for the technology, and it is precisely the dual accurate positioning of content and technology (Deng, 2020) and the clarification of audience's perception, interest and behavioral influence on ICH that will maximize the effectiveness of animation technology in preservation and communication.

It is worth noting that when this literature is divided by country, Chinese researchers tend to focus mainly on qualitative and applied research, and pay less attention to effects research with quantitative, while scholars outside China tend to concern more on applied and quantitative research. This also reveals the deficiency of China scholars in empirical research. Therefore, the study on the effectiveness of animation technology in the field of communication in CH is an important topic for Chinese researchers, and the horizontal comparison of the effectiveness of different animation technologies in the field of cultural communication is also a gap in the current field of ATiCH, requiring further in-depth research by scholars.

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## Conflict of Interest

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