Placemaking and the Dali Erhai Lake Science Education Center: Environmental Communication through User-experience Design

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Abstract: The Dali Erhai Lake Science Education Center is an integral part of the campaign to tell the story of Erhai Lake in Yunnan, China. The lake had remained one of China's most pristine until pollution pushed the lake toward a eutrophic state at which point conservation efforts were employed to restore the lake from Class IV water to between II/III with continuing improvements to date. The story of this lake, pollution, and restoration are the defining foundation of the center's narrative. The center is a beautiful example of placemaking (Fleming, 2007) using user-experience design to tell the story of conservation through architecture, narrative, and inhabitation of built space. The center's exhibits include examples of a variety of user-experience design principles created through multimodal, interactive displays. Through an analysis grounded in placemaking, this study explores the means whereby the Dali Erhai Lake Science Education Center functions as an integral part of the provincial environmental communication campaign.
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Introduction

Walking toward the Dali Erhai Lake Science Education Center on Erhe North Road, the grassy wetlands which border Erhai Lake beckon to be enjoyed. Families on picnics, children flying kites, fruit vendors, and bridal photo shoots dot the landscape. Mountains on all sides seem to embrace the borders of the lake as the city of Dali rises to the west and expands around the southern tip to the lake's eastern shores. The contrast between the urban center of Dali and the natural wonders of the lake and the Cangshan mountains create a vibrant and interesting atmosphere waiting to be explored. And yet, the placid waters and sunny shore mask the pollution hidden within. Erhai Lake, the second-largest lake in China's Yunnan Province and one of the country's few remaining pristine lakes, is suffering from the initial stages of eutrophication as a result of high levels of nutrients and phosphorous in the water (Wang, Zheng, Chen, Dohmann, & Kolditz, 2015). The lake's aquatic habit is showing signs of degeneration and native species of plants, fish, and other wildlife are disappearing (Wang et al., 2015). As is true for most watersheds in China, water pollution here has recently become a significant and compelling concern garnering international attention across a wide variety of disciplines (Dalin et al., 2015; Kroeber, 2016; Liu et al., 2018; Lu et al., 2015). Inside China, attention to environmental preservation is often at odds with desire for economic development even though both aims

are central components of the current political mandate (Economy, 2018). And China's focus on environmental communication in academic circles is growing but contains large gaps and issues of translation from academia and NGOs to Chinese news agencies (see Dai, Zeng, & Wang, 2017; Tong, 2017). While visiting Erhai Lake for an inspection tour in 2015, Chinese President Xi Jinping was famously photographed on the bank of the lake conversing with senior officials in Yunnan. "I told them that I hope, if a photo is taken years later, the water should be even clearer than today," Xi said, "If not, I will hold them [the officials] accountable" (*China Daily*, Jan. 22, 2015, para. 3). His comments about the pollution of Erhai Lake, including the one above, set in motion a massive expansion of the environmental campaign concerning the renowned lake and the surrounding watershed. Xi's words from that inspection tour not only set an agenda for the environmental renewal at Erhai Lake, but they are also words of welcome, greeting visitors in the lobby at the newly-constructed Dali Erhai Lake Science Education Center.

The Dali Erhai Lake Science Education Center was constructed as a tangible centerpiece of the environmental communication campaign at Erhai Lake. The center's location on the southern bank of the lake gives visitors sweeping views of the beauty of the lake that resonates with local officials and national leaders, as well as the millions of tourists that flock to Dali annually. After its opening in 2017, just two years after Xi's visit to Erhai, the center has become an educational site for school children, tourists, and others interested in the local environment. The center was designed to be experienced. Employing engaging, interactive exhibit design and an architecturally-deterministic visitor route, the center creates an experiential event: a story told through built architecture and user interaction with and in the space. Moreover, this experience is, in itself, an environmental communication campaign that intends to educate and entertain visitors at Erhai Lake. This study seeks to explore the means whereby the Dali Erhai Lake Science Education Center uses placemaking and user-experience design to create an interactive environmental communication campaign. The primary objectives of the study are to (1) conduct an analysis of the rhetorical placemaking strategies employed by the center; (2) to highlight the digital technologies that augment the experience of visitors; and (3) to interrogate the efficacy of using this built space as a foundational component of an environmental communication campaign.

Placemaking and User-experience Design

Placemaking and user-experience design are two user-focused approaches that can be applied to the study of built space to explore how the intentional design of spaces creates meaning for visitors (see McArthur, 2016). Placemaking began in the literary field (see Fleming, 2007) whereas user-experience design emerged from the study of technical communication (see Albers & Mazur, 2003). Despite their disparate beginnings, the two areas of study are effectively intertwined in the design of public spaces of education such as museums, monuments, and memorials (McArthur, 2016; McArthur, 2018), public art (Fleming, 2007), heritage and historic sites (Azaryahu & Foote, 2008), classroom buildings (McArthur, 2011), libraries (McArthur & Graham, 2015), and other educational and public spaces. In addition, emerging digital spaces connected to geographic locations also demonstrate evidence of placemaking (McArthur & Jauregui, 2019). This section will

address the user-experience design functions of placemaking to suggest a strategy for the study of the Dali Erhai Lake Science Education Center and the way that it functions as a built example of experience-driven environmental communication. Whereas this approach has not been widely applied in environmental communication research, the construction of centers like the one at Erhai Lake creates the opportunity for this type of study through the combination of education, built space, and advocacy intertwined in the experience of visitors.

Building on the traditional literary model of placemaking, Ronald Lee Fleming articulates the work of placemaking in built spaces in his book *The Art of Placemaking* (2007). Placemaking, he argues, is the work of designing "mental associations into a sustainable narrative that enriches sites and helps make them memorable" (p. 17). These narratives connect visitors to geographic locations through well-designed experiences of space and place. Placemaking is used to reveal, preserve, and share the hidden stories of locations. Items like historical markers, ebenezers, sculptures, murals, signage, and public art do this work to share single stories. But how much more might a museum, educational center, or archaeological site be able to share broad, complex stories of place? Landscape architecture professors Ebru Gurler and Basak Ozer suggest that designers of places "have the power to influence society's sociological and psychological structure, to keep cultural values alive, to change and even destroy them" (2012, p. 858). This is perhaps similar to the work of environmental communicators who seek to educate with information to activate behavioral change (Bendor, 2013). Placemaking can bolster the aims of such education through the intentional development of built spaces that crystallize educational information through the experiences of the user.

In Fleming's construction of placemaking, he divides the concept into four parts which work together to develop a sense of place in the experience of each visitor: orientation, connection, direction, and animation. Orientation refers to the process of revealing history in the geographic location to develop multiple layers of meaning. Often this history remains hidden to visitors in a site, but it serves as the foundation of and inspiration for the design cues present in the site. Connection refers to the process of design that creates meaning for the visitor in the geographic location. Design elements can reveal a piece of a hidden history or give visitors a feeling that evokes that history. Memorials often showcase this connection most clearly. For example, a book-shaped statue marking the site of the first electric light in China rests silently on Nanjing Street in Shanghai's pedestrian shopping district, waiting to be discovered. Its presence is a piece of connection that invites viewers into the history of that particular geographic location. Connection can occur as blatantly as the electric light marker or can be more subtle, such as a change in the texture of ground cover, a scent, a pinch point in a pedestrian area, or the use of reclaimed materials. Next, direction refers to the design elements which help visitors navigate spaces they inhabit. These typically fall in the category of wayfinding, such as route markers that help visitors find a bathroom, the correct gate at an airport, or a particular floor of a building. But, they can also be organizational tools that direct a user through an experience. At a market these might be sections devoted to different types of foods. In a school, classrooms might be organized by student age or grade level. In short, direction is shaped by navigational and organizational aids that help visitors find their way. Animation refers to the design

elements of a space that shape visitor behaviors during actual use of the space. Even though designers of places can attempt to envision how people will behave in a space, actual behaviors are typically varied. Indications of animation are observed behaviors mixed between dominant behaviors (those which were intended by the designer), alternative behaviors (those which were not intended by the designer), and subversive behaviors (those which upend the designer's original intent). This mix of behaviors changes over time and in relation to the cultural backgrounds of visitors in the space.

Placemaking relates specifically to the user's experience in the place as a result of intentional elements of design. These design elements, fabricated by architects, planners, and designers, create an experience for visitors by organizing data into information, using that information to give knowledge, and helping process that knowledge into wisdom (Shedroff, 2001). This shift – data to information to knowledge to wisdom – is the work of user-experience design, and placemaking articulates how built spaces can do this work for visitors. This type of design is a rethinking of information, no longer relying on cognitive processes alone, but also considering behavioral and affective (emotional) processes as central pieces of learning (see Carliner, 2000). This shift from a focus on the information to a focus on the user has moved from technical communication into the genres of business communication, scientific communication, and, notably for the purposes of this article, environmental communication (see Bendor, 2013). To be clear, the Dali Erhai Lake Science Education Center is not being positioned here as the first or the best or the largest example of this shift. The field of science education has explored this approach through the study of areas like learning exhibit design (Rowe et al., 2017), immersion exhibits (Mortensen, 2011), and museum pedagogy (Shaby et al., 2019). Rather, this study aims to connect with the ongoing conversation, using placemaking as a vehicle to explore the means whereby localized environmental communication campaigns might employ built spaces to connect experientially to visitors.

Research Method

To analyze the Dali Erhai Lake Science Education Center, this study employed a rhetorical analysis of the center using placemaking (Fleming, 2007) as a guiding theoretical framework. This analysis is a case study which can be used to position one case or text as an exemplar for similar cases or texts that might perform a similar function. In this case study, the Dali Erhai Lake Science Education Center is positioned as one text that, through a deep and comprehensive rhetorical analysis, reveals the means whereby built space can articulate an environmental communication campaign. A case study using placemaking as a theoretical model requires a series of analyses through which placemaking's four parts are assessed individually. Each part focuses on an individual element of place, and the information analyzed for each part is unique.

First, an analysis of orientation necessarily invokes deep discovery of history and in particular the history of a specific geographic location. Articles and commentaries based on oral and written traditions as well as journalism can often contribute to this historical analysis. Second, an analysis of connection is observational in nature. The cues of a visit to this geographic location in its current form are compared with the history observed in the previous part (orientation) to envision what markers of history are present and what

stories are excluded. Third, an analysis of direction is an exploration in the field of wayfinding and technical communication. The researcher explores the design cues available to visitors in this location that inspire or direct particular actions in the space. Finally, an analysis of animation is an outpouring of the previous part (direction) in which the researcher observes the behaviors of people in the place. These behaviors are compared with the directional cues to understand the dominant forms of visitor behavior in the space and to consider what alternative behaviors and subversive behaviors might look like in this place. This methodology for studying space and place through the lens of placemaking has been successfully employed in relation to public art (Fleming, 2007), museums and memorials (McArthur, 2016, 2018), and even digital places (McArthur & Jauregui, 2019) and a similarly-titled functional place-making analysis has been used in a variety of formats in urban design studies (as an example, see Razali, Ahmad, & Er, 2019).

By using these four concepts of placemaking to examine built spaces like memorials, museums, and other spaces of public education, researchers can articulate the ways that built spaces add meaning to their surrounding geographic locations. In the case of the Dali Erhai Lake Science Education Center, the built space and its location on the southern shore of the lake creates a compelling argument for environmental sustainability. Furthermore, the design of the Center employs user-experience design to create interactive behaviors in the space. The attention to placemaking through user-experience design allows the Center to function as a material showpiece for the environmental communication campaign surrounding Erhai Lake. Using Fleming's four design elements of placemaking as a theoretical grounding, this case study examines the Dali Erhai Lake Science Education Center as a built space example of a localized environmental communication campaign.

Findings

Orientation: A History of Erhai Lake

Orientation often refers to the unseen history of place (Fleming, 2007). A comprehensive analysis of the Dali Erhai Lake Science Education Center requires an understanding of the lake and its role in the environment. Thus, a study of the placemaking orientation of the lake in this context would necessarily include the geography of the lake, the historical relationship between the lake and local residents, and the environmental crisis surrounding the lake that led to the creation of the Center.

Geographically, Erhai Lake is a 42-kilometer long, 9-kilometer wide, ear-shaped lake located in Yunnan Province in southwest China. For reference, Yunnan is approximately the same size as France. The western side of Yunnan borders the Tibetan region with its high mountainous areas whereas Yunnan shares its southern border with Myanmar and Vietnam with their lush tropical rainforests. Yunnan's elevation changes almost 6,500 meters from north to south, and because of the climate disparities created by mountainous elevations, the province features high levels of biodiversity. Erhai Lake is located in Yunnan's western side at the base of the Cangshan Mountains near Dali. The lake rests at the high elevation of 1972 meters above sea level and remains the province's second largest lake, after Dianchi Lake to the east in Kunming. While Erhai Lake's watershed is confined geographically by its high elevation on a fault line in the Cangshan Mountains, the lake serves as one of several upriver catchments for the vast Mekong River watershed which

flows out of China and into lower Southeast Asia. Erhai Lake, Dali, and much of greater Yunnan plateau occupy a portion of the country with the moniker "eternal spring." The geography of this area provides a temperate humid monsoon climate (Xu et al., 2019) suitable for near year-round agricultural production and is also an increasingly popular site for tourism, particularly among Chinese urban-dwellers escaping the smog, called "smog-birds" by local residents.

The breadth of China's vast history seems limitless at times, and so too does the history of Erhai Lake and Ancient Dali City. Xu, Yang, Yang, and Hillman (2019) offers a complex and detailed history of the human-water system at Erhai Lake. The chapter chronicles human impacts on the watershed from the Qin dynasty (circa 200 BC) during the time of the Tea-Horse Road Network, later described as the Southern Silk Road. A simplified version of the history of people interacting with Erhai Lake begins with the Tea-Horse Road which stretched through Yunnan during the Qin dynasty, but settlement along the Erhai Lake basin was largely developed through military migrants in 1382 during the Ming Dynasty. In the subsequent half millennium, numerous floods, droughts, and engineering strategies to control the lake basin shaped its use over time. For generations, Erhai Lake was a natural fishery, full of a variety of freshwater fish, waterfowl, insects, and plant life including several rare and endemic species (Yamanaka et al., 2012). For centuries, the residents of Dali and its surrounding villages used Erhai Lake to fish and as a water source. According to Xu et al. (2019), even the religious tradition of the Bai ethnic minority, local to Dali and Erhai Lake, emphasizes the importance of the lake in its culture. The Dragon King, a symbol of water culture, became one of three important deities in local folk religion (Even though this is not the primary focus of this study, interesting work about giving voice to indigenous peoples through environmental communication in museums has received some attention in the literature (see Brady, 2011), and the Bai tradition is featured in the center's educational exhibits). In the last century, Erhai continues to supply water resources for agriculture to farm rice, corn, tobacco, peaches and any number of other fruits and vegetables. In the meantime, industry blossomed in Dali City as it did in many parts of China, and high-speed rail lines eventually connected Dali to the provincial capital of Kunming allowing the city's growth to continue. In the years since 2010, many entrepreneurial investors have been attracted to Erhai Lake due to a growing tourism economy.

Environmentally, Erhai Lake has been in crisis. As Yamanaka et al. (2012) notes, "because Lake Erhai is exposed to rapidly increasing human interference, both chemically and physically, further detailed and long-term monitoring of water temperature in the lake is required to conserve the aquatic ecosystem and to manage the water quality of the lake" (p. 135). In 2007, consultants on the Yunnan Urban Environment Project noted that Erhai is "generally now classified as Class III with localised deteriorations to Class IV" (p. 95). Class IV water is described as "mainly for industrial use or for use as a recreational area without direct human contact" whereas Class II water is described as "suitable for general drinking water" with filtration or treatment (Scally, 2015). The Yunnan Urban Environment Project (2007) suggested that the major drivers of pollution in the Erhai Lake were from four sources: (1) livestock breeding and (2) village domestic wastewater, which together constitute over half of the pollutants in the lake, as well as (3) agricultural runoff

and (4) urban, domestic, and industrial wastewater. In addition, in the last decade, 2,000 new buildings have been constructed with lakefront views, and the buildings vary in size from expansive high-rise buildings to bed-and-breakfasts (Desheng, 2019). Tourism in Dali is experiencing all-time record-highs. Unfortunately, many of these buildings began operating without the necessary permits and proper sewage controls. The combination of activities of farming, industrialization, and tourism continually polluted the lake. Desheng (2019) reports that the lake experienced toxic levels of blue-green algae blooms in 1996, 2003, and 2014 that choked life from the water. Several endemic species of fish once found in the lake succumbed to extinction due to pollution. In 2016, the local environmental protection authority reported that pollutants in Erhai Lake had increased by 50% between 2004 and 2016.

Although the environmental crisis at Erhai Lake was being documented as it degraded toward eutrophication (see Wang et al., 2015), conservation efforts were bolstered in 2015. That January, Chinese President and National Party Secretary Xi Jinping visited Erhai Lake and noted that the beauty of the lake should be preserved. "I told them that I hope, if a photo is taken years later, the water should be even clearer than today. If not, I will hold them [the officials] accountable," Xi was quoted as saying by *China Daily* (2015, n.p.). Coupled with a national focus on environmental protection, this comment inspired the provincial and prefecture governments to continue restoration efforts in Erhai Lake which included the demolition of over 1800 buildings erected on the lakefront to allow for the creation of 16-meter wide wetlands on the lake's borders (Desheng, 2019). One major component of this effort was the design and construction of the Dali Erhai Lake Science Education Center to tell the story of the lake and chronicle local conservation efforts.

Connection

In placemaking, the aims of orientation and connection should complement each other (Fleming, 2007). Through design elements, the placement, structure, and form of the Dali Erhai Lake Science Education Center reveal the site's connection to its history and geography. The entrance lobby of the museum features a giant screen containing a photograph of Xi Jinping during his 2015 visit and a written version of his directive for conservation. Moreover, the museum directly articulates the geography, history, and environmental crisis in the first three exhibits in the space. The first exhibit chronicles the direct ramifications of President Xi's directive through a series of before-and-after photographs of the lake. The second exhibit uses maps and geologic models to educate visitors about the geography of the Erhai basin catchment. The third exhibit articulates the major contributors to lake pollution. In addition, a tour guide walks visitors through these exhibits and details the history of the place. Later exhibits also demonstrate the species of fish, flora, and fauna that inhabit the lake including endemic and extinct species previously found there. These exhibits create connection in the mind of the visitor using direct, overt messaging, but connection is also established through the physical, geographic location of the Center.

The Dali Erhai Lake Science Education Center is built on Erhe North Road near the Xiaguan Olympic Center and the Government Service Center. Its location on Erhe North Road is significant because this road runs along the tip of the southernmost waterfront land

at Erhai Lake. The construction of this area is seemingly new, with newly constructed roadways and streetscapes leading to a roundabout occupied solely by the center. Visitors might get the feeling that a few of the over 1800 buildings demolished for lake renewal may have included some on the site of this center. The front doors of the center face the expansive lake, and from the front walkway, visitors have a lovely view of the water including a large, grassy wetland area. The lake looks beautiful and natural from this vantage point. This purposeful placement of the center on the lakeshore provides visitors an immediate connection to the lake's beauty and its grandeur. Moreover, it places visitors in proximity to the lake and highlights the redesign of the lakeshore for environmental conservation.

The entry to the center as well as the content of the educational exhibits function as a dynamic storytelling tool that lays the groundwork for the built space as an environmental communication campaign. By teaching the story of Erhai Lake to its visitors, the center educates them about the issues of water quality, conservation, and human impacts. This is the work of connection in the placemaking concept – to create opportunities for visitors to come in contact with the history of the location they inhabit. Imagine the difference in the connective impact of the center if it had been built in central Dali or near the train station. The connection to the work of the center would be missed by visitors, and their appreciation for the beauty of the lake – and thereby the impact of the environmental communication campaign – would be diminished. Notably, the center does not employ natural views of the lake (through windows, for example) as part of its storytelling function within exhibits. Thereby, the center could have been built on any parcel of land in any location with the same internal impact. However, the center's intentional placement on the shore of the lake in the midst of massive development serves as an important tool of connection both to the lake and to the environmental communication campaign. This connection establishes a foundation for the development of a strong environmental communication campaign through the final two pieces of placemaking: direction and animation.

Direction

Elements of architectural construction and experience design serve as directional cues for visitors to built spaces. Directional cues tell visitors where to go and what to do (Fleming, 2007). Typical design elements might include wayfinding techniques, directional arrows or cues, signage, proscribed routes, or other markers which help visitors navigate the space. Museums and educational centers have been working toward a variety of approaches to telling stories using exhibits by employing direction as a placemaking tool. For example, as visitors walk into the Shanghai Museum, a series of galleries spread over four floors greet visitors. Entering the Ancient Chinese Bronze gallery, the artifacts are arranged in loose chronological order, and visitors have multiple entry points and paths they can choose in the gallery. The result of a gallery exhibit planned in this way is that visitors have the ability to pick and choose the items they see during the visit. In fact, at the Shanghai museum, visitors can start at any of the 9 exhibits at multiple entry points leading from the central atrium. This multi-route, user-determined path is generally referred to as an example of architectural possibilism (Strange & Banning, 2001), meaning that the space is designed in such a way the visitors might choose how to navigate it from

any number of possibilities. For example, I started with the minority nationalities exhibit on the fourth floor and worked my way down, leaving ample time to explore the Ancient Chinese Bronze exhibit on the ground level. Others in my group started on the first floor and still others went directly to an exhibit that contained artifacts of interest and explored those first.

In the Shanghai Museum, a special exhibit titled "Lustre Revealed: Jingdezhen Porcelain Wares in Mid Fifteenth Century" guides patrons through an archeological process of unearthing ceramics from what was considered a ceramic dark age in China. In this exhibit, visitors start at an entrance and move through the exhibit to learn about the process of this work. Because this exhibit has a more distinct flow of ideas, visitors might be likely to start at the beginning of the exhibit and explore it in chronological order, culminating in a viewing of reconstituted ceramics. Even so, the exhibit has multiple entries and viewers could come and go easily from the exhibit at various points. This type of design represents architectural probabilism (Strange & Banning, 2001), meaning that the physical structure of the space is designed in such a way that visitors are likely to choose one particular route over others, in this case to view the exhibit from start to finish.

The Dali Erhai Lake Science Education Center employs a third approach to built space design – architectural determinism – which suggests that the space is designed to dictate visitor movement through the space (Strange & Banning, 2001). This concept is being employed more readily in museum and exhibit design as a way to give users a particular experience as visitors of the space. The US Holocaust Memorial and Museum in Washington, DC, USA, is one of the larger conceptual examples of this approach to full museum design. Attractions like Enchanted Tales with Belle at Walt Disney World in Orlando, Florida, USA, and the Biltmore House in Asheville, NC, USA use this same strategy by providing visitors with a unidirectional, one-way path that they must follow to exit the exhibit. The Dali Erhai Lake Science Education Center creates this architectural determinism using two strategies: the creation of a single, unidirectional route, and the use of tour guides and security personnel to ensure groups remain together.

Upon entering the center, visitors are presented with a one-way path to navigate through the exhibits. This path begins in the lobby with information about President Xi's visit and before-and-after images of the pollution in the lake. The path continues around a barrier into the first exhibit which articulates the geography and geology of the watershed. The route then curves into a history of Erhai Lake, adjoined by a room devoted to the causes of pollution in the lake. Next, visitors walk through an exhibit teaching water conservation into an exhibit on the specific conservation and water management efforts at Erhai Lake. Then, the route leads to an empty square room featuring a floor-to-ceiling pyramidal hologram projector. The lights dim and the hologram of a Bai dancer takes center stage. Next door, in a round room, an exhibit explores the natural auditory cues present at the lake and a serpentine hallway showcases the visual imagery of the lake. The path leads visitors on a walk by the lake during day and night, transitioning from light to dark. Next, on a lower floor, visitors explore the fish, wildlife, and plant life of Erhai Lake, including specific exhibits of native, endemic, non-native, and extinct species. An interactive classroom and a room of reflection serve as the final steps in the route before visitors are

returned upstairs to the lobby. The center also contains a theater for educational films which is added to the route when the floor change occurs in the middle of an extended visit.

Note that this pathway through the center follows a useful educational model. First, the center gives visitors the information they need concerning history, geography, geology, and human impacts to understand the region and the sources and causes of pollution. Next, it focuses on what people have done to intervene in the pollution and why the local people care about pollution. Then, it demonstrates tangible results of conservation by showing the beauty of the lake and its wildlife as well as the tangible results of pollution by indicating extinct and dying species. Finally, it invites visitors to participate by testing their newfound knowledge and writing a note of blessing for the lake. In this process, the visitor is moved from informational presentation to personal action. This movement is the heart of environmental communication campaigns at their foundational level – to provide people with information about their environment and inspire them to participate in personal or collective actions that benefit that environment. Bendor (2013) calls this the turn to experience in environmental communication. He suggests that the prevailing model of communication in this field has been the information deficit model – if only the public had all the information, then surely they will act on it. This model is being slowly replaced through an "appeal to resonant, felt, meaningful aspects of the public's perception of, and engagement with, environmental issues" (p. v). The center uses the route through its exhibits to add this emotional appeal to the work of information dissemination. The tour through the center culminates in a visitor's opportunity to take a first step toward personal action by leaving a note or blessing.

The predetermined route in the center is created partly through architectural determinism, meaning the walls of the exhibits suggest a single correct path, moving visitors from beginning to end. But this architectural influence is reinforced by the presence of both a tour guide who leads groups along the path as well as a security officer who follows behind the last members in a group tour. This guided wayfinding model ensures not only that visitors follow the proscribed route, but also that visitor groups stay together inside the route. The deterministic nature of this route becomes clearly evident when placed in contrast with the illustrations of the exhibits at the Shanghai Museum described earlier. Visitors can feel the difference between these various types of directional cues. As directional cues, built spaces that employ architectural possibilism, or probabilism, or determinism are neither better nor worse than the other models (McArthur, 2016). Instead, each model provides visitors with a certain type of experience. This experience of architectural determinism in the Dali Erhai Lake Science Education Center is the central feature that allows the center to ensure that visitors are all hearing the full story of the water improvement efforts. In addition, the flow of the pattern of the exhibits moves visitors from learning, to exploring, to reflecting, to acting. As noted, this educational pattern is the goal of environmental communication campaigns – to inspire viewers toward personal actions, in this case for conservation.

Animation

Animation can be explored by observing visitor behaviors in built space, and it builds upon the orientation, connection, and direction employed by the designer. These observed

behaviors are often the result of intentional suggestions prompted by directional cues in the space, but may also be behaviors that emerge over time through human interaction in the space. Based on the directional cues in the space, visitors are generally shepherded through the center. Thus, the dominant behavior observed in the space is the movement of tour groups along the unidirectional path through the ten exhibits and returning to the lobby. The tour guide facilitates each exhibit and helps uses glean information from each. However, the center uses digital augmentations throughout the exhibits to invite visitors to engage information individually and in groups. Along the route, each exhibit is imbued with interactive digital technologies. Interestingly, each exhibit utilizes a different type of interactive design to engage visitors (see Table 1).

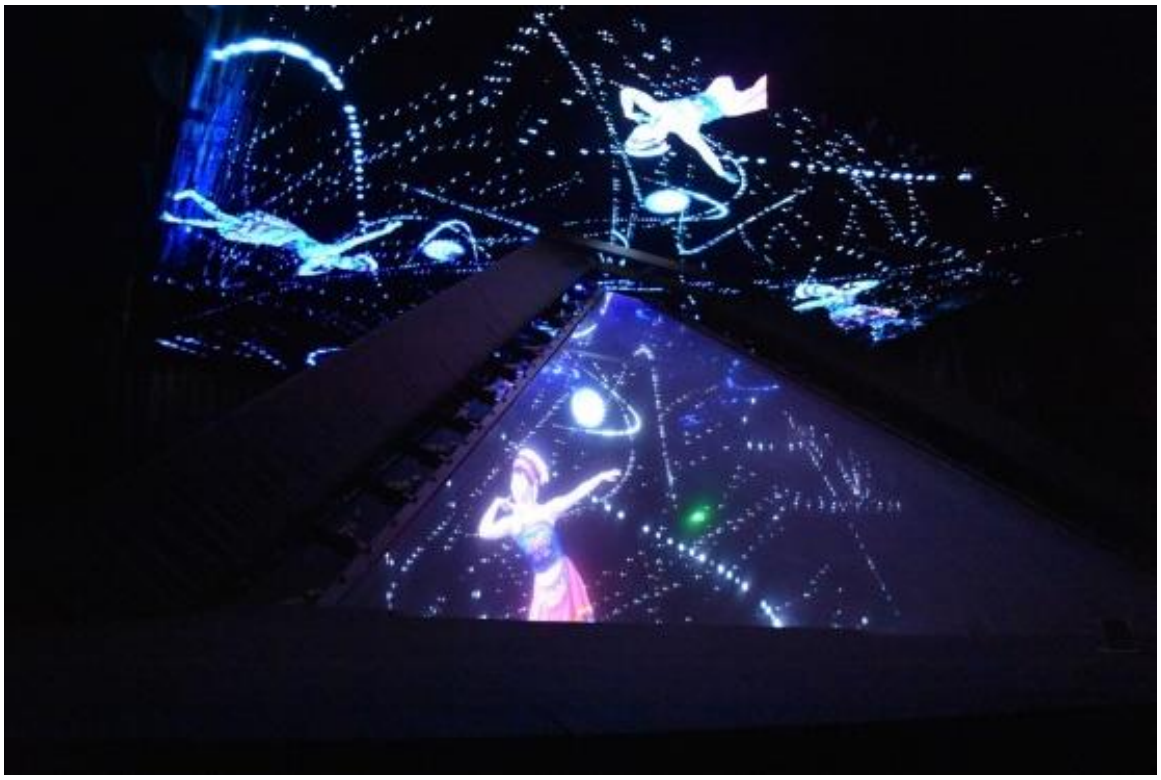
Table 1. Summary of Exhibits, Digital Augmentations of Space, and Environmental Communication Campaign Tactics Addressed

Exhibit Topic	**Digital Augmentation**	**Environmental Communication Campaign Tactic**
Geography & Geology	Kiosks controlling user-selected illumination of map features	Interactive features allow users to examine deeper levels of local environmental information and engage information in non-linear forms
History of Erhai Lake	Smart table interactive display of causes of pollution	
Water Conservation Tactics	Built-in touch-screen interfaces house digital water catching games	Interactive features illustrate human impacts on local environments both individually and collectively
Water Management Interventions	Moveable screen on a rail overlays a map of the lake to geolocate water management projects	
Local Culture (Bai)	Pyramidal hologram of Bai dancer as performance	Interactive features demonstrate the local, cultural sense of emotional investment in the lake
Erhai Lake Soundscapes	Sound pods hang from the ceiling to provide individual sound experiences	Interactive features create emotional and sensory connection between visitors and the lake
Erhai Lake Visual Imagery	Motion graphics and lighting visually illustrate views of the lake at various times of day, and mounted	

	binoculars offer additional viewing angles	
Wildlife, Plant Life, and Fisheries	Kiosks access a searchable wildlife database, and a virtual interactive aquarium holds visitor-generated fish	Interactive features illustrate the tangible results of local pollution on local wildlife
Interactive Classroom	6 controllers on stands create space for on-screen competition-style review of information	Interactive features encourage review and recall of learning about environmental issues
Visitor Reflection on Environmental Impact	Digital trackpad connected to projector displays handwritten messages in real time	Interactive features offer a possible first step in personal action toward environmental conservation

First, to augment the geography and geology exhibit, the center uses button-press activation of lighting displays. Visitors push buttons to activate lights on various portion of a map. For example, on a map of the Erhai Lake catchment, one button shows water flows into the Erhai Lake, while another shows outflow. Likewise, on a map of Yunnan Province, buttons on a digital display correspond to lighted markers of the various river basins throughout the province. Push-button lighting displays augment exhibit maps by allowing visitors to intentionally investigate areas of their own interest. In the second exhibit, augmentation of the history of Erhai lake was created through a round exhibit room with a smart table as a central feature. The smart table offers visitors the chance to explore various pollutants that have historically affected water quality in the lake. The screens around the room project visuals of pollution. Third, the water conservation exhibit features two interactive games on touch screens embedded in the wall which each challenge players to find ways to save water. The cartoon images instruct users how to play the game by turning water faucets on and off, or collecting water in cisterns. Fourth, in the water management exhibit, a screen mounted on a fixed track slides across a wall-sized map of the lake. As visitors move the screen, lights on the map turn on and off, corresponding with on-screen images and information about specific water treatment interventions. These interventions included things like wastewater management facilities, wetland restoration, and sewage infrastructure improvements. In the fifth exhibit, the Bai culture is presented in a digital form through hologram technology (see Figure 1). The transparent pyramidal structure reflects ceiling projections into a virtual hologram appearing in the center of the pyramid. Visitors could sit or stand on any side of the pyramidal structure and enjoy the same experience of the holographic dance. Sixth, an auditory experience utilizes listening pods mounted on the ceiling to create an experience of sound underneath. Visitors tend to approach these cautiously, unsure of whether they should position themselves under the

hat-like cones. But once underneath, they listen and then move from cone to cone (See Figure 1). Seventh, a constructed walk through the lake employs LED lighting and moving images on screens as well as mounted binoculars to allow visitors to explore the lake visually. Visitors navigate down the serpentine path, pausing to take photographs of themselves or pointing to features of the lake. Eighth, a wildlife exhibit offers touchscreen interfaces with a searchable database of waterfowl, fish, and plants containing extra information supplementing the preserved and taxidermy versions on display. Visitors can explore the display of preserved examples of fish or plants and then used the kiosk interface to search for more information about a particular plant or animal of interest. The fisheries exhibit also contains an interactive lake in which visitors could complete a puzzle on a touch screen interface to add a fish to the virtual lake. Onlookers could observe as a visitor tried to complete a puzzle on a large touchscreen and watched as the fish appeared in the virtual aquarium. The next visitor might then step up to add her fish to the display. Ninth, an interactive classroom contains a wall-display for a gameshow-type experience as well as 6 platforms for contestant participation (See Figure 1). Finally, the final room of reflection utilizes a trackpad-style interface which virtually inscribes a note of blessing, projected onto the walls of the room.




游戏
开始

Figure 1. Three augmentations of space impacting user experience: Auditory (listening) pods (top); Hologram Bai Dancer (center); Interactive Classroom (bottom). (Source: Author, June 2019).

These 10 augmentations allow the center to move from being a storehouse of information to a place that causes visitors to engage with information. In terms of Norman's (2005) three responses to design, the visceral, behavioral, and reflective responses are all integrated through these augmentations. First, at the visceral level, visitors are immediately challenged by the history of pollution at the lake. In addition to a visceral response to the content, the digital technology has a bit of a "wow" factor. It causes visitors to show interest and to want to engage the information. On the behavioral level, visitors participate in the center. They push buttons and play games and listen and view and build fish and answer questions. Their participation is welcomed and validated. And the center even starts visitors on a path to reflection by asking them to leave a message of blessing for the future of the lake. The visceral, behavioral, and reflective responses capture the visitor emotionally rather than logically or rationally, and they create an emotional response through the experience of being there.

Several noteworthy observations impact overall animation in the center, particularly language, hours of operation, and height of interface. First, all of the exhibit information is presented in Chinese, which is appropriate for the local and provincial audiences as well as domestic tourists. On my visit, the tour guide presented in English, and other language translations were available. However, the digital augmentations of touch-screen technology could be understood by non-Chinese speakers as the interactive tools were intuitive and therefore allowed engagement with technology despite any language barriers. Next, the hours of operation are limited at the center which schedules school groups tours throughout the week and varies its public open hours. Thus, it may be typical to visit the center with a group and be the only guests present, and it may also be typical to visit the center as one group among many on a given morning. However, the guest experience of the center under these two conditions may be fairly similar as the directed nature of the route in the center certainly keeps guest groups separated from each other. In addition, depending on the number of guests and their proficiency with the Chinese language, some visitors may find certain exhibits inaccessible, closed, or powered down. Finally, the height of the interface is low enough to be enjoyed by school children. Guests of tall stature may find themselves bending down to explore a kiosk or stooping low to place themselves under an auditory dome.

Everything discussed thus far in this section on animation all meet the criteria of dominant behaviors likely to occur in the space. Less likely behaviors that subvert the route pattern in the center are diminished by the presence of the tour guide and the trailing security figure which bookend groups. Nevertheless, a truly subversive visitor could barrage the tour guide with prying or off-topic questions, leave an unkind message on the wall of blessing, or try to go backwards through the exhibit. Subversive behaviors in this context would ultimately diminish the experiences of the other members of a group on tour and might be met with overt or covert correction. Even so, the space offered a few areas in which alternative behaviors could present themselves in an acceptable fashion. Behind the

fisheries exhibit, a single door to an access hallway remains open to reveal a student art exhibit added to the walls of the hallway. Explorations of these drawings are welcome although they are not part of the formal tour. Likewise, visitors might linger at an interactive station, missing the tour guide's subsequent introduction or ignoring the guide completely, making their experiences more or less informative than they might otherwise be.

Conclusions

Exiting the Dali Erhai Lake Science Education Center, the doors open to Erhe North Road and the grassy lakefront just beyond (See Figure 2). Having experienced the center, the visitor looks to the lake and immediately sees the rampant development across the lake. The issues of pollution fresh in their minds, visitors descend the steps, and walk to the grass, quickly finding a path to traverse out onto the shore. In the expansive outcropping dotted with people, the visitor might wonder: Was this site once occupied by one of the thousands of buildings torn down to preserve the lake? How many fish are swimming nearby? Should those children be putting their feet in the water? Which birds are those flying overhead? How polluted is it really? Being there conjures up mixed emotions. Sadness for the thought of vast pollution. Calmness from the experience of the lake breeze. Shame because of previous ignorance, now lost. Awe at the natural beauty of the environment. The reflective act of seeing the environment while better understanding its plight creates a moment that environmental communication campaigns attempt to achieve: a moment when information creates a meaningful emotional connection to the environment. This behavioral, cognitive, and reflective processing (Norman, 2005) occurs as a function of the experience design tactics (Shedroff, 2001) connecting visitor to built space and to place. And that connection is the strength and opportunity of using built space as a centerpiece for a local environmental communication campaign.

Figure 2. Visitors enjoy the Erhai Lake shoreline outside the center's entrance. (Source: Author, June 2019).

Environmental communication campaigns have long relied on flyers, posters, commercials, film, and graphic imagery shared through media of all kinds, from mass mailers to mobile messaging. And, they rely on news media to spread information. All have attempted to connect people to a particular environmental cause in a specific geographic area. The geographic, location-based focus of environmental communication lends itself well to utilizing built spaces to connect with visitors. The Dali Erhai Lake Science Education Center functions as a place-based built space that creates an argument. The resulting environmental communication campaign is experiential, personal, and informative, and it calls visitors to action. The key connection not to be missed here is that the center achieves this built space communication campaign through several design features revealed in this analysis:

(1) The center focuses on telling the story of one localized and specific environmental issue.
(2) Access to the center brings visitors into direct contact with the local place and environmental issue being studied.
(3) The center moves people through an experience of the environmental issue through visceral, behavioral, and reflective engagement.

Through the combination of these design features, this study aimed to add placemaking (Fleming, 2007; McArthur & Jauregui, 2019) to the discussion surrounding environmental communication and to offer a model for assessing the role of built space in environmental communication discourse (Bendor, 2013). These three design features employ experience design and placemaking to do the work of the environmental communication campaign, but only insofar as they occur together. A science education center in Dali that explores air, water, and soil pollution throughout China would fail on the first measure. A science education center about Erhai Lake located in Ancient Dali City would fail on the second. And a science education center that functions as a traditional museum would fail on the third. None of these examples would be bad places or spaces to build or have, but they would not fulfill the placemaking work of an environmental communication campaign.

Designers of environmental communication campaigns have a distinct (and unusual) opportunity to construct place-based communication. The center is a built space example of that work, but not all environmental communication campaigns have the means, space, resources, or even the need for an expansive center. Instead, designers might think of ways to employ these three design features using a scaled approach. For example, a broad digital communication campaign might select specific stories to tell that facilitate the overall goal of the campaign. The campaign might seek to bring prospective supporters into a place-based experience, geographically, virtually, visually, or physically. The campaign might seek to create opportunities for visceral, behavioral, and reflective processing of information, stair-stepping its requested actions by inspiring not only donation or advocacy, but also personal reflection, storytelling, and information sharing – taking their own experiences and connecting them to those of others.

At the end of this analysis, the central limitations of this study become clear. When discussing animation, this researcher is the first to note that I am an American, studying a Chinese environmental campaign. I do not speak or read Mandarin, and my interaction with the center is limited by the quality of Mandarin-to-English translation I received. Animation is altered by cultural difference in almost every case. I see this center through my own eyes, and yet, I wonder how much more clearly seen the design elements of orientation, connection, and direction might be for local citizens of the Erhai Lake Basin, Dali, Yunnan, and greater China.

As the field of environmental communication explores this turn to experience (Bendor, 2013), the connections that visitors feel with their environments will become more nuanced, and the felt connection to place will only become stronger. In using built space to create opportunities for visitor engagement, the lessons learned from the Dali Erhai Lake Science Education Center prove valuable. Creating experiences for visitors to focus on localized, specific environmental issues, on site, through user-experience design moves those interactions from education to participation to action. The pollution at Erhai Lake is reportedly decreasing, and the center is both a propagator and benefactor of that effort. News media covering Erhai describe its resurgence in Dali and are optimistic for the future. But, future scientific measurements and explorations of Erhai will be the true test of the success of this campaign and its ability to inspire the people of the Erhai Lake Basin and greater China toward action. If the campaign does not succeed, the center will become just a memorial to the once-beautiful Erhai. But if it does succeed, the Dali Erhai Lake Science Education Center can continue to promote environmental communication efforts for visitors to Erhai for years to come.

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