Sweetgrass AR: Exploring Augmented Reality as a Resource for Indigenous–Settler Relations

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Augmented reality (AR) is increasingly used as a digital storytelling medium to reveal place-based content, including hidden histories and alternative narratives. In the context of Indigenous–settler relations, AR holds potential to expose and challenge representations of settler colonialism while invoking relational ethics and Indigenous ways of knowing. However, it also threatens to disseminate misinformation and commodify Indigenous Knowledge. Here, we focus on collaborative AR design practices that support critical, reflective, and reciprocal relationship building by teams composed of members from Indigenous and settler communities. After a short history of Indigenous media development in Canada, we describe how we operationalized a participatory AR design process to strengthen Indigenous–settler relations. We document a series of iterative design steps that teams can use to work through

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ethical, narrative, and technical choices made in the creation of culturally appropriate AR content, and draw attention to the potential and limitations of this emerging medium.

Keywords: augmented reality, Indigenous media, Indigenous–settler relations, production/coproduction, participatory action research, copyright/intellectual property, knowledge management, ethics

Augmented reality (AR) is increasingly used as a digital storytelling medium to reveal place-based content, including hidden histories and alternative narratives. In the context of Indigenous–settler relations, AR holds potential to expose and challenge representations of settler colonialism while invoking relational ethics and Indigenous ways of knowing. The term "settler" refers to non-Indigenous peoples who moved and settled in Indigenous territories, or whose ancestors did. It is used to talk about settler colonialism, which is when these people occupy land, assert ownership, and "become the law" (Tuck & Yang, 2012, p. 6; see also Regan, 2010; Vowel, 2016).[2] The concept is meant to be unsettling: It challenges commonly understood notions of belonging, drawing attention to how colonial structures continue to be enforced today. Settler colonialism operates in a manner that impacts what is known and recognized as truth and history. For example, one common story is that the land currently known as Canada was empty and unused before pioneers arrived to make it productive, as reflected in histories of European explorers and settlers (re)discovering and (re)naming places already known and inhabited by Indigenous peoples (Epp, 2008). In contrast, settler governments often banned ceremonies that celebrated and transmitted Indigenous histories, such as the sun dance and potlatch, and removed Indigenous children from their homes, forbidding them to speak their languages in an effort to suppress their cultures (U'mista Cultural Centre, n.d.). Until recently, stories of the experiences of these residential school victims remained unknown to many settlers (Truth and Reconciliation Commission of Canada, 2015).

The dialectic between settler colonialism and countervailing forces of Indigenous self-determination encompasses a range of fields, changing in form, focus, and scope over time (McFarlane & Schabus, 2017). It is reflected, for example, in forms of traditional, new, and emerging media. Decades of communication research documents the historic and ongoing misrepresentation of Indigenous peoples in mainstream media and their lack of involvement in the institutions that produce and distribute it (Roth, 2005). At the same time, Indigenous peoples have long struggled for increased self-determination in the production and distribution of media generated by and for their communities. Their efforts are reflected in precolonial practices and continue in contemporary visual, oral, print, and broadcast media (Alia, 2010; Forde, Foxwell & Meadows, 2009; Molnar & Meadows, 2001). In recent years, these activities have expanded into digital media (Lewis & Fragnito, 2005; Loft & Swanson, 2014), podcasting networks (Indian & Cowboy Network, 2014), and online video (IsumaTV, n.d.). This shift accompanies widespread adoption of digital ICT by Indigenous users once access, availability, and affordability challenges are met (Duarte, 2017; Internet Society, 2018; O'Donnell et al., 2016).

In this article, we focus on the emerging medium of AR. As a form of location-based digital media that layers digital information over off-line spaces, AR has been used in Indigenous projects around the world to

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[2] There are differing viewpoints on whether the term "settler" is appropriate for people of color, particularly in cases when ancestors arrived under slavery or escaped from slavery.

reveal hidden histories and alternative narratives (Brown, 2008; Indigital, n.d.; Lacho, 2018). For example, in Aotearoa (New Zealand), Māori peoples are using AR to interpret Indigenous stories and teachings embedded in landscapes (Marques, McIntosh, & Carson, 2019). Several projects based in Australia, such as the Nyungar Place Stories Pilot, provide a platform to support Indigenous cultural sustainability (Irving & Hoffman, 2014). Similar projects are unfolding in countries now known as Namibia and Borneo (Sieck & Zaman, 2017), Norway (Cocq, 2017), and Mexico (Miranda-Bojórquez, Vergara Villegas, Cruz Sánchez, García-Alcaraz, & Favela Vara, 2016).

Although these initiatives play an important and necessary role in efforts to challenge settler colonialism and (re)assert Indigenous presence, our goals in this project are different. We document a participatory design process that uses a series of iterative steps that creators can use to work through the logistical, ethical, narrative, and technical choices made in the cocreation of culturally appropriate digital media content. As Todd (1996) argued, while "cyberspace" was historically conceived as placeless, and therefore countered the land-based orientation of much Indigenous media, AR provides an opportunity to re-place media and space through the combination of visual objects and the real world (see also Gaertner, 2016). In Azuma's (1997) widely cited definition,

> AR allows the user to see the real world, with virtual objects superimposed upon or composited with the real world. Therefore, AR supplements reality, rather than completely replacing it. Ideally, it would appear to the user that the virtual and real objects coexisted in the same space. (p. 356)

Tinnell (2017) stresses that as a narrative modality, AR enables a form of storytelling that is nonlinear and dispersed throughout space, in fragments of information sharing that situates our attention to people, places, and things in our immediate environments. AR can therefore provide important context beyond what is immediately observed in the "space of places" (Castells, 2010). Influenced by Hidalgo's (2015) model of augmented scholarship for social justice learning, we sought to develop "a collaborative process between researchers and oppressed communities to produce alternative narratives and reveal erased histories" (p. 301). To do this, we highlight the social construction of AR content, focusing on communication process as much as product.

However, we also recognize that AR threatens to disseminate misinformation and commodify Indigenous Knowledge. AR storytelling is rapidly diffusing across our societies; although still in its infancy, some estimates state that spending on AR will reach $60 billion by 2020 (Porter & Heppelmann, 2017). Major technology companies including Google, Apple, and Facebook are all heavily investing in AR technology, including by developing user-friendly AR tools and platforms (ARCore and ARKit, respectively). Although AR holds potential to increase public recognition of suppressed histories, societies, cultures, and epistemologies, care is needed concerning how such stories are cocreated and shared, particularly in the context of digital capitalism (Donner & Locke, 2019; Iseke & Moore, 2011; Langley & Leyshon, 2016; Pasquale, 2018). Many AR platforms are owned and controlled by corporate entities that can benefit from the commodification of Indigenous Knowledge, and AR storytelling threatens to spread incorrect information and inappropriate content, further undermining Indigenous protocols of knowledge stewardship and continuing to misrepresent diverse cultures and societies.

Inspired by Hidalgo and others, this article documents how we approached these challenges through a case study of our Sweetgrass AR project (2017–19). By using a hands-on, learning-by-design process (Kalantzis & Cope, 2016), our project documents a process that participants use to actively engage in Indigenous–settler relations by cocreating AR content about the Cree teachings embedded in the Sweetgrass Bear sculpture, which is housed in ᐊᒥᐢᑿᒌᐋᐧᐢᑲᐦᐃᑲᐣ[3] (amiskwacîwâskahikan; present-day Edmonton, Alberta, Canada).

We selected the Sweetgrass Bear Treaty 6 marker (see Figure 1) to activate digital content that teams would create and house on an AR platform. Sweetgrass Bear is one of a series of Treaty 6 marker bears carved by Stewart Steinhauer in response to Knowledge Keeper Dr. Diana Steinhauer's vision of marking treaty territories to affirm entitlement for future generations, accorded by the internationally recognized Numbered Treaties that cover much of modern-day Canada.

Figure 1. Sweetgrass Bear, a Treaty 6 marker bear located in the Enterprise Square building in amiskwacîwâskahikan (Edmonton), Alberta. Sculpted by Stewart Steinhauer from Saddle Lake Cree Nation. Photo by Greg Whistance-Smith.

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[3] Cree Syllabics for Edmonton (amiskwacîwâskahikan).

Sweetgrass Bear embodies Cree knowledge and teachings, and is designed as a physical expression of treaty relationships between the Cree Nation (Anishinaabe, Nakoda-Sioux, and Dene Nations) and the British Crown to allow colonial settlement and immigration on the treaty territories. The sculpture currently resides in the foyer of a former Hudson's Bay Company building, located just north of a North Saskatchewan riverbank camping and gathering site used for thousands of years by Indigenous peoples including Cree, Nakoda, and Blackfoot. The AR content created through our project reveals histories and knowledge associated with this area, using Sweetgrass Bear to activate stories. Users scan different parts of the sculpture (e.g., the Cree text on its legs; a treaty medallion on the base) to experience audio, image, and video that brings to life its role as a marker for treaty knowledge.

In working out a process to develop content for Sweetgrass AR, we draw on Stuart Hall's (1995, 1996) work encompassing the relations of representation and the politics of representation. In Hall's framework, the relations of representation refer to the ability of marginalized peoples to gain access to the means of production of cultural representation—for example, as media producers, journalists, or sources. The politics of representation considers the framing of peoples and issues in media content—for example, whether they are portrayed using negative stereotypes. To develop the Sweetgrass AR stories, we adapt this framework to the specific context of Indigenous–settler relations; content is created through a reflective AR design process grounded in Indigenous protocol and shared project governance, and guided by the relational ethics developed by Indigenous scholars like Tuhiwai Smith (1999), Kovach (2010), and Wilson (2008). As a way to unsettle the settler within (Regan, 2010, p. 13), Indigenous–settler teams connect with and learn from one another, with AR design an orientation point for conversations about cultural appropriation and misrepresentation, knowledge-sharing protocols, and the commodification of Indigenous Knowledge. Our goal is to encourage participants to question these impacts and propose storytelling strategies that might help mitigate its effects.

In this article, after a short history of Indigenous media development and the shifting nature of Indigenous–settler communication, we describe how we operationalized our participatory AR design process. This discussion framework encourages guided exploration of complex and sometimes challenging issues, such as settler colonialism, cultural appropriation, and project governance. It also describes active engagement in relationship-building activities, including sharing ideas and learning from one another throughout the story-making process, which offers practice in respectful and ongoing collaboration and relationship building. Teams can use these design steps to work through ethical, narrative, and technical choices made in the creation of culturally appropriate AR content, and draw attention to the potential and limitations of this emerging medium.

Laying a Foundation: Indigenous Media Development in Canada

Despite their diversity, mainstream media representations of Indigenous peoples around the world reflect similar colonial discourses. Authors like Fanon (1963) and Said (1979) theorized these similarities as strategies used to justify the usurpation of Indigenous lands and resources. They argued these discourses appropriate elements of European religious and philosophical thought to this end. For example, Chamberlin (1997) traces the influence of Matthew Arnold's 1869 book *Culture and Anarchy* in contemporary legal frameworks, describing how it was used to set up a series of dichotomies between "civilians" and "barbarians"

that continues to resonate today. Culhane (1998) similarly demonstrates how European settler governments invoked John Locke's writings on property rights to justify their dispossession of seemingly uncultivated Indigenous lands. Colonial governments used Rousseau's descriptions of Indigenous peoples as "noble savages," and Hobbes' writings on the violence of the uncolonized "state of nature," to justify their paternalistic administration of formerly self-determining Indigenous nations (Youngblood Henderson, 2000; see also Coulthard, 2014).

In the context of settler colonialism, the widespread production and dissemination of these discourses was significantly amplified through the emergence of mass media. In Canada, by the 1860s and 1870s, Indigenous peoples came to be represented in media as dying cultures. Their rich material and symbolic cultures—expressed through visual arts, crafts, songs, performances, words, and stories—were "collected by non-Natives and widely circulated in mainstream society as popular evidence of 'primitive' artifacts and practices" (Roth, 1993, para 2). Over time, mass media representations of Indigenous peoples coalesced into "a form of ethnic hegemony, premised on seemingly legitimate ideologies and attitudes, and often tacitly accepted by most members of the dominant majority group" (van Dijk, 2000, p. 34). Critical scholars argued that such discourses perpetuated an ahistorical, hierarchical, racialized social structure (Jiwani, 2006). Although these discourses change in form and content over time, their underlying metanarrative consistently presents Indigenous peoples as "childlike," incapable of self-determination, or dangerous (Harding, 2006). They also reflect the absence of Indigenous voices in mainstream media, even about issues that directly concern their communities. Media content created in metropolitan centers was typically sent to rural and remote communities through a one-way transmission process that affected Indigenous languages, institutions, and cultural practices (Savard, 1998; Valaskakis, 1992).

As settler societies became aware of these problems, well-meaning parties sought to bring more Indigenous peoples into mainstream media institutions. Typically located in southern, urban environments, although these institutions sometimes hired Indigenous staff, they often failed to adjust their media production policies and practices to enable new personnel to shape their own media content. For example, Evans (2008) argues that Inuit staff at the southern-based Inuit Broadcasting Organization ended up adapting the content they created to comply with exogenous pressures associated with commercial markets or mainstream audiences (Iseke-Barnes & Danard, 2007). Alongside these developments, Indigenous peoples created their own media—though this work involves a Faustian bargain (Ginsburg, 1991). While it offers support for Indigenous media content, at the same time it contributes to the introduction of ideas, terms, and principles from hegemonic non-Indigenous cultures. For example, Valaskakis (1992) identified several negative impacts stemming from Inuit involvement in media production and distribution. Non-Indigenous people acquired authority over Inuit peoples through their control over knowledge of and access to media, and the media content they produced introduced political and economic ideologies that contributed to the erosion of community social and political structures and cultural values. Ginsburg (1991) summarized this paradox:

> On the one hand, they [Indigenous peoples] are finding new modes for expressing indigenous identity through media and gaining access to film and video to serve their own needs and ends. On the other hand, the spread of communications technology such as home video and satellite downlinks threaten to be a final assault on culture, language, imagery, relationship between generations, and respect for traditional knowledge. (p. 96)

Acutely aware of these tensions, Indigenous peoples expressed their resistance and creative agency in many ways—including through new and emerging media (Coehlo, 2018). For example, when English- and French-language radio arrived in Inuit communities in the 1920s, community leaders raised concerns about its potential to contribute to social disintegration and unwelcome cultural hybridization (Valaskakis, 1992). Similar arguments arose when television broadcasts arrived in Northern Canada in the 1960s, and some communities voted against the introduction of the technology until Indigenous content became available (Roth, 2005; Savard, 1998). But despite these challenges, many people in these communities also used new media to document Indigenous Knowledge and languages (Hudson 2011; Menzies, 2015; Poitras Pratt & Lalonde, 2016).

Through this work, Indigenous peoples and their partners began questioning not only Western-derived conventions of representation and distribution but also central issues regarding the ownership and control of media production and distribution. In many cases, they began developing their own communication institutions and media production practices. In Canada, they advocated for public sector support of these projects, arguing that group-differentiated Aboriginal rights should include the capacity to produce and distribute culturally appropriate media content (Roth, 2005). The focus of this work ranged from process-oriented projects like the National Film Board's Challenge for Change program of the 1970s, to the creation of culturally and linguistically specific media content. Despite their diversity, these initiatives collectively became a means to produce and circulate discourses of self-determination, build community, support Indigenous customs and practices, and reinforce cultural identities. Today, we see the continued flourishing of Indigenous creativity in media from around the world, and a growing body of research and practice is demonstrating how media supports Indigenous cultures and languages (Battiste, 2018; Perley, O'Donnell, George, Beaton, & Peter-Paul, 2016).

This rich body of work not only reflects the Indigenous adaptation of new and emerging media technologies but also supports increased intercultural communication, and in doing so, helps diversify mainstream media (Burrows, 2018; Reporting in Indigenous Communities, n.d.). There are many exciting examples of intercultural communications among Indigenous peoples and their non-Indigenous partners and allies (Carlson, Rowe, Zegeye-Gebrehiwot, & Story, 2017; Gaertner, 2016; Hildebrandt et al., 2016). Some of this work reflects a normative shift from reconciliation to Indigenous–settler relations. Though reconciliation means different things to different people, one problematic way to think about it is as a fixed state, rather than an ongoing process (Noble, 2015). Instead of motivating social change and relationship building, such a position can situate settler colonialism as a past or historical event, rather than something that continues today. In Canada, Justice Murray Sinclair from the Truth and Reconciliation Commission of Canada has noted that the theory and practice of reconciliation should aim to help "put the relationship [between Indigenous peoples and settlers] back into balance" (cited in McGregor, 2017, para. 1, abstract). Such a relational process benefits from the diverse worldviews, epistemologies, and knowledges expressed in the work of Indigenous scholars like Tuhiwai Smith (1999), Menzies (2004), Kovach (2010), and others.

This kind of research, writes McGregor (2017), helps create space for discourses about "shared histories, present situations and future aspirations" (p. 820) to emerge through Indigenous–settler dialogue. Barker (2010) argues that such work should strive to engage in radical experimentation, "the willingness to examine current colonial problems in both a broad and personal context" (p. 326). Importantly, there is no

universally applicable model for such work; rather, it flows from a set of principles and an individual commitment to follow them. Taking this approach, in our Sweetgrass AR project we use media production practices as a vehicle to generate and sustain Indigenous–settler relations by critically reflecting on the technical, social, and political choices made in the cocreation of culturally appropriate AR content.

Sweetgrass AR: Operationalizing AR as a Resource for Indigenous–Settler Relations

The Sweetgrass AR project (2017–19) involved a sculptor and Knowledge Keeper from Saddle Lake Cree Nation and non-Indigenous faculty and students from the University of Alberta. This team codeveloped an AR design framework that illustrated the planning, documenting, sharing, and archiving of Indigenous stories. Using the Sweetgrass Bear Treaty 6 marker described earlier as a proof of concept, we explored respectful relationship-building practices through a process of collaborative storytelling. Importantly, our implementation of AR technology sought to serve Indigenous ownership, teachings, and story-sharing protocols. This provided a centrally important set of considerations: team members engaged in conversations on topics ranging from research ethics, treaty making, and settler colonialism to traditional and contemporary forms of data governance, ownership of cultural knowledge, and language revitalization. These conversations informed a flexible design process to help guide teams of Indigenous–settler storytellers through future projects. From this material we produced two freely available open educational resources (OERs)—one for students and one for teacher facilitators. These OERs are available for download on our Sweetgrass AR project website (www.sweetgrassAR.ca). Importantly, they do not serve as checklists that avoid the important work of intentional and collaborative relationship building; we stress that projects must emerge from discussions grounded in specific relationships developed over time (Castleden, Morgan, & Lamb, 2012). In the following sections, we highlight this and other normative considerations by explaining our rationale for the different considerations represented in the Sweetgrass AR design process.

Relational Accountability: Communication, Cultural Sensitivity, and Consent

Sweetgrass AR is grounded in relational accountability, which speaks to the ethical responsibilities that settlers and Indigenous peoples have to one another (Kajner, Fletcher, & Makokis, 2012; Wilson, 2008). It is core to the work of the Truth and Reconciliation Commission of Canada (2015), which points to the country's past and ongoing history of settler colonialism, describing the government's activities as a form of cultural genocide, "the destruction of those structures and practices that allow the group to continue as a group" (p. 5). Such activities, which sought to gain control over Indigenous land and resources, include persecuting spiritual practices, working to destroy social and political institutions, seizing land and other property, banning language and cultural practices, and disrupting families through residential schools. Recognizing this history, some authors point out that Indigenous peoples and settler Canadians have never had an initial conciliatory state—the relationship has always been rooted in conflict (Truth and Reconciliation Commission of Canada, 2015; see Alfred 2009; Coulthard, 2014). Others see reconciliation as a basis to try and overcome conflict and establish a healthy and respectful relationship. This second definition is the approach taken by the Truth and Reconciliation Commission of Canada (2015, and our project):

> To the Commission, "reconciliation" is about establishing and maintaining a mutually respectful relationship between Aboriginal and non-Aboriginal peoples in this country. In order for that to happen, there has to be awareness of the past, acknowledgement of the harm that has been inflicted, atonement for the causes, and action to change behavior. (p. 113)

Effective, sustained communication plays an important part in this work by holding relationships together. In the context of Sweetgrass AR, communication includes a holistic understanding of relationships, including (but not limited to) one's personal relations; relationships within one's community; relationships within Indigenous Nations or communities; and relationships among communities. Throughout the Sweetgrass AR project, participants build relationships with Indigenous team members through land-based teachings, participation in ceremony, and guided activities focused on collaborative project design and development. Following the principles of Indigenous methodologies (Kovach, 2011; Tuhiwai Smith, 1999; Wilson, 2008), we included several visits to Saddle Lake Cree Nation to plan and record digital stories.

In practicing relational accountability, we acknowledge and build on existing institutional research ethics. Critical scholars point out the limits of Western-derived research ethics: while institutional ethics involve professional standards, rules, and regulations, they can fail to address the specific requirements of work with diverse Indigenous peoples. For example, in Canada, the guiding framework for research with Indigenous peoples acknowledges the historic and ongoing tensions between university-based researchers and diverse First Nations, Inuit, and Métis communities, as well as the time and effort required to build trusting relationships (Canadian Institutes of Health Research, Natural Sciences and Engineering Research Council of Canada, and Social Sciences and Humanities Research Council of Canada, 2014). These ethical guidelines note that it "is not intended to override or replace ethical guidance offered by Aboriginal peoples themselves" (p. 1). However, they have been critiqued for failing to address issues of consent and treaty relations, instead focusing on general principles (Noble, 2015). The First Nations Information Governance Centre critiques the Tri-Council guidelines as representing a pan-Indigenous conception of "traditional knowledge" and "culturally appropriate" research methods. The organization points out the need to incorporate the specific priorities and values of First Nations as distinct ethnic and political groups with established governance structures and processes for community engagement. For example, all researchers working in the Northwest Territories in Canada must apply for a research license that is reviewed and approved by affected communities and Indigenous organizations. One organization that reviews license applications, the Gwich'in Department of Cultural Heritage, operates with a mandate to "document, preserve and promote Gwich'in culture, language, traditional knowledge and values" (GTC Department of Cultural Heritage, 2016, para. 1). It provides a set of requirements for researchers interested in working with Gwich'in communities (GTC Department of Cultural Heritage, 2011). This licensing process is one way to formalize requirements set by Indigenous Nations, as well as ensure that research contributes direct benefits to involved communities.

For Indigenous projects that might not have formal ethics standards in place, Younging (2018) provides suggestions to work through such considerations by practicing cultural sensitivity through ongoing collaboration, reciprocity, and consent among team members. Clear and ongoing consent is critical to effective and respectful collaboration. Western forms of consent usually involve documentation such as consent and media release forms, but consent for Indigenous projects will often reflect a holistic

consideration of relationships. For example, the Oral History Centre's (2014) *nindibaajimomin* digital story guides refer to multiple levels of written and oral consent: having a participant agree to participate in a project; having them approve the story; and requesting their approval for how the story will be shared. These consent activities are reflected in comprehensive documentation that includes options for participants to consent (or not) for each purpose.

In the context of specific projects, Indigenous Elders, Knowledge Keepers, storytellers, and community members can offer guidance about what forms of consent are most appropriate (Younging, 2018). For example, an Elder accepting tobacco is one way to provide consent, but different communities and individuals will have different protocol. As well, projects should recognize the authority of elected Indigenous leadership. For example, in Canada, projects involving First Nations should notify Chief and Council of any project activities that take place on their territories. Such a letter can briefly explain the project, funders, team members, and ethics approval.

Project Governance: Indigenous Protocol and Western Approaches

Discussions of ethics, collaboration, and consent tie to project governance: decision making, roles, and responsibilities related to the production, archiving, and sharing of digital stories. Projects involving Indigenous–settler relations formalize governance through Indigenous protocols as well as written documentation. From the perspective of many Indigenous peoples, protocol is an important part of governance. Specific protocol varies depending on the individual(s), community, and/or nation. In some cases, is it appropriate to hold community deliberations and discussions to ensure that the right people are involved in an initiative; in others, projects might be guided by individual Elders or Knowledge Keepers. In the context of Sweetgrass AR, our team members from Saddle Lake Cree Nation advised us that ceremony was to be observed to place the project on the pathway of success in Indigenous terms. Within this dimension, spirit is acknowledged, as are the ancestors whose lives were catalysts ensuring that Indigenous Knowledge flowed to the current generations. The responsibility of keeping the stories alive is maintained for the purpose of sharing and preparing the next generations to carry these forward. Ceremony observes the transfer of these processes and invokes the spirit of truth to be present in a relationship guided by kindness, honesty, sharing, and determination. To this end Sweetgrass AR began with a sweat lodge ceremony and offerings of tobacco and cloth to request the support of the Elders to ensure that the project moves forward in a respectful and appropriate way. At the end of this phase of our project, our team also engaged in a pipe ceremony to conclude the work in a good way.

Written documentation parallels this work. A formal memorandum of agreement (MOA) can serve as a basis of communication that partners can use to work through differentials in power and need. Such agreements can define the obligations and expectations of each partner, helping address decisions up front instead of confronting them on a case-by-case basis. Ross et al. (2010) describe how delineating and documenting the roles and expectations of partners allows time to reflect on and debate various points. However, this kind of contractual approach can be quite impersonal, and assumes the written contract will equitably represent the views of each party. It is important that each group exercises agency in the development of an MOA.

The iPinch (2015) project provides a template and questions to help project teams develop an MOA in the context of Indigenous cultural heritage. This resource is not a prescriptive checklist; rather, it outlines a series of questions and considerations that teams can discuss and customize. Importantly, the process of crafting the MOA in collaboration with partners is as important as the final document. Many projects therefore aim to develop a flexible MOA that has gone through multiple iterations: "The process of crafting, revising, and executing a MOA, rather than the signed document itself, leads to relationship-building and successful collaborations" (p. 1). For the Sweetgrass AR project, our team developed a written agreement that outlined ownership, responsibilities, communication, and roles for each party. This agreement is a living document informed by treaty relations that has been updated and revised continuously throughout the course of our project.

Intellectual Property (and Its Limitations)

The notion of intellectual property is challenging to navigate in the context of Indigenous Knowledge. Western perspectives may use concepts of copyright and intellectual property to convey ownership and access rights, such as how a story may be shared. However, for Indigenous peoples, stories may not be owned, but instead held collectively to preserve and share knowledge with and for future generations (Battiste, 2005). As well, some stories and knowledge may have conditions of use, be restricted to community members, or need to be earned (Wilson, 2008). There can also be differing opinions in the same community about what information to share, and how to share it. Anderson (2018) explores how these kinds of negotiations played out in the context of the Penobscot Tribe from Maine in the U.S., pointing out that some stories are created to be shared widely by the public, and others are meant to be shared only within a specific community, or within certain contexts. Permission to share stories may require certain relationships, protocol, and ceremony.

The forms that Indigenous Knowledge take are another point of distinction from Western models of intellectual property. At an early Sweetgrass AR project meeting, Dr. Diana Steinhauer noted that the English language is very noun based, and ownership is implicit in the language, whereas verb-based languages like Cree are more relationship based. This point is also noted in Wilson's (2008) discussion of Indigenous ontologies: "In the Cree language, the literal translation into English for a chair would be 'the thing you sit on' and the literal translation for pen would be 'something you write with'" (p. 73). These observations point out the importance of recognizing both Western and Indigenous approaches to intellectual property. Anderson (2015) provides a framework to think through the ways that Western legal traditions affect these issues. As Anderson notes, intellectual property rights may only extend to the expression or form of an idea, and so have clear limits. She raises the example of a court case between Urban Outfitters and Navajo Nation, wherein the clothing company argued that a product line named "Navajo Socks" was generic and descriptive—even though the Navajo Nation has trademarked the name "Navajo." When the Navajo Nation claimed trademark infringement, Urban Outfitters resisted, though the company eventually settled for an undisclosed amount. Although this case be a useful legal strategy, thinking of Indigenous Knowledge this way also holds potentially commodifying effects. Harry (2011), an Indigenous legal scholar of the Kooyooe Dukaddo peoples from Pyramid Lake, Nevada, warns that "once aspects of our cultural heritage are subjected to intellectual property rights, be it through copyright or patents, those aspects may be deemed market-ready" (p. 705), therefore conflicting with Indigenous values and the

collective nature of customary management systems. Copyright is further problematized when the content belongs to a group or whole culture (Battiste, 2005). Younging (2018) describes some of the ways that book publishers have tried to determine copyright in the process of publishing Indigenous Knowledge. In one example, an Elders Council required a book's copyright to be held by the participating Tribal Council; in another, a book's copyright is held by 10 involved Indigenous communities.

Another approach to this challenge is to use alternatives to copyright, such as Creative Commons licensing. In Indigenous contexts, traditional knowledge labels modify the Creative Commons concept to fit the specifics of Indigenous cultural heritage (Local Contexts, n.d.). As described on the Local Contexts website, traditional knowledge labels highlight "local protocols for access and use of recorded cultural heritage that is digitally circulating outside community contexts" (para. 1). Traditional knowledge labeling helps clarify what material has community-specific restrictions about access and use, such as for sacred and/or ceremonial purposes, gender restrictions, or seasonal conditions of use. The Local Contexts website offers several educational resources, including a step-by-step guide that communities can use to customize traditional knowledge labels. However, we should note that traditional knowledge labels are not legally enforceable; rather, they are an educational tool.

In the Sweetgrass AR project, to respect the entitlement of intellectual property in the context of Indigenous Knowledge, we thought carefully about access and ownership rights. When working with large organizations such as postsecondary institutions, internal processes and standard template documents may have conditions that are automatically implemented, and so we reviewed applicable university policies to navigate any copyright issues that such agreements may hold. After securing support from our funders, our team worked out a written agreement whereby copyright for the digital stories and knowledge documented in the project remain with the Saddle Lake Cree Nation team members. In turn, they agreed to share the OER and digital content that we cocreated with the public. It was important for our team to talk through and recognize the distinction between ownership (granted by copyright transfer) and public access.

Technical Considerations: Ownership, Control, Access, and Possession of Digital Data

The abilities of Indigenous peoples to gain ownership and control over their digital data—and associated access rights—affects the forms and scope of their activities. Available research suggests that many projects involving Indigenous peoples may be bypassing Web 1.0 platforms to move directly to commercial Web 2.0 platforms. Such proprietary platforms restrict the agency of both users and developers when compared with those hosted on local servers and managed by user groups (Bredin, 2001; Landzelius, 2006). Aware of the challenges of digital capitalism (Donner & Locke, 2019; Langley & Leyshon, 2016; Pasquale, 2018), Indigenous peoples have explored how the technical affordances of digital platforms and applications might serve Indigenous ownership, teachings, and knowledge-sharing protocols.

Data, encoded in digital form, can be found in many different formats and is subject to decisions about its stewardship and care. As discussed earlier, access rights and responsibilities affect the storage, security, and preservation of data—as well as considerations of who is allowed to experience and make decisions about that data (Taylor & Kukutai, 2016; Wemigwans, 2018). In diverse Indigenous contexts, these considerations include cultural protocols as well as practical and technical considerations. Indigenous

peoples have many different ways of collecting and presenting data, from oral storytelling to totem poles to Niitsitapi (Blackfoot) Winter counts (Rodriguez-Lonebear, 2016). The concept of data sovereignty is a way to think about these practices that derives from the inherent sovereignty of Indigenous nations; it is defined as "the right of a nation to govern the collection, ownership, and application of its own data" (U.S. Indigenous Data Sovereignty Network, 2018, para. 2). In Canada, the First Nations principles of OCAP™ (Ownership, Control, Access and Possession) reflect similar goals. Developed in the mid-1990s by the First Nations Information Governance Centre, the principles are adaptable and designed to allow each First Nation community or region to interpret and implement them according to its specific context (First Nations Information Governance Centre, 2014; Schnarch, 2004). They provide an important set of guidelines if one is developing or using a digital platform to house and present Indigenous data.

Indigenous peoples are acutely aware of the limitations of commercially available digital platforms, and have responded to this challenge by encoding principles of OCAP™ and data sovereignty into their own applications. To address the limitations of copyright noted above, Indigenous peoples have collaborated with technical designers to program Indigenous access rules into interface design. For example, a Māori Maps database of marae (sacred meeting grounds) in Aotearoa (New Zealand) offers three levels of database access: open access, password-initiated access (which is linked to permissions provided by designated Elders), and a cache of information maintained as a backup record for the use of designated Elders (Brown & Nicholas, 2012, p. 318). Mukurtu (n.d.), a free and open-source content-management system designed by and for Indigenous communities, is similarly flexible enough to meet the needs of diverse communities who wish to shape access rights to manage and share their digital cultural heritage in their own way, on their own terms (Mukurtu, n.d.). Other examples include an online archive developed with the Pitjantjatjara and Yankunytjatjara people of Central Australia that allows community members to manage a digitized collection of some 60,000 cultural artifacts (Hughes & Dallwitz, 2007; Leavy, 2007). In North America, the Reciprocal Research Network similarly enables Indigenous communities to curate their own virtual museums in partnership with research institutions (Hennessy & Moore, 2007). The Four Directions Teaching website presents traditional stories and Elder teachings in digital formats, and aims to reflect Indigenous cultural protocols about the storage and representation of community-held knowledge (Wemigwans, 2018). These various projects reflect how Indigenous peoples are appropriating online platforms to meet their needs by carefully parsing out forms of digital data and discussing how access rules might apply in different contexts (Landzelius, 2006).

As a new technology in the process of being developed for widespread commercial use, there are a range of competing AR platforms. Our Sweetgrass AR project took the above discussion into consideration when selecting an appropriate platform: it needed to be easy to use so that novices could create AR content; sustainable so that stories would be viewable in the future; free or low cost; and offer a high degree of control and ownership over data. A review of existing AR platforms determined that cost varies considerably; unsurprisingly, the flashiest platforms are aimed at marketing and come with a hefty price tag. Although the technical capabilities of various platforms are quite similar, major differences include the types of AR content delivery supported: forms of digital data range from static images, video, and audio to complex 3-D models. Many AR platforms want to encourage educational use and offer a high level of functionality with free educational licenses. However, they typically host data on their own servers, and may claim ownership of the content they house. The particular terms of a license vary considerably across platforms, so caution is required. When only an AR Software Development Kit (SDK) is used (on its own, or within software such

as Unity), story data can theoretically be stored separately from the AR platform, but this model requires a custom app, the cost of which may be over the budget of many projects (including Sweetgrass AR). Unfortunately, the only prominent open source AR platform we found (ARToolkit) is an SDK that requires implementation in a custom app.

Working with these requirements and limitations, we originally considered partnering with an Indigenous-owned geolocative AR app with a unique "story catching" (media storage) process that uses community-based authentication and vetting processes to authenticate and protect cultural content. However, this app's scanning capability and contextual awareness was still in development at the time of our project, and only five images could be supported at one time, limiting the possibility for hosting user-generated AR stories. We learned that the app also hosted audio and video content of stories on commercial (Soundcloud and Vimeo) platforms, prompting data ownership concerns. Although the app's development team was open to arranging different data hosting in the future, because of project requirements we decided to find an alternative platform to use (in part because of requirements for an upcoming graduate course built around the project).

We approached an AR company to develop a customized app but they were unable to produce a solution that met our requirements and budget. In the end, we decided on HP Reveal (formerly Aurasma), which is used extensively in education settings, is user friendly, and provided the required scanning capabilities. HP Reveal supports a wide range of devices and allows for the immersive AR overlays (including video) that we wanted to implement. Though free and easy to use, in exchange for using HP Reveal we gave up some control of our data—however, a review of the company's terms of service confirmed that story creators retain ownership over the AR stories that they create and house on the platform.

For a time, HP Reveal worked well as a temporary solution, and we used in for the Fall 2018 graduate course associated with this project. However, in late January 2019, the research team received an e-mail from HP Reveal with notification that the Web-based platform it used to create AR content would be "phased out," and all existing AR content would be removed by July 1, 2019. Hewlett-Packard had been developing another AR initiative called Link Creation Studio, with a corresponding app called LinkReader. Unlike HP Reveal, which was targeted toward image recognition and worked well scanning a sculpture with high-contrast imagery such as Sweetgrass Bear, Link Creation Studio is designed to scan print images and materials. This development illustrates the importance of sustainability considerations—and the need for project teams to back up data. That said, since we used HP Reveal as a temporary solution to develop a platform agnostic AR design framework, we escaped disaster, and we are currently determining a new platform for hosting the 13 AR stories currently shared through scanning imagery on the Sweetgrass Bear sculpture.

Conclusion: AR Design as a Cipher for Indigenous–Settler Relations

New media holds strong implications to support—or restrict—Indigenous–settler relations in contemporary societies. This article has explored this topic by documenting the design considerations that our Sweetgrass AR project used for AR storytelling in the service of Indigenous–settler relationship building. To share our findings with other educators, researchers and communities, we have created freely available OERs that document our AR design process and review how Indigenous knowledge rights and

responsibilities, and issues of ownership, control, access, and possession, are embedded in seemingly technical decisions. In this article we provided the guiding rationale for this work, and hope that it is useful to others working in this space.

As the Sweetgrass AR project progressed, the team also worked to translate our design considerations into a technical proof of concept that respected Indigenous protocols regarding the ownership and control of digital data through a sustainable, low-cost, user-friendly AR platform. Conceptually, we sought to separate digital content (texts, images, and audio and video files) from a "dumb" AR viewer that kept digital content files under the control of designated Indigenous Knowledge Keepers. Given the pace of change surrounding AR technology, we wanted to build a system that mitigated the risk of an AR platform changing (or even disappearing) without affecting the digital content housed on it. Even if this solution means waiting until Web-based AR has advanced, we feel comfortable with it because it will help ensure that digital content owned by Indigenous Knowledge Keepers is kept preserved and viewable for many years to come.

The Sweetgrass AR project helped our team develop a clear sense of the constraints and possibilities of AR storytelling. Moving forward, we plan to integrate our findings into the design of a custom app. To illustrate our concept, we created a basic geolocative Web-based story viewer which, despite lacking AR capabilities, addresses many of our project's technical requirements and decentralist aims. We are currently exploring ways to develop this viewer into a more user-friendly platform that will support user-generated AR content while retaining core normative design principles discussed in this article. Reflecting on this work, we stress the importance of using a long series of incremental steps to arrive at the technology required for projects of this nature. At every stage of the process, setting small, achievable goals can help advance what available technology can accomplish while mitigating the risks involved in working with existing platforms—even when they are owned by major companies such as Hewlett-Packard. We intend to continue sharing our progress, documenting, and refining our technical developments as they slowly scale up—in much the same way that we will continue to share and practice Indigenous–settler relations.

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