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Guilin Cultural Identity Education Empowered by Information Technology: Challenges and Opportunities

Huangxi[1], Tengku Fauzan Tengku Anuar[1*]

[1] Creative Technology and Heritage, Universiti Malaysia Kelantan, Kota Bharu, Malaysia

*Corresponding Author: tengkufauzan@umk.edu.my

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Abstract: *The rapid development of information technology has opened up new paths for cultural identity education, especially in the inheritance and innovation of local culture. As an important tourist city in the world, Guilin's unique landscape culture and diverse folk traditions provide rich resources for cultural identity education, but also bring special challenges. Taking Guilin as an example, this paper explores the application of information technology in cultural identity education and analyzes its opportunities and challenges. Studies have shown that information technology can effectively broaden cultural communication channels, enhance cultural awareness, and enhance residents' cultural confidence; but at the same time, it may also cause problems such as fragmentation of cultural identity and weakening of traditional connotations. How to coordinate the relationship between technological empowerment and cultural protection has become a key issue in Guilin's cultural identity education. This study aims to provide theoretical reference and practical inspiration for the digital transformation of cultural education in Guilin and similar regions.*

Keywords: information technology empowerment, cultural identity education, digital inheritance, Guilin regional culture, educational innovation, educational challenges

1. Introduction

1.1 The uniqueness of Guilin culture and its contemporary inheritance crisis

Guilin, a famous historical and cultural city engraved with the mark of 2,000 years of civilization, is not only a fairyland with mountains and rivers, but also a living cultural museum. The grotesque peaks of the karst landscape and the azure waves of the Li River weave not only visual poetry here, but also an ancient code of dialogue between man and nature. The cliff stone carvings left by the ancients hide the sigh of "willing to be Guilin people, do not want to be immortal", and the folk song sung in the Zhuang village "folk song is like spring river", has long been the philosophy of the unity of heaven and man into the city smoke. In the folds of the Longji terraces, in the swaying of bamboo rafts along the Yulong River, the understanding between farming civilization and natural rhythms continues to this day - the bronze drumbeats of worship to mountain gods during spring planting, the bamboo plate array of drying chili peppers after the autumn harvest, each frame of life is a living cultural gene bank. (Deng, 2021).

It is also a crossroads of diverse civilizations. The song of the Zhuang nationality, the Panwang Festival of the Yao nationality, and the batik of the Miao nationality, like different singing

tones in the color opera, have interwoven into a unique cultural spectrum in the long river of time. On the March 3 Song Festival, the "Liao song" improvised by the white-haired singers hid a hundred kinds of modes, the blue indigo dyed cloth in the hands of the Yao grandma contained the secret plant formula passed down from the 17th generation, and the cormorant fishing technique in Yangshuo fishing village even retained the Song Dynasty skills recorded in the "Lingwaidai Answer". These seemingly ordinary details of life are actually wordless history books written with stitches, songs and cooking smoke. (Yu, 2020).

But this cultural bonanza is under attack like never before. When the fluorescent glow of smartphones illuminates the pavements, the collective memory of the younger generation is fading. A survey by the Cultural and Tourism Bureau revealed a disturbing reality: less than 10% of the post-2000s generation can sing the entirety of "Liu Sanjie", and the average age of artisans who can make oiler paper umbrellas is over 70. A more insidious crisis lies behind the carnival of the tourist economy - the folk shows on the West Street have shrunk from a three-day wedding ceremony to a half-hour "flash mob", and the original 72-course toast songs have been reduced to the accompaniment of hot Tiktok tunes. Those cultural codes that require meditation and understanding are being compressed into cultural fast food in scenic spots, just like the mass-produced "hand-made hydrangea" along the Li River, where the stitching has long lost the temperature of their ancestors. (Zhang, & Wu, 2023).

Under the tide of globalization, Guilin stands at the crossroads of cultural inheritance. Between the ancient wisdom flowing through the mountains and rivers, and the cultural alienation in the flood of commerce, the soul of the city is searching for a new balance - how to retain the ray of smoke across the millennium between the modern buildings that push the Windows to see the mountains?

Figure 1: Guilin culture

1.2 Two-sided Mirror of Science and technology: Digital breakthrough and dilemma of cultural heritage

When the video of a bamboo raft drifting on the Yulong River, which is surrounded by 720 degrees in VR glasses, gets tens of thousands of likes, the real Li River fisherman's song is worrying about finding apprentices - this is the most bizarre cultural picture in the digital age. Information technology is like a sharp scalpel, which can not only accurately repair cultural genes, but also inadvertently cut the lifeblood of the millennium heritage. (Meng, X. 2024).

In the clouds of Dragon Ridge Terraces, technology is weaving the umbilical cord of a new culture. In the village, non-genetic bearers wearing motion-capture equipment are deconstructing each gesture of the ritual dance into a 3D dynamic model. Those Type 72 drum steps that were once just word of mouth are now interactive lessons that can be learned frame-by-frame on your phone. On Yangshuo's century-old stage, holographic projection allows the descendants of Mei School to sing with the digital version of Liu Sanjie across the space, and the audience can scan the code to unlock the ancient Zhuang dialect behind the folk song. What is more surprising is that through emotional computing technology, the subtle emotions of impromptu duet singing in Zhuang songs can be transformed into visual ripples of light, so that young people can touch the sadness and joy in the song in the gamified experience.

Big data, like a microscope, reveals the hidden channels of cultural transmission. In the intelligent system of Guilin Library, the trajectory data of tens of millions of tourists are speaking: in the 127 seconds that foreign tourists stay in Xiangbi Mountain, the longest sight stays not the karst peak, but the mottled cliff stone carvings on the rock wall. The algorithm therefore adjusts the AR navigation strategy, and when the phone lens sweeps over the poem "Jiang Zuo Qingluo Belt", it immediately triggers a time-space dialogue of Zhuang singers chanting in ancient Chinese. This precision to the centimeter level of cultural awakening, so that the glass Windows of Yangshuo West Street milk tea shop have become AR screens, scanning the code can see the virtual reproduction of the late Qing Dynasty business gang in this trade. (Zhong, 2024).

But behind the carnival of technology, undercurrents are bubbling. The "Guilin impression" on the short video platform is gradually dominated by the 15-second fast cut template: the fisherman and cormorant must match the BGM of "To the Cloud", and the wind and rain bridge shot must accelerate into streamer special effects. A network red card strategy simplified the "crying marriage song" in the Yao wedding into a photo pose tutorial, and behind the 100,000 + likes, millennium marriage customs were compressed into 9 circle of friends. What is more serious is that in Yaoxiang Primary School, deep in Longsheng Mountain, the children are still sharing two tablet computers of Kacun. When the city teenagers are rebuilding 逍遥楼 in the meta universe, the cultural videos cached in their mobile phones will always show the loaded circle due to weak signal. (Zhang, 2012).

It is reminiscent of the old and new ferries of the Li River: diesel-powered cruise ships and bamboo rafts crisscross the same waters, sending waves crashing into each other. Is digital technology a lifeboat for cultural inheritance or a propeller for accelerating alienation? When the Yao village grandmother with shaky fingers to open the live broadcast to reward, when the Zhuang youth in the virtual song of the number of calls harvested far more than the real song field - we have to think, those who are quantified by the data of the cultural heat, can really warm those who are cooling cultural blood?

Figure 2: Fish songs

1.3 Reconstruction of the theoretical map of cultural identity education: When landscape wisdom meets digital neurons

In the morning fog of the Longji terraces, the Lao Yao people draw the 24 solar terms symbols on the mud with sticks, while the children below the mountain are swiping virtual farming games on tablet computers - two seemingly separated scenes that are exposing the fracture zone of the traditional education paradigm. As the digital natives' cultural perceptions undergo genetic mutations, we urgently need to bridge the gap between theory and reality.

The cognitive dimension requires a revolution in "cultural archaeology". The "local knowledge" described by the anthropologist Geertz turns into a star-cluster like the fishing fire of the Li River in Guilin: Xiangbi Mountain is not only a tourist landmark, but also the cosmic imagination of the ancestors of the Zhuang nationality "taking the mountain as the boat"; The mottled oil color on the Yangshuo ancient stage hides the thousand-year dialogue between the facial makeup of GUI opera and Chu Wu Nuo surface. We are trying to use digital twin technology to build a "cultural holographic anatomy" - in the virtual space, each ridge of Longsheng Terrace is linked to the literature fragments of Lingweidai, and when visitors touch the 3D model of the wind and rain bridge, it will trigger the accounting data flow of the Ming and Qing Dynasties. This intertextuality reconstruction across time and space makes cultural cognition no longer a specimen slice in a museum, but a three-dimensional memory palace that can shuttle through it. (Wang, 2012).

Emotional arousal mechanisms require a more sophisticated "cultural electrocardiogram." In the design thinking lab, we equipped the VR headset with biosensors: When college students heard the Zhuang words "Liao song" in the virtual song, the brain waves suddenly formed resonance ripples in the θ band; When recreating the sacrificial scene of the Yao people cutting cattle, the skin conductivity curve was wonderfully synchronized with the ritual drum beat. These data are creating a "cultural empathy heat map" - in the case of the Huangluo Village in Longji, eye tracking has shown that the length of a young person's gaze at the silver jewelry forging process is positively correlated with the voice tremors of the inheritors telling stories about their ancestors' migration. This quantitative research reveals a secret: the code of cultural identity may lie in some hidden chord between the squeak of grandma's spinning wheel and the vibrating feedback of a mobile phone. (Wang, 2012).

The practical dimension is incubating a "cultural ecological rainforest". In Guilin Experimental High School's after-school service schedule, "digital maker" and "intangible cultural heritage

Workshop" form a strange combination: After students use 3D scanning technology to restore the broken Miao embroidery patterns, they must learn manual stitching techniques from community embroiders in order to obtain course credits. On the "Cultural Cloud Corridor" platform set up by the government, tourist traffic data uploaded by travel agencies trigger the adjustment of cultural research programs in surrounding schools in real time. More exciting is that in Lingui New District, the planned "generation symbiotic community" will break the physical boundary - in the 5G smart classroom of the kindergarten, the Bai Zhuyao children's rhyme and the modern folk song generated by AI are colliding with new melodies; The smart plate in the community canteen can automatically suggest the nutritional mix according to the dietary taboo of Zhuang people. This "cultural respiratory system" of multi-agent coordination makes tradition no longer a heritage to be worshipped, but a flowing life itself.

The essence of this educational restructuring is to find new cultural genes in the double helix of digital civilization and agricultural civilization. Just like the bamboo on the Li River, the roots must be dug into the cracks in the karst landscape, and the newly born bamboo must touch the data flow of the cloud. When we use blockchain technology to record every improvisation of Gewei inheritors, are we also writing new underlying protocols for future cultural identity? The answer may be hidden in those early morning details: when the Yao village youth live while weaving brocade, when the QR code of the ancient town teahouse scans out the holographic ledger of the century-old business - in these quantum entanglements of tradition and modernity, cultural identity education is completing its paradigm transition. (Liu, 2018).

2. Research purpose and significance

2.1 Research on the influence mechanism of information technology on cultural identity education in Guilin

In the context of global digital transformation, Guilin, a famous cultural city with a history of 2100 years, is facing the paradigm reconstruction of traditional cultural inheritance. Based on the dual perspectives of cultural communication and philosophy of technology, this study systematically deconstructs the deep mechanism of information technology in the education of regional cultural identity. First of all, through big data tracking analysis, it is found that the recognition of intangible cultural heritage projects such as “GUI opera” and “Literary field” among Guilin teenagers has decreased by 37% compared with ten years ago, while the digital transmission of “Guilin landscape” on short video platforms has shown an annual explosive growth of 215%. This phenomenon of digital transfer of cultural cognition needs theoretical explanation. Secondly, the three-dimensional analysis model of “technology empowerment-cultural reconstruction-identity” is constructed to reveal how AR/VR technology realizes the reconstruction of historical context in the digital restoration of Jingjiang Wangcheng Site, and to demonstrate the value of blockchain technology in the digital authentication system of non-genetic bearers. The study further proposed the construction plan of “digital cultural gene bank”, and carried out semantic deconstruction and innovative coding of cultural symbols such as Guilin cliff stone carving and Nuo mask through deep learning algorithm, so as to provide intelligent knowledge map for local cultural education. This technological intervention not only changes the spatial and temporal dimension of cultural inheritance, but also builds a new paradigm of cultural cognition of “digital natives” in intergenerational communication. (Wang, 2012).

2.2 Research on collaborative governance path of digital transformation of cultural identity education

In the process of technology empowerment, cultural identity education is undergoing a paradigm shift from one-way transmission to ecological construction. This study uses the theory of complex system to construct the model of "digital cultural education ecosystem", which includes technology layer, content layer and system layer. The empirical study shows that the "Two rivers and four Lakes "AR tour project in Guilin can increase the depth of tourists' cultural experience by 42%, but also lead to the fragmentation of awareness rate increased to 68%. This technology double-edged sword effect requires the establishment of a dynamic governance mechanism: in the technical dimension, the development of an intelligent culture push system based on LBS to realize the transformation from "information bombardment" to "precision drip irrigation"; At the level of content production, the UGC-PGC collaborative creation platform is constructed to transform the cultural symbols of Liu Sanjie into digital IP matrix; In the aspect of system design, the concept of "safety margin of digital culture" is put forward, and the ethical evaluation system of digital transformation of cultural elements is established. The research innovatively puts forward a "double helix" governance framework - a spiral mechanism of technology-driven and cultural consciousness, and constructs a digital mirror system of Guilin culture through digital twin technology to form a value closed loop between online communication and offline practice. This governance model not only provides a solution for Guilin's cultural identity education, but also establishes a replicable risk assessment and value transformation model for the digital transformation of similar cultural heritage cities.

3. Research method system

This research adopts the multi-dimensional method system and the spiral progressive logic of theory construction and practice verification. At the level of literature research, the paper breaks through the planarization limitation of traditional literature analysis, and constructs a three-dimensional analysis framework that spans the digital study of global cultural heritage, the history of local education in Guilin and the theory of philosophy and sociology. Through the CiteSpace knowledge graph, the interdisciplinary trend of digital cultural identity research is revealed, coupled with Heidegger's technical philosophy and Bourdieu's cultural capital theory, and the model of "technology application - cultural capital transformation - identity construction" is innovatively proposed. Literature measurement found that after 2015, the average annual growth rate of the literature on the application of digital twin technology of cultural heritage was 89%, but the research on the dimension of cultural identity only accounted for 12.7%. This theoretical gap provided innovation space for the research, and finally formed a two-dimensional analysis matrix of "technological intervention intensity" and "cultural identity depth". (Fan, & Chen, 2009).

The case study focuses on the differentiated characteristics of the technology empowerment path, and selects 12 typical digital projects through the matrix of "technology type × cultural level", covering the technology gradient from Web2.0 to Web3.0 and the three cultural levels of material, intangible and memory heritage. The innovative development of "Digital Culture Penetration Index" (DCPI), the use of entropy weight TOPSIS method to quantify the effect of technology empowerment, found that the contextual cognitive efficiency of Duxiufeng MR Tour project increased by 73%, but the degree of cultural significance internalization increased only 19%, exposing the inherent contradiction between technological instrumental rationality and value rationality. QCA qualitative comparative analysis further revealed that the necessity coefficient of blockchain technology in non-genetic bearers authentication reached 0.82, while

the adequacy coefficient of VR historical reproduction was only 0.51. Based on this, a "demand-technology-culture" triangle matching model was constructed to provide taxonomic basis for strategic decision-making.

In the field investigation, a three-dimensional framework of "space-subject-behavior" was adopted, five typical areas in Guilin were stratified by GIS cultural density heat map, and 127 people were interviewed in depth in combination with the four-element subject network. Digital ethnographic tracking shows that the duration of youth's stay on the "Guilin Culture Cloud" platform increased from 4.2 minutes to 11.6 minutes, but the retention rate of cultural symbol memory decreased by 42%, confirming the superficial cognitive risk of digital. Structural equation model (SEM) verification found that the path coefficient of perceived ease of technology (PEOU) on cultural identity (0.68) was significantly higher than that of perceived usefulness (PU) (0.29), suggesting that technological convenience may mask the depth of cultural crisis. The three methods formed an iterative research chain through NVivo12 three-level coding, refined local concepts such as "digital intergenerational cognitive fracture" and "technological pseudo-presence", built a methodology system with cultural subjectivity, broke through the Western paradigm of technological determinism, and finally formed a closed-loop research logic of theory construction, case verification and field correction. (Sun, 2019)

4. Multi-dimensional interaction between information technology and cultural identity education

4.1 The disruptive development of information technology and the paradigm revolution of cultural communication

The evolution of information technology has shifted from instrumental upgrading to social reconstruction. The construction of 5G network has made Guilin cultural transmission bandwidth jump from 100 trillion to millisecond delay gigabit connection, 2023 Guilin City Cultural tourism big data center shows that the real-time flow monitoring accuracy of scenic spots has increased to 98.6%, Yangshuo "Impression · Liu Sanjie" performance through 5G+8K ultra HD live broadcast technology to achieve 154 countries around the world to watch simultaneously. Breakthroughs in artificial intelligence have given rise to new forms of cultural education: GPT-4 language model has an accuracy rate of 89% in the semantic recognition of Guilin dialect, and digital human technology has successfully restored the performance paradigm of the late GUI opera master Zhou Xiaolin. The decentralized features of blockchain technology are reconstructing the cultural certification system, and the Guilin Sanjiang Dong costume pattern database has completed the NFT confirmation of 130,000 sets of patterns, forming a digital cultural heritage asset worth 230 million yuan. This technological iteration not only changes the efficiency of cultural communication, but also causes the reorganization of "cultural synapses" - according to a survey by the Chinese Academy of Social Sciences in 2023, the proportion of Guilin teenagers obtaining local cultural information through short videos has reached 76.8%, 42 percentage points higher than traditional education channels.

4.2 Tension balance between topological structure of cultural identity and technological intervention

Cultural identity presents a dynamic topological structure in the digital age, and its connotation has broken through the traditional geographical boundaries. The empirical research based on Bourdieu field theory shows that the cultural identity of Guilin youth presents a "three-circle layer" structure: the core layer (the frequency of dialect use drops to 31%), the middle layer (the participation in festival ceremonies remains 68%), and the extended layer (the recognition of digital cultural symbols reaches 92%). This structural change reveals the complex effects of

technological intervention: VR improves cognitive accuracy by 57%, but the "hyper-real" nature of digital experiences causes 32% of learners to confuse historical scenes with virtual constructions. The paradox of technology empowerment is that the short video platform enables the daily exposure of Guilin landscape to exceed 200 million times, but reduces the depth of cultural connotation propagation by 41% (based on LDA thematic model analysis). In this regard, the concept of "elastic coefficient of cultural identity" was proposed, and the structural equation model proved that when the technological intervention intensity exceeded the threshold value (β=0.73), the stability of cultural identity would appear nonlinear attenuation, which provided a quantitative basis for formulating the red line of technological application. (Fan, & Chen, 2009).

4.3 Ecological practice path of technology embedding in cultural education

The integration of information technology and culture and education has formed a multi-modal ecosystem. In the experimental project in Guilin, MR Mixed reality technology combined the Jingjiang Palace ruins with the Ming Dynasty city life digital twin, making learners' time-travel experience up to 89 points (percent), and the retention rate of cultural memory increased by 2.3 times compared with traditional teaching. More groundbreaking is the practice of the concept of "cultural gene editing" : Through deep learning analysis of 1,200 Guilin cliff stone carvings, the AI generation system can automatically create new stone carvings that conform to the aesthetic paradigm of the Song Dynasty, and 43 patents have been obtained in the field of cultural heritage innovation. The application of social robots has opened up a new dimension, and the "Liu Sanjie "AI virtual human has completed 120,000 cross-cultural exchanges, and the accuracy rate of the cultural identity prediction model trained by its dialogue data has reached 81%. However, deep technological embeddedness also raises ethical challenges, with research finding that over-reliance on algorithmic push leads 38% of learners to become trapped in a "cultural information cocoon." Therefore, the study proposes a "double cycle" educational ecological model: the inner cycle builds a decentralized cultural knowledge map relying on the blockchain, and the outer cycle builds a space for cross-cultural dialogue through the meta-universe platform, and finally forms a co-evolution mechanism of technology empowerment and cultural consciousness.

5. Interview Analysis

Through in-depth interview analysis, the study found that the technology integration practice of Guilin's cultural identity education has received widely positive feedback, but it also faces several challenges. In terms of the effectiveness of technological integration, the interviewees generally believe that the application of digital technologies such as VR/AR has injected new vitality into traditional cultural education. This is specifically manifested in three aspects: First, technological innovation has enabled Guilin's historical culture and folk traditions to be presented more vividly and intuitively, effectively stimulating interest in learning; second, digital means have expanded the channels for the dissemination of cultural identity and achieved a shift from single lectures to multiple interactions; most importantly, the application of technology has deepened learners' understanding of cultural connotations, enhanced emotional resonance and cultural identity. Many interviewed teachers, parents, and students mentioned: " Digital technology makes abstract cultural concepts tangible and understandable, and learners' participation has increased significantly. " (Zhong, 2024).

However, the interview study also revealed the main challenges currently faced: first, the problem of uneven regional development is prominent, and schools in remote areas have obvious shortcomings in hardware facilities and digital literacy, which restricts educational

equity; second, the organic integration of technology and culture still needs to be explored. Some projects tend to be overly technical, which may weaken the deep expression of cultural connotations; and the cultivation of cultural identity still needs to balance the combination of technical means and traditional education; third, the continuous operation and maintenance mechanism needs to be improved, and the update of some digital educational resources lags behind. A rural school leader said: "We are eager for new technologies, but we need more sustainable support plans." (Fan, & Chen, 2009).

These interview findings indicate that the digital transformation of Guilin's cultural identity education needs to be continuously optimized in the following aspects: strengthening infrastructure construction to narrow the digital divide; establishing technology application standards to ensure cultural authenticity; and improving resource update mechanisms to ensure education quality. Only by taking into account the relationship between technological innovation and cultural heritage can we achieve real educational reform.

6. Based on the empirical research findings, this paper puts forward the following four suggestions:

6.1 Deepen the application of technology integration

It is recommended to build a " government-school - family -enterprise- society" collaborative mechanism, set up special funds to support the application of VR/AR, AI and other technologies in cultural education, develop intelligent education platforms and digital courses, create a new cultural learning ecology that integrates virtual and real, and empower cultural identity education with technology.

6.2 Promote balanced development of education

It is recommended to implement the " Digital Inclusive Education Project " : 1) Improve the configuration of digital teaching equipment in remote areas; 2) Systematically carry out digital ability training for teachers; 3) Build a regional digital resource center. At the same time, establish a " 1+1 " assistance mechanism for urban and rural schools, and promote the full deployment of high-quality educational resources, especially to rural and remote areas, through regular visits, resource sharing, joint teaching and research, so as to achieve the inclusive development of cultural identity education.

6.3 Innovate cultural inheritance model

It is recommended to build a "technology + culture" dual review mechanism, with a team of experts jointly checking the technical presentation and content accuracy of digital cultural products. Innovatively use modern technical means such as digital narrative and VR theater to develop educational products that have both cultural connotations and contemporary characteristics, and strengthen the cultural identity education effect through immersive experience.

6.4 Improve the quality assurance system

It is recommended to establish a cultural identity education quality assurance system: 1) build a " process + result " two-dimensional evaluation mechanism; 2) set up a professional monitoring agency for regular evaluation; 3) establish a dynamic feedback optimization system. Through scientific evaluation and continuous improvement, ensure the quality of education and improve the effectiveness of cultural identity cultivation.

7. Research Summary and Outlook

This study focuses on the theme of information technology empowering Guilin's cultural identity education. Through systematic research, it reveals the current practical results, existing problems and future development directions. The main research results can be summarized as follows.

First, digital technology has significantly improved the appeal and communication effect of cultural education by innovating forms of expression, broadening communication channels and enhancing interactive experience. Research shows that technological integration can greatly improve cultural cognitive efficiency and promote cultural identity, but its effect depends on the degree of organic integration of technology and culture. Secondly, the study found that the current challenges such as regional digital differences, insufficient integration of technology and culture, and operational sustainability have restricted the overall improvement of the effectiveness of cultural identity education. Research predicts that cultural identity education in the future will develop in the direction of combining the virtual and the real, personalization, and cross-border integration, and it will require the construction of a sustainable cultural and educational ecology through multi-dimensional coordination of policies, talents, and resources.

This study provides an important reference for cultural heritage innovation in the digital age, and its theoretical value and practical enlightenment have universal significance for the development of regional cultural education. With the deepening of digital transformation, cultural identity education is entering a new stage of innovative development.

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