Co-Creation's Role in Digital Public Archaeology

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Public archaeology programs have been experimenting with ways to successfully engage the public for decades. The introduction of the Internet has provided a plethora of engagement platforms but also a host of new challenges. One of the most critical issues is how to create digital resources that people will actually use and benefit from. This paper suggests that using co-creative methods can help digital public archaeology projects ensure that the resources they create are engaging and useful to their audiences. The concept of co-creation as defined by Simon (2010:187) describes a process of collaboration in which individuals or institutions (in this case, archaeologists or archaeological organizations) work with non-specialist communities (e.g., descendant communities, local communities, etc.) to create programs or projects that address the communities' *expressed needs and interests.*

ABSTRACT

Simon (2010:187) notes that the purpose of co-creative community projects is "to give voice and be responsive to the needs and interests of local community members; to provide a place for community engagement and dialogue; and to help participants develop skills that will support their own individual and community goals." This paper explores the role that co-creation currently plays in digital public archaeology and discusses how co-creative methods can inform broader archaeological digital engagement efforts. It begins by placing co-creation in its proper context in order to demonstrate its unique characteristics, its value, and how it complicates approaches used in other types of archaeological engagement projects, such as Open Access initiatives. The discussion then turns to evaluating its impact and the broader need to measure success in digital public engagement projects. A discussion of research from the archaeology and the cultural heritage sectors provides examples of evaluation metrics and methods for assessing digital public archaeology projects. The paper concludes by suggesting that all digital engagement projects can benefit from incorporating some of the principles that are inherently part of co-creative methods but that not all archaeological digital engagement projects should strive to be completely co-creative.

Simon (2010:187) señala que, "el propósito de los proyectos comunitarios en colaboración es el de "dar voz y ser sensible a las necesidades e intereses de los miembros de la comunidad local; proveer un espacio de participación y diálogo a la comunidad; y ayudar a los participantes a desarrollar habilidades que les permitan lograr sus metas individuales y comunitarias". Este trabajo explora el papel que juega actualmente la creación en colaboración en la arqueología pública digital y discute como sus métodos amplían los esfuerzos del compromiso arqueológico digital. Este mismo comienza ubicando a la creación en colaboración en su propio contexto para demonstrar sus características únicas, su valor, y cómo dificulta los enfoques utilizados en otros tipos de proyectos de participación arqueológica, tales como las iniciativas de Acceso Abierto. Habiendo demostrado el significado de la creación en colaboración, la discusión se torna hacia la evaluación de su impacto y en un sentido más amplio medir el éxito de los proyectos de participación pública digital. Una discusión académica desde la arqueología y los sectores del patrimonio cultural proveen indicadores y métodos de evaluación para la revisión de los proyectos de arqueología pública digital. Este trabajo concluye, sugiriendo que todos los proyectos de participación pueden beneficiarse de la incorporación de algunos principios inherentes a los métodos de creación en colaboración, pero que no todos los proyectos de participación en arqueología digital deben esforzarse para lograr ser completamente de creación en colaboración.

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As noted by McDavid (2014) and Bollwerk et al. (2015), the end goal of co-creation is that it has to be both *co* (that is, it has to share power in some way) and *creative* (that is, we cannot just do the same things better, we need to do something *new).* When engaging in co-creative processes, archaeologists must be ready to share power and authority to create something that meets their own goals and those of their community partners. Archaeological co-creative projects in the physical world have successfully created resources that serve a partner community's needs and interests (see Bria and Cruzado 2015; Connolly 2015; Ferguson et al. 2015; Kasper and Handsman 2015; Means 2015; Miller 2015; Moyer 2015; Popetz 2015; Reeves 2015; all articles are included in this issue). The ways co-creation plays out in digital engagement, however, are not immediately obvious. This paper explores the role that co-creation currently plays in digital projects and discusses how co-creative methods can inform broader digital engagement efforts.

Although digital engagement with non-specialist audiences has been a growing area of research and discussion in the discipline (Beale 2012; Boast and Biehl 2011; Bonacchi 2012; Kansa et al. 2011; Lake 2012; McDavid 2002, 2003, 2004a, 2004b; Richardson 2013, 2014; Watrall 2002, 2014) an overarching model of digital engagement has yet to be introduced. The lack of a comparative framework makes it difficult to determine whether or not a project is co-creative, which can limit the ability of archaeologists to implement co-creative methodologies in digital spaces. This article offers such a model, called the Engagement Spectrum, which is adapted from informal science education (Bonney et al. 2009) and the museum/cultural heritage sector (Phillips 2014; Ridge 2013a; Simon 2010). With a framework for identifying digital co-creation in place, the discussion turns to evaluating its impact. Case studies of digital archaeological projects based in the United States (U.S.) and the United Kingdom (UK) that meet co-creation criteria are discussed. By placing co-creation in its proper context within this larger framework, it is possible to see its unique characteristics, its value, and how it complicates approaches used in other types of engagement projects, such as Open Access and Open Data initiatives.

Having delineated concrete examples of co-creation and its benefits, this paper's focus shifts to consider the broader need to define and measure success in digital public engagement projects. This paper outlines challenges in measuring success in digital engagement, whether co-creative or not, another issue of concern for archaeologists seeking to create digital resources for the public (Pett and Bonacchi 2012). A discussion of research from archaeology and the cultural heritage sector provides examples of evaluation metrics and methods for assessing digital public archaeology projects. The paper concludes by suggesting that all digital engagement projects can better serve their users by incorporating some of the principles and methods that are inherently part of co-creative projects. However, it also notes that not all archaeological digital engagement projects should strive to be completely co-creative.

A Brief History of Digital Public Archaeology

Before jumping into a discussion about co-creation, it is necessary to discuss the history of digital engagement in archaeology. Archaeologists have become increasingly aware over the last 20 years of the variety of new methods for public outreach and engagement introduced by the digital revolution. Richardson (2013:4) has used the term Digital Public Archaeology to encompass "the many potential methods for engaging the Internet-using public with archaeology including Web and mobile technologies, as well as social media applications, and the communicative process through which this engagement is mediated online." Digital Public Archaeology began when the explosion of the Internet's popularity in the 1990s resulted in a number of archaeological organizations creating websites that helped to increase awareness of archaeology and to disseminate information. The shift from Web 1.0 to Web 2.0 opened new doors for archaeological research and engagement. If Web 1.0 flourished primarily as a publishing information platform, Web 2.0 has made the Internet into a communication medium (O'Reilly 2005; O'Reilly and Battelle 2009).

Web 2.0, as conceptualized by Tim O'Reilly, founder and CEO of O'Reilly Media, is focused on "harnessing collective intelligence" and "managing, understanding, and responding to user-generated data" to build "applications that literally get better the more people use them" (O'Reilly and Battelle 2009:1). Although the relevance of the term Web 2.0 in 2015 is questionable, there is no doubt that the movement propagated by it has created new and exciting opportunities for creating connections and generating information from users around the world. The impact of Web 2.0 on archaeology in the U.S. and UK has been considered in depth (Kansa et al. 2011; cf. Richardson 2013; Shanks and Witmore 2012), although it no doubt continues to evolve.

ArchNet (Simon and Crider 2002) and the Society for American Archaeology's Archaeology for the Public webpages (Jeppson et al. 2003) were some of the first websites to focus on engaging non-specialist audiences through digital platforms. In recent years, the Open Access, Open Data, and Open Software movements have created more momentum for archaeologists to share data and content online and provided additional venues for archaeologists to reach a broader set of audiences. These projects include efforts to create new methods for archaeologists to interact and collaborate professionally, such as the construction of new platforms that provide open access to data, publications, and collaborative tools for researchers, like the Chaco Research Archive (CRA 2014), the Digital Archaeological Archive of Comparative Slavery (DAACS 2014), the Digital Index of North American Archaeology (DINAA 2014), Open Context (Kansa 2011; Kansa and Kansa 2011), the Archaeology Data Service (Richards et al. 2011), and the Digital Archaeological Record (tDAR) (McManamon and Kintigh 2010). Efforts also consist of various applications that engage non-specialists, including indigenous communities (Boast and Biehl 2011; Rowley et al. 2010), descendant and local communities (McDavid 2002, 2003, 2004a, 2004b; Remixing Catalhöyük 2014), and the general public (Beale 2012; Goskar 2012; Harris 2012; Lake 2012; Mazel et al. 2012; Pett and Bonacchi 2012; Richardson 2013, 2014; Smith 2014; Watrall 2002, 2014). Public engagement platforms include social media (Birch 2013; Kansa and Deblauwe 2011; Richardson 2012; Walker 2014), blogging (Richardson 2014; Rocks-Macqueen and Webster 2013; Thornton 2012), creating websites and mobile experiences to serve as portals for information and interpretation of archaeological sites (Birch 2013; Goskar 2012; Jeppson et al. 2003; Mazel et al. 2012; Portable Antiquities

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Scheme 2014; Remixing Catalhöyük 2014; Richardson 2014), and community-based programs that have explored the creation of content management systems (Boast and Biehl 2011; Christen 2008, 2011, 2012a, 2012b; Rowley et al. 2010) to help preserve and protect communities' cultural property.

As public archaeology has shifted to encompass digital engagement, it has met challenges similar to those involved in projects based solely in the physical world. A major challenge is the difficulty inherent in sharing authority (Beale 2012:620; Bevan 2012; Boast and Biehl 2011:120–121; Harris 2012:585–586; Kansa 2011:23–24; Lake 2012:473; Morgan and Eve 2012:533; Richardson 2013:5–6), which includes the risks, or perceived risks, of making data public and opening interpretative frameworks to incorporate different knowledge systems. In particular, the integration of data generated by engagement projects with data from professional archaeological research (Boast and Biehl 2011:141–142; Harris 2012:588) has been a source of discussion. The challenge of creating engaging and user-friendly programs (Richardson 2013; Rowley et al. 2010) is also shared by physical and digital public projects.

However, digital public archaeology also faces new challenges. In particular, knowing what audiences or communities are being reached is more difficult in an age when anyone in the world can access content and remix it in ways that were not necessarily conceived of by the institution that released the data (Beale 2012:616–617). Although Facebook, Twitter, blogs, and website portals open opportunities for engagement, it is still not clear who these efforts are reaching. McDavid (2002, 2004a), Richardson (2013), and Walker (2014) have questioned whether new audiences are being reached through digital projects. All in all, Web 2.0 has greatly lessened the barriers to dissemination of information, but interpreting the reaction to engagement efforts is more complicated. Moreover, it is common knowledge that the impact of digital resources must be considered and planned prior to their implementation but anticipating and measuring impact is difficult in the digital realm (Bonacchi et al. 2014; Pett and Bonacchi 2012).

These challenges are not unique to archaeology. Museums and cultural heritage professionals, archivists, and other academic disciplines are facing the same challenges and concerns (Adair et al. 2012; Christen 2012a; Eisner et al. 2012; Finnis et al. 2011; MacDonald 2015; Ridge 2013b; Tanner 2012). New sets of evaluation measures are needed, but so too is a model for digital engagement that takes into account the changes that are happening with the shift to digital projects. In the next section, a model is offered that can help organize and categorize different digital projects. The comparative framework helps individuals and organizations better understand the goals of their projects and identify appropriate assessment metrics. In terms of this paper, the model provides relevant context for determining the defining characteristics of co-creative projects.

The Digital Engagement Spectrum

Initially, engagement models were primarily a two-step process. First, conduct research. Second, share results of research with the public. The sharing of results with audiences outside of academia improved relationships. Yet considerable debate, dialogue, and analysis of the collaborative process (Atalay 2012; Colwell-Chanthaphonh and Ferguson 2008; Hodder and Hudson 2003; Little and Shackel 2007, 2014; Merriman 2004; Shackel and Chambers 2004) have inspired a more nuanced idea of engagement and its relevance to the discipline as a whole. Recently, Colwell-Chanthaphonh and Ferguson (2008:10–12) have suggested that collaboration and the process of engagement fall on a continuum that is simultaneously different for every community. A similar model can be used to help visualize engagement in the digital realm.

To better understand engagement, this paper draws from the Public Participation Model portrayed by Simon (2010) and the Open Authority Spectrum created by Phillips (2014). Both of these models were originally based on the model of "Public Participation in Scientific Research" (Bonney et al. 2009:11). The model/spectrum is not meant to be viewed as a linear progression; rather, a project or strategy can focus on one or multiple aspects of the spectrum. There can be multiple aspects and considerations to any project or strategy, and organizations can choose to utilize multiple aspects of the spectrum in one project. However, knowing where a project is on the spectrum can help individuals and organizations determine what audience(s) is/are the focus of the project, what kind of impact is desired, and how to measure that impact.

The Digital Engagement Spectrum is a continuum but has four major levels (Figure 1). The first consists of publicizing to a wider audience. This type of engagement can disseminate information to a large audience but does not necessarily create a great deal of two-way interaction. In many cases, this could be categorized as publicity or marketing. This level is not actually included in the original models and was added by the author. Although it may not seem to justify inclusion on the spectrum, creating channels for communication and sharing information, content, and data are a vital component of engagement.

Websites and email listservs provide a venue for this type of information-sharing, as do social media outlets. Social media works well for publicity and information dissemination mostly because of the way platforms are designed. Many social media platforms have an asymmetric following model (Russell 2014:7), which allows individuals and organizations to share information with large groups of people. For example, in the case of Twitter, a user can decide to follow another user, but the first user does not necessarily have to follow that person, organization, or entity back. On the engagement spectrum, the asymmetrical following relationship plays out in a variety of ways. The use of social media for publicity means that a user (a celebrity, for instance) can accrue thousands of followers but only end up following a few people. Most users are generally in the middle, following a good number of people and having a number of users follow them back, but the ratio could go either way. Some individuals and organizations choose to follow nearly everyone who follows them.

As shown in Table 1, many of the most popular archaeological entities on Twitter have high follower-to-friend ratios (i.e., the ratio of followers to people followed), which suggests that these organizations are primarily using Twitter to share information and making connections with other organizations and individuals is a secondary goal. For example, although such organizations may retweet messages from other users that mention

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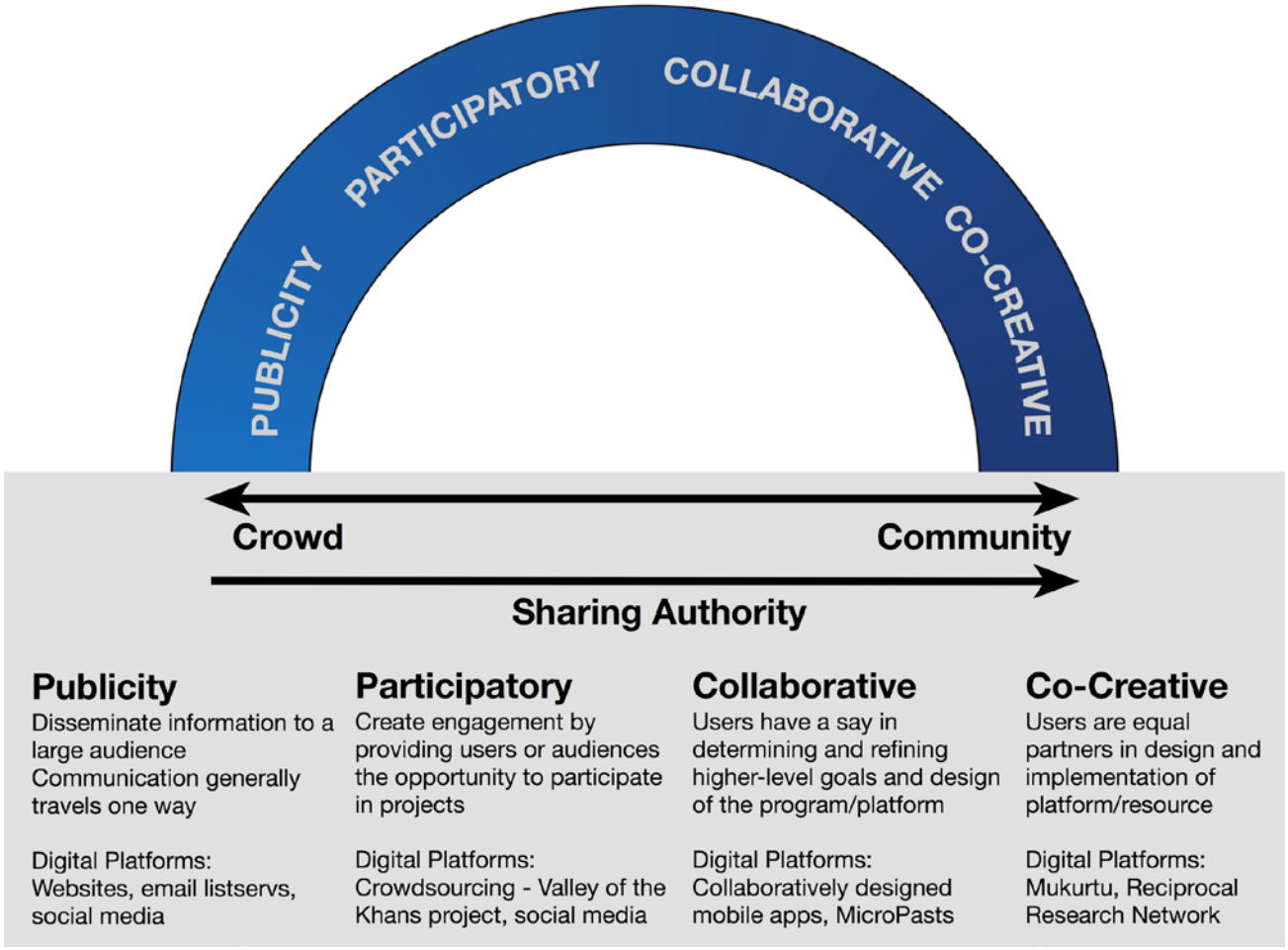

FIGURE 1. The Engagement Spectrum (adapted from Bonney et al. 2009:11; Phillips 2013; Ridge 2013a; Simon 2010).

them, they are unlikely to follow those users. Facebook organizational pages follow a similar asymmetric relationship model in which many users can "like" a page, thereby adding its updates to their feed. The organization or individual running the page can like other pages to keep up with their posts but does not have an equal one-to-one following relationship with individual users.

The second level of the engagement spectrum includes contributory/participatory projects. Participatory projects try to create engagement by providing users or audiences the opportunity to participate in the platform. Facebook and Twitter offer a participatory option for engagement, as well as being information dissemination tools. Users can generate content on Facebook organizational pages by liking, commenting, or posting. Facebook groups, which are essentially forums for people with common interests to share and collaborate, allow communities to grow around shared interests. People can post interesting articles, links, or images to the group's wall and invite other members of the group to comment on them. Archaeological groups on Facebook range from the Society for Clay Pipe Research to the Public Archaeology Interest Group.

Twitter hashtags also provide a way for individuals and groups to create and follow topics of shared interest. For example, searching for #DayofArch, #PubArch, and #DigiArch will provide a host of tweets focusing on public outreach efforts in the digital and physical worlds and provide ways for people to share and discuss information. However, the degree to which these efforts are reaching individuals outside of the archaeological community is still an open question (Richardson 2012, 2014; Walker 2014). Digital games also provide fun and useful educational opportunities for the public to virtually engage with archaeological research and ethics (Watrall 2002, 2014).

Another form of participatory project includes digital platforms where individuals volunteer and participate in tasks that are created by an organization. In the digital realm, this often takes the form of crowdsourcing. Crowdsourcing, a term coined by Howe (2006), "represents the act of a company or institution taking a function once performed by employees and outsourcing it to an undefined (and generally large) network of people in the form of an open call." Although the term originated in the for-profit sector, crowdsourcing is an evolving phenomenon that has been recast in the non-profit world. Ridge (2013b:3) defines crowdsourcing in cultural heritage as

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TABLE 1. Follower-to-Friend Ratio for Major Archaeological Entities on Twitter.

Organization	Twitter Handle	No. Followers	Following	Follow Ratio**
Archaeology News*	@HeritageDaily	30,900	2,944	10:1
ArchaeoTweets	@ArchaeoTweets	6,166	135	45:1
ASI Archaeology	@ArchaeologyTO	850	400	2:1
Digital Archaeology	@CoDA_UCB	3,989	603	6.6:1
Open Access Arch	@OpenAccessArch	6,454	3,136	2:1
Past Horizons	@PastHorizons	7570	1,068	7:1
SAA	@SAAorg	2,562	199	12:1
SHA*	@SHA_org	11,800	638	18:1
Then Dig	@thendig	840	405	2:1

Note: Totals as of March 28, 2015.

*Number of followers is rounded to the nearest hundred.
**Ratio is rounded to the nearest whole number.

> an emerging form of engagement with cultural heritage that contributes towards a shared, significant goal or research area by asking the public to undertake tasks that cannot be done automatically in an environment where the tasks, goals (or both) provide inherent rewards for participation.

In the realm of museums, cultural heritage, and scientific research, crowdsourcing has been utilized for engagement through the citizen science framework. Citizen science is the coordinated engagement of volunteer citizens in data collection, management or analysis for large-scale research projects (Boyd 2014:99). Citizen science projects on digital platforms such as Zooniverse draw on the "efforts and ability of volunteers to help scientists and researchers deal with the flood of data that confronts them" (Zooniverse 2014). Citizen science has a long history, but in the digital realm participants transcribe digital versions of written records, help search through digital photographs or satellite images and classify certain phenomena that are of interest to researchers, and record geo-referenced observations of flora and fauna (Bonney et al. 2014; Carletti et al. 2013; Ridge 2013b; Smith 2014:754–758).

National Geographic's Digital Media Survey for the Valley of the Khans project (Lin et al. 2014; National Geographic 2010) is an example of crowdsourcing in archaeology. Volunteer workers review satellite imagery and maps for the Valley of the Khans project and mark anomalies they believe could be man-made structures. Researchers use this information to identify and explore potentially new sites in a vast area that is difficult to survey through traditional archaeological methods. Archaeology in the UK also has taken advantage of participatory digital platforms with projects like the Portable Antiquities Scheme (PAS 2013), which allows members of the public to record archaeological objects they have found. A recent project called MicroPasts (Bonacchi et al. 2014; MicroPasts 2013) allows volunteers to take part in tasks as diverse as transcribing letters and identifying the accurate location of artifact findspots or photo-masking images that are stitched together to make 3D models.

Users interact with these platforms by completing well-defined tasks in scaffolded or highly structured participatory frameworks (Ridge 2013b:440). User feedback is considered valuable and generally used to alter and improve the end product. Yet the user base is often so large that participants do not have a say in the larger decisions about how the project is structured or implemented. Final say about the structure and implementation of these programs generally remains with academic researchers, specialists, or professionals (Phillips 2014; Simon 2010), although some projects have opportunities for the public to be involved in the design stage (Bonney et al. 2009; Ridge 2013b:9). While the participation of a wider user base helps to make principles of data collection, organization, and analysis more transparent and greatly increases awareness and participation in scientific research, the structure of the relationships between researchers and participants still follows a more traditional model of the specialist teaching the enthusiast or amateur.

The third area of the spectrum describes collaborative projects in which users have some say in determining and refining higher-level goals and design of the program, although the ultimate decision-making still lies with the professional organization. Negotiation of authority and dialogue are key factors in the production and maintenance of these programs (Beale 2012; Boast and Biehl 2011; Harris 2012; Rowley et al. 2010). Collaborative projects tend to focus more on understanding and incorporating alternative ways of knowledge production and data. For example, many large-scale digital projects that deal with data use fairly rigid, standardized metadata schemas and ontologies for data collection and organization. This is to help ensure interoperability of data across a wide variety of institutions and sectors. However, these schemas are often based on tacit knowledge that is part of specialist training. Consequently, the ontological frameworks are not immediately accessible to communities outside of the specialist realm (Boast and Biehl 2011; Srinivasan et al. 2010).

While participatory projects can help interested users understand such schema, collaborative projects go beyond that to

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incorporate ideas and feedback into the design of the project. One example is the Rock Art on Mobile Phones (RAMP) app, whose interpretative content was developed based on feedback incorporated from a variety of audiences. The app's developers created a "design space" that allows interested individuals to weigh in on the interpretative methods used to discuss the rock art findings. One noteworthy result of this feedback is that the interpretative content was presented in a conversational tone and drew from multiple perspectives, rather than relying on a single authoritative explanation (Mazel et al. 2012). The Jordan Levi Plantation website, where archaeological interpretation was presented as one voice alongside many others, including descendant communities' oral traditions (McDavid 2002, 2003, 2004b), is another example. Finally, the previously noted MicroPasts project (Bonacchi et al. 2014:7) is aiming to eventually create new archaeological research projects jointly developed by academics and community partners who are users of their online application. The researchers involved with these projects have noted that the inclusion of voices and perspectives from multiple communities (expert or otherwise) created more engaging content. In the case of MicroPasts, it will hopefully create research agendas that speak to a wider audience.

The incorporation of multiple perspectives becomes more difficult when the content and data being organized and used are of interest to different expert communities who use their own informed experiences and categories to organize and interact with their world (Boast and Biehl 2011:120; Srinivasan et al. 2010). Mirroring what has played out in the physical world, digital collaborative projects that include different types of communities, such as indigenous and descendant groups, cannot solely rely on archaeological frameworks for data organization and interpretation if they want to have a substantial impact on the communities they are working with. A number of researchers have noted that digital collaborative projects must be very flexible about their data schema to accommodate alternative (i.e., non-specialist) perspectives of what data are and how they are organized (Beale 2012:620–621; Boast and Biehl 2011:142–143; Christen 2008, 2011, 2012a, 2012b:334–335; Harris 2012:586–588; Rowley et al. 2010; Srinivasan et al. 2010). The challenge lies in incorporating these alternative forms of knowledge into professional artifact catalogs and collections management systems or providing indigenous and aboriginal groups with ways to use the information to create their own resources. The latter, in particular, provides opportunities for co-creation.

Collaborative projects that include communities outside of archaeology from the start and make them *equal partners* in the design and implementation of a project are co-creative**.** Co-creative projects have diverse user groups that help shape the digital application or platform with their perspectives and knowledge. In many cases, the platform is created as a resource for the community, rather than being a platform for the general public. So what does co-creation look like in the digital realm? One area in which the co-creative process is very active is in archives and content management systems. Shifting traditional content management and metadata structures to adapt to non-Western ways of viewing or organizing data has been a primary component of digital co-creation. Such projects include indigenous and community partners in all stages of application planning and implementation and create data structures that help users manage and preserve their cultural heritage.

The Reciprocal Research Network or RRN, (Iverson et al. 2008; RRN 2014; Rowley et al. 2010) is an example of a co-created project. The RRN was co-developed by three First Nations communities, the Musqueam Indian Band, the Stó:lō Nation, and the U'mista Cultural Society, along with the Museum of Anthropology at the University of British Columbia. Professionals from a dozen other museums also participated in the development process. The goal of the project was to "develop a new research tool for accessing information housed in geographically dispersed locales as well as providing network functions for effective engagement and collaboration among researchers with different backgrounds … and across culturally distinct knowledge systems" (Rowley et al. 2010). The result was a virtual space that allows users from a variety of professional and cultural backgrounds to access cultural items held at 24 different institutions and to collaborate with other users to conduct research.

Another example of a co-creative project is Mukurtu (pronounced MOOK-oo-too). Mukurtu is a free and open source digital archive platform (Mukurtu 2015). It is a content management system built with indigenous communities to manage and share digital cultural heritage. Dr. Kimberly Christen started the software project as a direct response to the Warumungu Aboriginal community's specific archival needs in the Central Australian town of Tennant Creek (Christen 2008, 2012a, 2012b). The original archive, called the Mukurtu Wumpurrarni-kari archive, translated the community's cultural protocols to different levels of access and security. In practice, this means that a potential user creates a profile that contains information on their gender, age, and role within the community. When individuals log onto the system, they can only view information that matches the cultural constraints of their user profile (Christen 2012a:332). This allows indigenous groups to create a "safe keeping place" for cultural information while deciding what can be made accessible to and circulated among certain members within their community and outside viewers (Christen 2008, 2011, 2012a, 2012b).

After co-creating the system with the Warumungu, Christen found that a variety of indigenous communities faced the same challenges and wanted a similar program to protect their intellectual property and make it accessible (Christen 2012b:2881). Subsequently, Christen and her collaborators developed the Mukurtu CMS, an open source archive and content management system, built using the open source Drupal 7 content management platform, which is adaptable to multiple indigenous contexts (Christen 2012b:2882). It has been adopted by roughly 500 organizations (Ashley 2014), including the National Museum of the American Indian and the Association of Tribal Archives, Libraries, and Museums. Although Mukurtu does not deal directly with archaeological data, Christen (2008:21) has argued that Mukurtu is relevant to archaeologists because it helps reframe and facilitate the sharing of material and data with indigenous communities.

Collaborators for both of these projects note that flexibility in technical design and open communication to keep decision-making transparent were key factors in their successful development (Ashley 2014; Christen 2012b:2882; Rowley et al. 2010). The way data were collected, structured, and represented in each of these projects was different from a typical content management system because more flexibility was necessary to incorporate different forms of knowledge and knowledge

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production. For Mukurtu, this took the form of having access levels map to sociocultural protocols. For the RRN, the content management system was designed to incorporate the variety of different types of information community members wanted to add to object records. Users can verbally record stories about objects using Skype and tag objects using their own vocabulary. What is most important is that the system retains all of user-generated content associated with the record and, like Mukurtu, provides various levels of security that determine what other types of users can see that information. The incorporation of such applications has allowed both the RRN and Mukurtu to serve as important collaborative resources for their respective communities.

In addition to shifting data structures and management methods, co-creative projects complicate the question of accessibility. The challenge of intellectual property protection has been an integral part of the digital engagement movement and has brought to light questions about Open Access and Open Data (Christen 2015). Archaeologists, anthropologists, and cultural heritage specialists have acknowledged that the principles behind the Open Access movement may not work for every project (Ashley 2014; Beale 2012; Boast and Biehl 2011; Brown and Nicholas 2012; Christen 2012a; Kansa and Kansa 2011). Although many digital efforts in the discipline have focused on making archaeological data more open and ensuring that the discipline is more transparent, approaches that aim to share all information do not always mix with many communities' wishes to make decisions about how their intellectual property is shared. In the same way that archaeology as a discipline has been concerned about sharing sensitive data, so too are aboriginal, indigenous, and descendant communities.

Consequently, in some cases, producing digital resources that are truly co-creative means respectfully recognizing that communities have clear understandings of what it means to manage and care for their cultural materials and that they may not want to make them available to outsiders, including archaeologists (Ashley 2014; Brown and Nicholas 2012; Boast and Biehl 2011; Christen 2011, 2012a, 2012b, 2015; Rowley et al. 2010). In order to create resources that are useful for these communities, it is necessary to find ways of collecting, organizing, and protecting that information so they can choose their own privacy settings and how they want to circulate their data. Mukurtu, with its layers of security that map to cultural protocols, provides a particularly provocative example of how to do this.

Co-creative projects have also shown that the complicated nature of accessibility is not limited to data security but also includes the limitations some communities face in accessing technology or the Internet. A number of collaborative and co-creative projects have acknowledged that a large part of the collaboration entails creating or coordinating access for communities that typically may not be able to use or want to use the Internet (Ashley 2014; Christen 2012a:2881–2882; McDavid 2002:308–309; Rowley et al. 2010). As a result, the projects not only focused on building archives or digital platforms, but also included components for getting information out into the community or providing ways and means for community members to access and contribute to the resource, including those members who may have no interest in computers or technology. Without actively going into communities and helping them access digital resources, archaeology is still limited in the audiences it is reaching (Richardson 2013:7–8; Walker 2014:90).

What Can Digital Engagement Learn from Co-Creative Projects?

As demonstrated above, archaeologists have a plethora of platforms for digital engagement, including blogs, Twitter, Facebook, Instagram, crowdsourcing, websites, and collaborative content management systems. Yet having so many options can actually make engagement more difficult. One lesson learned from co-creative projects is to focus on immediate community needs and to build something that meets those needs. If that effort is successful, it can grow. Thus, before choosing a platform or method, the individual or organization creating the engagement project has to determine whom they want to engage and how they want to do so. The "build it and they will come" mentality generally does not work for digital projects (Tanner 2012:25).

Such considerations impact a project on multiple levels. For example, an organization must make the decision of whether a project aims to engage a crowd or a community. Crowds are not necessarily people an individual or organization is familiar with, but are generally larger in number than a community. On the other hand, if an organization is seeking to create a community around a resource or to engage a community with it, they are likely intimately familiar with users, but the impact will reach a smaller number of people. It is important to define these criteria because the type of engagement that is possible will differ for a crowd vs. a community (see Figure 1). For example, co-creative projects are difficult, if not impossible, to manage on a crowd level because of the need to equally balance multiple perspectives. On the contrary, participatory projects often benefit from having a larger and more diverse pool of users to successfully complete the necessary tasks for large-scale projects. It is worth noting, however, that some studies have questioned whether "crowdsourcing" is actually reaching new audiences or just engaging participants already interested in archaeology in a new way (Walker 2014:87).

In addition to knowing the scope of users, archaeologists need to be realistic about what audiences can be reached through digital mediums. An inherent part of the co-creative projects discussed above is the necessity of building resources that do not assume computer literacy. This kind of awareness is important for all digital projects. As Richardson (2013:6–8) has argued, although the growth of digital communication tools and online production has removed barriers to access for some groups, digital literacy is not equally distributed in the UK. McDavid (2004a) noted the same disparity roughly a decade ago, and the U.S. Census suggests that it remains true for American households. The most recent Census Bureau report on Computer and Internet Use in the United States (File and Ryan 2014) indicates differences in computer ownership and Internet accessibility between demographic groups. In particular, "computer ownership and Internet use were less common in Black and Hispanic households than in White and Asian households" (File and Ryan 2014:5). Additionally, ownership of handheld devices alone was more common among Black and Hispanic households (File and Ryan 2014:7). The comparison of handheld devices to other types of computers is relevant because software interfaces

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greatly impact user experience and should factor into decisions about which platforms to use when creating a public engagement project.

A related concern is whether the target audience actually uses the type of platform the project is based on. For example, each social media platform varies in popularity among different social demographics, although Facebook tends to remain the most popular overall (Duggan and Smith 2014). Thus, audience research should be a key component of any project, both in terms of providing a better understanding of the potential audience and in terms of whether the program or platform used is the proper fit for communicating with that audience.

Although they may seem to be relevant only in certain situations, the importance placed on dialogue, collaboration, and power sharing should not be restricted to co-creative projects. The emphasis placed on working with communities to create resources that are useful to them in co-creative projects is a model that all digital engagement projects can benefit from. Projects like Mukurtu and the RRN are valuable models for engagement because the resource is something that is of value *to the user community*. The larger lesson is that to build something that has impact, it is important to first try to understand what your audience wants or needs (Finnis et al. 2011). This of course begs the question of how to determine whether a digital engagement project is actually meeting a perceived need. Assessing the impact of digital engagement is a growing area of interest in archaeology (Bonacchi et al. 2014; Pett and Bonacchi 2012; Richardson 2014). The next section will briefly describe methods of evaluating user engagement and metrics for success that recent research has found can help any organization better understand how their digital platforms are being used.

Evaluating Digital Engagement

While designing a platform and after its launch, it is necessary to measure its impact on the target audience. Evaluative metrics depend on the engagement goals. If information dissemination is the priority, quantitative assessments such as page views, likes, number of followers, number of tweets and retweets (Birch 2013:8–9; Villaespesa 2013:217), or number of people downloading the resources can provide sufficient feedback. Whatever metrics are chosen, it is important to create benchmarks for success and ways for determining return on investment (Finnis et al. 2011). However, purely quantitative measures do not provide adequate feedback if the goal of digital engagement is facilitating audience participation or the collaborative creation of a digital resource. A number of recent studies of digital engagement in archaeology and the cultural heritage sector (Finnis et al. 2011; Pett and Bonacchi 2012; Richardson 2014; Tanner 2012) indicate page views, downloads, and likes provide only a one-dimensional view of how people are interacting with a project or resource. As a result, there is a concerted effort in the cultural heritage sector to create a more holistic notion of assessment for digital engagement projects. Studies have found that in order to determine the impact a resource has for its user community, organizations must use a combination of qualitative and quantitative assessments to measure impact and conduct iterative evaluation throughout the development process (Bonacchi et al. 2014; Finnis et al. 2011; Tanner 2012; Villaespesa 2013:271; Walker 2014:89–91).

Measuring impact, however, is easier said than done. A useful tool for organizations is Tanner's (2012:4) Balanced Value Impact Model (BVI), which "assesses whether and how a digital resource is impacting the community for which the resource is intended." The model is based on Tanner's research of Impact Assessment indicators and processes across a variety of disciplines. He defines impact as "the measurable outcomes arising from the existence of a digital resource that demonstrate a change in the life or life opportunities of the community for which the resource is intended" (Tanner 2012:12). In Tanner's model, an organization must also investigate whether the resource has social or economic value of tangible worth for a community. Audience research is critical for planning and development purposes and plays a key role in evaluating the success of the application. Tanner (2012:Appendix D) provides a variety of methods and data gathering techniques that will help organizations achieve these goals.

For participatory projects, there are certainly important quantitative measurements, including the number of people visiting the site, unique and return visitors, and amount of user-generated content. Again though, for a better sense of how this is helping relate archaeology to the public, it is necessary to look more closely at user information. What *types* of users are engaging with the project? At a basic level, it is possible to use Google Analytics to geographically segment users and determine whether they are from areas local to the organization, from the U.S., or from elsewhere in the world (Finnis et al. 2011:14–15). For platforms that gather additional information about users, such as social media platforms or participatory projects in which users have the option of providing demographic information when they create accounts, it is possible to use social metrics to better understand audience composition. Quantitative information on demographics can be combined with content analysis of comments or tweets (Villaespesa 2013:270–272) or Facebook posts and user-generated content (Finnis et al. 2011:18). User surveys provide helpful feedback (Boast and Biehl 2011:141; McDavid 2002) and can be compared with data tasks performed (Bonacchi et al. 2014) to provide a better understanding of how users are engaging with the organization and the resources it has created. Kansa and Kansa (2011:61, 67), Rowley et al. (2010), and Beale (2012:621) have noted that iterative evaluation throughout the development process is important.

Evaluation for collaborative and co-creative projects can be more difficult. The significant impact of Mukurtu and the RRN is best demonstrated by the fact that the platforms are still used and have been adopted by more communities. Ideally the impact of such projects will be measured in longitudinal studies like the one conducted by McCreedy and Dierking (2013), which followed girls who had participated in informal STEM programs to determine whether their experiences had impacted their future choices in education and career goals. Studies that focus on how communities use archaeological digital resources and how they impact their future choices and goals will help solidify their value to audiences outside of archaeology.

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Conclusion: Successful Digital Engagement in Archaeology—What We Can Learn from Co-Creative Projects and Why All Projects Should Not Strive to be Completely Co-Creative

The previous sections demonstrate that there is no shortage of digital engagement projects in archaeology and their goals, platforms, and audiences cover all parts of the spectrum. Although digital engagement has increased the potential for archaeology to reach new audiences, there is no guarantee of success. Moreover, the variety of available platforms can make digital engagement daunting for organizations already strapped for time and resources. The Engagement Spectrum can help organizations overcome the initial hump by providing general guidelines for different types of engagement, which also makes it easier to determine the types of metrics that can be used to measure their impact and success.

As Kansa has noted (2011:22), the introduction of digital methods to archaeology provides a new platform for long standing debates between researchers who "emphasize contextual nuance and particularistic interpretations [and] others [who] seek more generalized patterns in more or less interchangeable empirical data." The variety of digital engagement methods discussed here can be compared in a similar manner. On one end of the spectrum are large-scale digital projects that seek to make archaeological data and content open and interoperable and archaeological methods more transparent to as many people as possible for them to explore and interpret. On the other end are co-creative projects that create digital resources for particular communities who may or may not choose to circulate their data.

However, even large-scale projects can benefit from some of the principles that are an inherent part of co-creative projects. Having metrics that measure impact beyond citations and downloads and that link digital resources to tangible social benefits is important. Providing alternative ways for communities to access and learn from the resource online and offline can help increase the reach of digital engagement projects. Furthermore, information should be curated and circulated in a way that is respectful to different cultural perspectives and cognizant of accessibility challenges. This is not meant to devalue larger-scale projects but to highlight opportunities for other archaeologists to use the resources they create for engagement as well as research. If one can learn anything from co-creative projects, it is that archaeologists must take data to non-specialist communities and then work closely with those groups to learn how they want to use that information. Information needs to be accessible so that many audiences can enjoy and benefit from it.

On the flip side, projects such as Mukurtu and the RRN have benefited from best practices developed by large-scale projects that must deal with vast amounts of data. Open Source and Open Access applications such as Open Context, DINAA, Wessex Archaeology, Archaeological Data Service, CRA, DAACS, tDAR, and MicroPasts are actively tackling problems of data transparency, interoperability, and accessibility. These applications provide structures and best practices that help users make connections between disparate datasets that were previously very difficult or nearly impossible. Once these datasets are available, other archaeologists can use them to create their own engagement resources. While larger-scale projects do not include users as equal partners at every stage, they provide content and methods for reaching audiences at larger scales and balance co-creative projects that by their very nature often cater to smaller audiences. Digital co-creative projects cannot operate and grow without the technology that allows them to be flexible and responsive, which has grown out of the Open Source and Open Access movements. In fact, Christen (2012b:2882) has noted that some systems designed to accommodate specific community needs are less sustainable because the lack of flexibility and the absence of a consistent community of users make it difficult to continually adapt and update the software. Hence not all digital projects should strive to be completely co-creative and narrowly focused on a community's needs, as community resources can benefit from larger projects that tackle other problems and goals.

There is no doubt that it will take a variety of digital public archaeology projects to help the discipline move forward with its goal of engaging non-specialist audiences. While there are a variety of ways to engage the public in the digital realm, to be successful in any part of the spectrum, archaeologists need to know their audience(s), know how they want to make an impact, and know how to measure it regardless of what size audience they are aiming to engage and how they hope to do it.

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Data Availability Statement

All data used for analysis in this paper are contained within the body of the article (Table 1).

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