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“Some Account of an Extraordinary Traveller”: Using Virtual Tours to Access Remote Heritage Sites of Inuit Cultural Knowledge

« Quelques récits d’un voyageur extraordinaire » : Recourir aux tours virtuels pour accéder à des sites patrimoniaux éloignés des savoirs culturels inuit

Peter C. Dawson, Cecilia Porter, Denis Gadbois, Darren Keith, Colleen Hughes et Luke Suluk

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Résumé de l'article

L’utilisation d’images panoramiques pour transporter les téléspectateurs dans des emplacements géographiques éloignés remonte aux théâtres panoramiques de Londres victorienne du XIX^{e} siècle. Plus récemment, le projet World Wonders de Google a utilisé des panosphéros à 360 degrés pour capturer certains des sites patrimoniaux les plus célèbres du monde. En utilisant des flèches qui délimitent un chemin de déplacement défini, les utilisateurs peuvent virtuellement visiter ces sites en « sautant » d’une panosphère à l’autre. Le lieu historique national Arvia’juaq est situé près de la communauté d’Arviat. Bien que la valeur patrimoniale du site soit très significative, Arvia’juaq voit peu de visiteurs nationaux et internationaux en raison de son emplacement éloigné. Pour diverses raisons, certains Inuits locaux éprouvent également de la difficulté à visiter régulièrement le site même s’il existe en tant que source importante d’identité culturelle. Dans cet article, nous explorons la façon dont les panosphères peuvent être utilisées pour créer des visites virtuelles interactives de sites patrimoniaux comme Arvia’juaq. Bien qu’il y ait quelques réserves, nous soutenons que VR Tours sont potentiellement des outils puissants pour relier des personnes à des sites patrimoniaux qui pourraient autrement être inaccessibles. Cela a des répercussions importantes sur la sensibilisation au patrimoine polaire et a son importance pour les Peuples autochtones, ainsi que pour le public national et international.

“Some Account of an Extraordinary Traveller”: Using Virtual Tours to Access Remote Heritage Sites of Inuit Cultural Knowledge

Peter C. Dawson,[i] Cecilia Porter,[i] Denis Gadbois,[ii] Darren Keith,[iii] Colleen Hughes,[i] and Luke Suluk[iv]

ABSTRACT

The use of panoramic images to transport viewers to remote geographic locations can be traced back to the panorama theatres of nineteenth-century Victorian London. More recently, Google’s World Wonders Project has utilized 360-degree panospheres to capture some of the world’s most famous heritage sites. Using arrows that demarcate a defined path of movement, users can virtually tour these sites by “jumping” from one panosphere to the next. Arvia’juaq National Historic site is located near the community of Arviat. Although the heritage value of the site is highly significant, Arvia’juaq sees few national and international visitors because of its remote location. For a variety of reasons, some local Inuit also find it difficult to regularly visit the site even though it is an important source of cultural identity. In this paper, we explore how panospheres can be used to create interactive virtual tours of heritage sites like Arvia’juaq. Although there are some caveats, we argue that virtual reality (VR) tours are potentially powerful tools for connecting people to heritage sites that might otherwise be inaccessible. This has important implications for raising awareness of polar heritage and its significance to Indigenous people, as well as national and international audiences.

KEYWORDS
Digital heritage, virtual tour, oral history, Inuit, heritage at risk, Arctic

RÉSUMÉ

« Quelques récits d’un voyageur extraordinaire » : Recourir aux tours virtuels pour accéder à des sites patrimoniaux éloignés des savoirs culturels inuit

L’utilisation d’images panoramiques pour transporter les téléspectateurs dans des emplacements géographiques éloignés remonte aux théâtres panoramiques de Londres

i. Department of Anthropology and Archaeology, University of Calgary, Alberta, Canada. pcdawson@ucalgary.ca

ii. Department of Art, University of Calgary, Alberta, Canada.

iii. Kitikmeot Heritage Society, Cambridge Bay, Nunavut, Canada.

iv. Arviat, Nunavut, Canada.

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MOTS-CLÉS
Patrimoine digital, tour virtuel, histoire orale, Inuit, patrimoine à risque, Arctique

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To truly understand the significance of a heritage site, it is often thought that a visitor must experience it firsthand. Walking among buildings, tent rings, caches, and other structures places cultural features into a context that facilitates the communication of key messages that define the meaning and significance of the site. This is precisely why heritage agencies restore historic buildings, and place such a high value on seasonal attendance figures. However, what happens when heritage sites are far removed from the public eye, as in the Canadian Arctic where geographic isolation and the high costs of travel make it next to impossible for many potential visitors to physically experience a site? Within Inuit communities, advancing age, poverty, and the high cost of transportation can also prevent individuals from regularly visiting sites of great cultural significance. Elsewhere, virtual tourism is emerging as a way of experiencing heritage sites when travel to the actual destination is perhaps too dangerous, too expensive, too logistically complex, or some combination of the three (Boland and Johnston 1996; Roy and Christal 2002; Brown 2008; Addison 2001; Deshpande, Geber, and Timpson 2007; Huang 2011; Dawson, Levy, and Lyons 2011). For example, 3D computer reconstructions of historic buildings and other cultural features can be reverse engineered from archaeological and historic data, and placed into virtual heritage environments that portray the site as it would have appeared during the time it was occupied (Dawson and Levy 2005a, 2005b, 2005c, 2016; Levy and Dawson 2006, 2014; Dawson et al. 2007; Dawson, Levy, and Lyons 2011). Immersive photospheres like Google's Street

View images also offer a means of transporting users to remote heritage sites without leaving the comfort of their living room (Anguelov et al. 2010; Fingas 2012; Hoelzl and Marie 2014). In this paper, we discuss how the roots of immersive virtual reality (VR) in heritage tourism lie in the Victorian era, where vast panoramic paintings were used to create the illusion of travel to exotic destinations. We then present our virtual tour of Arvia'juaq National Historic site, discussing how immersive panospheres can increase access to remote heritage sites, as well as afford opportunities to communicate key messages about their significance to Indigenous, national, and international audiences. We end by outlining the challenges and caveats facing virtual heritage and its use in northern Canada, and its potential for communicating information about sites of Inuit cultural knowledge.

Victorian Panoramas and Virtual Tourism

Google's World Wonders Project provides an excellent example of the role that virtual tourism can play in rendering world heritage sites accessible to the masses (Google and University of Virginia 2010). In a piece written for *PC World* in 2012, John P. Mello Jr. exclaimed, "Want to take a trip to Stonehenge? How about Versailles? While many of us can't hop on a plane to visit those places, thanks to Google's new World Wonder's Project they're just a mouse click away." Using their Google Street View technology, Mello Jr. goes on to explain how heritage sites such as Pompeii and the Hiroshima Memorial Dome can be explored by "walking around" via clicking on direction arrows that move the user through the site along defined pathways (Mello 2012). The 360-degree panospheres[1] used to create such tours are collected from specialized cameras mounted on cars, bicycles, and backpacks, and linked together to create ground-level tours of heritage sites. Information about each location can be accessed from within the tour, creating opportunities for primary and secondary school instructors to teach history and geography. The value of Google's approach to heritage is that it circumvents the problems of time and space when dealing with heritage sites, especially those that are remote. In other words, one can visit heritage sites that are either local or distant from any location with an internet connection, and at any time of the day or night. As a side benefit, the Google Cultural Institute also explains that capturing world heritage sites in this way preserves them for future generations. Thus, it has garnered the support of such well-known heritage organizations as UNESCO, the World Monuments Fund, and Getty Images.

1. A panosphere is a 360-degree high-resolution image created using a process where multiple photographic images with overlapping fields of view are combined to produce a segmented panorama.

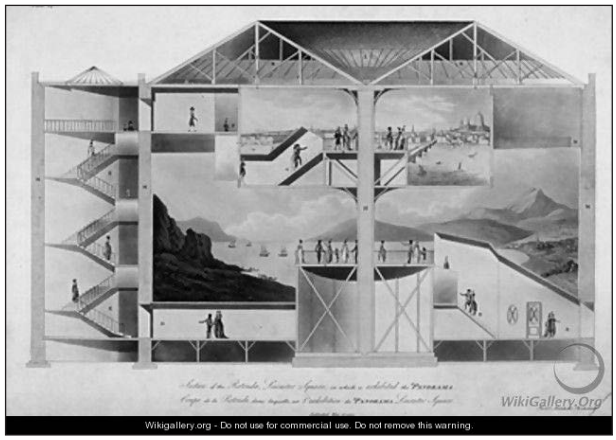

Figure 1. Robert Mitchell, *Section of the Rotunda Leicester Square in which is Exhibited the Panorama 1801*, 1801. Oil on canvas. Source: http://www.wikigallery.org/.

While there has been a tendency to view the use of VR as a novel means of experiencing heritage, immersion via media to create the illusion of travel to remote destinations has been with us since the Victorian era. As early as the late eighteenth century, paintings of enormous size were displayed in large circular rotunda theatres, where they were viewed by patrons from elevated platforms (Figure 1) (Byerly 2012; Huhtamo 2013; Potter 2007). When illuminated by natural light or koniaphostic (lime) light, the optical distortions created through the manipulation of perspective on these vast painted canvases formed an immersive experience that transported the spectator to another time and place (Potter 2007). The effect was said to be so convincing that Queen Charlotte of Mecklenburg-Strelitz became seasick while viewing a panorama depicting the British Fleet at Spithead (Potter 2007, 5). The subjects of Victorian panoramas varied from the cityscapes and street scenes of London, Paris, and Cairo, to depictions of natural disasters such as earthquakes (Byerly 2012; Potter 2007). During the Franklin era, panoramas presenting images of the Canadian Arctic were especially popular. To the Victorian mind, the Arctic was as far removed from the realities of London as one could get. Only during those rare winters when the River Thames froze over could nineteenth-century Europeans begin to contemplate the experience of overwintering aboard a British naval ship surrounded by sea ice (Ward 2008). Yet stepping into Robert Barker's London Panoramic Theatre in Leicester Square in 1850 afforded one the opportunity to experience the Franklin Expedition Rescue Ships HMS *Investigator* and HMS *Enterprise* as they battled Arctic sea ice (Potter 2007, 41). Many of these Arctic panoramas compressed time and space by presenting events that occurred throughout an entire expedition along the length of the canvas. For example, a

panorama depicting John Ross and James Clark Ross's voyage to the Boothia Peninsula recreated scenes from each of the four winters they experienced in the Canadian Arctic, including the loss of their ship HMS *Victory*, and their miraculous rescue by HMS *Isabella* (Potter 2007, 46). Like the published narratives of these Arctic voyages, British naval commanders recognized that panoramas were a powerful tool for communicating key messages of their exploits to the British public. This was especially the case for John Ross, who was the subject of much satire at the hands of *Punch* magazine following an earlier unsuccessful Arctic voyage in 1818 to discover the Northwest Passage (Potter 2007, 49). It is said that Ross himself supervised the panorama depicting his miraculous return from a later expedition to the Boothia Peninsula, continually revising images and scenes created by the artists to acquire the greatest possible authenticity. In one sweep, the resulting panorama helped to restore his standing among such Arctic explorers as William Parry and Sir John Franklin. Later polar voyagers, such as Elisha Kent Kane and Adolphus Greely, also utilized panoramas to illustrate and inform the public about their endeavours (Potter 2007, 27). In Greely's case, stereoscopic images created from dioramas were used to depict the return of James Booth Lockwood and David Brainard from an epic sledging trip, where they achieved a "farthest north" record that beat an earlier one set by the British Arctic Expedition (Greely 1884; Dick 2001).

The idea of travelling without leaving home may explain why Victorians were so fascinated by panoramas (Byerly 1997, 2012). This aspect of panoramas was satirized by writers such as Charles Dickens, who created the character of Mr. Bolley—a Victorian everyman who considers himself a "seasoned traveller" even though his experiences were confined to the panoramic theatres of London (Potter 2007, 78). In a piece written by Dickens for his magazine *Household Words*, Mr. Bolley is "resolved to make a journey to the ice-bound arctic regions" (Dickens 1850, 1908). He joins the expedition of Sir James Boss [*sic*] aboard his ships *Enterprise* and *Investigator*. He overwinters onboard the ships, sees all manner of Arctic wonders, but fails to meet any Eskimo [*sic*] (Dickens 1850). Thankfully, he is not alone in the Arctic, as he finds himself in the company of two Scottish gardeners and a variety of other folk, who the reader deduces are standing beside him in the panorama theatre viewing the same canvas (Dickens 1850). The scene into which Mr. Bolley wanders in Dickens's story "Some Account of an Extraordinary Traveller" is, in fact, Burford's 1850 panorama exhibited in Leicester Square, depicting the Franklin Rescue ships HMS *Investigator* and HMS *Enterprise* (Potter 2007). In addition to Dickens, *Punch* magazine also parodied the idea that panoramas were a legitimate substitute for real travel. In reviewing the aforementioned 1850 Arctic panorama, *Punch* readers were advised to protect their noses from frostbite and recommended it as a "cooling retreat during the summer months" (Potter 2007, 45).

In his book *The Shows of London*, Richard Altick describes the Victorian obsession with panoramas as part of an overall fascination with "mimetic effects,"

which included animated clockwork figures, dioramas, and other simulations of reality (Altick 1978, 51). In fact, panoramas eventually became mechanized through the invention of the "moving panorama." Traditional panoramas were already of an enormous size (Huhtamo 2013). By way of illustration, the lower room of the Leicester Square rotunda theatre operated by Henry Aston Barker (1774–1856) displayed a panorama 84 feet, 6 inches in diameter and 35 feet, 9 inches in height (Potter 2007, 41). Moving panoramas, in which scenes painted on long sheets of linen were wound onto two spools and then mechanically reeled from one to another past the viewer's eye, further enhanced the sensation of immersion by adding the illusion of movement (Huhtamo 2013). River scenes were particularly popular subjects for moving panoramas, and these simulations of travelling down a waterway could take several hours to experience from start to finish (Huhtamo 2013, 4; Potter 2007). In what could be considered as a form of "Victorian augmented reality," real objects and waxwork figures were occasionally placed in front of stationary and moving panoramas as a means of adding to the authenticity of the scene (Potter 2007). For example, artifacts recovered during the search for the lost Franklin Expedition were displayed alongside panoramas depicting scenes of ships trapped in ice. Narration and music were also added to moving and stationary panoramas to enhance their educational value (Huhtamo 2013; Potter 2007, 156). Regardless, most Victorian panoramas were intended to function as spectacles more than as educational experiences.

In summary, Victorian panoramas were liminal spaces that functioned as passageways allowing Victorians to experience distant places without the discomforts and challenges of travel in the nineteenth century (Potter 2007). Panoramas were also virtual spaces where Victorians could "try out" new experiences or world views before committing to them via actual travel or emigration to new areas of the empire (Byerly 2012). Between 1818 and 1883, there were no fewer than sixty Arctic shows, including twenty-two moving panoramas, three fixed panoramas, twelve lantern exhibitions, four mechanical automata theatres, and four public exhibitions of Inuit or "Eskimaux." This intense interest in the Arctic as a virtual destination for Mr. Bolley and other "extraordinary travellers" of the Victorian era is possibly due to the geographical remoteness of this region of the world, along with the gothic images of these frozen lands that emerged as the true fate of the Franklin Expedition was determined. These included such paintings as *Man Proposes, God Disposes* by Edwin Landseer, and *The Wreck of the Hope* by Caspar David Friedrich. Today, the spectre of climate change has been added to this list. The Arctic remains a destination of great interest, primarily because the effects of climate change are now creating a narrative of "last chance to see," as sea ice, polar bears, and even heritage sites are portrayed to be on the verge of being lost to a warming polar climate. Today, VR, 360-degree photospheres, and IMAX all have their roots in Robert and Henry Aston Barker's nineteenth-century panoramas and their

cousins. Consequently, the immersive effects produced by these twenty-first-century technologies could potentially make remote polar heritage sites more accessible to Inuit communities, as well as national and international audiences.

Polar Heritage and the Need for Visitor Experience

The historic significance and cultural values associated with polar heritage sites are often challenging to define and communicate to the public. This is not because values are lacking or that individuals or groups lack opinions on what those values are. Rather, the remoteness of polar heritage severely limits opportunities for individuals to visit, experience, and learn about these sites firsthand (Bennet 1995). In Canada, those charged with preserving and protecting heritage such as Parks Canada, and territorial/provincial government agencies, rely heavily on firsthand experience to communicate why certain sites and cultural features have been deemed significant. Consequently, historic buildings and machinery are often fully restored to recreate what life would have been like when the events being commemorated took place. Within these heritage settings, visitors frequently interact with staff members dressed in period costumes who assume the personas of historic individuals. These kinds of immersive experiences are thought to make visitors more receptive to the messages of significance that define a heritage site. Such approaches to heritage present obvious challenges in remote regions such as the Arctic and Antarctic (Dawson and Levy 2016). Nevertheless, circumpolar heritage sites, and the messages they convey, remain of great interest to governments and the public. For example, the recent discovery of the Franklin ships HMS *Erebus* and HMS *Terror* has been deemed highly significant by the Canadian federal government because of the ships' perceived ties to Canadian Arctic sovereignty (Humphries 2014). In fact, both *Erebus* and *Terror* were designated as National Historic Sites decades before they were even located (Canadian Register of Historic Places 1992). Public interest in the Franklin ships has also been great, as reflected in extensive national and international press coverage, as well as the debates sparked by Inuit insistence that associated Franklin relics be placed on permanent display in the Nunavut community of Gjoa Haven (Humphries 2014).

Many of the same accessibility challenges also impact northern Indigenous heritage sites, albeit to varying degrees, and for different reasons. Arvia'juaq National Historic site, which is the subject of our virtual tour, is located on a small island nearby the community of Arviat and can only be accessed by boat (Figure 2). A second National Historic Site called Qiqiktaarjuk is accessible by land but is far enough from the community that transport by ATV is required. Accessing such sites can be challenging for Arviat Elders who are dealing with health and mobility issues. We know of at least one case in which an Elder regularly utilized Google Earth to access places on the land that he was no longer able to physically visit. Similarly, Arviat families lacking reliable access to

ATVs, boats, and snow machines, either because of poverty or the demands of others, can also face restricted access to important sites of Inuit cultural knowledge.

In summary, virtual tourism represents a potential solution to the challenges of making remote polar heritage sites accessible to Indigenous and non-Indigenous audiences. In the following section, we provide an overview of Arvia'juaq National Historic Site, and describe how VR and 360-degree panospheres were used to create an immersive tour of the site. A brief account of a community visit to Arviat in 2017 to obtain feedback on the tour is then used to examine some of the problems and prospects of VR tours in northern communities where internet access is unreliable and download speeds can be frustratingly slow.

Arvia'juaq National Historic Site

Arvia'juaq or Sentry Island is located approximately five kilometres off the western coast of Hudson Bay, northwest of the community of Arviat (Figure 2). The island is long and narrow in shape, and is of modest size, being less than 4.5 kilometres in length and 0.5 kilometres at its widest point. The island is an

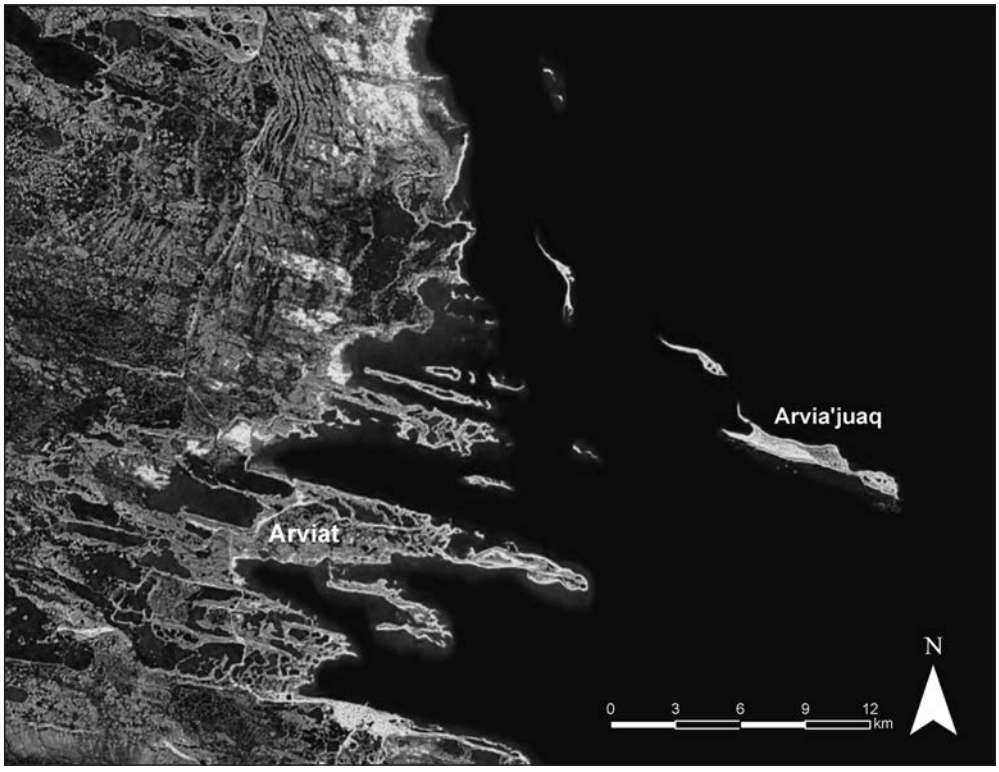

Figure 2. Map showing the location of Arviat and Arvia'juaq National Historic Site.

important harvesting location for Arviarmiut,[2] and many families hunt beluga and fish for Arctic char during the warm season months (Birket-Smith 1929; Henderson 1995; Lyons et al. 2010). The highest part of the island is dominated by two navigational beacons. The earlier beacon is constructed from wood obtained from the wreck of the ship *Qulaituk* (Henderson 1995). The second is a steel structure containing a navigational light for ships travelling in the area. The first Euro-North American to describe the island was Kaj Birket-Smith, a member of the Danish Fifth Thule Expedition (1921–1924). He noted an immense number of stone features, including tent rings (*tupirviit*), meat caches, kayak rests (*qayauhiviit*), cooking shelters, and drying areas for seal meat. Also present were offering cairns (*tunnillarvik*), burials, festival areas, games, and healing stones. Most of these stone features seem to concentrate on the plateau and beach ridges that surround it. Among the most significant cultural features on the island are kayaks (*qajait*) outlined in stone that were used in a game designed to test the harpoon-throwing skills of young hunters (*qillaluguajarvik*, beluga *qajaq* game) (Figure 3). A second game located nearby consists of

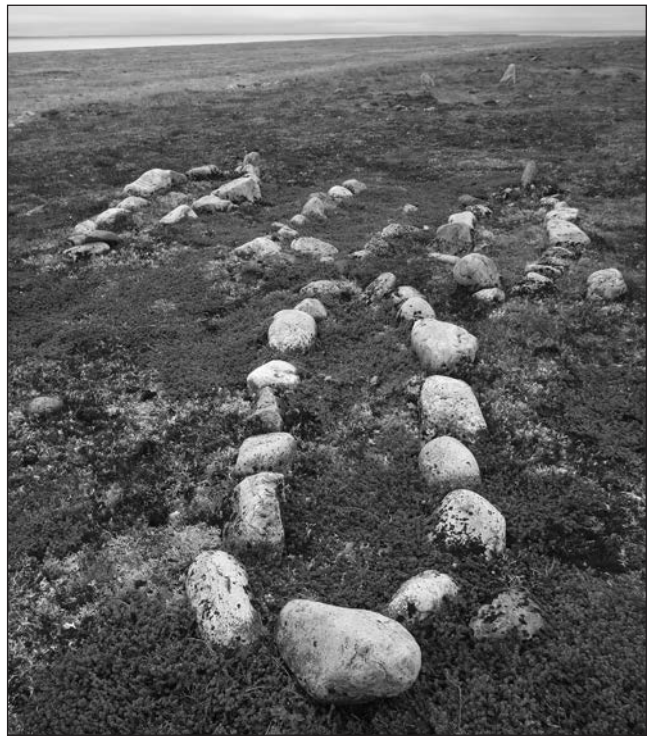

Figure 3. *Qillaluguajarvik*, beluga *qajaq* game. Stone outlines of three *qajait*.

2. *Arviarmiut* are the Inuit inhabitants of the community of Arviat, Nunavut.

two parallel rows of stones. Called *nallujarviit,* caribou crossing game, the objective was for two players to push each other over one of the two lines of stones. *Kibvakattaq* or weight-lifting stones were also used in games designed to test the strength of competitors. Several of the stone features on the island are associated with the activities of shaman, and *kattauyaq*—or shaman's healing cairns—are found in at least two places on Arvia'juaq. These features consisted of two stones placed approximately three feet apart. A sick person is taken through the stone feature by a shaman to cure her/his illness. Because Arviat was a traditional summer meeting place, a great number of *tupirviit* or tent rings visibly dominate the landscape (Suluk, pers. comm, 2015). Most of these habitations are located on a series of beach ridges, where the abundant rocks could be used to secure hide tents and provide adequate drainage.

Arvia'juaq is a place of great cultural significance to Arviarmiut. There are many stories from Inuit oral histories that relate to the island and its many stone features. Perhaps one of the best examples are the *arnaqatirjuarjugiik*—competing cousin stones (Henderson 1995). These stone features are a physical testament to the tragic story of two cousins who became bitter rivals in a dispute over a young woman. Oral histories explain that the present location of the rocks is due to a competition in which the two cousins tested their strength by lifting the rocks into place. The competition ended when,

> at the next drum dance, the single man entered the drum dance procession with a hunting spear in hand…Of course, the other began to run away from him since he wasn't armed yet. He might have obtained one eventually, but never-the-less, the one with the spear began throwing it at the man inside the tent. The other man ran around behind the people in the tent. Sometimes he would squeeze himself between the tent and the poles as he attempted to escape from being hit…Finally, he slid under the tent which was weighted down with stones and escaped outside. He ran as fast as his legs could carry him to the top of the hill.
>
> The person with the hunting spear spotted him running up the hill and pursued him some more. The other man had a knife or a spear head which he (found) somewhere along the way. The other man ran straight into the sea without being caught, but the man with the hunting spear speared the man from above the water. He pulled the man up ashore. It must have been a frightening experience as the crowd followed the man after he had speared the other person. The other person also had (received) a stab wound (during the fight).
>
> Both of them were still alive at this point, with spear and knife wounds. The other man told the crowd to go ahead and bury him since he knew he was going to be dead soon anyway.
>
> The crowd was sad about the whole thing but had to follow the dying man's wish despite their feeling against it. They got a bull caribou hide that

> was stretched out to dry and put the dying man on it face up. As they folded the skin casket with the dying man in it, the person who stabbed him was standing next to the dying man. He was wounded too, and was in great pain. The dying man called to the other wounded man and demanded him to seal up the skin casket with a piece of rope…
>
> As the casket was being sealed up with a rope, he called out to say they missed one hole on the edge of the skin. He said (to his cousin), "My poor cousin, here is another hole." This was a dying person talking to an opponent who was sealing up his own skin casket. The man died eventually, while they were still fastening the seal rope. The other man died too, a little later, and they were buried side-by-side. (Margaret Aniksak, Arviat Historical Society, 1992, 5, cited in Henderson 1995)

Like many of the stories associated with Arvia'juaq, the tale of the competing cousins is embodied in the two large stones and how they are placed on the landscape. The stones serve as mnemonic devices that remind visitors of historic and mythological events, and the cultural values they reflect. The fact that Arvia'juaq resonates so strongly with Inuit cultural values and traditions may explain why a certain power is associated with the island. Luke Suluk has explained that some type of inconvenience or hindrance is often experienced by those with plans to work on the island, and therefore a certain degree of caution is always exercised during visits.

The strong ties between Arvia'juaq's many stone features and Inuit cultural knowledge explain why the site is highly significant to Arviarmiut. In many ways, their lifeways and cultural values are chronicled through these abundant and diverse stone features. Thus, on August 12, 2000, Arvia'juaq and its sister site Qikiqtaarjuk were commemorated for their national historic value by the Historic Sites and Monument Board of Canada. The Honorable Sheila Copps, then minister of Canadian heritage, stated that "Arvia'juaq and Qikiqtaarjuk are part of the Inuit cultural landscape demonstrating the relationship between the Inuit people and the land. This national historic site of Canada is important to all Canadians as it testifies to the knowledge and adaptability that allowed Inuit to survive in this part of the Canadian Arctic" (Parks Canada 2000). While many Arviarmiut are aware of, and receptive to, such key messages of heritage value, communicating them to national and international audiences is much more challenging. As previously mentioned, Arvia'juaq is visited by only a handful of national and international tourists each year. Furthermore, the development of a tourism industry in nearby Arviat is hampered by the high costs of airfare, food, and accommodation. Regardless, raising awareness of the heritage value of these sites is critical to the management of their cultural resources. For example, the integrity of Arvia'juaq has been threatened in recent years by human activities, such as the use of rocks to write personal names and dates of visits (Henderson 1995). Erosion is also placing certain stone features at risk via the encroachment

of a sandy plain. For example, sand now covers a portion of the *qajaq* game, and cultural features located close to the south shore of the island are threatened by erosion caused by storm surges.

Constructing a virtual tour of Arvia'juaq has the potential to address such issues. Like a Victorian panorama, the 360-degree panospheres used in virtual tours create a sense of "you are there." The heightened level of engagement created through the immersive visual presentation of cultural features and their relationship to Inuit oral history and tradition potentially allows for the more effective communication of key heritage messages. Furthermore, the high degree of coverage offered by panospheres has the added benefit of producing a photo document of the site, as it would have appeared during the time of fieldwork, that could be used to monitor and track changes. However, there are some important factors that need to be taken into consideration when building virtual heritage tours.

Community Engagement

Seeking guidance from the community was among the first steps undertaken during the development of this project. Meetings with the Arviat Hunters and Trappers Organization (HTO) were undertaken to plan the virtual tour and define how it might be useful to the community. Several members of the HTO are tour operators and regularly take visitors to nearby heritage sites, including Arvia'juaq and Qiqiktaarjuk. Many saw the virtual tour as a means of bringing Inuit heritage to the attention of global audiences. Perhaps most interesting, however, was that several HTO members viewed the virtual tour as useful for encouraging people to visit and experience the *actual* site. In their minds, the virtual tour seemed to enhance rather than replace engaging with Arvia'juaq in the real world, indicating that the physical and virtual were not mutually exclusive. Several HTO members suggested that the virtual tour should be accessible at the Arviat airport and Margaret Aniksak Visitor's Centre using interactive video displays to attract tourists and increase awareness of Inuit heritage. Representatives from the Department of Education, Government of Nunavut, proposed that the virtual tour could be an innovative way of taking students from across Canada on virtual field trips to important Inuit heritage sites, given that physical visits to such locations are rarely practical.

Aesthetic Context Verses Scientific Accuracy

In re-creating Arctic landscapes and scenes of polar exploration, Victorian panoramas were often criticized for placing aesthetic considerations ahead of authenticity and accuracy (Potter 2007). Many were painted from sketches done by British naval officers trained by the Royal Geographical Society to accurately and scientifically illustrate the flora, fauna, landscapes, and Indigenous Peoples encountered during their expeditions to the Arctic (Levere 1993). Because the resulting images frequently lacked artistic sensibilities that would have made

them more engaging to the public, it was felt that some artistic licence was required when transcribing them onto large panoramic canvases. However, to what extent is authenticity a requirement of constructing an immersive experience? Do aesthetic considerations greatly enhance the sensation of virtually visiting a distant location? We argue that when representing a heritage site, aesthetic considerations are a very important part of the workflow. Reality capture technologies such as 3D laser scanning and photogrammetry provide a means of accurately and precisely documenting a heritage site, so that actual numbers and measurements can be taken directly off the resulting images. While heritage managers, historians, and archaeologists value such information, they are usually of little consequence when designing a visitor experience piece. Instead, the visual characteristics, textures, and ambience of a heritage site make more of a lasting impact in the eyes of the virtual tourist. Thus, the creation of content for virtual tours should be as much an exercise in art as it is in science.

In the case of Arvia'juaq, aesthetic considerations played a large role in determining where panospheres should be placed on the landscape, and the environmental conditions under which they should be shot. The latter includes such considerations as the colour and angle of the sun, weather conditions, the presence or absence of waves and sea ice, and the occurrence of specific types of flora and fauna. When combined, these factors can create an atmosphere that can further enhance the communication of key heritage messages. The skills of an artist are therefore required to determine where, and at what height, the camera must be located to achieve the desired effect. Consequently, our research team includes a highly skilled visual artist who works along side archaeologists, heritage managers, and local knowledge holders. This ensures that aesthetic considerations do not take a back seat to scientific agendas. By way of illustration, heavy fog covered most of Arvia'juaq for much of the first day of fieldwork. The archaeologist (Dawson) expressed concern over how the fog might impact the ability to accurately and completely capture various stone features. In contrast, the artist (Gadbois) felt that the presence of fog made the site more engaging and mysterious, as cultural features were alternately concealed and revealed. In the end, the artist was correct.

Building a Virtual Tour

Arvia'juaq was imaged over a period of two days using a workflow designed in collaboration with the visual artist (Gadbois). Local cultural historians Luke Suluk and Billy Ukutak provided guidance in how to structure the tour spatially, suggesting we use the trail to sequence the stone features. Both men ensured that the most significant stone features were identified and captured in the panoramic images and shared knowledge and stories about the island, which were incorporated into the tour. Panospheres were created at two levels of elevation, providing alternating visual perspectives on the stone features. A

pole-mounted digital SLR camera was used to capture images at an elevation of ten metres above the ground (Figure 4). For larger features, such as the beluga *qajaq* and caribou crossing games, a camera mounted on a small, unmanned aerial vehicle/drone was flown at an elevation of roughly thirty metres (Figure 5). Both camera platforms (tripod and drone) were positioned at key locations along a well-defined interpretive trail running from one end of the island to the other. A series of videos were also shot of local knowledge holders discussing the cultural significance of selected stone features (Figure 6). In some cases, they even enacted recreational activities such as how the *qajak* and caribou crossing games were played. Upon completion of the fieldwork, project team members met with other knowledge holders in the community of Arviat to further discuss the proposed virtual tour. These included Luke Suluk and Joe Karetak (Department of Education [Arviat Office], Government of Nunavut), Billy Ukutak, and members of the Arviat Hunters and Trappers Organization.

Figure 4. Denis Gadbois using a pole-mounted digital SLR camera to create photospheres at Arvia'juaq.

Figure 5. A DJI Phantom 3 Drone with camera is readied for launch.

Figure 6. Colleen Hughes (left) and Billy Ukutak (right) create a video describing how the *qillaluguajarvik*, beluga *qajaq* game, was played.

Following the team's return to Calgary, the complex process of stitching the images together was undertaken by Gadbois to create a series of immersive photospheres. Porter then utilized Panotour Pro version 2 software to build the virtual tour as part of her master's thesis research at the University of Calgary (Figure 7). Panotour is a commercially available software package used to create immersive virtual tours by linking together successive 360-degree panoramic photographs using "hot spots." These clickable icons are suspended within each photosphere, allowing the user to "jump" from one sphere to another (Figure 8). Panotour also provides a means of anchoring text, video, and other types of media content to objects/subjects visible within the panosphere. In the case of our virtual tour, descriptive textboxes, illustrative photographs, and videos were anchored to specific stone features using clickable buttons with symbols designed by Arviarmiut school children (Figure 9). There were, however, certain challenges that had to be overcome. For example, the Panotour Pro software has a steep learning curve. Second, it was often difficult to accurately position and sequence each panosphere in the tour so that it matched the interpretive trail. This was partially because some of the images used to create the panospheres lacked embedded GPS information. Third, correctly identifying individual stone features against a backdrop of hundreds of other features within the panospheres was often challenging. Luckily, we had access to a comprehensive GPS survey and GIS database of Arvia'juaq's stone features that was completed by Parks Canada archaeologists in the early 1990s (Henderson 1995). The resulting shape files allowed us to correctly sequence the panospheres, as well as accurately identify individual stone features. Fourth, some users became disoriented when jumping between panospheres leading them to become lost within the tour. This disorientation was partially caused by the rotating 360-degree view of the panosphere, which can make it difficult for the user to determine what direction they are facing. These types of navigation issues are a similar concern in video game design, where getting lost might result in a player prematurely exiting a game out of frustration (Burigat and Chittaro 2007). To avoid similar issues in our virtual tour, users can access a small map showing their location on the island, as well as the direction they are facing (Figure 10).

The completed tour, which was constructed by Cecilia Porter (2017) as part of her master's thesis, is currently hosted by the Arctic Institute of North America at the University of Calgary, and is live and accessible through the following link: http://www.aina.ucalgary.ca/arviajuaq/.

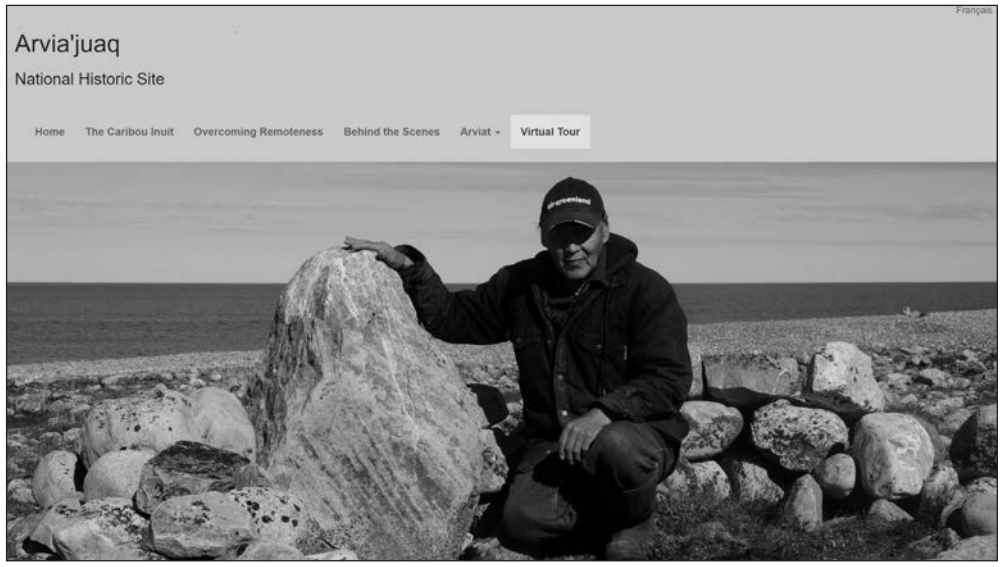

Figure 7. Landing page of the Arvia'juaq Virtual Tour.

Figure 8. One of the Arvia'juaq panospheres shot from the drone. Clicking on the various symbols listed in the legend allows the user to access various media content, as well as "jump" to adjacent panospheres on the island. The symbols used in the tour were designed by Arviat school children.

Figure 9. Examples of media content accessed by clicking on symbols anchored to stone features within the panosphere. A text box containing oral history information (upper) and a slide show of the Birket-Smith offering stone (lower).

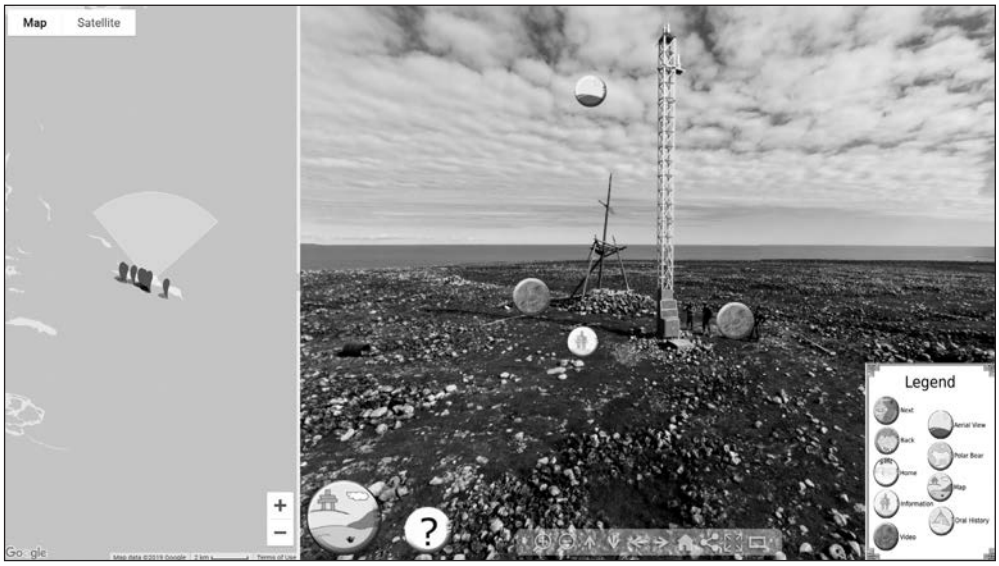

Figure 10. A ground-level panosphere with symbols that provide access to various media content. The map on the left serves as a navigation aid, showing the user their current position on the island and the direction they are facing.

Discussion

There are obvious parallels between the Arctic panoramas of the nineteenth century and our virtual tour of Arvia'juaq. Both function to create immersive experiences that enable individuals to visit remote and distant places without the associated logistical challenges. Both utilize the visual characteristics, textures, and ambience of the setting to make a lasting impact on the virtual tourist. Both are experiential as well as instructive, albeit to varying degrees. For example, some Victorian panoramas were used by polar explorers to communicate the significance of their expeditions (or to justify their cost) to the public (Potter 2007). Alternatively, our virtual tour uses panospheres to communicate the heritage significance of Arviarmiut Inuit lifeways, cultural values, and traditions to national and international audiences, as well as local Indigenous communities. Furthermore, tools such as digital SLR cameras, drones, computers, and software allow these messages to be far more complex, nuanced, and directed towards specific audiences.

The types of heritage messages defined by the National Historic Sites and Monuments Board of Canada for Arvia'juaq focus on how the stone features, along with terrestrial and marine wildlife resources, constitute a complete and whole cultural landscape that chronicles generations of Inuit cultural knowledge (Canadian Registry of Historic Places 1995). The immersive and interactive qualities of the virtual tour, as described previously, draw out these messages in ways that more conventional approaches (e.g., pamphlets, government websites) simply cannot match. Generating public interest through interactivity and VR is obviously beneficial because it can result in funds for supporting future site protection and restoration projects, as well as stimulate the development of polar tourism in the Kivalliq region of Nunavut.

Heritage messages directed at Arviarmiut and other local Inuit groups focus on how various features of the natural and cultural landscape reflect the continuity of Inuit cultural knowledge and occupation of the Kivalliq region. To illustrate, the stone tent rings, games, and other features are the material evidence of generations of Inuit returning each summer to camp and harvest the abundant resources associated with the island. Traditionally, archaeological sites, oral histories, and contemporary activities conducted at Arvia'juaq have also provided a central focus for passing on cultural knowledge to young people. Such heritage messages therefore play an important role in revitalizing local Inuit culture and re-enforcing the unique cultural identities of Arviarmiut. The immersive qualities and interactivity of the virtual tour can potentially play a crucial role in communicating these messages to Inuit youth, many of whom are extremely interested in digital media and technology. By way of illustration, a recent visit to Arviat to gain feedback on the Arvia'juaq virtual tour included classroom demonstrations of the website for school children at Qitiqliq Middle School. The children accessed the virtual tour using a Samsung Galaxy View tablet with a large 18.4-inch touch screen. Google Cardboard viewers were also

used to provide the children with an even greater immersive VR experience of the site and its contents. Smartphones preloaded with panospheres of Arvia'juaq were inserted into the Google Cardboard viewers (Figure 11). Sensors in the smartphone are controlled by the Google Cardboard app so that the phone tracks the user's head movement. This allowed the children to "look around" each panosphere by moving their heads up, down, and around, as if they were standing at the actual site.[3] These demonstrations were a huge hit with the children and generated a great deal of excitement. This suggests that virtual tours of local and regional heritage sites could be successfully integrated into classroom activities, and perhaps even into the curriculum of Nunavut schools for the purposes of cultural revitalization and the promotion of secure cultural identities in young people.

Figure 11. Arviarmiut explore panospheres of Arvia'juaq using Google Cardboard VR viewers.

3. Google generously donated Google Cardboard viewers for our demonstration of the tour at Qitiqliq Middle School.

Of course, there are always caveats. Ironically, perhaps of greatest concern is the issue of accessibility. When creating virtual heritage exhibits, there is often the presumption that the bandwidth necessary to ensure smooth loading and operation of the website and its media contents is present in source communities, and that devices such as smartphones and tablets are easily accessible. Unfortunately, this is not the case in many northern hamlets and towns where reliable high-speed broadband internet connections are non-existent or extremely expensive. The same is also true for computer hardware. Creative solutions for addressing this "digital divide" will need to be developed to ensure that all Inuit have access to these and other forms of digital heritage. One such solution is to preload the tour onto devices already in the community, thereby eliminating the need for internet connectivity. Another may be to run the VR tour off local servers. For example, Porter successfully used PAW Server for Android to turn the Galaxy View tablet into a local server, which could then be accessed by other devices in a classroom or other setting. Another solution is to use Google Cardboard viewers to deliver the tour and its content to Inuit users. By preloading the virtual tour onto Android and Apple smartphones or tablets, these inexpensive and easy to use VR viewers further enhance the feeling that "you are there." Users can "jump" between panospheres with a simple click of a cardboard button located on top of the viewer. As mentioned previously, the Arvia'juaq virtual tour will be fully operational within the Google Cardboard viewer platform. Access to hardware such as tablets, smartphones, and computers is obviously more challenging because of their cost. One solution might be to obtain enough devices to use in a classroom setting. The devices could then be preloaded with the virtual tour, packed into pelican hard cases, and shipped to different schools in Canadian Arctic communities, along with lesson plans. Such travelling virtual exhibits could potentially provide a temporary solution to some of these digital divide issues.

At the time of writing, and under the direction of Cecilia Porter, the Arvia'juaq virtual tour has been online and accessible since the fall of 2017. Future work will focus on an in-depth analysis of web analytics from the tour, so that we may better understand and optimize its usage. We are also currently seeking funding to establish two permanent kiosks (computer plus monitor) for installation in the airport and visitor's centre. The challenge here lies in ensuring that the hardware remains operable from a distance. Therefore, we are hoping to enlist the Arviat Wellness Center Coding Club, which consists of Arviat youth who are learning computer coding, to maintain these kiosks in the years to come.

Conclusions

As government agencies struggle to protect and preserve heritage sites threatened by climate change and human-caused destruction, new methods for communicating their significance to global audiences need to be developed. This

is critical because it is only through public support that the funds necessary to ensure their physical preservation can be raised. Similarly, as Indigenous Peoples seek to reassert their cultural identities in light of the impacts of coercive tutelage and government modernization programs, there is a need to explore new ways of engaging Indigenous youth with their cultural traditions. Digital heritage projects, such as the Arvia'juaq Virtual Tour, are one way this might be accomplished. Reliable internet connectivity and access to computer hardware will likely remain issues in northern communities for years to come. Nevertheless, digital heritage projects provide a means of engaging Indigenous youth with cultural knowledge, as well as provide training opportunities in new media technologies. This is already occurring through Nunavut-based organizations such as Pinnguaq, who have been successfully running computer-coding camps for youth in communities across Nunavut for several years now. While acquiring digital technology skills has obvious implications for future employment, they also empower Inuit youth to begin digitally capturing and recording their own traditions. This is a direction we are hoping to move in as we begin to explore how small 360-degree photosphere cameras, such as the Ricoh Theta 360 and Nikon Key Mission, can be used by Inuit to record culturally significant places themselves (Figure 12). Like the Victorian panoramas of the nineteenth century, the idea of using panoramic images to transport viewers to remote locations continues to resonate through such projects and Google's World Wonders and our virtual tour of Arvia'juaq. Rather than be relegated to the sidelines as simply entertainment, these types of virtual tours demonstrate the potential that VR has in protecting and promoting heritage sites, as well as transferring cultural knowledge to Indigenous youth.

Figure 12. Colin Suluk uses a Ricoh Theta 360 camera to create a panosphere of a stone feature at Arvia'juaq.

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