Sustaining MedArt:
The Impact of Socio-Technical Factors on Digital Preservation Strategies

Report Authors

Alison Langmead, *Clinical Associate Professor and Director, Visual Media Workshop, Dietrich School of Arts and Sciences; Associate Professor, School of Computing and Information, University of Pittsburgh*

Aisling Quigley, *Doctoral Candidate, School of Computing and Information, University of Pittsburgh*

Chelsea Gunn, *Doctoral Student, School of Computing and Information, University of Pittsburgh*

Jedd Hakimi, *Doctoral Candidate, Film and Media Studies, University of Pittsburgh*

Lindsay Decker, *MLIS Candidate, School of Computing and Information, University of Pittsburgh*

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Introduction

Summary

This report details the findings of the Sustaining MedArt project which considered the socio-technical history of a scholarly website, *Images of Medieval Art and Architecture* (http://medart.pitt.edu) as part of a broader exploration of preservation practices and sustainability plans for user-facing, web-based digital humanities projects. Although this website emerged during the web's infancy, it has persisted to this day, remaining relatively constant in its technology, appearance, and functionality throughout the years. Known colloquially as "MedArt," this pioneering, online, image-centric information resource provided opportunities for our research team to investigate the recurring challenges faced in producing and maintaining long-lasting digital scholarship. The Sustaining MedArt project team looked to MedArt's initial creation, its functionality over time, and its potential future sustainability to create a robust account of the people and material practices that have supported its persistence. Each one of these research facets revealed the ongoing efforts necessary to sustain digital, academic work.

This report documents the outcomes of our analysis of the MedArt website, responding in particular to the following questions: What were MedArt's conditions of creation and what have its conditions of persistence been? How might we use this information to create viable and appropriate digital preservation and sustainability plans for this project? And, finally, how can we generate recommendations for other project managers interested in creating actionable sustainability plans based on our experiences? In particular, what might be some potential best practices for ensuring that digital scholarship, especially when presented to the public on the World Wide Web, remains accessible, legible, and sustainable over time?

In particular, the project team examined both the human-centered and technological factors that have contributed to the development and evolution of *Images of Medieval Art and Architecture* since its conception (ca. 1994), and have then used this research as a strategic resource to incite contemporary action via the creation of a project-focused workshop entitled the "Socio-Technical Sustainability Roadmap" (STSR; http://sustainingdh.net). The STSR is an exercise designed to lead digital humanities project creators through the process of creating sustainability plans for their projects. It constitutes a method for creating ongoing, iterative digital sustainability strategies that addresses both the technological and human-focused needs of these projects. With the STSR, we have outlined a sustainability model for the digital humanities that incorporates professional-grade approaches to digital preservation alongside an ongoing documentation strategy that can ensure that projects persist for as long as their creators and stewards wish for them to persist.[1]

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[1] There is a solid base of scholarship on the topic of digital preservation in the digital humanities, although most of this work has been created for an audience of archivists working as the stewards or custodians of such projects and/or other professionals working with inactive records. Please see for example, Linda Cantara, "Long-Term Preservation of Digital Humanities Scholarship," *OCLC Systems & Services: International Digital Library Perspectives* 22 (2006): 38-42 or William Kilbride, "Saving the Bits: Digital Humanities Forever?," in *A New Companion to Digital Humanities*, ed. Susan Schreibman, Ray Siemens, and John Unsworth (Chichester: John Wiley & Sons, 2015), chap. 28, https://doi.org/10.1002/9781118680605.ch28. A number of humanists have also addressed these issues, although again usually from the perspective of retiring a project or working with inactive projects. On this, please see Bethany Nowviskie and Dot Porter, "Graceful Degradation Survey Findings: How Do We Manage Digital Humanities Projects through Times of Transition and Decline?" 2009-2010, http://nowviskie.org/Graceful_Degradation.pdf and Geoffrey Rockwell, Shawn Day, Joyce Yu, and Maureen Engel,

Potential Impact: Sustaining Academic Scholarship in a Digital Ecosystem

With this research, our aim is not to offer prescriptive rules for digital sustainability planning within the context of the humanities, but instead to use a close examination of *Images of Medieval Art and Architecture* (MedArt) and its history to describe what sustainability strategies would be most feasible and effective for this site, and why. MedArt's remarkability as a resource resides as much in our ability to reflect on it historically as a technological and social artifact as it does in the site's contribution to the scholarship on medieval art and architecture. With this information under our belt, we can then begin to wonder how the lessons learned from this particular study might best be shared with a broader audience.

Images of Medieval Art and Architecture belongs to a very special cohort of web-based projects produced by the "humanities computing"[2] community of the mid-1990s that have survived the past twenty years of rapid-fire technological change. Other sites within this peer group have employed different strategies to survive their own technological and sociological vicissitudes. While some, like Ed Ayers' *The Valley of the Shadow: Two Communities in the American Civil War* (http://valley.lib.virginia.edu/) and Jeffery Howe's *A Digital Archive of Architecture* (http://www.bc.edu/bc_org/avp/cas/fnart/arch/contents_europe.html), have elected to remain virtually unchanged, or frozen, in the intervening decades since their creation, others have opted to continuously renew or regenerate their project sites. Princeton University's *Index of Christian Art*, now the *Index of Medieval Art* (https://ima.princeton.edu/), falls into this latter category. The original *Index*, founded as early as 1917, expanded into the digital realm in 1991, and under the current leadership of Pamela Patton, is continuing to evolve and change both the overall design as well as the affordances offered by their online resources.

There is yet a further category of projects, one to which Gregory Crane's *Perseus Digital Library* (http://www.perseus.tufts.edu/hopper/) might be said to belong, that occupies a sort of a middle

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"Burying Dead Projects: Depositing the Globalization Compendium," *Digital Humanities Quarterly* 8, no. 2 (2014), http://digitalhumanities.org:8081/dhq/vol/8/2/000179/000179.html. For digital preservation guidelines used primarily by information professionals, see the "Digital POWRR Institutes," Digital POWRR, http://digitalpowrr.niu.edu/ and the Digital Preservation Coalition's *Digital Preservation Handbook, 2nd Edition* (2012): http://dpconline.org/handbook.

[2] For a brief overview of the era of "humanities computing," see Susan Hockey, "The History of Humanities Computing," in *A Companion to Digital Humanities*, ed. Susan Schreibman, Ray Siemens, and John Unsworth (Malden, MA: Blackwell, 2004), chap. 1, http://digitalhumanities.org/companion/. An account of one of the first conferences on computing in the humanities to consider more fields than literary text processing can be found in *Computers for the Humanities?: A Record of the Conference Sponsored by Yale University on a Grant from IBM, January 22-23, 1965*, (New Haven: Yale University Press, 1965). As the field switched from "humanities computing" to the "digital humanities" a few essays stand out to mark this passage including Matthew Kirschenbaum, "What Is Digital Humanities and What's it Doing in English Departments," *ADE Bulletin* 150 (2010): 55-61, http://doi.org/10.1632/ade.150.55 and Patrik Svensson, "Humanities Computing as Digital Humanities," DHQ: Digital Humanities Quarterly 3, no. 3 (2009), http://www.digitalhumanities.org/dhq/vol/3/3/000065/000065.html and Edward Vanhoutte, "The Gates of Hell: History and Definition of Digital | Humanities | Computing," in *Defining Digital Humanities : A Reader*, ed. Melissa Terras, Julianne Nyhan, and Edward Vanhoutte (Farnham: Taylor & Francis Group, 2013), 119-48 and Jules David Prown, "The Art Historian and the Computer: An Analysis of Copley's Patronage, 1753-1774," *Smithsonian Journal of History* 1, no. 4 (Winter 1966): 17-30 and Michael Greenhalgh, "Databases for Art Historians: Problems and Possibilities," in *History and Computing*, ed. Peter Denley and Deian Hopkin (Manchester, Manchester University Press, 1987), 156-167.

ground between the first two. *Perseus* has added numerous additional texts and features since its conception around the year 1997, but it has not changed as significantly in outward appearance as the *Index of Medieval Art* has or even, more dramatically, *The William Blake Archive* (http://www.blakearchive.org/), which was founded in 1996 and whose interface was recently entirely renovated. Indeed, it is to *Perseus'* category of projects that *Images of Medieval Art and Architecture* belongs, having been considerably expanded and altered in the decade following its inception but without experiencing significant design changes.

All digital humanities projects, whether they are being actively created or recreated, marching through a period of ongoing maintenance, or are moving towards retirement, require planning and carefully articulated maintenance strategies to remain legible for as long as their creators wish for them to be accessible. They have formal qualities and historically contextual relationships that are important components of how they remain intelligible and useful. MedArt cannot be preserved or made sustainable by printing its content as a book, transferring its images into PowerPoint decks, or archiving its original 35mm slide resources in a storage closet, because such solutions neglect how MedArt works, what the site does, and who it serves.

The MedArt website was first constructed in 1995 by Dr. Alison Stones, now Professor Emerita of art history at the University of Pittsburgh, and her then-student Jane Vadnal. The project began as an online collection of digital images, all scanned from Dr. Stones' own personal collection of 35mm slides. The pair wished to use the abundance of new technologies available in the pioneering age of the World Wide Web to create a large gallery of images as well as a number of online curricular tools, glossaries, and maps for use in the art history classroom. The site is best known today as a well-organized collection of digital images, as well as a time-tested glossary of terms relating to medieval art and architecture. It has developed over time into a well-known and reputable resource utilized by scholars all over the world.

According to Miriam Posner's recent classification of digital humanities projects, MedArt can be considered a "gallery of primary sources," or what Carole L. Palmer has also referred to as a "thematic research collection created by scholars."[3] Alison Stones, one of MedArt's co-creators, stated in 1999 that it was indeed the original aim of the project, "...to provide more images, more conveniently than books do, so that these images may form a basis for description, analysis, and comparisons done orally or in written form by students themselves as part of an active learning process."[4] MedArt's approach to helping to make this kind of meaning relies on a hypertextual framework—the arrangement of the site, its links, and its associations are all encoded into what it accomplishes as a scholarly resource, and it accomplishes this task using little more than basic HTML.

As William Kilbride has pointed out, all "digital scholarship, especially in the humanities, has a distinctive need for digital preservation."[5] Any sustainability strategy must account for the particular network of interrelated technologies that work together in a website's expression, no matter how simple or

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[3] Miriam Posner, "How did they make that?" *Miriam Posner*, http://miriamposner.com/blog/how-did-they-make-that/; Carol L. Palmer, "Thematic Research Collections," in *A Companion to Digital Humanities*, ed. Susan Schreibman, Ray Siemens, and John Unsworth (Malden, MA: Blackwell, 2004), chap. 24, http://digitalhumanities.org/companion/.

[4] Alison Stones, "Teaching and Research in Medieval Art on the Web: Three Sites," in *Computing and Visual Culture*, ed. T. Szrajber (London: CHArt, 1999), 115.

[5] Kilbride, "Saving the Bits."

complex. In this way, while MedArt's technological platform is made up of relatively few bells and whistles, attention to their sustainability is of the exact same stripe as any other user-facing, web-based digital humanities project. Moreover, as our research into the conditions of creation and persistence of MedArt has shown, the technological infrastructure of a project is only one vector upon which its sustainability resides.

Like all digital humanities projects, MedArt's form and structure have also always been intrinsically tied to the needs and goals of its creators. Over time, this project gained and lost a large number of volunteer and student workers, all of whom were participating in the work for various personal and professional reasons. Stones and Vadnal were present through most of its history, serving as the source of "project memory" for MedArt. Nearer to the end of its active life, Philip Maye joined this group, eventually serving as the vector for the most complicated technologies used on the site. MedArt also existed in a complicated institutional infrastructure that both supported, and sometimes thwarted, the desires of the team. These social affordances of the project had just as important an impact on the way that MedArt persisted as the technologies.

MedArt is not technologically complex, and so the identification of effective sustainability tasks in the technical domain was straightforward for the research team. However, because this was the case, we were able to focus more of our time on the myriad ways that the complicated social infrastructure surrounding MedArt impacted its ongoing sustainability needs. The "Sustaining MedArt" research project became an excellent mechanism by which to learn more about the ways that sustainability efforts could be considered a *socio-technical* problem, drawing importance from both the ongoing needs of the project team as well as the technological infrastructure. The study concludes that while there are, of course, many technical issues that need to be addressed in order to ensure ongoing persistence for any digital humanities project, there is also an entire universe of non-technologically-focused issues that must be attended to in order to create effective sustainability strategies. Structuring and encouraging project management consistency turns out to be the key.

With this lesson learned, and to assist others with the process of designing and implementing digital sustainability plans for their work, the "Sustaining MedArt" project team has taken the prominent findings from our research and embedded them into a workshop entitled *The Socio-Technical Sustainability Roadmap* (STSR; http://sustainingdh.net). The STSR is a structured, process-oriented workshop, inspired by design thinking and collaborative learning approaches. This exercise, which may be implemented in a variety of institutional contexts, guides project stakeholders through the practice of creating effective, iterative, ongoing digital sustainability strategies that address the needs of both social and technological infrastructures. There is no one-size-fits-all-and-forever approach. Sustainability is an ongoing project management task.

Theme 1: Conditions of Initial Creation

Originary Context

As a site originating at the University of Pittsburgh (Pitt) in the mid-1990s, *Images of Medieval Art and Architecture* was a project that participated in the birth and initial growth of the World Wide Web. Spearheaded by Dr. Alison Stones, now Professor Emerita in the Department of History of Art and Architecture, and her long-term collaborator and then-student, Jane Vadnal, the website today contains approximately 10,000 images of French and British medieval art and architecture organized according to a text-based, faceted, browsing hierarchy. When the site was first conceived, Stones and Vadnal assumed that the site would serve primarily as a supplement for undergraduates taking architecture and art history classes. As Stones later recounted, it was "deliberately developed without reference to a particular academic curriculum, and without narrative explanatory text, with the idea that its potential use as an image site should be unrestricted."[6] After it launched, however, they became aware of MedArt's broader appeal, and they accordingly managed the site to serve as a resource for a range of students, scholars, hobbyists, and random visitors alike.[7]

As an institution, Pitt was engaged with the infrastructure and affordances of the Internet quite early, even in comparison to other research institutions within its peer group. Like only a handful of other American universities, the University of Pittsburgh had backbone access to this "network of networks" well prior to the introduction of the World Wide Web, due to its 1986 participation in a consortium of institutions that co-founded and co-directed the Pittsburgh Supercomputing Center (PSC) connected to the NSFNET, one of the infrastructural precursors to the Internet. Being one of only six main nodes on this early NSF-funded network, the PSC was a catalyst for the city's connection to the later "Inter-Net" and the early Web. Indeed, Tim Berners-Lee gave one of the very earliest talks introducing the "World-Wide Web" at a conference in Pittsburgh in March 1993, and by October of that same year, the University of Pittsburgh offered a campus-based, digital information service called "PittInfo" that could connect to it.[8]

MedArt's early history typifies the moment when the World Wide Web began to profoundly affect how faculty research and teach, students learn, universities administer, and collaborators communicate. When Stones and Vadnal began the pilot project for MedArt in the summer of 1994,[9] the entire Web comprised fewer than 2,500 commercial websites total (compared to around a billion today).[10] It was in

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[6] Stones, "Three Sites," 115.

[7] Stones explained this herself: "Although I had an audience of American undergraduates primarily in mind, email responses to the site suggest that the audience ranges vary considerably, from elementary and high school students, to their parents, to university students all over the world, and to the general public at large." Stones, "Three Sites," 115.

[8] Mike Sajna, "Expanding PittInfo Provides Wide Range of Information," *University Times,* November 23, 1994, http://www.utimes.pitt.edu/?p=4198; Tim Berners-Lee, "World-Wide Web" (paper presented at the Online Publishing 93 Conference, Pittsburgh, PA, March 22, 1993), https://www.w3.org/Talks/OnlinePublishing93/Overview.html.

[9] Stones mentions that the project received "research assistance funding" in the summer of 1994. Stones, "Three Sites," 121; Mike Sajna, "Teaching the History of Art on the Internet," *University Times*, March 2, 1995, http://www.utimes.pitt.edu/?p=4307.

[10] Robert H Zakon, "Hobbes' Internet Timeline - the Definitive Arpanet & Internet History," *Hobbes' Internet Timeline v.*23, last updated January, 1, 2016, https://www.zakon.org/robert/internet/timeline/. Available courtesy

this pioneering environment that they decided to create a website on the University of Pittsburgh's web-enabled Andrew File System (AFS) that would host and contextualize the hundreds of 35mm slide scans that Vadnal was producing from Stones' personal research image collection in order to make them available on the Web as a resource.[11] While there is no written record of the official launch date for the site, and the original creators have long since forgotten when it was first posted, MedArt's records do show that the design and creation of the webpages took place between 1993 and 1995, and the project was certainly available and accessible on the Web somewhat in advance of June 1996, when it was mentioned as an "L.A. Times Pick of the Day."[12]

MedArt was a pioneering example of online humanities scholarship, but its participation in this early moment in the history of the Web was no accident. Its origins can be attributed to a confluence of a number of extraordinarily driven individuals who were interested in utilizing new technology in the service of scholarship and pedagogy, as well as an institutional climate interested in accommodating such innovations.

Alison Stones

For Stones, the development of MedArt was consistent with her decades-long record of developing innovative pedagogical practices using new technology. By her own account, this interest in technology was sparked by seminars she attended as a faculty member at the University of Minnesota from 1969 to 1971 focusing on "new and developing educational techniques and technologies and their potential for improving instructional programs."[13] In these seminars, Stones was introduced to the work of psychologist B.F. Skinner, whose research focused extensively on harnessing developing technology for educational purposes through "programmed instruction."[14] The development of automated "teaching machines" was not meant to replace teachers outright, but to improve teaching by keeping up with a quickly changing technological landscape in which media like television had become commonplace. For Skinner, teaching machines were specifically meant to be interactive, surpassing passive reception by allowing students to take on active roles as they received information. Unlike perceived inertness of the television experience, the teaching machine could provide "immediate feedback" and "propose a

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the Internet Archive, captured June 09, 2016, https://web.archive.org/web/20160609020347/https://www.zakon.org/robert/internet/timeline/.

[11] As of March 2018, individuals affiliated with Pitt can still use the Andrew File System (AFS) for hosting content on the web. The instructions provided by the university still use screenshots taken from Netscape Navigator, suggesting that they may have not been updated for over two decades. "Help with HTML," University of Pittsburgh, http://technology.pitt.edu/help-desk/how-to-documents/help-html. AFS was developed by Carnegie Mellon University and is known for being an early, and important, distributed file system for the academic community. "Andrew File System," Wikipedia, s.v. last updated January 24, 2018. 20:41, https://en.wikipedia.org/wiki/Andrew_File_System.

[12] Carolyn Cline and Timothy Howard, "Los Angeles Times Pick for June 7, 1996," *Los Angeles Times*, June 07, 1996, http://www.latimes.com:80/HOME/BUSINESS/PICK/1996/pick960607.htm. Available courtesy the Internet Archive, captured May 09, 1997, https://web.archive.org/web/19970509105720/http://www.latimes.com:80/HOME/BUSINESS/PICK/1996/pick960607.htm.

[13] Russell Burris, Sheila McNally, and Alison Stones, *Research on New Approaches to Teaching Art History* (Consulting Group on Instructional Design, University of Minnesota, 1982), 2, 5-11. Skinner is cited as major foundation for this project in chapter 2.

[14] Stones specifically explained in relation to MedArt that she "became interested in active-learning aspects of pedagogical method while working on 'Programmed Learning' projects based on modified behaviourism at the University of Minnesota in the late 1970s and early 1980s." Stones, "Three Sites," 121.

system in which each student could move at his own" pace, two dynamics that Skinner argued were crucial for the development of active learning.[15]

In an approach centered on actively using technology to improve education, we find a model for the pedagogical framework behind Stones' early adoption of the technologies of the World Wide Web. But in fact, MedArt was not the first occasion Stones had used to experiment with a new technology for augmenting instruction. Starting in 1969 and continuing through the 1970's, Stones participated in a number of research projects at the University of Minnesota focused on innovating art history pedagogy, efforts which were well-documented in the co-authored report *Research on New Approaches to Teaching Art History*.[16] Initially the technology that Stones primarily relied upon was the "tape-slide," which enabled lecturers to pre-record a soundtrack on audio cassette tapes that would accompany, and automatically advance, a 35mm slideshow (Figure 1).[17]

Figure 1. Wollensak 3M, 2570AV Slide Sync Cassette Recorder, dated to 1970s. Hifiphilly [username], posted November 19, 2016, US Audio Mart, accessed March 28, 2018, http://www.usaudiomart.com/details/649313352-vtg-wollensak-3m-cassette-tape-deck-system-in-working-condition/.

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[15] B. F. Skinner, *The Technology of Teaching* (BF Skinner Foundation, 2016), 33.

[16] According to the published report, these projects were funded in part by the Educational Development Program of the University of Minnesota and the National Endowment for the Humanities (Grant No.: EH 9642-74-144). Burris, McNally, and Stones, *Research on New Approaches to Teaching Art History*, v.

[17] The tape-slide mechanism worked by encoding magnetic tape cassettes with two audio layers simultaneously— the first would be any recorded audio while the second would be special tones that triggered the slide changes. For compatible slide projectors, these tones would be inaudible, however, when the tapes were played on standard cassette tape players, the tones would be audible and could prompt manual slide changes as well.

Once recorded, these audio cassettes could be run through specialized tape decks connected to 35mm slide projectors or compact slide viewers, allowing educators essentially to create portable slideshows with audio accompaniment. In their final published report, Stones and her colleagues described precisely how they utilized these tape-slide units within their introductory art history curricula at the University of Minnesota. The tape-slide units themselves, along with written workbooks containing questions and information written by Stones and her colleagues, were held at centralized locations at the University of Minnesota's library and made available to students to watch on their own time.

In the report, Stones specifically endorsed the flexibility enabled by the tape-slides and the fact that, "the self-paced instructional materials are stored in the Learning Resources Center located in the University Library, so specific units can be made available even if the medieval survey is not being taught in a particular quarter."[18] The use of slides had long been standard practice within art history classes, but Stones here emphasizes the importance of Skinner's notion that students, "set their own pace; spending a great deal of time going over work that is new or difficult skipping rapidly over material that is familiar or easy."[19] The tape-slide technology was customizable in so far as students could rewind, pause, and fast-forward their way through the material. The teacher would no longer be solely in charge of the cadence and timing of the lecture. Stones followed Skinner's idea that individualized personalization and customization of the visual material was a principal method for, "stimulat[ing] active participation by asking students to test themselves on their comprehension of information and to use the information to solve new problems."[20]

This project, and others she was engaged with at the time, provided the opportunity for Stones to test her pedagogical conviction that students learn art history best when, "concepts are presented first on a purely visual basis." Accordingly, she described that she was, "concerned above all with developing students' visual perception," something she specifically contended was developed through, "exposure to a large number of slides."[21] It was a model of instruction that provided students with direct access to the visual material, but not without access to a contextual understanding offered by the instructor—that is, the workbooks and tape-slides offered a scaffold for understanding this visual material, to be perused at the students' own pace. Well before MedArt, then, Stones' pedagogical philosophy envisaged a method for learning primarily through visual means which could be tailored to each student, a mode in which students maintained agency and interest in how the visual material was navigated.

There were downsides to the tape-slides, however, and Stones' report described the ways that mechanical failures and large class sizes periodically made it hard for students to access the tape-slide material. By 1982, she recognized that the tape-slide technology might be outmoded by videotapes, which sacrificed the image quality of 35mm slides but offered gains in accessibility and convenience. As Stones explained, videotapes were expected to be, "smaller and easier to package and distribute [and eliminate] practical concerns such as keeping the slides in order and synchronizing the slide projector and tape recorder."[22] A little more than ten years after the rise of the videotape, of course, the World Wide Web would offer even further advances in this direction, making this visual material accessible to anyone with a connection.

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[18] Burris, McNally, and Stones, *Research on New Approaches to Teaching Art History*, 74.
[19] Ibid., 22
[20] Ibid.
[21] Ibid., 69-70.
[22] Ibid., 78.

What we find in Stones' extensive use of tape-slides, video tapes, and early experiments with the Web, then, was a consistent pedagogical approach to using technology as a means for providing increasingly individualized access to visual content, or, as it was initially described in a 1995 interview with Stones and Vadnal, "something better than textbooks with a scattering of photographs and drawings surrounded by columns of droning text, and supplemented by lectures with slides."[23] In each of these successive technological environments, there was a sense that pedagogical content could be encoded into a portable artifact so that students could then access that content on an individualized, and increasingly convenient, basis. From this point of view, the Web not only provided greater interactivity, it allowed for multiple users to learn from the same information simultaneously—something less feasible with tape slides or videotapes when checked out individually from a library. MedArt can be seen as the latest in a long line of experiments in Stones' career that worked towards providing the most convenient access to teaching materials to the largest number of students.[24]

Jane Vadnal

Stones may have come to this project through her own interests in educational technologies, but she has long credited the idea and early implementation of MedArt to Jane Vadnal, a student of hers who had enrolled at Pitt to obtain a Master's degree in art history after a career in information technology at Equibank.[25] As revealed by a 2009 account of MedArt's creation written by later MedArt contributor Philip Maye and presented publicly at the International Congress on Medieval Studies, Vadnal had worked as Stones' teaching assistant for long enough prior to the creation of the site to become familiar with Stones' tape-slide and workbook units, which, by that point, were operating on roughly 20-year-old technology. Maye's account also describes that Vadnal recognized the flaws in the tape-slide units, and, because she had become familiar with Mosaic and the Web from other projects, she "saw the potential of reworking [Stones'] materials for web use [by] scanning the images and creating web pages."[26] With input and resources provided by Stones, Vadnal built the site between 1994 and 1996, with the help of

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[23] Sajna, "Teaching the History."

[24] It is worthy of note that the creation of pedagogical image resources was not Stones' only early foray into the field of humanities computing. In an entirely separate project in the early 1980's, Stones collaborated with a Minnesota-based technology company Control Data, Inc. to explore the prospect of using computer technology to create a searchable database for an archive of images of illuminated manuscripts. In this report, the team presents "PARIS," which was to be "a vehicle for indexing, storing, and retrieving the pictorial information recorded in illuminated manuscripts." Alison Stones and Robert S. Arthur, "Manuscripts, Illumination, and Paris," in *Information Management and the Fine Arts* (Minneapolis, MN: Control Data Corporation, 1981).

[25] "[Vadnal] was working for me as a teaching assistant; she was in the master's program in art history. And she said one day, 'You know, you've got an awful lot of slides, why don't you let me scan them up and make a page for you.' And I said fine." Alison Stones, "Interview with Alison Stones," December 1, 2016. We were unsuccessful in our attempts to speak directly with Jane Vadnal about her participation in MedArt, despite numerous attempts. We reconstruct here all that we were able to glean from the archival documentation belonging to the project, as well as the recollections from Alison Stones and Phil Maye. Further evidence of Vadnal's past training comes from her curriculum vitae which remain on the archival hard drives of the project. Here we have seen that her CV lists her position at Equibank as "Senior Systems Analyst." Jane Vadnal, "Janevadnalcv2.doc," last updated August 27, 2007, Word document found on "Last Chance" hard drive at //Last Chance/VRCOLL-medart/JVadnal/Jandvadnalcv2.doc, formerly used by *Images of Medieval Art and Architecture*, collection of The Visual Media Workshop, University of Pittsburgh.

[26] Philip A. Maye, "History of MEDART.doc," last updated April 2, 2009, Word document found on "Last Chance" hard drive at //Last Chance/VRCOLL-medart/medart/Kalamazoo/History of MEDART, formerly used by *Images of Medieval Art and Architecture*, collection of The Visual Media Workshop, University of Pittsburgh.

volunteers, undergraduates, and graduate students.[27]

While we were not able to contact Vadnal directly, despite numerous attempts by Stones and the members of the "Sustaining MedArt" research team, our archival research and interviews with other project participants has demonstrated that it was Vadnal who provided the significant interest, principal labor, and technical expertise to adapt Stones' pedagogy and resources to the Web. Indeed, it was Vadnal who took the initiative to begin scanning the slides and then use HTML to publish the website in the first place. Stones noted that Vadnal also took the initiative to travel to Europe and take hundreds of photographic slides that would then be posted to the Web under MedArt's aegis.[28] It was also Vadnal who, in 1995, explained that she had recognized the "promise of the Internet"[29] as many as two years prior to the moment that the University of Pittsburgh began providing instruction for faculty in setting up their websites.[30] We also know from our archival research on MedArt's past hard drives, that in addition to being a graduate student in Art History, Vadnal also began a graduate degree in the University of Pittsburgh's School of Information Sciences. This training, alongside her clear interest in the history of art and architecture, suggests that she was aiming to develop the ideal skillset for a digital humanist in the days of humanities computing.

In fact, MedArt was only one of many digital humanities projects that Vadnal was involved with at the time. In 1995, while MedArt was still being built, Vadnal participated in the "Virtual Pompeii" project which was housed in the Studio for Creative Inquiry at Carnegie Mellon University and described as "virtual reality reconstruction of the Theater District in the Roman city of Pompeii" (Figure 2).[31]

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[27] Stones, "Three Sites," 115.

[28] Stones, interview.

[29] Sajna, "Teaching the History."

[30] "CIS Fall '96 Workshops," *University of Pittsburgh Computing and Information Services,* last updated September 19, 1996, http://www.pitt.edu/~workshop/. Available courtesy the Internet Archive, captured November 21, 1996, https://web.archive.org/web/19961121231237/http://www.pitt.edu/~workshop/.

[31] Jeffrey Jacobson and Jane Vadnal, "The Virtual Pompeii Project," ed. In G. Richards, *Proceedings of E-Learn 2005, World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education* (Vancouver, Association for the Advancement of Computing in Education, 2005) 1644-49, https://www.learntechlib.org/p/21434/.

Figure 2. Virtual Reality Lab at the Studio for Creative Inquiry, Carnegie Mellon University, *Virtual Pompeii (1996)*. "SFCI Archive: Virtual Pompeii (1996)," posted by Carnegie Mellon University's STUDIO for Creative Inquiry on Vimeo, https://vimeo.com/25042731. Screenshot by authors.

The project was sponsored, in part, by Silicon Graphics and displayed at the DeYoung Museum in San Francisco in 1995.[32] Vadnal was variously credited over time on that project as a "Historical Researcher" and "Art Director," and clearly assumed many different responsibilities for its production.[33] In addition to writing about the project in an article for *Archaeology* Magazine, she was co-author for a 2005 conference presentation describing the past and present of the Virtual Pompeii project. Like MedArt, Virtual Pompeii was built to be an educational tool "offered to the public."[34] For Vadnal, it seems, MedArt was merely one of several ways she was interested in using technology in the service of advancing art history scholarship.

The University of Pittsburgh

Both Stones and Vadnal were scholars who, for their own reasons, were ready to take advantage of the affordances offered to them by the early Web, and the University of Pittsburgh provided a climate

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[32] Jacobson and Vadnal, "The Virtual Pompeii Project," abstract.

[33] Jane Vadnal, "Virtual Antiquity," *Archaeology* 48, 5 (1995): 67-70. Vadnal is Credited as "Art Director" in her article in *Archaeology* and credited as the "historical researcher" on the virtual Pompeii website. "Contact & Credits," *Virtual Theatre District (VRML),* http://artscool.cfa.cmu.edu/~hemef/pompeii/credits.html.

[34] Jacobson and Vadnal, "The Virtual Pompeii Project," 5.

uniquely suited to fostering such early technological experimentation. In 1988, the University was constructing a campus-wide, Ethernet-based network that could connect out to BITNET, a wider network of university computing centers that had begun in 1981.[35] By 1990, Pitt announced that both, "…BITNET and INTERNET are available for electronic mail or file transfer."[36] In the year following this announcement, the options grew again to include, "BITNET, INTERNET, CCNET, NSFNET, and PREPNET."[37] By 1991, the University had branded their completed campus-wide Ethernet network "PittNet," and touted that it enabled, "users to communicate with each other...regardless of where they are or what device they are using" on campus.[38] One reason that Pitt was almost certainly on top of providing this type of connectivity was that it was a stakeholder in one of the six initial supercomputers networked together by the NSFNET, one of the infrastructural precursors to the global Internet (Figure 3).[39]
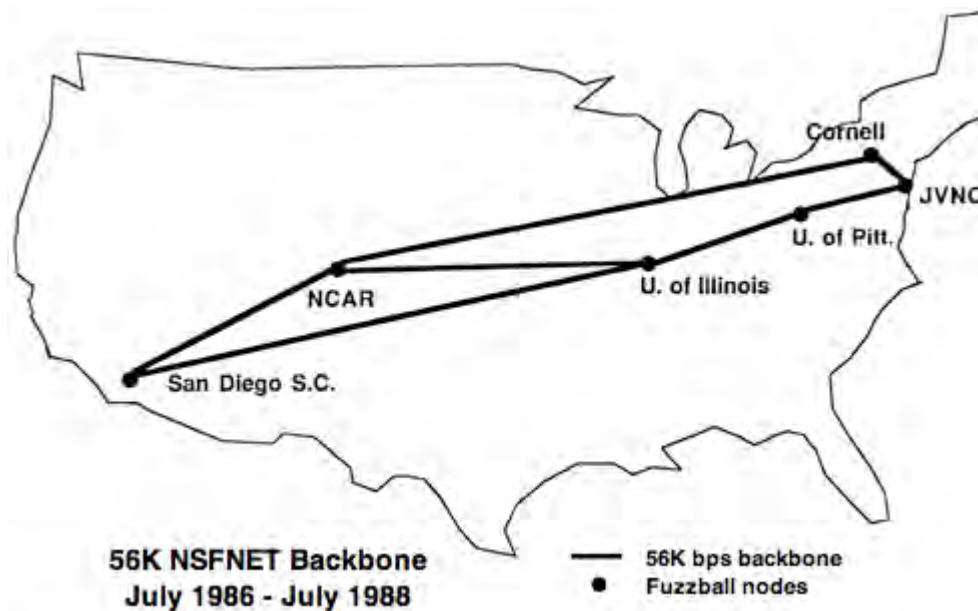

Figure 3. Map of the NSFNET 56K backbone as it existed between July 1986 and July 1988. Please note that while the dot representing the hub in Pittsburgh is marked "U. of Pitt," the Cray supercomputer housed there was a joint venture between the University of Pittsburgh, Carnegie Mellon University, and the Westinghouse Electric Corporation. *NSFNET 56K Backbone Map, July 1986 - July 1988.* Wikimedia Commons, accessed March 28, 2018, https://commons.wikimedia.org/wiki/File:NSFNET-backbone-56K.png.

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[35] University of Pittsburgh, *Fact Book, September 1988* (Pittsburgh: University of Pittsburgh, 1988), 95.

[36] University of Pittsburgh, *Fact Book, September 1989* (Pittsburgh: University of Pittsburgh, 1989), 97.

[37] University of Pittsburgh, *Fact Book, September 1990* (Pittsburgh: University of Pittsburgh, 1990), 109.

[38] University of Pittsburgh, *Fact Book, September 1991* (Pittsburgh: University of Pittsburgh, 1991), 103. Within institutional literature, the University of Pittsburgh mentions its connections to the Internet in 1989: "To access networks outside of the University, BITNET and INTERNET are available for electronic mail or file transfer." *Fact Book, September 1989,* 103.

[39] Pittsburgh was the final member to be added to this cohort after the initial instantiation of the John von Neumann Center at Princeton University, the San Diego Supercomputer Center at UC San Diego, the National Center for Supercomputing Applications at the University of Illinois at Urbana-Champaign, the Cornell Theory Center at Cornell University and the National Center for Atmospheric research in Boulder, Colorado in 1985. Boulder was the only subject-focused center on this net.

NSFNET was a "general high-speed network… connecting existing regional networks, which [the National Science Foundation] had created, and local academic networks."[40] This was to be an "inter-net" that connected numerous self-sufficient networks together, while initially also providing connections to ARPANET. When it began in 1986, NSFNET connected together the initial set of six supercomputers and their associated sub-networks, but by 1991, when it was upgraded to a T3-speed network (or ~45 MBPs), it connected sixteen major hubs that then linked out to 3,500 local and academic networks, providing a substantial part of material substructure of the early Internet.[41]

In 1992, Tim Berners-Lee posted the very first image to the World Wide Web, which had become by then a small, but quickly growing, set of interconnected, hyperlinked documents produced in a standardized markup language (HTML) and distributed over the Internet. [42] Within two years of this initial Web-based image, Vadnal and Stones had begun to pilot the project that developed into MedArt. The Web we take for granted today is largely populated by complex sites with meticulously constructed responsive interfaces, designs which have been informed by two-decades-worth of evolving design principles made possible by exponential technological advancements, but when the basic idea behind MedArt was being conceived in 1994, the Web was seen more as a platform for immediate, accessible communication.[43] For Vadnal and Stones, this new technical platform presented an opportunity to create pedagogical tools for activating and engaging with learners.

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[40] National Science Foundation, "The Internet - the Launch of Nsfnet," in *America's Investment in the Future* (Arlington, VA, National Science Foundation, 2000), 11, https://www.nsf.gov/about/history/nsf0050/pdf/internet.pdf.
[41] National Science Foundation, "The Internet - the Launch of Nsfnet," 12.
[42] Adam Clark Estes, "The Story of the First Photo on the Web," *Gizmodo,* January 16, 2015, https://gizmodo.com/the-story-of-the-first-photo-on-the-web-1686067248.
[43] For example one account in 1994 explains that the World Wide Web "stands poised to become the basis for the revolution in information and connectivity we've all read about but are still waiting to see." John December and Neil Randall, *The World Wide Web Unleashed* (Indianapolis: Net Publishing, 1994), 9.

Theme 2: Conditions of Persistence

In this theme, we will examine a few pivotal moments in MedArt's history, each of which demonstrates ways that the site was created, updated, and maintained in the past, providing lessons for sustaining digital scholarship on an ongoing basis. Despite the Internet Archive's periodic snapshots of the web, the forensic data pulled off of the project's archival hard drives, and multiple interviews with project participants, the "Sustaining MedArt" research team has concluded that we will probably never know the precise date that MedArt went live. The earliest evidence of MedArt's presence on the Web is offered by the Internet Archive, whose technologies created a site capture in late December 1996.[44] This was, indeed, the very same year that the Internet Archive began to collect images of the Web at all. However, MedArt's arrival on the scene may have predated that service by as much as a eighteen months.[45] While the December 1996 capture of the homepage bears a modified date of October of that year, internal pages, such as the landing page for "Medieval Architecture in England," are inscribed with earlier dates such as, "Last updated April 14, 1996 JV [Jane Vadnal]."[46] Moving a full year farther back in time, we know from reporting by Pitt's *University Times* that Stones and Vadnal had a pilot project focused on Chartres already available on the Web before March 1995.[47] Indeed, from published accounts offered by Stones, the project had received summer research funding from the Department of History of Art and Architecture in the summer of 1994.[48] It is our best guess that *Images of Medieval Art and Architecture* first went live onto the World Wide Web in that very summer, or by September 1994 at latest.

Snapshot 1: MedArt's Earliest Recorded Years, 1994-1996

Images of Medieval Art and Architecture has been consistently available to users on the Web for over 22 years. The earliest evidence of the project's look-and-feel at its inception is found in a site capture completed by the Internet Archive on December 22, 1996 (Figure 4).

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[44] The earliest site captures were created by the Alexa crawlers. To view all of the captures and redirects for the site http://www.pitt.edu/~medart, which is the earliest Web address for *Images of Medieval Art and Architecture*, see the calendar view of the Internet Archive, which spans from January 20, 1999-July 20, 2001, located at, https://web.archive.org/web/*/www.pitt.edu/~medart, last accessed March 28, 2018.

[45] Internet Archive, "Who was involved in the creation of the Internet Archive Wayback Machine*," Internet Archive FAQ*, n.d., https://archive.org/about/faqs.php#7.

[46] "Medieval Architecture in England," *Images of Medieval Art and Architecture*, last updated April 14, 1996, http://www.pitt.edu:80/~medart/menuengl/maintin.html. Available courtesy the Internet Archive, captured December 25, 1996, https://web.archive.org/web/19961225011836/http://www.pitt.edu:80/~medart/menuengl/maineng.html.

[47] Sajna, "Teaching the History."
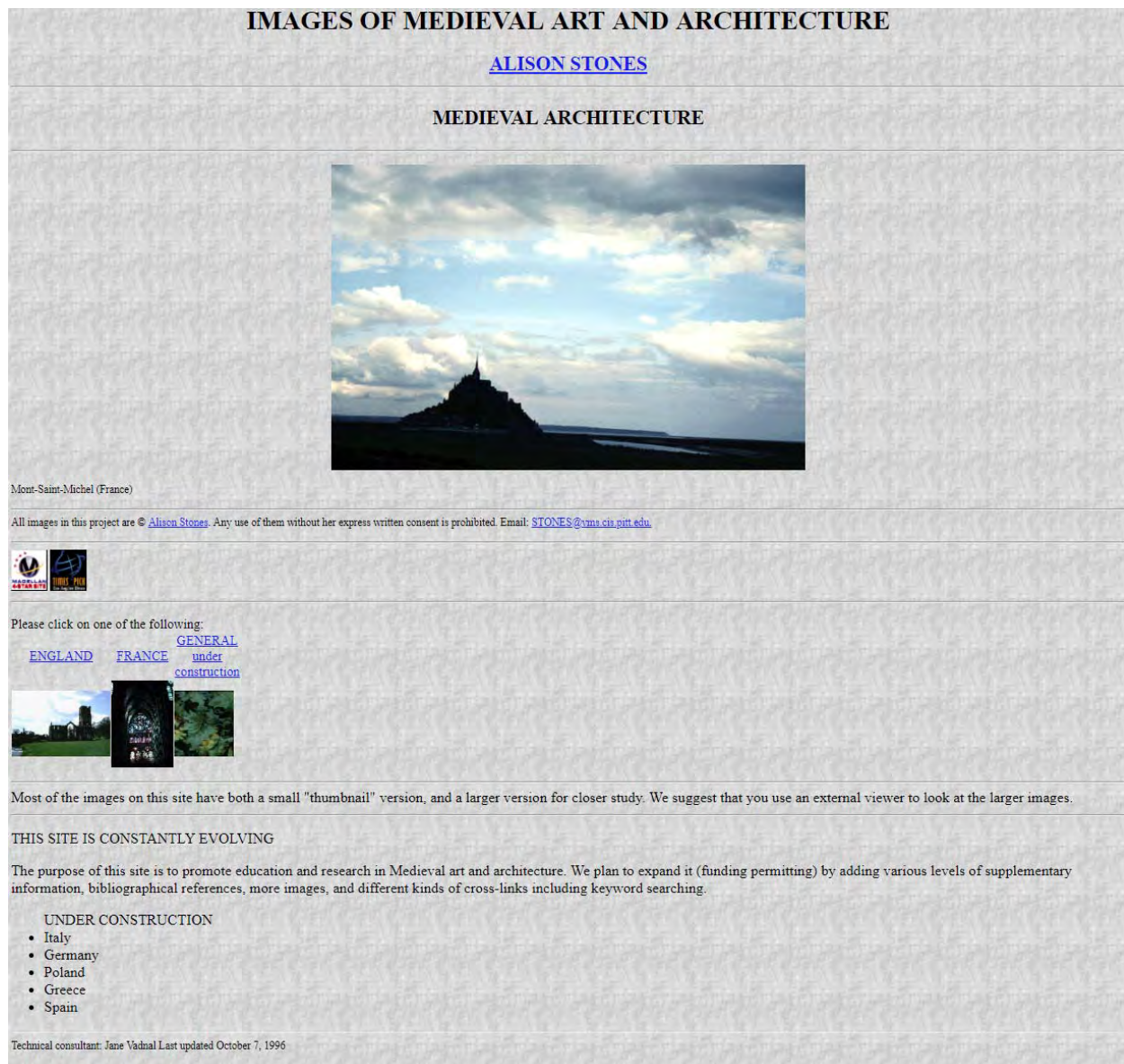
[48] Stones, "Three Sites," 121.

IMAGES OF MEDIEVAL ART AND ARCHITECTURE

ALISON STONES

MEDIEVAL ARCHITECTURE

Mont-Saint-Michel (France)

All images in this project are © Alison Stones. Any use of them without her express written consent is prohibited. Email: STONES@vms.cis.pitt.edu.

Please click on one of the following:

ENGLAND   FRANCE   GENERAL under construction

Most of the images on this site have both a small "thumbnail" version, and a larger version for closer study. We suggest that you use an external viewer to look at the larger images.

THIS SITE IS CONSTANTLY EVOLVING

The purpose of this site is to promote education and research in Medieval art and architecture. We plan to expand it (funding permitting) by adding various levels of supplementary information, bibliographical references, more images, and different kinds of cross-links including keyword searching.

UNDER CONSTRUCTION
- Italy
- Germany
- Poland
- Greece
- Spain

Technical consultant: Jane Vadnal Last updated October 7, 1996

Figure 4. Earliest screenshot of the homepage of *Images of Medieval Art and Architecture*, updated October 7, 1996, http://www.pitt.edu/~medart. Available courtesy the Internet Archive, captured December 22, 1996, https://web.archive.org/web/19961222212926/www.pitt.edu/~medart. Screenshot by authors.

Visually comparing this record of the site to the way it looks today (Figure 5), shows how little has changed over time in terms of MedArt's visual appearance. The project has not only stayed relatively stable in terms of its looks, it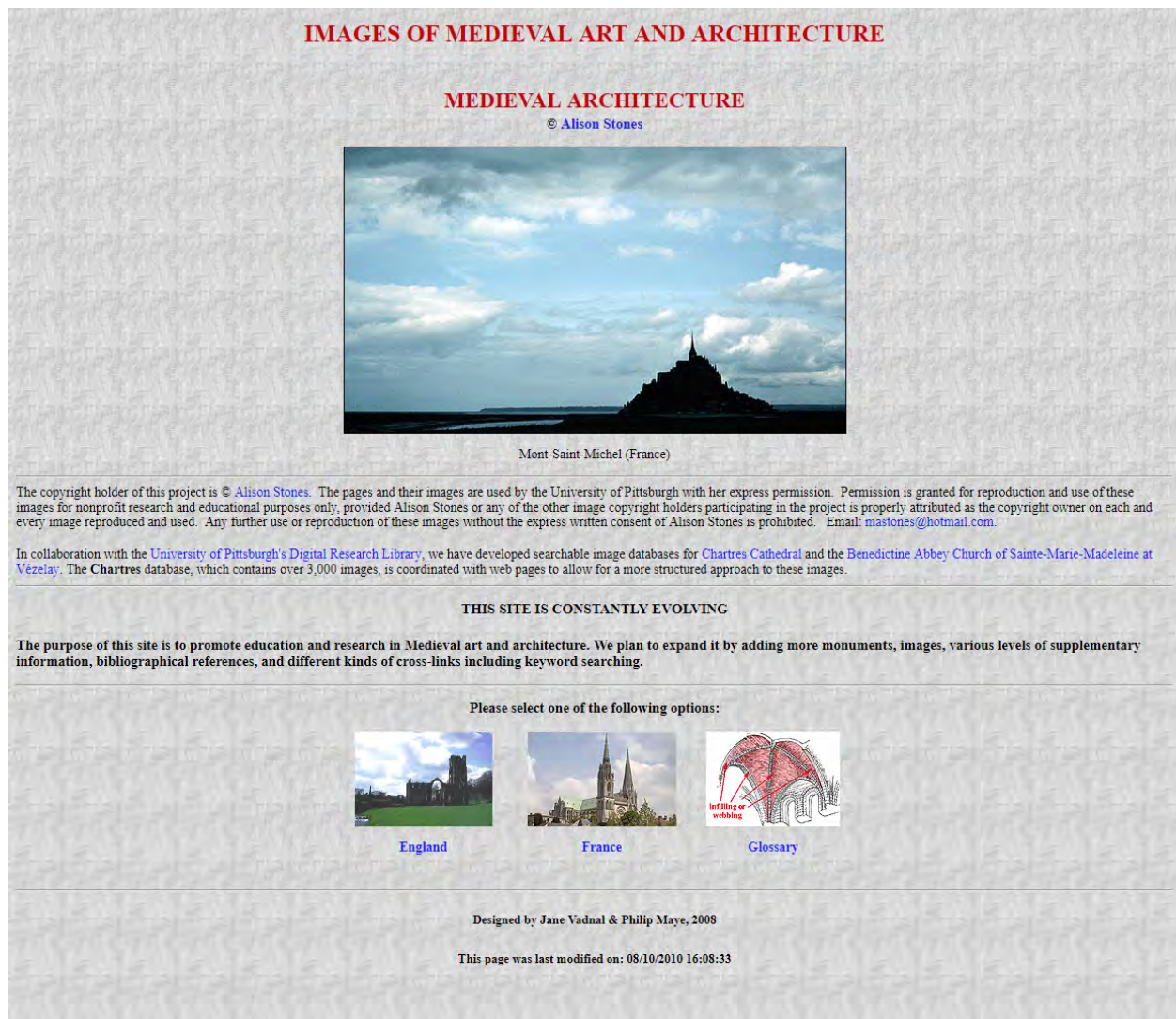 has also maintained its connection to its original URL, http://www.pitt.edu/~medart, which today redirects to http://medart.pitt.edu.

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Figure 5. Screenshot the homepage of *Images of Medieval Art and Architecture*, updated August 10, 2010, http://medart.pitt.edu. Screenshot by authors.

At its inception, Stones and Vadnal were committed to creating a substantial collection of images and interactive resources for use by students of medieval art and architecture, but they were also clearly aware of the time and effort this would take. While MedArt's general site structure and interface have changed relatively little since our first visual evidence from 1996, there have been a few noteworthy modifications and experiments over the years that reveal that the site was far from static. As noted on the very first incarnation of the homepage, and indeed on every subsequent homepage of this site—even to this very day—the site was to be "constantly evolving," a moniker that could be considered not only the motto of *Images of Medieval Art and Architecture* over time, but also for the World Wide Web itself.

Project Development

Jane Vadnal and Alison Stones had high ambitions for the site from the very start, a fact not only demonstrated their tireless efforts to post hundreds upon hundreds of images, plans, diagrams, and maps to the site by means of FTP and hand-coded HTML, but also in their experiments with other

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pedagogical materials made interactive by the affordances of the Web. As noted above, MedArt has long lived by the credo, "THIS SITE IS CONSTANTLY EVOLVING," a phrase that has appeared on the homepage since the earliest snapshots down to the present day (Figure 6). Each such "evolution" symbolized hours of labor behind the scenes, including travelling to locations to take pictures, meticulously scanning slides, or building webpages for new locations.[49]
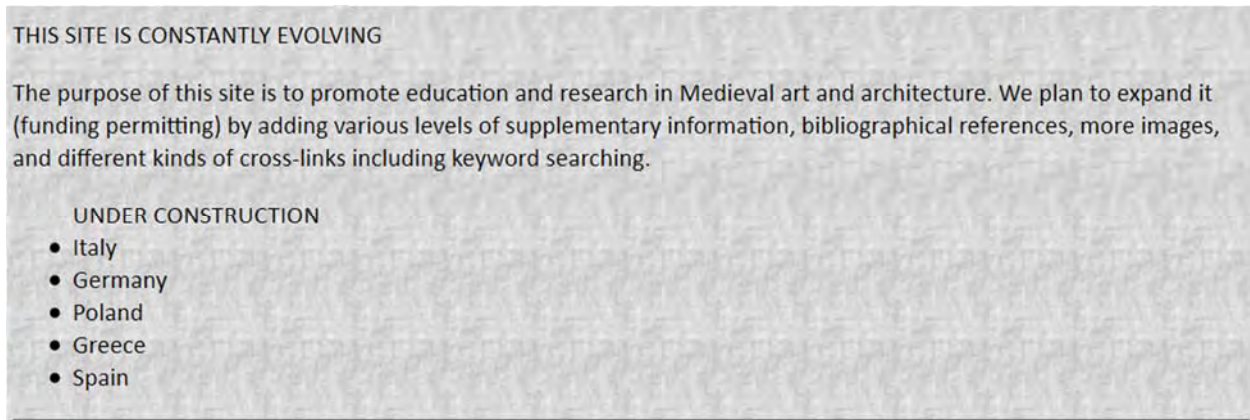

THIS SITE IS CONSTANTLY EVOLVING

The purpose of this site is to promote education and research in Medieval art and architecture. We plan to expand it (funding permitting) by adding various levels of supplementary information, bibliographical references, more images, and different kinds of cross-links including keyword searching.

UNDER CONSTRUCTION
- Italy
- Germany
- Poland
- Greece
- Spain

Figure 6. Detail of the screenshot of the homepage of *Images of Medieval Art and Architecture*, updated October 7, 1996, http://www.pitt.edu/~medart. Available courtesy the Internet Archive, captured December 22, 1996, https://web.archive.org/web/19961222212926/www.pitt.edu/~medart. Screenshot by authors.

Images of Medieval Art and Architecture has also always been somewhat of a misnomer geographically, as, in practice, the site has mainly focused on images of medieval England and France.[50] However, even the earliest screenshots show that the team was planning from the very beginning to post images from many additional European countries, such as Italy and Germany, but this would never come to pass. However, the "Sustaining MedArt" team has discovered, through our research on the archival hard drives of the project, that Vadnal had built a significant number of websites for these other European countries—they were simply never made public. It remains an open question as to why these countries were never added, but by around 2004 the statement promising they were under construction was taken off the front page. At the same time, we have found additional evidence in the metadata that the files pertaining to some countries, like Spain, were being worked on as late as 2008, indicating that there still was some intention to finish the pages for these countries even nearing the end of MedArt's active life.

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[49] Stones, interview. According to Stones, around 1998, Vadnal began contributing images to MedArt that she herself had taken while travelling through Europe. In the year 2000, Ruth Dean, a colleague of Stones' also donated her collection of slides to the project. For the earliest known mention, see "Medieval Architecture in England," *Images of Medieval Art and Architecture*, n.d., http://info.pitt.edu:80/~medart/. Available courtesy the Internet Archive, captured August 16, 2000, https://web.archive.org/web/20000816202109/http://info.pitt.edu:80/~medart/.

[50] There is a small exception to this rule for images of Vienna, which was briefly posted to the site in the year 2000. "Austria: Vienna," *Images of Medieval Art and Architecture*, last updated February 9, 2000, http://vrlab.fa.pitt.edu:80/medart/image/Austria/Vienna/vienna.html. Available courtesy the Internet Archive, captured May 10, 2000, https://web.archive.org/web/20000510042758/http://vrlab.fa.pitt.edu:80/medart/image/Austria/Vienna/vienna.html.

Just above the words, "UNDER CONSTRUCTION" in Figure 6, one can also see that Stones and Vadnal had planned to provide "different types of cross-links including keyword searching" for the site, but this too was something that would never come to pass. And, again, this is despite the fact that there is direct evidence that Vadnal had done significant amounts of work to make it so. The archival hard drives from the project contain a number of files entitled "forms1.html," which show her work on creating a search feature for the site. In one of these test files, she begins the body with, "<h1>Here's hoping</h1>," revealing both her hopes for and frustrations for this feature (Figure 7)[51]

Figure 7. Detail from the rendered file "forms1.html," last modified December 5, 1997, HTML document found on "Last Chance" hard drive at //Last Chance/PITT_EDU-medart/menuengl/forms1.html, formerly used by *Images of Medieval Art and Architecture,* collection of The Visual Media Workshop, University of Pittsburgh. Screenshot by authors.

Other copies of this file show that Vadnal eventually made more progress on the feature, but in the end, it was never successfully implemented. Despite a lack of coherent recordkeeping from these early days, forensic discoveries like these have been the key indicators of the trajectories of the team's initial goals for MedArt and their struggles in trying to meet them.

Beyond the homepage, the earliest years of this project also revealed the efforts made by the project team to produce resources that took advantage of the collection of images they were making. Beginning in Spring-Summer 1996 at latest, Vadnal and Stones created teaching materials that were in the same vein as Stones' tape-slide lectures, this time using the affordances of the Web to increase their interactivity and variety. In the Fall of 1996, Stones taught a version of "HAA 0050 Introduction to Medieval Art and Architecture" that integrated both web-based, interactive, pedagogical exercises and the images hosted by MedArt into the course curriculum in a number of ways. The syllabus for this course, which remains online at its original server location within MedArt's directory structure, not only included three paper assignments that linked directly to image resources, but also a chart comparing images of the west facades of French ecclesiastical structures drawn from MedArt, and a pair of interactive exercises designed to help students learn the professional nomenclature for the parts of these buildings (Figure 8).[52]

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[51] Jane Vadnal, "forms1.html," last updated December 5, 1997, HTML document found on "Last Chance" hard drive at //Last Chance/PITT_EDU-medart/menuengl/forms1.html, formerly used by the project, "Images of Medieval Art and Architecture," collection of The Visual Media Workshop, University of Pittsburgh.

[52] "HA&A 0050: Introduction to Medieval Art and Architecture," *Images of Medieval Art and Architecture*, accessed March 19, 2018, http://pitt.edu/~medart/courses/intromedieval/syllabus.html. Not all of the links resolve, but many of them still do. The version of MedArt found at this original location is in a state of graceful degradation.
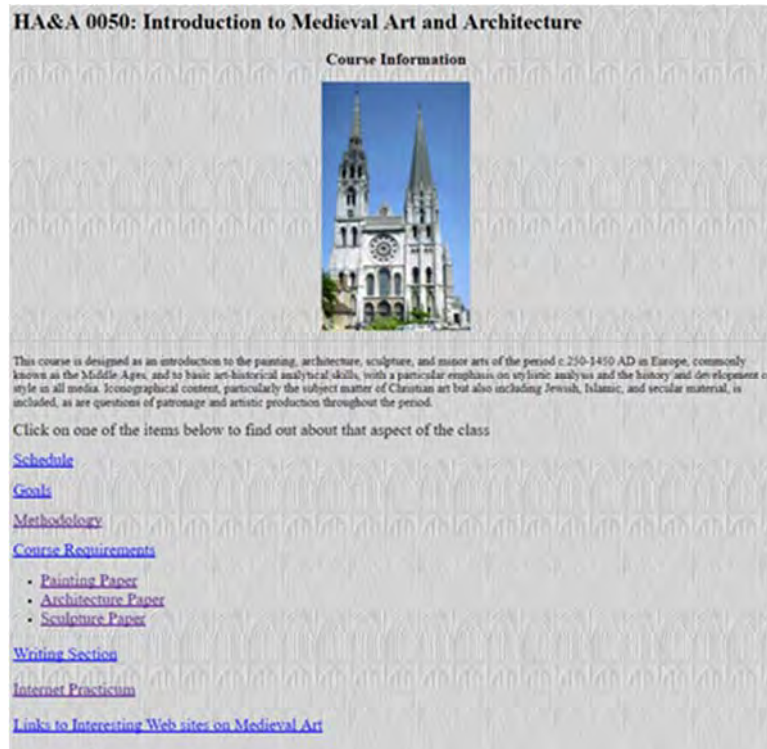
Figure 8. Screenshot of the online syllabus for the Fall 1996 class *Introduction to Medieval Art and Architecture*, updated April 16, 1997, http://pitt.edu/~medart/courses/intromedieval/syllabus.html. Screenshot by authors.

That the paper assignments posted to the Web included thumbnails and links to appropriate images housed within MedArt was part and parcel of Stones' original goals for MedArt, which were led by the desire to make finding images more convenient and accessible for her students.[53] Indeed, "Paper 2-Medieval Architecture" linked to six different cathedral pages on MedArt and asked students to examine one of them within an original, synthetic essay, "NOT an image-by-image analysis." (Figure 9).[54] Stones has mentioned that she had originally imagined that one of the primary goals for the project would be for students to be able to download images and "construct whatever it is that they wanted to construct."[55] Easy access to imagery facilitated Stone's emphasis on image-focused learning, allowing students to spend more time looking and writing, and less time hunting down images to include in their paper.

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[53] Stones, interview.

[54] "FA005: Introduction to Medieval Art, Paper 2-Medieval Architecture," *Images of Medieval Art and Architecture*, accessed March 22, 2018, http://pitt.edu/~medart/courses/intromedieval/paper2/menu1.html.
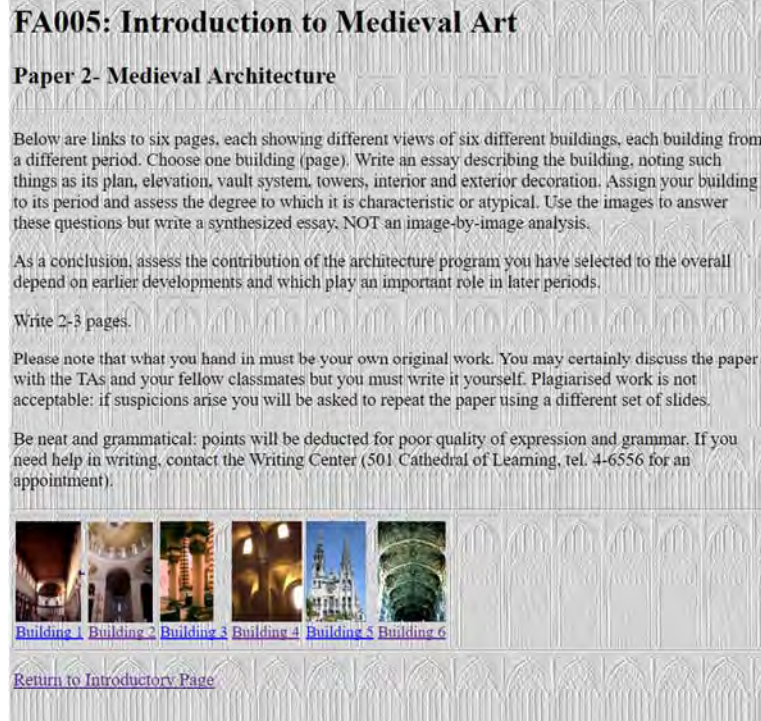
[55] Stones, interview.

Figure 9. Paper topic for Alison Stones' Fall 1996 class, which incorporated MedArt's images directly into the assignment. The course number FA005 is equivalent to HAA005. *Paper 2- Medieval Architecture*, updated November 10, 1997, http://pitt.edu/~medart/courses/intromedieval/paper2/menu1.html. Screenshot by authors.

The Fall 1996 syllabus for "HA&A 0050: Introduction to Medieval Art and Architecture" also made note of the existence of a weekly "Internet Practicum" that accompanied the lectures. Jane Vadnal herself served as the instructor for this practicum that had a stated, twofold mission, "First, the student will learn to scan and enhance images using Adobe Photoshop, and to use them to create [pages] on the World Web. Secondly, by working closely with these images, the student will gain an intimate understanding of [outstanding] works of Medieval art and architecture."[56] With session topics such as "Introduction to the World Wide Web," "Introduction to Adobe Photoshop, " and "Designing Glossary Pages," it would appear that this course rider doubled as a way to produce webpages for MedArt itself.[57] And, indeed, there are a scattering of folders on the original MedArt server that are named for students and contain pages created by them that also testify to this practice.[58] Stones and Vadnal were clearly interested, from the very beginning, in involving students in the continued development of the project, and felt that it was important and necessary for them not only to teach medieval art history but also the principles of Web design in these early years. This approach would also, of course, offer a way to sustain and improve the site by working within the academic infrastructure of Pitt. Stones would indeed later mention that she and Vadnal had been assisted by a, "large number of undergraduate and graduate students working for academic credit" when first producing the site.[59]

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[56] Syllabus for an "Internet Practicum," *Images of Medieval Art and Architecture,* accessed March 22, http://pitt.edu/~medart/courses/intromedieval/websection.html.
[57] Ibid.
[58] The most prominent of these folders was created by rcd9 [username], "Robin's Page," *Images of Medieval Art and Architecture*, accessed March 22, 2018, http://pitt.edu/~medart/courses/intromedieval/robin/.
[59] Stones, "Three Sites," 112.

Further pedagogical uses noted on that initial syllabus included a series of hypertext-based, interactive "quizzes" related to introductory topics in medieval architecture (Figure 10 a-b). In these quizzes, which were originally created in April 1997, students were to be asked to click on the part of the picture corresponding to a chosen architectural term or, conversely, click on a word corresponding to a particular part of an image. Depending on where they clicked, the browser would then redirect them to a page congratulating them on getting the question right or wrong. This sort of pedagogical interactivity fell right in line with Stone's "programmed-learning-based" approach to teaching.
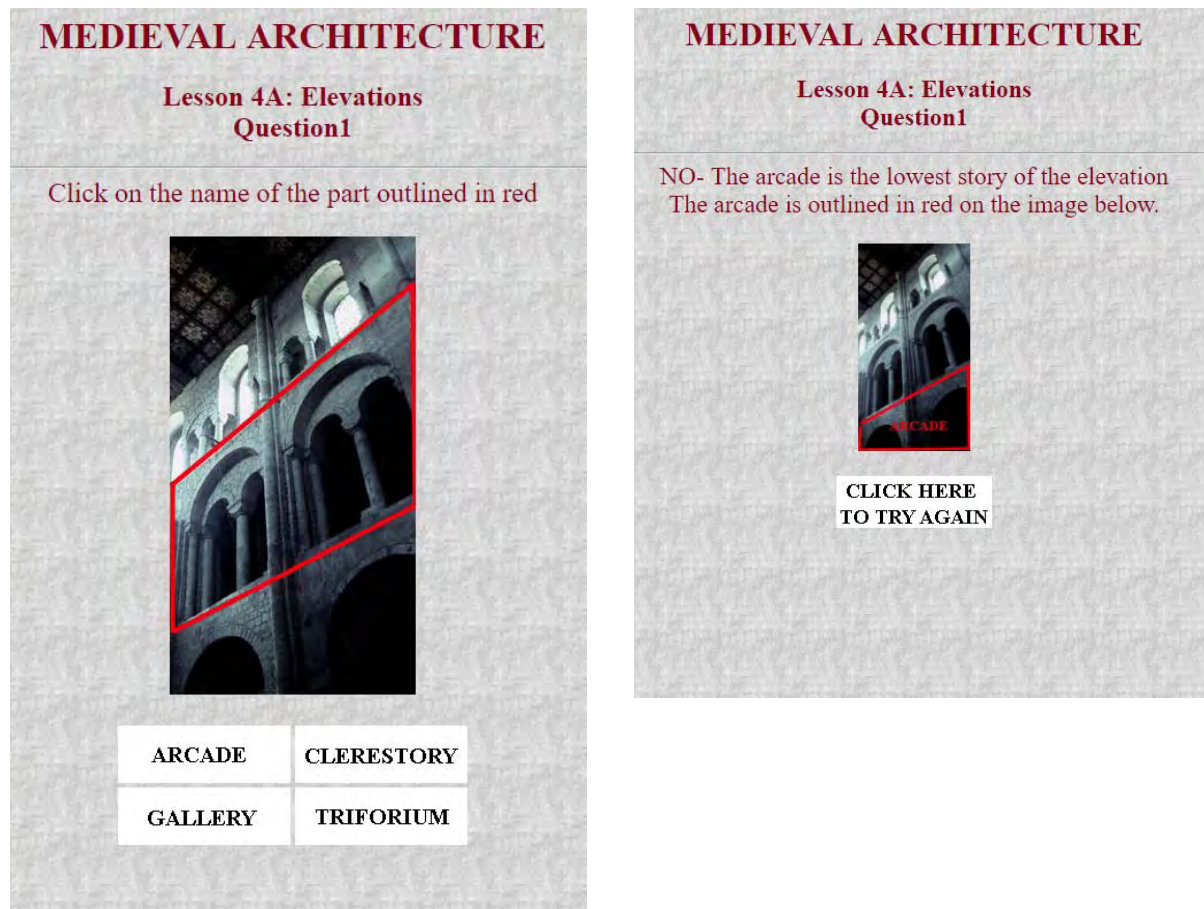

Figure 10 a-b. *A,* (left) "Question." *B,* (right) "Try Again." Prototype for an interactive quiz on MedArt's servers. *Lesson 4A: Elevations,* updated April 16, 1997, http://pitt.edu/~medart/grant/q3/q3.html. Screenshot by authors.

Finally, it was during this period that Vadnal, with help from a student (or volunteer) named Eric White, built out MedArt's glossary.[60] This glossary is the part of the site that currently receives the greatest number of hits, and in the user interviews conducted by the "Sustaining MedArt" team (discussed further in Theme 3), numerous scholars mentioned using this feature in their classrooms and on their syllabus to this day.

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[60] Eric White's name is scattered throughout the glossary entries. For example, his name appears in the 1997 updated definition of "Pendant." "Glossary of Medieval Art and Architecture," *Images of Medieval Art and Architecture,* last updated February 21, 1999, http://www.pitt.edu:80/~medart/menuglossary/INDEX.HTM. Available courtesy the Internet Archive, captured February, 21, 1999, https://web.archive.org/web/19990221163216/http://www.pitt.edu:80/~medart/menuglossary/INDEX.HTM.

Human Infrastructure

During these years, Stones and Vadnal were at the center of the creation of a project that was not only a thematic research collection made up of a gallery of digital images available to everyone on the World Wide Web, but also a pedagogical resource that directly responded to Stones' interest in active, engaged learning practices. It is clear, though, that they were not the only scholars working on the project. There was a large team of students who were working for academic credit on this project as well. Stones would also mention a bit later that they were also assisted by a number of volunteers, although it is unclear from the record how these volunteers were recruited.[61]

Through interviews and forensic evidence, we also know that while Stones always oversaw the project, and that she and Vadnal were close collaborators, Vadnal was doing most, if not all, of the work in supervising the team of students and volunteers, as well as building, maintaining, and updating the site. Stones has recounted how the pair would have ongoing discussions about page layouts—Vadnal arguing for the images to be clustered more centrally on the pages, and Stones arguing for a more distributed layout—but the daily interaction with the site itself was the work of Vadnal. According to Stones, then, the chief reason that her own name was so prominently listed in the masthead of the site, and the site lives under her copyright, was because she "was the one with the appointment at Pitt."[62] From our research, we also know that Vadnal was not always compensated for her labor as the years went on; she was clearly working on a labor of love.[63] Vadnal, like Stones, had a personal interest in MedArt's content and the larger project, but without an ongoing appointment at the university, her central role on the project was reliant on her own good will and willingness to work, often, for free.

Technological Infrastructure

The same years that saw MedArt's formation saw the formation of the World Wide Web itself. According to the Matthew Grey's early automated scans of the Web, in June of 1994 there were 2,738 active websites *total* on the Internet, but by June of 1996 there were approximately 230,000.[64] *Images of Medieval Art and Architecture* was a part of this growth, and was recognized as a noticeable player at the time by the early Web curation community infrastructure. Two badges of this type of recognition were prominently displayed on the front page by the time of our first site capture in December 1996 (Figure 11 a-b):

Figure 11 a-b. Images found on the earliest screen capture taken by the Internet Archive: *A,* "Magellan 4-Star Site" badge and *B,* "*Los Angeles Times* Pick" badge, *Images of Medieval Art and Architecture,* updated October 07, 1996, http://www.pitt.edu:80/~medart/. Available courtesy the Internet Archive, captured December 22, 1996, https://web.archive.org/web/19961222212926/http://www.pitt.edu:80/~medart/. Screenshot by authors.

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[61] Stones, "Three Sites," 112.
[62] Stones, interview.
[63] Philip A. Maye, "Interview with Philip A. Maye," December 06, 2016.
[64] Matthew Gray, "Web Growth Summary," *Internet Statistics*, Massachusetts Institute of Technology, 1996, http://www.mit.edu/people/mkgray/net/printable/web-growth-summary.html.

The "Times Pick" badge was an acknowledgment that MedArt had been mentioned on June 7, 1996 by *The Los Angeles Times* in a daily, web-based column featuring curated website recommendations. The posting for that day included a link to MedArt's page on the Chartres Cathedral in an article themed around "Notre Dame."[65] Meanwhile the "4-Star Site" rating from Magellan was a nod from the curated guide to the Internet produced by the search engine Excite. The Magellan group used the judgement of a,"team of editors and writers," who, according to their FAQ page from the time, evaluated sites on criteria such as comprehensiveness, innovation, ease of exploration, and whether or not the site is, "hot, hip, or cool."[66] These badges, which were joined by several others over the years, remained on MedArt's homepage until 2008.[67] These emblems provide some idea of how some visitors may have found MedArt during those first years. Before the dominance of search engines—Google, in particular—curated lists of new or interesting sites on the Web provided crucial network hubs, providing access to an array of other sites. These hubs and portals functioned also as gatekeepers to the extent that they disseminated information to larger groups of people and determined how individuals came across new content.

These badges also help articulate the ways that the MedArt team began to establish a form of credibility and scholarly authority as a website on the very early Web. As Kathleen Fitzpatrick has pointed out, peer-review for digital humanities projects has always presented its own set of difficulties.[68] While these badges were certainly not comparable to peer review, they do signify the team's desire to project a certain amount of credibility to early website visitors, using the very language of the Web. Other methods of asserting authority, such as the "pitt.edu" URL and Alison Stones' respected reputation, also came with the territory.

And, over the first years of the project, more and more people could be expected to stumble across, or even proactively search for the site. According to research conducted by the University of Virginia, in 1994 there were about 13 million worldwide households with Internet access, but by 1997, this number had increased to about 76 million, all potential visitors to MedArt.[69] While this number was large, it is

[65] Carolyn Cline and Timothy Howard, "Los Angeles Times Pick for June 7, 1996," *Los Angeles Times,* June 7, 1996, http://www.latimes.com:80/HOME/BUSINESS/PICK/1996/pick960607.htm. Available courtesy the Internet Archive, captured May 9, 1997, https://web.archive.org/web/19970509105720/http://www.latimes.com:80/HOME/BUSINESS/PICK/1996/pick960607.htm.

[66] From the FAQ's explanation of the categories for judging a website: "Depth: Is it comprehensive and up-to-date? Ease of Exploration: Is it well-organized and easy to navigate? Net Appeal: Is it innovative? Does it appeal to the eye or the ear? Is it funny? Is it hot, hip, or cool? Is it thought provoking? Does it offer new technology or a new way of using technology?" "Magellan's Frequently Asked Questions." *Magellan by Excite*, n.d., http://www.mckinley.com:80/feature.cgi?faq_bd. Available courtesy the Internet Archive, captured October 20, 1996, https://web.archive.org/web/19961020024949/http://www.mckinley.com:80/feature.cgi?faq_bd.

[67] Specifically there was the "Lightspan Study Web Academic Excellence Award" "Britannica Internet Guide" The Scout Report for Social Sciences Selection" and "Suite101.com Best of the Web." The badges are viewable in snapshots from the mid-2000's. "Medieval Architecture," *Images of Medieval Art and Architecture,* n.d., http://www.pitt.edu:80/~medart/. Available courtesy the Internet Archive, captured September 4, 2004, https://web.archive.org/web/20040904080148/http://www.pitt.edu:80/~medart/.

[68] Kathleen Fitzpatrick, "Peer Review," in *A New Companion to Digital Humanities*, ed. Susan Schreibman, Ray Siemens, and John Unsworth (Chichester: John Wiley & Sons, 2016), chap. 30, https://doi.org/10.1002/9781118680605.ch30.

[69] University of Virginia, "1994-2008 Web Statistics, U. Va." *Virginia*, last updated July 16, 2009, http://www.virginia.edu/virginia/archive/webstats.html. Available courtesy the Internet Archive, captured August 3, 2016, https://web.archive.org/web/20160803113833/http://www.virginia.edu/virginia/archive/webstats.html.

also worth recalling what it was like at the time to access the Internet. Whereas college campuses like Pitt generally had high-speed access to the Internet, most households relied on dial-up modems running 14.4kb or 28.8kb speeds and accessed the Web via metered service providers like CompuServe and America Online. And, even though Pitt was indeed so well-connected to the Internet, Stones noted at the time she was not able to use MedArt in the classroom in the early years because, even on Pitt's campus, it took too long to load the images on the fly from the Internet; instead she was looking into downloading the pages onto Zip drives and running the site locally for in-classroom use.[70] Much of what we take for granted about the Internet today—constantly updating content, a tremendous amount of server space, high-speed connectivity, interactive interfaces, reliance on search engines, social networking—did not exist when MedArt was being constructed and went live.

In that regard, it is important to acknowledge just how much MedArt's initial design was shaped by technological restrictions of the time. While Pitt was a relatively early adopter to the web, MedArt was particularly image-heavy and, therefore storage-intensive, so finding server space to host the site was always a challenge for the team. Stones remembered regularly having to campaign for more server space from "wherever" she could get it, a process which she described as "very frustrating in the initial stages."[71] Part of this issue was that conserving space resulted in a necessary sacrifice in image quality, even for the time—and many of these images persist on the site today. Stones recalled being disappointed by the image quality in the early scans of her slides, but these images were often further compromised when the files were compressed from the "tif" format to one requiring less memory (mostly jpg files). In fact, sheer technical practicality drove a lot of the early decisions regarding MedArt's design. In their meetings discussing the site, Stones and Vadnal would plan out MedArt's design and debate practical decisions. According to Stones, however, their aim was always to keep the site "as simple as possible" so that Vadnal would be easily able to update the site. The constant search for more server space would become a central technical impediment to the site over the next decade or so.

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[70] Stones, "Three Sites," 116.
[71] Stones, interview.

Snapshot 2: MedArt's Coming of Age with the Web, 1999-2000

In the years following its initial creation, *Images of Medieval Art and Architecture* grew in fits and starts. There were intense periods of scanning and posting images, spurred on by Stone's survey courses that integrated working on the Web into the curriculum, by Vadnal's photography trips to Europe, and eventually, by donations of images from fellow scholars.[72] Between mid-1999 and the end of the year 2000, Vadnal also overhauled some of the main internal navigation pages to accommodate this growth. Such changes were also concomitant with the arrival of a new server named "vrlab," housed directly within the Department of History of Art and Architecture.[73] Indeed, for MedArt, the turn of the millennium saw the drive to find server space for the project reach somewhat of a fevered pitch, and led to the distribution of the site across a number of different machines at the university.[74] The Web was maturing and more parts of the university were gaining access to its infrastructure, such that Web servers were no longer solely hosted centrally by the administration. Instead of moving the project wholesale to these new, department-level servers, however, the MedArt team retained the site's presence on the older machines, keeping all previous pages active, while turning to create new resources only on these new machines. The result was that MedArt became lodged on a warren of sites and sub-sites nestled on a number of different servers scattered across the University of Pittsburgh.

Project Development

As new images were created and posted during this period, Vadnal was making efforts to think about the ways that the nation-based navigation menu for England could better match the size and shape of MedArt's growing collection.[75] Originally, the menu page for this country consisted of a map of Southern England offering users the ability to click on marked locations that would then link them to the appropriate pages within the image collection (Figure 12). This map was the primary interface to navigate MedArt's group of images relating to English medieval architecture between 1996 and 1999.

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[72] Colum Hourihane of the (then) *Index of Christian Art* donated images during this period from his personal collection as did Ruth Dean, a venerable scholar of medieval French Literature who had amassed a significant collection of images of medieval architecture. For the earliest known mention of the Dean donation, see "Medieval Architecture," *Images of Medieval Art and Architecture*, n.d., http://info.pitt.edu:80/~medart/. Available courtesy the Internet Archive, captured August 16, 2000, https://web.archive.org/web/20000816202109/http://info.pitt.edu:80/~medart/.

[73] Moved to VRLAb in April 1999 based on "Medieval Architecture in England," *Images of Medieval Architecture*, http://vrlab.fa.pitt.edu:80/medart/menuengl/maineng.html. Available courtesy the Internet Archive, captured April 27, 1999, https://web.archive.org/web/19990427064932/http://vrlab.fa.pitt.edu:80/medart/menuengl/maineng.html.

[74] This included a mirror of the homepage "Medieval Architecture," Images of Medieval Art and Architecture, updated June 2, 1999, http://info.pitt.edu/~medart. Available courtesy the Internet Archive, captured October 6, 1999, https://web.archive.org/web/19991006001222/http://info.pitt.edu:80/~medart/.

[75] The nation-based navigation menu for France never appears to have been map-based. Instead, it relied on an alphabetized list of sites and monuments—the solution that would eventually be transferred to the menu for England as well.
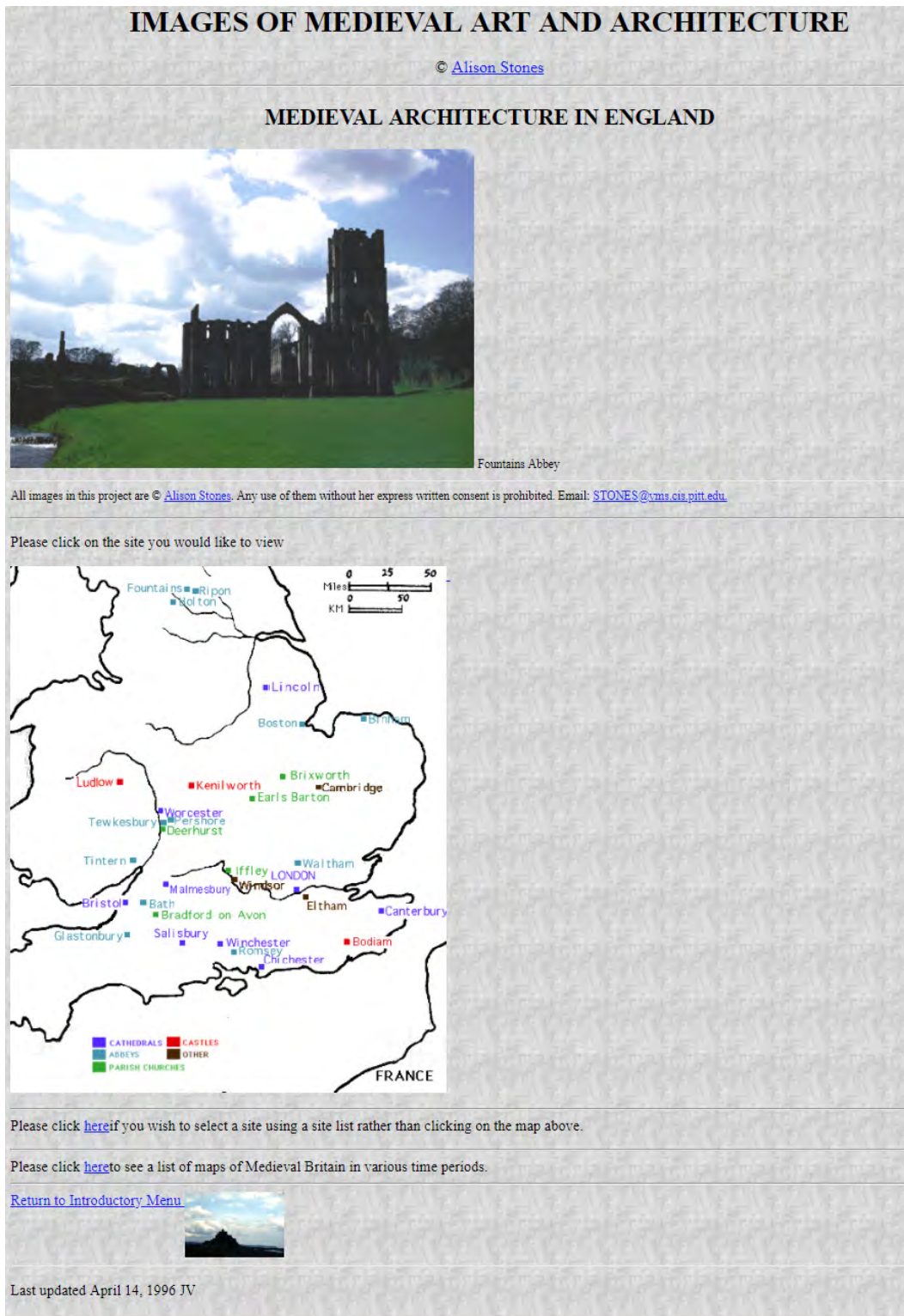
IMAGES OF MEDIEVAL ART AND ARCHITECTURE

© Alison Stones

MEDIEVAL ARCHITECTURE IN ENGLAND

Fountains Abbey

All images in this project are © Alison Stones. Any use of them without her express written consent is prohibited. Email: STONES@vms.cis.pitt.edu.

Please click on the site you would like to view

Please click here if you wish to select a site using a site list rather than clicking on the map above.

Please click here to see a list of maps of Medieval Britain in various time periods.

Return to Introductory Menu

Last updated April 14, 1996 JV

Figure 12. Menu page, "Medieval Architecture in England," *Images of Medieval Art and Architecture,* updated April 14, 1996, http://www.pitt.edu:80/~medart/menuengl/maineng.html. Available courtesy the Internet Archive, captured February 9, 1999, https://web.archive.org/web/19990209192034/ http://www1.pitt.edu:80/~medart/menuengl/maineng.html. Screenshot by authors.

To create this menu back in 1996, Vadnal used an early server-side mapping protocol called "HTImage" that used an executable binary file housed on the host server to resolve the user's clicks on the image map.[76] With the 1997 release of the HTML 3.2 specifications, these server-side image maps would be deprecated in favor of client-side image maps, and this preferred client-side solution would become commonly recognized by browsers in the years following.[77] By modern standards, the server-side method for creating image maps was quite cumbersome, but this technique was the best way to create this type of functionality at a time in the Web's history when client browsers could not be relied upon to recognize and resolve the action of a user clicking on a particular part of an image.

And indeed, Vadnal implemented these older types of image maps relatively widely across MedArt. They were clearly essential to the interactive, image-focused pedagogical goals that were the heart of the project. The original page for Chartres Cathedral, for example, was presented as a type of visual guided tour of the space, using a clickable, HTImage-powered image map to display hyperlinked thumbnails over a floor plan of the cathedral that were placed in locations that roughly corresponded to view sheds that would be possible from those spots (Figure 13).[78]

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[76] For more information, see "W3C httpd Clickable Image Support," W3C, https://www.w3.org/Daemon/User/CGI/HTImageDoc.html. The script itself was not a publicly facing page so the archived version no longer functions. However, on the AWS pages that use this technique and that are still hosted to the web, the HTImage script indeed still works. For example, see "France: Saint-Gilles-du-Gard," *Images of Medieval Art and Architecture,* last updated February 1998, http://pitt.edu/~medart/menufrance/sgilles/sgilmain.html. It is worth noting that the authors of this page are Vadnal and a colleague named Eric White, who we assume to be one of the many undergraduates working on the site.

[77] "13.6 Image Maps," HTML 4.0 Specification W3C Recommendation, revised April 24, 1998, https://www.w3.org/TR/1998/REC-html40-19980424/struct/objects.html#h-13.6. HTML 3.2 of January 1997 also included client-side image maps as an option, although the specification notes, "The MAP element provides a mechanism for client-side image maps. These can be placed in the same document or grouped in a separate document although this isn't yet widely supported." "Map," HTML 3.2 Reference Specification, copyright 1997, https://www.w3.org/TR/2018/SPSD-html32-20180315/#map.

[78] Jane Vadnal, "CHARTRES (CATHEDRAL OF NOTRE-DAME)," Images of Medieval Art and Architecture, n.d., http://www.pitt.edu:80/~medart/menufrance/chartres/charmain.html. Available courtesy the Internet Archive, captured December 27, 1996, https://web.archive.org/web/19961227053744/http://www.pitt.edu:80/~medart/menufrance/chartres/charmain.html

FLOORPLAN WITH IMAGES

To see a large version of one of the images, click on it. If an image is surrounded by a red border, clicking on it will bring up many images and other information.
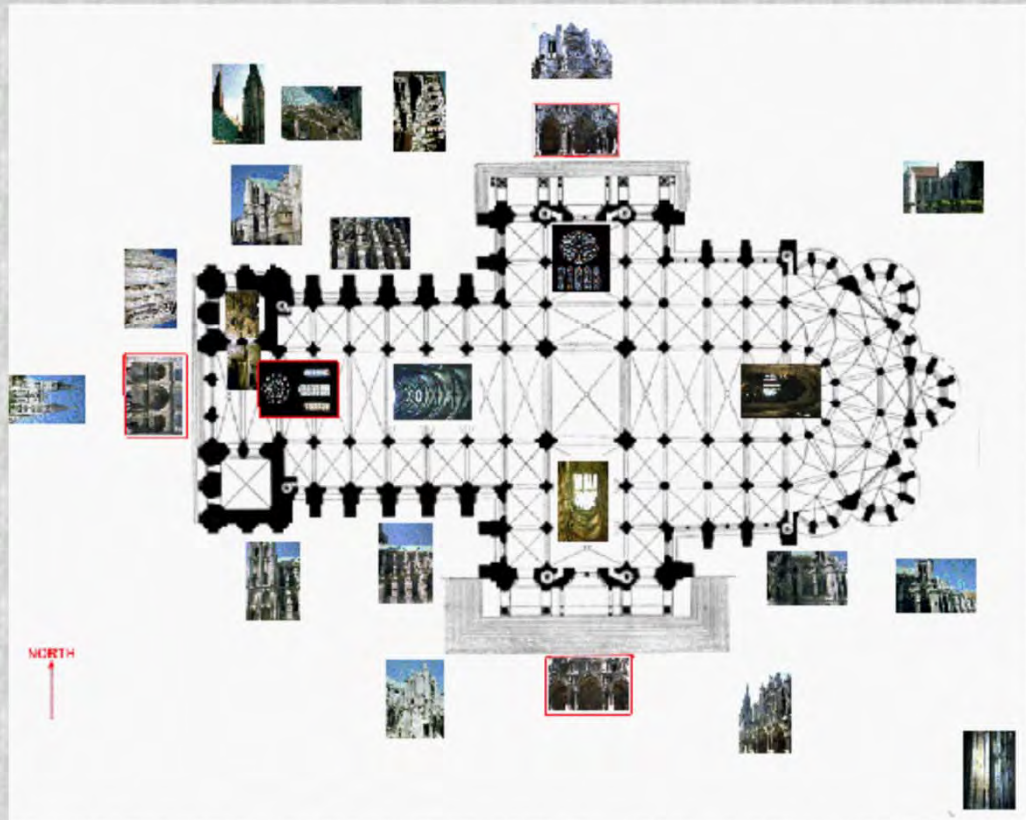
NORTH

Figure 13. The clickable floorplan for Chartres cathedral on MedArt in 1996. "France: Chartres (Cathedral of Notre-Dame)," *Images of Medieval Art and Architecture,* n.d., http://www.pitt.edu:80/~medart/menufrance/chartres/charmain.html. Available courtesy the Internet Archive, captured December 27, 1996, https://web.archive.org/web/19961227053744/http://www.pitt.edu:80/~medart/menufrance/chartres/charmain.html. Screenshot by authors.

The image map, as seen on Figure 13, had the accompanying instructions: "To see a large version of one of the images, click on it. If an image is surrounded by a red border, clicking on it will bring up many images and other information." Not only were images of these view sheds available, then, but also additional descriptive and interpretive information that would allow the user to make sense of the diagrammatic experience set before them. Such virtual guided tours were, of course, part of Stones' vision of an active, engaged pedagogy where students would be able to take the reins of their learning and "walk" around the site on their own. With their early use of server-side image mapping, Stones and Vadnal were pushing the available tools of the era to their limits in order to make their vision a reality.

However, by late 1999, client-side image mapping had become more wholly integrated into common Web architectures, and the team began to take advantage of this progress. At this same time, MedArt garnered server space on a new machine housed in the Visual Resources Lab in the Department of History of Art and Architecture, giving the project more server space and the chance to experiment with new ways of implementing their original ideas in a new setting. It was during this period of change that

Vadnal overhauled the navigational map that served as the primary point of access for the images of England. Indeed, this new menu was no longer just focused on England, due to the new images added to the project. It now offered access to the "Medieval Architecture of Britain."

Vadnal's new menu-map was much more comprehensive and included a significantly greater number of clickable locations (Figure 14).[79] Once again, each place name was meticulously hyperlinked to a corresponding page in MedArt's collection, although this time, Vadnal relied on the client-side image-mapping functionality now more widely supported by Web browsers.

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[79] The early 2000 Internet archive snapshot (dated on the page as December 1999) MedArt's England menu redirects user to pages hosted at the "vrlab" server. Medieval Architecture in England, Images of Medieval Art and Architecture, updated December 1999, http://www1.pitt.edu:80/~medart/menuengl/maineng.html. Available courtesy the Internet Archive, captured February 29, 2000, https://web.archive.org/web/20000229232507/http://www1.pitt.edu:80/~medart/menuengl/maineng.html. User redirected to "Medieval Architecture in Britain," Images of Medieval Art and Architecture, last updated January 2000, http://vrlab.fa.pitt.edu/medart/image/England/maineng.html. Available courtesy the Internet Archive, captured February 29, 2000, https://web.archive.org/web/20000229171734/http://vrlab.fa.pitt.edu:80/medart/image/England/maineng.html.
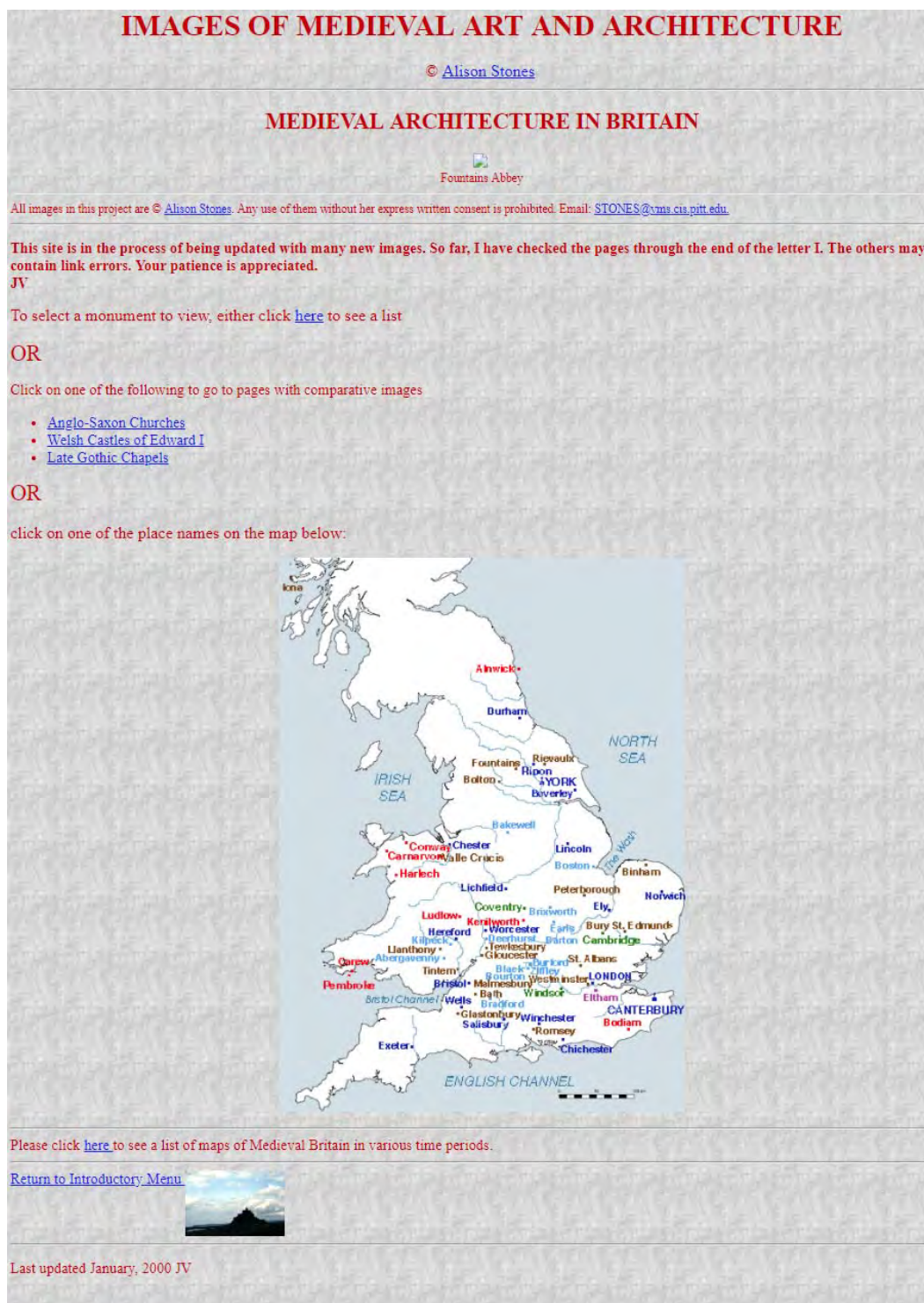
IMAGES OF MEDIEVAL ART AND ARCHITECTURE

© Alison Stones

MEDIEVAL ARCHITECTURE IN BRITAIN

Fountains Abbey

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This site is in the process of being updated with many new images. So far, I have checked the pages through the end of the letter I. The others may contain link errors. Your patience is appreciated.
JV

To select a monument to view, either click here to see a list

OR

Click on one of the following to go to pages with comparative images

- Anglo-Saxon Churches
- Welsh Castles of Edward I
- Late Gothic Chapels

OR

click on one of the place names on the map below:

Please click here to see a list of maps of Medieval Britain in various time periods.

Return to Introductory Menu

Last updated January, 2000 JV

Figure 14. Menu page, "Medieval Architecture in Britain," *Images of Medieval Art and Architecture,* updated January 2000. http://vrlab.fa.pitt.edu:80/medart/image/England/maineng.html. Available courtesy the Internet Archive, captured June 16, 2000, https://web.archive.org/web/20000616080635/ http://vrlab.fa.pitt.edu:80/medart/image/England/maineng.html. Screenshot by authors.

It is worthy of note that, at the same time that this new navigational map was added, another decision was made to relocate the link for the text-based navigation for these sites—that is, the hyperlinked, alphabetical list of locations that had always been an alternative, if somewhat hidden, way to browse for and find images—to a position above the map, making this way to use the site much more prominently visible and available to the users. This "text-forward" system would later become the primary means of navigating MedArt's image library sometime between May and December 2008, and would replace the map-based menus altogether.[80] As *Images of Medieval Art and Architecture* increased in size, it eventually became unwieldy to present a clear, functioning, map-based representation of all the available British sites.

Returning to the years 1999-2000, Stones and Vadnal also continued to work on translating Stones' active-learning-based pedagogical materials to the environment of the Web. The Spring Term 1999 version of the HAA 0050 syllabus, the same "Introduction to Medieval Art and Architecture" mentioned previously, demonstrates that the team had posted many more of the workbook materials and exercises to the Web (Figure 15).[81]

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[80] For the first known capture of the text-based menus, see "Britain," *Images of Medieval Art and Architecture,* n.d., http://vrcoll.fa.pitt.edu:80/medart/image/England/maineng.html. Available courtesy the Internet Archive, captured December 16, 2008, https://web.archive.org/web/20081216020153/http://vrcoll.fa.pitt.edu:80/medart/image/England/maineng.html

[81] "HAA0050 Introduction to Medieval Art and Architecture," [SITE NAME], n.d., http://vrlab.fa.pitt.edu:80/stones-www/stones-haa0050/index.html. Available courtesy the Internet Archive, captured November 28, 1999, https://web.archive.org/web/19991128111746/http://vrlab.fa.pitt.edu:80/stones-www/stones-haa0050/index.html.

HAA0050 INTRODUCTION TO MEDIEVAL ART AND ARCHITECTURE

SPRING TERM, 1999

Prof. Alison Stones

This site is copyrighted by Alison Stones. This means that it is available with her permission to students in HAA 0050 only. The site is accessed by limited access password (contact Prof. Stones for details). Each student may download or print one copy for personal use for this class only. Any other use of these images and text is an infringement of copyright and is a punishable offense.

CONTENT: This course is designed as an introduction to the painting, architecture, sculpture, and minor arts of the period c.250-1450 AD in Europe, commonly known as the Middle Ages, and to basic art-historical analytical skills, with a particular emphasis on stylistic analysis and the history and development of style in all media. Iconographical content, particularly the subject matter of Christian art but including Jewish, Islamic, and secular material, is also included, as are questions of patronage and artistic production throughout the period.

GOALS: Students will learn the basic skills of stylistic and iconographical analysis, both in terms of isolating the individual components of style or iconography and in terms of defining a style as a whole (construction and deconstruction, part:whole, whole:part). They will be able to relate these concepts to the stylistic periods of the Middle Ages and have a firm grasp of what constitutes stylistic development in all the media over the entire period of c.250-1450 AD. They will be able to ask questions about this material its context and its content, and answer them verbally and in writing, using sophisticated and accurate technical terminology.

METHODOLOGY

REQUIREMENTS

COURSE SCHEDULE:
Week I Chronology of the Middle Ages
Jan 12 History of the Church
        Techniques and media of medieval painting (wall painting, mosaic, illumination, stained glass)
        Workbook Units 1A, 1B, 50, 51,
        Section: Media: Ex. 51

Week II Methods: manuals, sketchbooks, and the concept of copying
Jan 19   Iconic and narrative traditions
         Iconography: Old and New Testament subject matter and typology;
         The Life of Christ
         Workbook Units 52, 53, 54, 55, 56
         Section: Ex. 53,56

Week III Iconography continued: The Saints, Secular Themes, Portraits,
Jan 26   Symbols
          Introduction to Style: Concepts of stylistic analysis
          Early Christian and Early Medieval
          Workbook Units 57, 58, 59, 101, 102,103
          Section: non-biblical subjects; style. Ex. 58, 59, Media and Iconography Exercise, 101, 102, 103

Figure 15. Syllabus for "HAA0050 Introduction to Medieval Art and Architecture," updated January 1999, http://vrlab.fa.pitt.edu:80/stones-www/stones-haa0050/index.html. Available courtesy the Internet Archive, captured November 28, 1999, https://web.archive.org/web/19991128111746/http:/vrlab.fa.pitt.edu:80/stones-www/stones-haa0050/index.html. Screenshot by authors.

Each week listed on this syllabus contained links to "workbook units," as well as other exercises (marked "media") for recitation/section. The "workbook" pages consisted of collections of images that appeared alongside additional interpretive information, all of which were thematically related to the subject of the lecture that week. One could think of these workbook pages as brief, thematic, "textbook-like" information resources. As would befit a survey course in medieval art, most of these pages documented both media and geographies that were not addressed by MedArt itself. In practice, this meant that, by and large, the images on the workbook pages were scans of materials found in books and other printed sources rather than images drawn directly from MedArt's library. For their part, the "exercise" pages were further developments of the interactive "quiz" prototypes mentioned above. They also used images from MedArt when appropriate, but mainly drew on images from elsewhere.

Because these workbook and exercise pages contained images belonging to other parties, they could only be distributed to the students by Stones and Vadnal under the copyright principle of Fair Use. To this end, the team used password protection to ensure that only their students could access these resources. This practice was, and still is, a sound one, but it had the effect of making these pages

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impossible for the Internet Archive to capture. While information about these resources cannot be found in publicly-accessible Web archives, an analysis of MedArt's archival hard drives has revealed that Stones would go on to use these pedagogical materials nearly up until the date of her retirement. Indeed, many of the files used for the Spring Term 2007 offering of HAA 0050 still bear modification timestamps dating back as far back as 1999 (Figures 16 and 17).

Figure 16. "Workbook unit 1A," last modified August 29, 2007 (created ca. 1998-1999), HTML document found on "Last Chance" hard drive at //Last Chance/VRCOLL-stones1/Stones-HAA0050/Section-1A/AngloSaxon.html, formerly used by *Images of Medieval Art and Architecture*, collection of The Visual Media Workshop, University of Pittsburgh. Screenshot by authors.

Figure 17. "Question 1 of Exercise 53," last modified January 18, 1999, HTML document found on "Last Chance" hard drive at //Last Chance/VRCOLL-stones1/Stones-HAA0050/Exercise-53-Iconography/question01.html, formerly used by *Images of Medieval Art and Architecture*, collection of The Visual Media Workshop, University of Pittsburgh. Screenshot by authors.

In Figure 17 (Question 1 of Exercise 53), we see another example of the team's success in creating the particular types of interactivity dear to the main project goals of MedArt from very simple technologies. In this case, we find that they used a relatively ingenious method of using HTML frames to create an exercise in which the source code did not reveal the results of the question until the user clicked the "Click here for answer" link. Because these particular exercises were based solely on HTML functionality, these pages still function quite well even when run directly from a local hard drive. Beginning with an introductory page, the student would click on a link that launched "question01.html." This file initialized two HTML frames, one over the other, set at 80% and 20% of the height of the window. Into the top panel was loaded, "question01top.html," while a blank HTML page, "empty.html," was placed below. When the user then clicked on the link to reveal the answer, "question01answer.html" was loaded into the lower frame, which not only provided the student with the correct answer but also with the ability to move to the next question.

What is particularly striking about this mechanism is that the technology was not present in order to automatically grade the students or check the veracity of their answers. Instead, it was setting up an environment in which the student was asked to proactively use their memory and identify the iconography of a given scene. As was common to pedagogies of "programmed instruction," it was not necessarily the automation of the grading that was the purpose of this approach—it was more the act of ensuring that the students did not remain passive in their education. By these simple means, students were being asked to directly interact with this resource and, should they wish to learn, actively use their minds to recall the iconographies. Although mechanisms to check the veracity of students' answers was indeed programmed into other exercises on this syllabus, when the student got the answer incorrect, the system did not simply tell them they were wrong and offer the correct answer, it also offered additional information to help them learn the difference between accurate and inaccurate responses.

Human Infrastructure

During this period, the staffing for *Images of Medieval Art and Architecture* appears to have been much the same, consisting of Stones and Vadnal at the center of a cluster of students and volunteer contributors. But there were other stakeholders in this process who became more visible at this historical moment, as it was at this time that Stones and Vadnal realized that the audience for MedArt was quite different from the small group of college students they had originally anticipated. The project had begun to receive correspondence from users all over the world, from elementary school students to scholars of medieval art scattered across the globe. The users of MedArt would contact Stones via the email address she published on the website for any number of reasons, from requests to use the project's images to simply offering their thanks. In retrospect, Stones explained that while she had expected the site to primarily serve as a resource for students writing papers, she also knew that the site could be used in novel ways and was happy for this to be the case.[82] However, when asked about the ways that these new user groups impacted the team's plans for the project, Stones stated the existence of these unexpected communities did not affect their plans much at all. The type of users the site received did not become a critical or central part of the team's decision-making process. MedArt was initially designed—as it continued to go on—as a functional, well-organized collection of images of medieval art and architecture arranged by geographic location.

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[82] Stones, interview and Stones, "Three Sites," 115.

Technological Infrastructure

In terms of the technological infrastructure for the project, during this period, MedArt became dispersed over a number of different Web servers. Between 1999-2001, the project was partially housed on no fewer than three separate servers, all of which saw ongoing development. By early 1999, a new redirect page had appeared at http://info.pitt.edu/~medart that would automatically send users to the main MedArt homepage hosted at its original location, http://www.pitt.edu/~medart.[83] That the project had garnered a presence as a subdomain of the central "PittInfo" site for the University of Pittsburgh demonstrated a certain prominence, but this new page also served as part of the technological solution to the problem that MedArt became scattered over multiple other servers by the end of that year.

Indeed, by October 1999, http://info.pitt.edu/~medart was no longer simply a redirect page to the original server, but had become a complete copy of the project's homepage whose links no longer sent requests solely to the original server housed on the Andrew File System, but also to a new server named "vrlab," a machine located directly within the Department of History of Art and Architecture.[84] Judging from evidence gleaned from the Internet Archive, it would appear that Vadnal, along with contributors Eric White and G. David Donahue, were creating pages on the new "vrlab" server as far back as mid-1998, but the new server would only truly be in full swing by the following year.[85] Webpages such as those for Saint-Gilles-du-Gard, Saint-Denis, and Vézelay all appear to have been first created on the "vrlab" server, while all of the resources that preceded them stayed in their original location to be maintained and updated in situ. In mid-2001, the "vrlab" files would again move to a new departmental server named "VRCOLL," but this time, the old server was removed from the Web altogether.[86]

All of these different machines have left their traces not only within the Internet Archive but also on the archival hard drives that remain the responsibility of the MedArt project. These storage devices contain copies of the original information housed on these Web servers at the moment of their decommission in 2010. In many respects, the current research project has had access to quite a bit of information about the historical aspects of MedArt, such as the interactive pedagogical exercises above, *only* because the original MedArt team used their servers as a form of digital palimpsest. Many of their files were used,

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[83] To view all of the captures and redirects for the site http://info.pitt.edu/~medart, see the calendar view of the Internet Archive, which spans from January 20, 1999-July 20, 2001, located at https://web.archive.org/web/*/info.pitt.edu/~medart, last accessed March 28, 2018.

[84] "Medieval Architecture," *Images of Medieval Art and Architecture*, updated June 2, 1999, http://info.pitt.edu/~medart. Available courtesy the Internet Archive, captured October 06, 1999, https://web.archive.org/web/19991006001222/info.pitt.edu/~medart.

[85] White and Donahue were very likely to have been Pitt undergraduate students, although due to a lack of records, they could also have been volunteers on the project. Overall, the 1997-1998 period in MedArt's history is a bit trickier to piece together than many others because the Internet Archive data has a conspicuous absence of new site captures for the entire year of 1998. Perusing other captured sites from the time, it would appear that there was a low ebb of capturing activity from the Internet Archive's crawlers during this year, and so it is unlikely that this was caused by an activity on the part of Vadnal or Stones. Either way, the end result is that we have no direct evidence of how the site changed between late 1997 and all of 1998. For evidence of this gap, see the calendar view of the Internet Archive for http://www.pitt.edu/~medart, which spans from December 22, 1996-September 2, 2017, located at https://web.archive.org/web/*/www.pitt.edu/~medart, last accessed March 28, 2018.

[86] For the first time that the links resolve to "vrcoll" rather than "vrlab," see "Medieval Architecture," *Images of Medieval Art and Architecture,* n.d., http://www.pitt.edu:80/~medart/. Available courtesy the Internet Archive, captured November 07, 2001, https://web.archive.org/web/20011107102103/http://www.pitt.edu:80/~medart/.

updated and reused. In addition, as new resources were created, if there were older versions available, they were often left accessible in their previous locations and allowed to gracefully degrade in place.

Furthermore, the MedArt team used their servers not only as a way to post their materials to the Web, but also as a project "file share" drive. Personal documents were mixed in with professional documents and MedArt files can be found alongside the files for a number of other digital projects launched by Stones and her collaborators. Indeed, the file listings on the archival hard drives are often difficult to parse due to the intermingling of the numerous types of projects and deliverables that this team was responsible for producing. That said, it is the reliance on this shared site of project documentation—along with the hard work of the Internet Archive—that has allowed us to piece back together the history of *Images of Medieval Art and Architecture*. There was no proactive project documentation that helped us make sense of these hard-drive palimpsests; they came to us as unprocessed archival collections.

Indeed, these hard drives are the *only* source of information about a number of deliverables associated with the MedArt project, such as the pedagogical exercises made and updated during the 1999-2000 period. Because these webpages contained copyrighted information which the team protected with a password, they were inaccessible to the crawlers of the Internet Archive. In fact, from Stones' own point of view, copyright was one of the most critical bottlenecks for the *Images of Medieval Art and Architecture* project full stop.[87] She felt that it was US copyright law that prevented MedArt from growing beyond a ragtag collection of architectural images that Stones has typified as more "random" than systematic, to become a site truly devoted to both art *and* architecture.

While architectural photographs tend to be taken in public such that the rights to use such images belongs to the visitor, it is not necessarily so in museum or library settings. As a scholar of medieval manuscripts by training, Stones has stated that, given the choice, she would have begun MedArt as a collection of medieval manuscript images, but that the libraries that held, and continue to hold, these objects would not allow their images to be offered freely online. Especially at the turn of the millennium, such institutions often maintained incredibly strict control over the rights to use images of the objects in their collections. Such conduct, of course, disallowed the MedArt team from posting many images of objects of medieval art to the open Web, and required them to implement password protection when they were indeed used. For Stones, this limitation on the types of images MedArt could post was also a real hindrance to using the website directly in the classroom, as it made it impossible to construct a fully-formed pedagogy based solely on the architectural images that the team was able to post.[88] Restricted, as they were, to using only those images of medieval architecture to which they held the copyright or that their colleagues allowed them to share online, the MedArt team was fully hindered in their desire to create a complete resource of images of medieval art and architecture.

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[87] Stones, interview.
[88] Ibid.

Snapshot 3: MedArt's "High Point:" 2004-2006

The period between 2004 and 2006 would see significant changes made to the interfaces and the collections of the *Images of Medieval Art and Architecture* project. Not only did the team garner a new technical developer, Philip Maye, but they also began a major collaboration with the University of Pittsburgh's Digital Research Library. At this time, Maye would also produce some of the most complex visualizations that the project would ever support. These changes would constitute the last push of active development on the MedArt website to date.

Project Development

During this period, the MedArt team entered a major new phase of production focused on the photographic documentation of Chartres Cathedral. The history of this chapter of the project is well summarized by a text posted to the site itself in 2006:

> In 2004 Alison Stones, in collaboration with Ed Galloway of the Digital Research Library, planned a 1,500-image web image collection devoted to Chartres Cathedral. Beginning in May 2004, Jane Vadnal wrote planning documents, organized existing images, and drafted initial metadata on the windows. In Spring 2005, Dr. Stones' Chartres Cathedral Seminar studied the cathedral, both in class for a semester and on site for two weeks, during which half of the website's photographs were taken. The classroom component involved research on specific windows and other features for the website. After the return from Chartres, the website was transformed by the addition of many photographs, more extensive metadata, over 70 diagrams, and bibliographies. Led by Alison Stones, the main project team now consists of Jane Vadnal and Philip Maye, assisted by Julia Wozniak and many contributing photographers.[89]

As was the case back at the founding of the project, the MedArt team had again tied the ongoing development of the website to a course led by Stones. This time, the class in question was not an undergraduate survey, however, but a graduate seminar focused on Chartres Cathedral that then concluded with a two-week, on-site photography trip.[90] The seminar itself was focused on the cathedral, but also on the creation of this new image resource. Ed Galloway, the head of the Digital Research Library, attended a number of the class sessions to discuss plans for the project, and the coursework of the seminar was tied to the eventual photographic assignments that each student would receive on the trip. The webpage that contained the credits for the Chartres project included a list of more than a dozen individuals involved in some capacity with the site, as well as a picture of the group that travelled over to France.[91] This cohort consisted of students from the Chartres seminar as well as friends and family of the MedArt team. It is clear that this group worked very diligently on this project, as what was planned to be a collection of 1,500 images of Chartres, ended up having twice that number.[92]

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[89] "The Site's History and Contributors," *Images of Medieval Art and Architecture,* last updated April 30, 2009, http://medart.pitt.edu/image/France/Chartres/Chartres-Cathedral/Site-History/Site-History-and-Contributors.html.

[90] While this was a graduate seminar, at least two undergraduates participated, including Philip Maye himself.

[91] "The Site's History and Contributors," *Images of Medieval Art and Architecture,* last updated April 30, 2009, http://medart.pitt.edu/image/France/Chartres/Chartres-Cathedral/Site-History/Site-History-and-Contributors.html.

[92] This was highlighted in the title of a 2005 press release, "Pitt Unveils Website That Includes More Than 3,000 Images of Chartres Cathedral," University of Pittsburgh News Services, October 20, 2005, http://www.news.pitt.edu/news/pitt-unveils-web-site-includes-more-3000-images-chartres-cathedral.

Stones has described the Chartres project as a "high point" in the history of MedArt, and indeed it was a period of dramatically renewed attention to the site.[93] Besides providing a huge amount of new photographic content, this undertaking also saw the increased involvement of the University of Pittsburgh's Digital Research Library (DRL), an internal institutional partner. The DRL participated directly in the design of the Chartres project because they had signed on to become the sole hosts of the images produced by the team in their professionally-run content management system based on the Digital Library Extension Service platform (DLXS).[94] This was, in fact, not the first collaboration between MedArt and the DRL, as the groups had worked together the year prior to post a library-hosted collection of images of the Benedictine abbey church of Vézelay.[95] Maye would later recall that Vézelay was a form of "test run" for the Chartres project.[96]

For the MedArt team, this collaboration with the library was beneficial on a number of levels, not least of which was that the DRL agreed to serve as the host for the thousands of images, taking the lead on providing the necessary extra server space that had, for so long, been a bottleneck for MedArt.[97] However, moving these images to the library's servers would also have disadvantages for the team, including a loss of direct control over their organization as well as the creation of yet another server warren housing a small part of the overall MedArt project. The DLXS platform used by the Digital Research Library allowed the MedArt team to construct URL-based queries to retrieve particular images (or particular sets of images), and indeed many new pages were created on MedArt's home servers linking out to the DRL's repository. This work was accomplished by Jane Vadnal and a new addition to the technical team, Philip Maye.

Philip Maye was a "second-career" student who had returned to Pitt to finish an undergraduate degree in art history when he began contributing to MedArt. Maye was a student in Stones' Spring 2005 Chartres seminar and travelled with the class to photograph the cathedral. By Maye's own account, he had taken several classes with Stones prior to the Chartres seminar, but it was only after returning from that trip that he became involved with the site itself.[98] During this period, Vadnal and Maye would, between the two of them, create over 20 new subpages for the Chartres section of MedArt corresponding to different facets and areas around the cathedral (Figure 18). In this final phase of the site's active creation, Maye would also become a driving force for technological innovation.

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[93] Stones, interview.

[94] "The Digital Library Extension Service," DLPS University of Michigan, http://www.dlxs.org.

[95] The DRL Vézelay site was first promoted on MedArt sometime between January and May 2004: "Medieval Architecture," I*mages of Medieval Art and Architecture,* n.d., http://www1.pitt.edu:80/~medart/. Available courtesy the Internet Archive, captured May 11, 2004, https://web.archive.org/web/20040511224819/http://www1.pitt.edu:80/~medart/. It can now be found at "Vézelay: Benedictine Abbey Sainte Marie Madelein[e]," *ULS Digital Collections,* University of Pittsburgh, http://digital.library.pitt.edu/collection/v%C3%83%C2%A9zelay-benedictine-abbey-sainte-marie-madelein.

[96] Maye, interview.

[97] "Chartres: Cathedral of Notre-Dame," *ULS Digital Collections*, University of Pittsburgh, http://images.library.pitt.edu/c/chartres.

[98] Maye, interview.
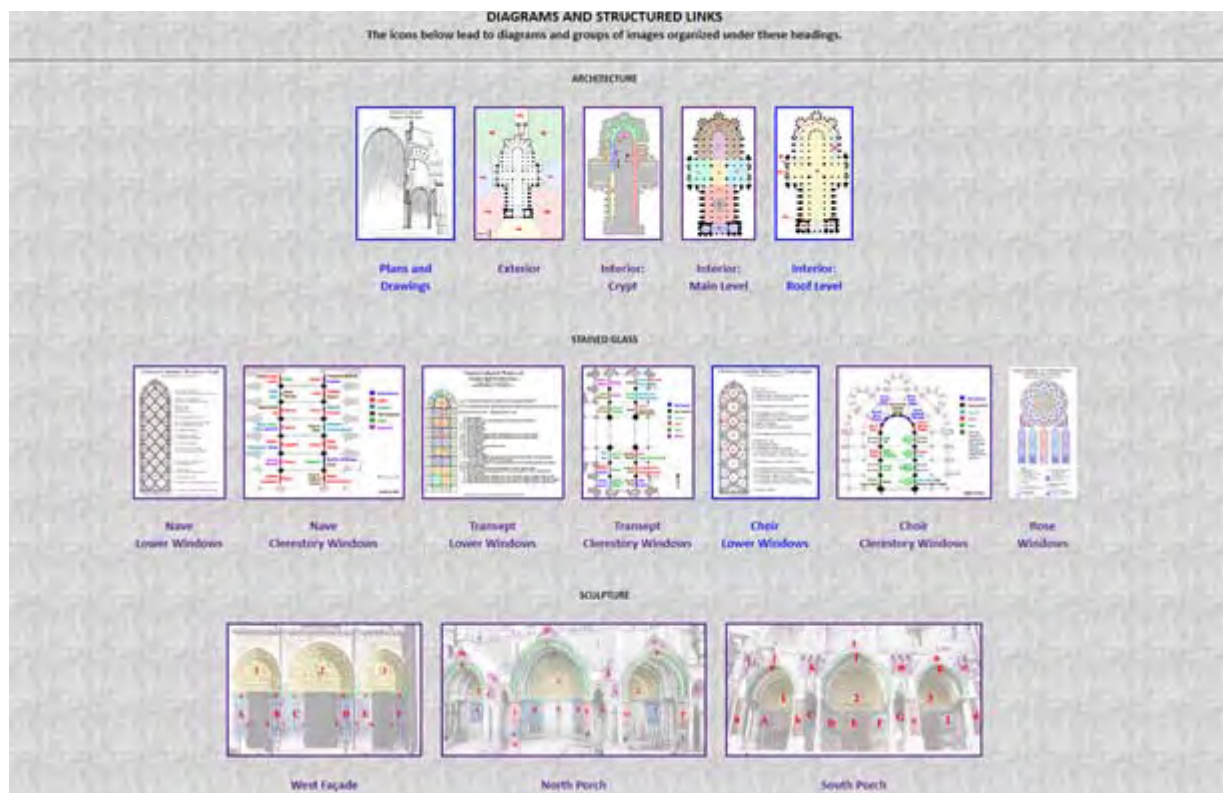
Figure 18. Screenshot of part of the menu page for Chartres cathedral, as redesigned after the images began to be hosted by the University of Pittsburgh's library. "Diagrams and Structured Links," on the page "France: Chartres (Cathedral of Notre-Dame)," *Images of Medieval Art and Architecture*, updated April 4, 2009, http://www.medart.pitt.edu/image/France/Chartres/Chartres-Cathedral/chartres-main.html. Screenshot by authors.

The thumbnail diagrams that appeared on these 2006-era pages for Chartres all linked to subpages containing duplicate, often larger, images of the pictured drawings or plans, each of which were then encoded as clickable image maps. These image maps were used to orient the visitor and link them to appropriate images hosted by the DRL by means of URL-based search queries. Some of the links on these diagrams would send the user directly to the library site in order to view a single image, while others were carefully constructed search queries that would show a full set of results within an HTML frame at the bottom of the screen, allowing the visitor to stay within the MedArt site itself (Figure 19).[99]

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[99] To see an example of the links that would send the visitor over to the DRL site to view one, single images, see "Clerestory Windows in Choir," *Images of Medieval Art and Architecture*, updated June 20, 2006, http://www.medart.pitt.edu/image/France/Chartres/Chartres-Cathedral/Windows/Clerestory-windows/Chartres-Clerestory-Choir/Chartres-Choir-Clere.html. Available courtesy the Internet Archive, captured July 24, 2017, https://web.archive.org/web/20170724020752/http://www.medart.pitt.edu/image/France/Chartres/Chartres-Cathedral/Windows/Clerestory-windows/Chartres-Clerestory-Choir/Chartres-Choir-Clere.html.
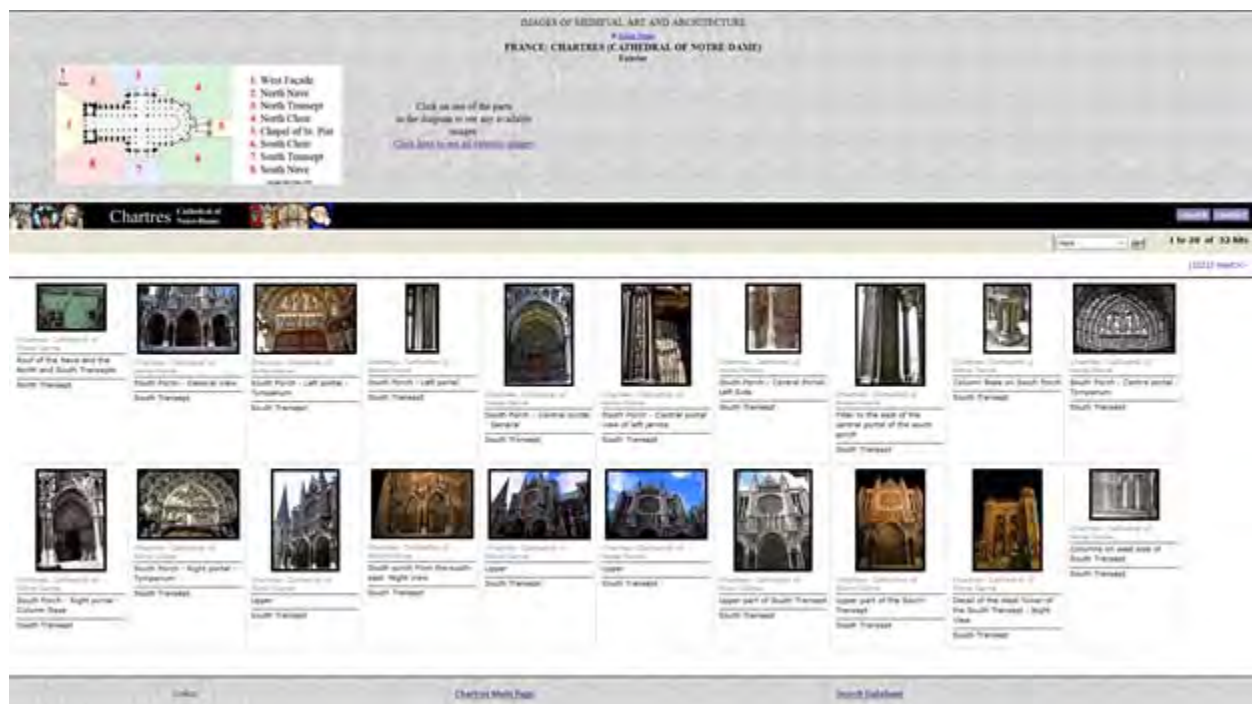
Figure 19. The "Exterior" subpage within MedArt's Chartres collection used a frame to embed the library's hosted images. This screenshot shows the results of clicking on "7". "France Chartres (Cathedral of Notre Dame)-Exterior," *Images of Medieval Art and Architecture,* n.d., http://www.medart.pitt.edu/image/France/Chartres/Chartres-Cathedral/Architecture/Exterior/Diagram/Chartres-Exterior-Main.html, this image was captured directly from the MedArt website on July 09, 2017. In order to see this functionality now, one must visit the captured pages on the Internet Archive, here: https://web.archive.org/web/20170709083214/http://www.medart.pitt.edu/image/France/Chartres/Chartres-Cathedral/Architecture/Exterior/Diagram/Chartres-Exterior-Main.html. Screenshot by authors.

Stones has since noted that the original interface to MedArt's collection images of Chartres (Figure 13, above), was always more in line with her original goals for the project to offer images within a highly contextualized, active learning environment. The grid-based, image-plus-metadata organization of the DRL site, she felt, was never as effective as the work that Vadnal had originally done putting the images of this cathedral in conversation with the floorplan, "the… version that Jane [Vadnal] first produced gives a better approach to understanding the building as it is structured, based on the ground plan, whereas the [library's] database by definition is random so nothing fits together."[100]

In addition, because the library was now the host for the images, all of these new pages became utterly dependent on the functionality of a database that was not under the control of MedArt's core team of Stones, Vadnal, and Maye. And indeed, during the course of our Sustaining MedArt research, the Digital Research Library switched away from their original DLXS platform and moved to a Fedora/Islandora-based content management system. The screenshot that appears here as Figure 16 was taken in Spring 2017, but due to the change at the DRL, the search queries that were so carefully constructed by Vadnal and Maye to make the image map of the plan of Chartres function, no longer resolve properly. When

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[100] Alison Stones, email to Alison Langmead, July 27th, 2017.

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modern-day visitors click on the diagrammatic floor plan, the frame at the bottom of the window resolutely remains blank.[101]

There were also a number of pages created during this period by Phil Maye—particularly those of Chartres' west façade—that included even more technological bells and whistles than these standard image maps (Figure 20a-b).
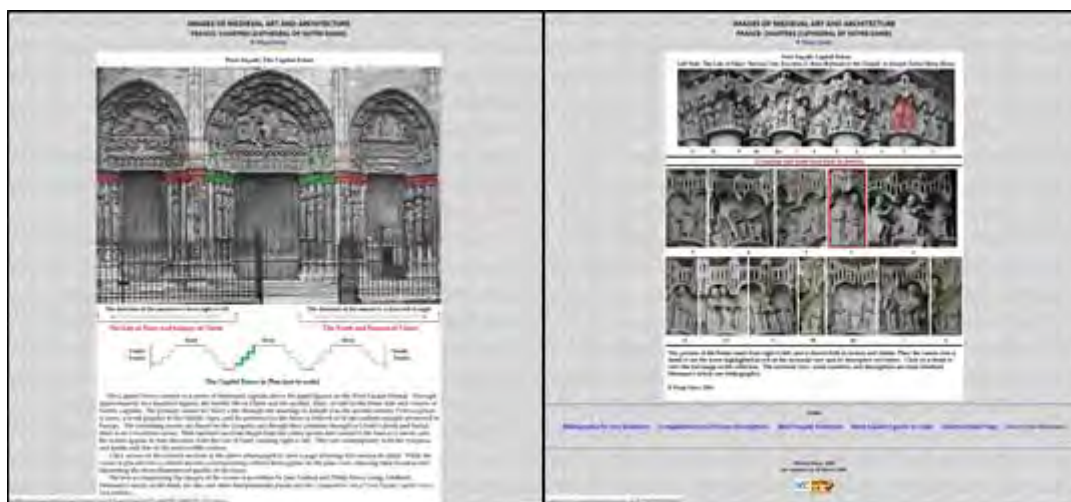
Figure 20 a-b. "France: Chartres (Cathedral of Notre-Dame)," *Images of Medieval Art and Architecture. A,* (left) "West Façade Main," updated April 6, 2008, http://www.medart.pitt.edu/image/France/Chartres/Chartres-Cathedral/Portals/westfacade/Frieze/Main/Main-Images/FCS-WEST-FRIEZE-ALL.html. *B,* (right) "West Façade Sec1," updated March 28, 2008, http://www.medart.pitt.edu/image/France/Chartres/Chartres-Cathedral/Portals/westfacade/Frieze/Sec1/Sec1Files/FCS-WEST-FRIEZE-731.htm.

These interactive diagrams included a more instantaneously responsive rollover feature, created using JavaScript, that could highlight particular details of the sculpture in multiple places on a webpage at the same time. Depending on where the visitor's mouse cursor was hovering at any given moment, other parts of the webpage would light up and help the visitor understand how the diagrams related to the photographs, or how the detail images related to a broader view. Clicking would lead the visitor to another sub-page within MedArt or over to a particular image in the DRL's collection.[102] The interactivity of these diagrams was right in line with the original goals for the project and stand today as some of the most complex interactivity available on the site.

In the Chartres project, then, MedArt's role shifted away from being the host and primary access point for a collection of images to being the creator of a *particular* kind of interface for searching and browsing the 3,000+ images hosted by the University of Pittsburgh's Digital Library System. In each of the new pages built by Vadnal and Maye for Chartres, their aim was to provide spatial and historical

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[101] As the steward of *Images of Medieval Art and Architecture*, the Visual Media Workshop is in conversations with the DRL about how, or whether, these search queries can be reconstituted. The Chartres pages captured by the Internet Archive retain some of this former functionality. For an example, see the July 9, 107 capture of the page shown in Figure 19, here:
https://web.archive.org/web/20170709083214/http://www.medart.pitt.edu/image/France/Chartres/Chartres-Cathedral/Architecture/Exterior/Diagram/Chartres-Exterior-Main.html, last accessed March 28, 2018.
[102] Many of the images on the pages similar to the one displayed in Figure 17b link now to the homepage of the DRL site rather than to the exact image selected because of the switch to the Fedora/Islandora CMS.

context for the cathedral using diagrams, maps, and images. At each step, they were still helping the visitor understand the building more holistically, but the delegation of the image hosting did come with compromises. The MedArt team was now limited in how they could link and embed the original images, and they were increasingly beholden to the DRL to provide consistent access with every URL-based search query they implemented.

Human Infrastructure

The major change to the human infrastructure during this period was the arrival of Phil Maye. Unlike with Jane Vadnal, the Sustaining MedArt research team was indeed able to speak directly with Maye. He spoke very fondly of the project, and was clearly quite proud of what the team had accomplished. When Maye first joined the project, he had assumed that there was a large team behind the website, but was somewhat surprised to find out that the technical work was being done solely by Vadnal. He threw himself into the project and was happy to help Vadnal, but also to take the project in new directions.[103]

Maye also noted that he was not financially compensated for his time, skills, or labor (he jokingly referred to his time working on the Chartres project as "two years of slave labor"), and mentioned that Vadnal had not always been consistently compensated either. It seems that Maye's participation, and to a certain extent Vadnals', was fueled by personal passion rather than money. By his own account, Maye had some prior interest in graphic design, architecture, and photography, and MedArt certainly provided an outlet for productively developing those interests. While collaborating with Vadnal, he also taught himself how to create websites, use Photoshop, and manage Web-based resources.[104]

It seems that Vadnal and Maye, along with a handful of other participants, worked consistently on the Chartres pages between 2004 and 2006. After this period, by Maye's account, he and Vadnal took it upon themselves to go through each of MedArt's sections systematically, updating images and bibliographical information. It was during this last phase of work that the image-based navigation menus for Britain were removed.[105] Maye and Vadnal would eventually offer a talk on the Chartres Project, as well as the history of *Images of Medieval Art and Architecture*, at the International Congress of Medieval Studies in May 2009. In the presentation notes for this talk, Vadnal explained that they changed the organization of the images on MedArt during this period because the lists of places had become too long, and so they split them into segments of the alphabet. This document also attests to the fact that, even in 2009, Vadnal and Maye were confirming their intention to add Spain, Germany, and Italy to MedArt.[106] After 2010, however, it seems most work on the project had ceased, in part due to personal reasons and in part because of Stones' retirement in that year. From this point forward, MedArt was to be managed, but no longer updated.

Technological Infrastructure

In retrospect, MedArt's partnership with the DRL represents a critical watershed with regard to the way MedArt was run. At least for the pages devoted to Chartres, MedArt was no longer the primary host for the images, essentially transforming the main function of the site into an interpretive interface for a

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[103] Maye, interview.

[104] Ibid.

[105] Phil himself has noted that he "rebuilt the list pages" for Britain in October 2008. Philip A. Maye, "A Rough Chronology of my Involvement with MEDART," document in hand.

[106] Philip A. Maye, "History of MEDART.doc," last modified April 2, 2009, Word document found on "Last Chance" hard drive at //Last Chance/VRCOLL-medart/medart/Kalamazoo/History of MEDART, formerly used by *Images of Medieval Art and Architecture*, collection of The Visual Media Workshop, University of Pittsburgh.

database that was controlled by another institutional partner. This made the MedArt team completely reliant on another stakeholder for consistent, long-term access to their primary source materials. The collaboration came with advantages, of course, including the fact that the DRL began paying for the cost of storing and hosting these images. In addition, as a digital library, they were offering a more secure, long-term location for the images. However, as we have seen, with the DRL's recent change in content management platforms, the ties that bound the MedArt pages to the DXLS platform were broken. The URL-based search queries have ceased to function. The interfaces on MedArt are now empty shells, no longer connected to their reserve of images.

There is also evidence of a "major server crash" in the years leading up to the Chartres project, but there is no evidence that any information was lost.[107] During this period, MedArt and its resources could be found on the original AFS server (http://www.pitt.edu/~medart) and on the VRCOLL server in the Department of History of Art and architecture (http://vrcoll.fa.pitt.edu/medart). Of course, the images for Chartres and Vézelay were now housed by the University of Pittsburgh's Digital Research Library.

It was during this period, too, that the first new technologies beyond HTML were added to the MedArt site. Phil Maye was responsible for creating some of the most technically complex visualizations for the site, adding JavaScript for the first time to the technological stack used by the project. To the end of its active life, MedArt would continue to use very few technological bells and whistles, accreting new tools very slowly. This decision—and if it was not intentional, this happenstance—has been one of the reasons that much of MedArt still works the way that it was originally designed. The places where the site is degrading most rapidly are in the places where stakeholders were needed to ensure the smooth operation of more complex technological stacks.

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[107] There is also evidence of a "major server crash" which was forcing the team's hands. First evidence, April 2, 2003: "France: Chartres (Cathedral of Notre-Dame)," *Images of Medieval Art and Architecture*, n.d., http://www.pitt.edu:80/~medart/menufrance/chartres/charmain.html. Available courtesy the Internet Archive, captured April 2, 2003, https://web.archive.org/web/20030402035425/http://www.pitt.edu:80/~medart/menufrance/chartres/charmain.html.

Snapshot 3: MedArt's Ongoing Maintenance, 2010-present

By the year 2010, active work on MedArt had effectively come to an end. The last proactive changes to the site implemented by either Vadnal or Maye would be made in October of 2009. Stones, too, began to focus almost all of her attention on other projects as she moved toward her retirement in 2012. It was also at this historical moment that the university ceased to fund departmental-level IT support staff and, in response, the Department of History of Art and Architecture (HAA) prepared to decommission their Web servers. These machines contained far more than just the work of Stones and Vadnal by this point, and so the act of taking them offline was somewhat more complicated than simply finding a new server for MedArt. To this end, the HAA chair at the time, Kirk Savage, contacted Alison Langmead, then a colleague from the School of Information Sciences (SIS), for help. In Spring Term 2010, Langmead and a pair of students from the Master of Library and Information Science Program at SIS performed a recordkeeping analysis of these departmental servers, distributed all non-Web-based digital information back to its creators, and rehoused MedArt on a new university-run server.[108] In July 2010, Langmead would be hired into a full-time, joint position between HAA and SIS that installed her as the steward of *Images of Medieval Art and Architecture*, a position she holds to this day. She is also currently the Principal Investigator for the Sustaining MedArt project, and has used her direct experience with this 2010 project to inform this research.

Project Development

During Fall Term 2009, Alison Langmead was approached by Kirk Savage, then chair of the Department of History of Art and Architecture, with an opportunity to assist with digital recordkeeping/digital sustainability needs of the department.[109] One of the departmental Web servers had failed and the university had discontinued the funding for the departmental IT staff position whose responsibility it had been to run these servers over the years. There were, in fact, three servers housed in HAA by this time: Zen, Hemlock, and VRCOLL. Hemlock was the server that crashed, but luckily for the department, Veronica Gazdik, HAA's Visual Resources Coordinator, had performed a routine backup of the Hemlock drive in September 2009, just days before its complete demise.[110] It was VRCOLL, however, that was home to the majority of the files belonging to the MedArt project, although the original pages created in 1995-1998 were still served by the original AFS server and linked throughout the site. The "PittInfo" page had been decommissioned in 2001.[111]

Savage could see the writing on the wall for these servers and decided that it was time to prepare for the eventual deactivation of these machines by reaching out to Langmead to see if working on this problem would be a project that a student from the School of Information Sciences might wish to take on as a learning opportunity.[112] Langmead agreed to lead an Independent Study opportunity during

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[108] The work of this team would eventually also result in the rehousing of Stone's *Lancelot-Graal Project* and Frank Toker's course materials, both also served to the Web by HAA's servers, to university-run machines.

[109] "Server/archive crisis," Kirk Savage, email to Alison Langmead, October 20, 2009.

[110] Jefferson Bailey and Hillary Gatlin, "Report on the History of Art and Architecture Department Server Project," April 29, 2010, prepared for "LIS 2901 Independent Study," 1.

[111] See the calendar view of the Internet Archive for http://info.pitt.edu:80/~medart/, which spans from January 20, 1999-July 20, 2001, located at https://web.archive.org/web/*/http://info.pitt.edu:80/~medart/, last accessed March 28, 2018.

[112] At the time Langmead was an adjunct lecturer in the School of Information Sciences, but by July 2010, she would assume a full-time joint appointment at Pitt with a joint appointment as Lecturer in the Department of the History of Art and Architecture in the Dietrich School of Arts and Sciences and as Assistant Professor in the Library and Information Sciences Program in the School of Information Sciences.

Spring Term 2010 that was specifically focused on analyzing these servers and put out a call to all interested students pursuing a Master of Library and Information Science degree at the School of Information Sciences. Two students—Jefferson Bailey and Hilary Gatlin—responded. Over the course of the term, both of these student-scholars were incredibly dedicated to the work and each contributed essential skills and ideas to the process.

The "HAA Server Project" was not focused specifically on rehousing MedArt, although this would eventually become part of its mandate. The HAA departmental servers contained a great deal of information that belonged to about a dozen stakeholders within the HAA community writ large. As the final report for this project noted, "The data contained on these servers included both web-shared and internal material, current and dormant faculty research, graduate student data, class syllabi and teaching images, a number of department websites, and a variety of files of indeterminate function, ownership, and origin."[113] Much of the work for Langmead, Bailey, and Gatlin was to tease out what data belonged to whom, what information needed to be handed back to its creators, and what information needed to find another institutional home, whether served to the Web or not.

In order to figure out what was what, the team took a two-pronged approach: surveying the users and performing a functional recordkeeping analysis on the servers themselves. Using directory-tree-printing tools such as TreePrint and YourDir, the team was able to gain superficial intellectual control over the drives which allowed them to understand, at a first pass, what sorts of materials were stored there and who the main stakeholders were. As the team would later note, this process was not easy, "One of the difficulties of establishing intellectual control over the servers was the diffuse nature of the data contained therein…Disparate or duplicative file types, uncommon naming conventions, and unclear organization all hindered the preliminary records survey."[114]

With this knowledge in hand, the team then surveyed all faculty and graduate students in the HAA department, letting them know which files were found that seemed to belong to them (if any) and also asking if they had any other information stored on these servers to their knowledge. The survey concluded by asking these stakeholders what they wished to have done with their files and offering to meet with them at their convenience about this process. In the end, the servers would reveal themselves to be somewhat of a twisted labyrinth of different project ideas, stakeholder claims, and use-case scenarios. The team would note in their final report that, "…identifying owners and creators of digital content involves moving beyond the data easily inferred from file directory schema[ta]. Naming devices and folder structures are as diverse as their creators."[115] Without access to the original creators, this team would have had a much more difficult time teasing out the different sites of production housed on these machines.

During this process, Stones was identified by both the records survey and knowledgeable HAA department staff member, Veronica Gazdik, as the most prominent user of these servers, controlling over half the files on all the hard drives.[116] This information was also not just about MedArt. Indeed, eventually the team corralled Stones' work into four broad categories that worked, by her own estimation, to adequately represent her data: Research Projects, Classwork, Talks/Publications, and Personal Files. As noted previously, it was this palimpsestic use of these servers that would eventually

[113] Bailey and Gatlin, "Report on Server Project."
[114] Ibid., 5.
[115] Ibid., 16.
[116] Ibid., 5-6.

allow the Sustaining MedArt team to piece together the history of that particular project, although it would have been far preferable to have had at our disposal a more clearly organized collection of files and documents demonstrating project goals as well as change over time. The Sustaining MedArt project definitely benefited from all of the hard work that the HAA Server Project did gaining intellectual control over these information resources.

After the stakeholder survey was complete and face-to-face meetings with a handful of individuals were held, the team was able to identify owners for all of the files found on these servers. This community consisted of stakeholders as varied as the University Library System, the University Art Gallery, HAA departmental administration, as well as individual faculty members and graduate students, both currently and not currently affiliated with the department. And, by the end of Spring Term 2010, all of the information on these machines was either handed back to its creators, destroyed by their direct request, or destined for relocation on another reliable site of storage controlled by the university. All of the different sites of production found on these servers made it, in the end, into the hands of a directly responsible party.

The websites that were marked for ongoing persistence, including MedArt, Stones' personal website, Stones' Lancelot-Graal project, and the course materials of HAA faculty member, Frank Toker, were all slated to move to Pitt's Enterprise Web Infrastructure (EWI). EWI was, and is, a set of Web servers, all controlled and funded by the University of Pittsburgh's CSSD Information Technology group. This infrastructure had been identified by Langmead, Bailey, and Gatlin as the ideal place to relocate all Web resources from the HAA servers that would require ongoing accessibility.

The team chose to use EWI to rehouse MedArt and the other websites marked for persistence because it was free to University of Pittsburgh faculty, was maintained centrally by Pitt's IT personnel (CSSD), offered Web analytics, and supported off-campus network connections for faculty and students. EWI also did not place storage limitations on the sites that it hosted, putting at an end the struggle to garner sufficient server space for the project.[117] According to the team's report the interactions with this university unit took on an especial flavor of a business transaction, noting, "the Enterprise Web Infrastructure (EWI), while a business of Pitt IT Services, functions much more as a vendor than as a university resource."[118] Just as the addition of the DRL's resources changed the stakeholder groups for MedArt to include professional librarians and their needs, the EWI team would become another type of stakeholder in these projects, one that worked on a more transactional basis than scholars and librarians tend to do with one another.

While the overall HAA Server Project was centered on the need to decommission the machines and not on "saving" MedArt in particular, that site's prominence on these machines garnered it a certain amount of extra attention during the semester. The "/medart" subdirectory housed on VRCOLL was found to contain 100GB of information. The team also learned about the files still located on the original AFS server that still formed a direct part of MedArt's infrastructure. To increase the ability to steward this project effectively, it became part of the team's mandate to consolidate the project into one location housed by EWI.

These conversations would occasion the only interactions that Langmead would ever have with Jane Vadnal. Stones would write by email, "Jane is here and we are discussing the bits of medart [sic] that are

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[117] Ibid., 12.
[118] Ibid.

housed on the unix mainframe server [AFS]. She thinks it is about 400 images….She thinks it can be retrieved but would take time, it's scattered in bits and pieces (50 here, 50 there…)"[119] In the search to discover what the password was to the AFS account, Langmead would meet with Vadnal to discuss the project on Friday, March 5th.[120] In this conversation, Vadnal seemed distracted, but discussed the history of the project, focusing specifically on the Chartres years.[121] She did not remember the password, and doubted that Maye would have ever known it. And, indeed, it was true that he did not. Eventually the team would need to contact CSSD to reset the password as no remaining team member could remember it.

To begin consolidating MedArt's server warrens into one central location, the team used the application "HTTrack" to run a number of full site crawls of *Images of Medieval Art and Architecture*.[122] Using the seed domain corresponding to MedArt's home page (http://www.pitt.edu/~medart), these crawls revealed that only about 4 GB of the over 100GB of information found on VRCOLL and AFS was accessible via links on the website itself.[123] The team had initially thought that they would manually copy all of the files and folders served by VRCOLL and the AFS server and relocate them to EWI, however the labyrinth of data was such that the most efficient and effective way to re-house MedArt was to mount these crawled copies of the site themselves. The benefit of this approach was that the team could, by definition, recreate on the new server the exact way that MedArt behaved in Spring 2010. The downsides included that all of the metadata for the files (creation date, modification date and the like) would be stripped from the site. The decision was made, however, to prioritize the user-facing aspects of *Images of Medieval Art and Architecture*, and so it was a designated crawl of the site, downloaded especially systematically and carefully via HTTrack, that was uploaded to EWI as the "new MedArt." Over months, Langmead, Bailey, and Gatlin would then hone and do quality assessment tests on this copy to make sure that it worked perfectly within this new environment.

The move to EWI would also occasion a change to MedArt's main domain name, transforming the site from http://www.pitt.edu/~medart to http://medart.pitt.edu. The original Web address was, of course, retained and today redirects to the new one. Because of this change, however, the team learned through conversations with Stones and Gazdik that they would need to be in touch with Ed Galloway of the Digital Research Library to inform him of the update, and help with any modifications that the library would need to make between the Chartres project images and the MedArt site itself. In the end, the consolidation of all of MedArt's previous domain names to the single http://medart.pitt.edu would have a number of ramifications for the links hosted by the DRL's sites, but these were able to be replaced programmatically.[124]

By April 2010, Langmead reported to the team that the new EWI site was currently operating at full steam. The site would contain 23,627 operational links.[125] By July of 2010, Langmead had taken a new position at the university, one that placed her in charge of HAA's Visual Resources Collection and also the remaining departmental servers. She would work through that summer finishing the transfer of all

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[119] "Meeting with Jane," Alison Stones, Email to Hillary Gatlin, March 3, 2010.
[120] "Meeting about Medart on Pitt's Servers," Alison Langmead, Email to Jane Vadnal, March 4, 2010.
[121] Alison Langmead, personal recollection.
[122] "About," HTTrack Website Copier, copyright 2018, https://www.httrack.com/.
[123] Bailey and Gatlin, "Report on Server Project," 11. In 2010, the AFS site had just under 1GB of files. It may very well have been that the site only ever garnered 1GB of storage from that infrastructure.
[124] "Re: Chartres Site and MedArt," Alison Langmead, email to Jefferson Bailey, April 12, 2010.
[125] "Things I Have Discovered So Far," Alison Langmead, email to Jefferson Bailey and Hillary Gatlin, April 14, 2010.

applicable websites from VRCOLL to the EWI infrastructure, and also concluded the work with Ed Galloway correcting the final links between MedArt and the DRL collection of Chartres images. The HAA departmental servers would be fully removed from the Web by August, with the EWI (http://medart.pitt.edu) site serving as only remaining copy of MedArt on the open Web from the date of Saturday, August 7th, 2010. [126]

Human Infrastructure

Phil Maye, by his own account, posted his last updates to MedArt in October of 2009. At that time, he was working his way alphabetically through all of the local sites for Britain, updating links and bibliographies, and had made it through "Bredon (Bredon Parish Church)."[127] It is unclear when Jane Vadnal's last update was, but Maye reported that he worked with her less frequently after May 2007.[128] After these last few years of activity, and in large part because of the decommissioning of the HAA servers and Stones' retirement in 2012, MedArt saw the end of its primary phase of active development—a period that had lasted from 1995-2009. Langmead would become the project's steward, and would work to maintain the site in the years that followed, eventually successfully applying for the NEH grant to study MedArt's sustainability needs for the long term that resulted in this report and also in the Socio-Technical Sustainability Roadmap (see Theme 4, below).

From a steward's point-of-view, the MedArt of the present is part of an entire historical trajectory. It partook of an entire, complex ecosystem of socio-technical infrastructures throughout its history down to today. But nowhere was that clearest to the Sustaining MedArt team than here in its transition from active development into ongoing maintenance. MedArt was one of many projects that existed on VRCOLL, and when the project team of Langmead, Bailey, and Gatlin began their work, the server represented a tangle of different needs and interests, all of which they were tasked to address to the best of their ability. In working with the files left by the project, Langmead, Bailey and Gatlin would note, "two themes…would remain prevalent throughout the course of the [team's] activities: the fickleness of stakeholder relations and the diplomacy necessary in navigating between different departments and administrative hierarchies."[129] Not every stakeholder wanted the same thing out of this process. Some emphasized rapidity of resolution, while others emphasized attention to detail. Some wished to be highly involved in this process while others did not: "many of the stakeholders had unrealistic expectations for [the team's] project, such as web-site redesign."[130]

The team would also report on the complexity of stakeholder relations even beyond the Department of History of Art and Architecture, "Working through additional organizations, such as the Technology Department [CSSD] and the Dean's Office also proved a challenge…This project team is grateful for the help of Linda Hicks [HAA Departmental Administrator] and other administrators with invaluable knowledge on how [to] maneuver through the department in the most effective way."[131] Veronica Gazdik was one such additional member of the HAA community without whose institutional memory neither the 2010 server project nor, indeed, the Sustaining MedArt project could have succeeded.

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[126] "Re: Mastone site," Alison Langmead, email to Melissa Speidel [CSSD/EWI], August 6, 2010. In this email, Langmead states, "…VRCOLL is off-line as of an hour ago." A subsequent email notes that Melissa's last day of work in this department was the week prior, and so was not able to help with the request.

[127] Maye, "Rough chronology." Phil offered this document on the day of his interview in 2016.

[128] Ibid.

[129] Bailey and Gatlin, "Report on Server Project," 4.

[130] Ibid., 14.

[131] Ibid., 18.

Technological Infrastructure

During the HAA Server Project, Langmead, Bailey, and Gatlin focused their work on describing and sorting through large amounts of data on multiple hard drives that a significant number of stakeholders relied upon. The team was responsible for definitively assessing which information belonged to which people and then what was to go back to the stakeholders and what needed to be retained on university-supported infrastructure. For their work on *Images of Medieval Art* in particular, the convoluted state of MedArt's files was at times surprising and at times incredibly frustrating. For example, in their evaluation of MedArt's file structure, there were a number of places in the file tree that had an extensive, recursive duplication of nested file folders. The main folder for Sées Cathedral contained, for example, 34 copies of itself nested within (Figure 21).

```
|-------rouen
|---------s-maclou
|---------s-ouen
|---------s.maclou copy
|-----france-s-except-st
|-------s-gilles
|---------Central-Portal
|---------General-Views
|---------Left-Portal
|---------Right-Portal
|-------saintes
|---------abb-des-dames
|---------cathedral
|---------s-entrope
|-------sees
|---------sees
|-----------sees
|-------------sees
|---------------sees
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|-------------------------------------------------------------sees
|---------------------------------------------------------------sees
|-----------------------------------------------------------------sees
|-------------------------------------------------------------------sees
|---------------------------------------------------------------------sees
|-----------------------------------------------------------------------sees
|---------senlis
|-------senlis
|-------sens
```

Figure 21. Screenshot of the "Sees" error. From a text attachment to an email: "Medart Files," Alison Langmead to Jefferson Bailey, February 4, 2010. Made with TreePrint. Screenshot by authors.

In addition, the team found during their analysis of the crawled copy of the website that HTTrack had itself created a duplicate of a large portion of the site, beginning at the very top of the hierarchy. In the root folder of this copy, an "index-2.html" file had appeared. 4031 files had then been duplicated

beneath this initial page by the Web crawler itself, appending these duplicate files with a "-2." As noted by the team's report, "…to the dismay of the entire team, when working to get MedArt in order on the [EWI] stage site before taking it live, it was discovered that an entire shadow site existed within MedArt. On many pages, the "return to menu" link [would link] to a duplicate menu page with an entirely different set of links to duplicative content."[132] Once one entered the "-2" universe it was difficult to escape, and also impossible for the user to notice the slippage. In the final analysis, the duplicative files appeared to be a complete copy of the "Medieval Britain" materials. No explanation was found for this error, however, all such files were located and removed manually by the team.

Using Web crawlers to do this work was clearly not without its flaws. The program chosen for this project, HTTrack, also made separate subfolders for each webserver it encountered, and so the team would eventually need to manually interfile all of the documents from the server warrens. Moreover, because these files were all hand-coded HTML documents, the team would have to manually edit all of the links hard-coded to refer to either the AFS server or VRCOLL and change them to refer to EWI. Furthermore, when HTTrack encountered a broken link (broken, say, because of a typo), it could, of course, not follow successive links on the page that, from the browser's perspective, was incorrectly addressed. Entire directories could be found missing from the copy because of such errors.[133] Because this process was so prone to error, a great deal of manual labor was expended by the team to check all the links on the final site. To do this work, the team used Adobe Dreamweaver to locate broken links and correct them, either manually or using search-and-replace functionality when possible. In the end, the team still felt that this process, despite its flaws, produced a far more functionally equivalent version of MedArt than a hand-culling of the original files would have produced.

The strength of the broadband connectivity on and off-campus also caused problems for the team in a way that was reminiscent of the early years of the MedArt project. Residential broadband connections did not provide sufficient speed at this time to support the work of crawling and editing these websites, so the team often needed to do this work directly on Pitt's campus. Since they had been given only limited weekly access to the physical locations of the servers, this was a bit of a hindrance to the efficiency of their workflow. As Bailey noted in April of 2010, "I've been working on it all weekend and making some progress. Between the multiple mirror sites, different original server locations, our incomplete webcrawls, trying to eliminate the www.pitt.edu links, etc., it's going very slowly. Plus, given the # of files and file sizes, my wireless isn't fast enough, so I can only work on-campus (and even the Hillman [Library] wi-fi is laggy lately). So, at the moment, it's somewhat frustrating. […]" However, in the end, this exhaustive manual labor would eventually pay off, as Bailey continued, "That said, you can spend a good while clicking through and find no errors and all the vrcoll and pitt.edu links should be gone. I think my last "broken link" count was ~6K, but some of those are "false positives" (many seem broken on the main site too). So from the human POV, it's in decent shape -- maybe 80-90% done?" [134] By August of that year, all links would be verified and MedArt would, by all appearances, function on the EWI server in the same way it had functioned across its historical server warrens.

After the work of Spring Term 2010, Langmead was left in charge of finishing the transfer of MedArt, as well as Stones' and Toker's other projects, to EWI. After this was complete in August 2010, Langmead copied all of the remaining files from Zen and VRCOLL to a local hard drive named, appropriately, "Last

[132] Bailey and Gatlin, "Report on Server Project", 14.
[133] Ibid., 13.
[134] "Re: Next Tuesday," Jefferson Bailey, email to Alison Langmead and Hillary Gatlin, April 11, 2010.

Chance." There was no direct intention on her part that the files on Last Chance would be saved to serve as archival records for the history of MedArt.

This 2010 snapshot of Images of Medieval Art and Architecture will not be its last. This year marked a transitional moment between the project's phase of active creation and its phase of ongoing maintenance, but MedArt persists as an vigorous participant in the scholarly life of the field of medieval studies and also in the history of humanities computing and the digital humanities. Given what the Sustaining MedArt project has revealed about the development of this website, the way(s) that it should be sustained going forward is a question that would best take into consideration its past, present, and possible futures. The past and present have been revealed by this case study, but to discern this last piece of information—MedArt's possible futures—the Sustaining MedArt team must turn to the site's current stakeholders. What do the sites' original creators want for the project? What do the current users like about the site, and what would they like to see changed? What are the resources, both human and technological, that the current stewards have at their disposal to meet those needs? What will MedArt need to be sustained in a way to meet all of these stakeholder requirements? How should MedArt persist?

Theme 3: Contemporary Functional Expectations

The four themes of this report correlate with the narrative arc of the Sustaining MedArt Project itself, beginning with an investigation of the context of the origination for this scholarly project, continuing with its ongoing development and utility over time, and the decisions made about the site's future. Understanding MedArt through all of these thematic lenses is helpful precisely because it articulates the challenges of producing long-lasting, innovative digital humanities projects and can help us propose tactics for dealing with those challenges for projects beyond MedArt's boundaries.

In the first theme, we presented MedArt's "conditions of initial creation" and provided a retrospective, historical account of the social and technical factors that enabled the site's initial formulation and our ability to look back at that early context of its formation. MedArt was made possible by means of a confluence of knowledges and skills brought to the table by Alison Stones and Jane Vadnal, but also by seemingly isolated institutional decisions regarding technology, like the University of Pittsburgh's early adoption of the Internet, which was part of the narrative that facilitated this then-unanticipated avenue of scholarship in the humanities. By recognizing the locus of factors that led to the site coming online when it did, we considered the importance of historicizing digital projects through robust contextualization and documentation practices.

In our second theme, we considered the "conditions of persistence" for the project as we thought through the sustained legibility and utility of MedArt over time. As a historical artifact, MedArt provides a range of significances that can be framed by its genealogy and development. In terms of pedagogical history, MedArt serves a practical example of how evolving technology can be adapted into teaching practices in a way that accords with, and sometimes expands, previously held pedagogical theories. MedArt also supplies an enduring snapshot of the ways that the early Web allowed specialized information—here in the form of a scholar's personal collection of images pertaining to medieval architecture—to become widely accessible, thus creating a network of interested parties where none might have previously existed.

This historical narrative brings us now to the third theme, focused on MedArt's "functional expectations." This section deals with certain current and future practicalities. Given that the research team now understands how MedArt got to be the way that it is today, how should this project be sustained on an ongoing basis? What are the expectations made of the project's stewards at this point in time, and can those expectations be met by current resources, both human and technological? To discern answers to this questions, the research team investigated the current expectations of MedArt's most critical stakeholders—its initial creators and its current users—not only to paint a picture of the precise needs and requirements that they have, but also to figure out which of them can or should be met by the resources available to MedArt's current stewards.

Current Expectations of the Project's Creators

While the principal individuals invested in the MedArt's original creation and upkeep, Alison Stones, Jane Vadnal, and Philip Maye, are no longer directly in charge of maintaining the site, their opinions about how MedArt might best be sustained over the long term is essential to the appropriate, responsible, and ethical stewardship of the project. As noted above, we were not able to speak with Jane Vadnal during the course of this research study, but we did conduct interviews with Stones and Maye in late 2016. In those conversations, the Sustaining MedArt team asked not only about their

memories of the project, many of which are discussed above, but also their thoughts on its current state and possible futures.

Alison Stones

In our interview with Stones, we asked whether or not *Images of Medieval Art and Architecture* had furthered her career, and she surprised us with the answer that, if anything, the site had been an impediment. She noted that, during the period of her career in which she chose to spend time on MedArt, a number of her colleagues had written textbooks that not only earned them additional income, but also offered a form of academic clout. "Nobody gave a damn about MedArt in terms of academic whatnot," she stated. "I didn't gain much of anything, really. I gained a lot of general public appreciation, which is fine. My own personal academic goals lay elsewhere." [135] For Stones, then, MedArt appeared to be an interesting labor of love, a sideline. It was instead in work such as her "Lancelot-Graal Project," another of Stones' early humanities computing research projects, and manuscript research that she found her greatest career satisfaction.

However, during the conversation, Stones also noted that the historical perspective taken by the Sustaining MedArt team was an entirely new way of thinking about the project for her, one that held promise as she worked to compile an edited book comprised of a selection of her essays, stating:

> Well, I never would have thought of studying [MedArt] historically until you guys came along and started doing that. It's not a sort of approach that I would ever have dreamt of. So, you know, I was very surprised, and I have to sort of build that into my thinking now, I mean, and why not…I'm all for it!

As she continued to speak, she offered a marvelous assessment of both the historical trajectory of the project and its ongoing value, all from the point-of-view of one of its initial instigators,

> As long as the thing is up there and accessible, there's nothing to stop people from keeping on using it in the way it was intended first to be used, but that doesn't stop the historiography of it coming into play as well. [The historiography] is another layer—it becomes a multi-faceted tool at that point, which is very interesting.

In terms of MedArt's ongoing sustainability, then, Stones was pleased to hear that the project had found a home in the Visual Media Workshop that it could inhabit for the longer term, "A lot of websites that I have used in the past have disappeared when people either retire or die, so it is kind of nice to know that there is an ongoing aspect to this, even if it wasn't the aspect that I myself had envisaged." For Stones, MedArt was clearly changing, but also persisting, and this was a good thing.[136]

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[135] Stones, interview

[136] As it happens, when the Digital Research Library switched content management platforms in 2017, Stones noticed the disruption almost immediately, sending emails to the DRL straight away asking if/how the functionality of the Chartres pages on the MedArt site could be restored. Future plans for correcting this situation are discussed below. Stones clearly cares deeply to this day about sustaining the usability of the site as it is and has also shown herself to be interested in possible future updates, but it remains to be seen what sort of engagement comes to fruition.

Philip Maye

In our conversations with Maye, we learned that, from the very beginning of his involvement, he was much more inclined to see *Images of Medieval Art and Architecture* as a site with both historic and contemporary interest. Having come a bit later to the project, Maye had always considered MedArt to be a robust, time-tested scholarly resource. He began our conversations by saying, "I have always been curious…I know a moderate amount about MedArt beyond my own involvement. I knew Jane [Vadnal], and I've known Alison [Stones] for years, but it'll be interesting to see the final result of all this." The past, present, and future of the project was of great interest to him.

Maye not only had a lot to tell us about the day-to-day work that was involved in creating MedArt during his tenure, but above and beyond the technical and scholarly details of producing this Web resource, he also foregrounded his later surprise at learning about the extensive global reach of the site. This occurred during the team's visit to present at the International Congress of Medieval Studies in 2009, and he stated, "I had, to my mind, a staggering number of people tell me how much the Chartres site, and the various things we did on MedArt, like the MedArt diagrams for Chartres diagrams, contribute to doctoral dissertations, undergraduate things, high school and even grade school [work]." He was especially interested to get this feedback from actual users of the site, as he had been frustrated by the fact that, back in 2009, the Digital Research Library did not have a mechanism for placing a "visit counter" on their Chartres image collection that would let the team confirm how many visitors they were attracting. Attending the Congress and speaking with real users was an eye-opening experience for him.

In terms of the project's ongoing sustainability, Maye was not only interested in having it persist, he also still held images that he would like to post to the site. Part of this continuing desire to help MedArt grow is clearly scholarly; Maye took great pride in producing a resource that is of benefit to the medieval studies community. There were also some career benefits for him as well, as the prominent placement of his photography on the site helped to promote his work as a photographer. Maye, while very proud of the scholarly impact that MedArt has had, and continues to have, also reaps some, very small financial reward for his participation.

Current Expectations of a User Community

When we began this project, we entered into our research with the assumption that the current users of *Images of Medieval Art and Architecture* would find that the site's utility was fading due to its technological stability and old-fashioned design. One emblematic indication of MedArt's visibly "outdated" appearance is the site's background, a striking design feature that looks precisely the same as it did when the site first launched (Figures 4 and 5, above). This background is tiled from a 1kb image file entitled "small-grey-stone.jpg," repeated across the width and length of virtually every page on MedArt (Figure 14).[137]

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[137] To view all of the captures for the image "small-grey-stone.jpg," see the calendar view of the Internet Archive, which spans from December 25, 1996 to September 22, 2016, located at https://web.archive.org/web/*/http://www.pitt.edu:80/~medart/logo/small-grey-stone.jpg, last accessed March 28, 2018.

Figure 14. Image used as the background tile in the earliest screen capture taken by the Internet Archive: "small-grey-stone.jpg," n.d. Available courtesy the Internet Archive, captured December 25, 1996, https://web.archive.org/web/19961225011751/http://www.pitt.edu:80/~medart/logo/small-grey-stone.jpg.

Originally, the background was created using the now deprecated "background" attribute for the body tag within HTML, although now it is produced using CSS, an update that was almost certainly implemented by Phil Maye in late 2008.[138] Despite this change to the underlying code, however, the visual effect of the background is identical.

The fact that MedArt looks a lot like it did in 1996, then, means that the site appears fairly archaic by the standards of modern Web design and, as Wendy Chun has recently mused, there is enormous social pressure for anything associated with "new media" to be constantly updating and reinventing itself.[139] The World Wide Web has changed in important ways since MedArt's prime years of operation, and visual clues such as this tiled background call our attention to this historical trajectory. When MedArt was launched, websites were mostly static pages linked through hypertext; they lacked the responsive interfaces and user generated content which have subsequently become staples of the Web after "Web 2.0." Although Maye added a number of more complex, JavaScript-enabled rollover features to the Chartres pages in 2006, the MedArt site was never completely overhauled in a way that some of its peers have been.[140]

That said, the fact that MedArt is still largely functional today without undergoing any major technical overhauls is, in large part, a testament to the fundamental simplicity of the technology that was available to Stones and Vadnal during the birth of the World Wide Web. The basic HTML used to code MedArt has withstood the test of time precisely because it is utterly fundamental to the Web's infrastructure and has not suffered the more unpredictable fate of privately owned, third-party, applications. However, the sustainability benefits of using older, more time-tested, technologies are not necessarily as visible to the user as is the fact that the site *looks* old-fashioned, even retro. So, while MedArt's content may remain entirely usable and relevant to students and scholars, we wondered if the dated design of the site would affect how its utility is perceived.

The research team thus became interested to hear how a sampling of possible, contemporary users would describe and interpret the look and feel of the *Images of Medieval Art and Architecture* site in terms of its possible utility and preservation-worthiness. To this end, the team conducted usability tests on *Images of Medieval Art and Architecture* during the 51st International Congress of Medieval Studies in Kalamazoo, Michigan in May 2016. There, five researchers from the Visual Media Workshop at the University of Pittsburgh used semi-structured interviews to gather 107 responses to the website from this international community of medievalists.[141] We spoke to attendees at coffee breaks, in the halls,

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[138] For the first appearance of the CSS, see *Images of Medieval Art and Architecture*, updated March 29, 2018, http://vrcoll.fa.pitt.edu:80/medart/index.html. Available courtesy the Internet Archive, captured December 04, 2008, https://web.archive.org/web/20081204073242/http://vrcoll.fa.pitt.edu:80/medart/index.html.

[139] Wendy Hui Kyong Chun, *Updating to Remain the Same: Habitual New Media* (MIT Press, 2016).

[140] For more about the project's development, see the introduction of this report.

[141] The researchers were Alison Langmead, Aisling Quigley, Sarah Reiff Conell, Kiana Gonzalez Jones, and Jacqueline Lombard.

and at wine hours. An iPad was used to offer the survey, giving participants the chance to see and interact with the site on the spot. During each interview, the participants were asked about their familiarity with medieval art and architecture and the MedArt project itself. They were also asked to perform a brief usability task on the website (finding images of Canterbury Cathedral) using the iPad, and given opportunities to reflect and comment upon this experience, as well as their own image-finding practices. Finally, the interview gathered their thoughts on the importance of preserving MedArt for the long term. The full text of the survey instrument can be found in Appendix A.

We did not perform these surveys with an eye towards any eventual rigorous generalization of these particular findings, although this research has definitely impacted the design of the Socio-Technical Sustainability Roadmap (see Theme 4 below). Instead, we simply wanted to gain a solid understanding of the ways that a sample of scholars of medieval studies—a likely group to have a native interest in MedArt's content—perceives the site, both as a project with historical interest, but also as an ongoing concern within their community.

We performed a small-scale grounded theory analysis of this interview data, and discovered a number of fascinating findings about these users' experiences of this website. Our data suggests that this community's notion of the site's utility is relative, and is implicated in a complex set of concepts that includes the authority imputed to the project, its accessibility, and the user's current needs. Before turning to our findings, it is important to note that since only 15 (or 14%) of the approximately 107 participants had seen the site before, our findings skew towards these users' first impressions.

To begin, we discovered that when it comes to finding a *scholarly* website useful, users are quite flexible and adaptable. While the design of the site suggested to a few that MedArt may be out-of-date, many more interviewees were inclined to see the site's age as a sign of its persistence through time, or as evidence that it had resisted the call of the constant change of the Internet. One participant stated that MedArt has "a very venerable and a very old, old pedigree," and that despite the fact, or even *because*, it looks "old-fashioned," the site actually "comes with a level of trustworthiness." This same interviewee recognized Dr. Stones' name and was aware of her scholarly credentials, so believed the site implicitly "has a kind of scholarly seriousness."[142] Such responses suggest that creators of user-facing, Web-based humanities resources might do well to consider the ways that scholarly reputation and authority interact with issues of usability in their projects.

In our conversations with these users, the scholarly nature of this project also clearly contributed to their assessment of how its dated appearance might relate to its ongoing utility. Many of the interviewees proactively stated that they were inclined to find the site useful because they implicitly trusted the authenticity and reliability of its content due to visible clues such as the site's clear academic affiliation, as expressed through the ".edu"[143] in the site's URL, and also the prominent presence of copyright statements.[144] Numerous respondents noted that they would consider the site to be useful to them when looking for image resources for their publications because the copyright for each image was not only clear, it was also easily apparent how the users would go about asking for permission to use them in a publication. Even though the quality of these images is low by today's digitization standards, their ease-of-reproduction was an important feature for many when it came to considering the site's usefulness. Overall, users showed themselves to be thoughtful and on the lookout for context clues

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[142] Conference attendee, interview by Alison Langmead, May 13, 2016, interview Fri-07al, transcript.
[143] Conference attendee, interview by Alison Langmead, May 13, 2016, interview Fri-04al, transcript.
[144] Conference attendee, interview by Alison Langmead, May 13, 2016, interview Fri-08al, transcript.

when they are assessing the site for its utility. They are willing to work with the features they are given and proactively seek out evidence of authenticity and trustworthiness that are not necessarily associated with technological bells and whistles.

Secondly, we discovered that users can be considered "agents of change" and can play an important role in the ways that sustainability strategies might be devised and implemented. Although many participants were willing to accept—and even sometimes proactively appreciate—the way that MedArt's visible age might lend it a form of respectability and authority, many others were also concerned that the usability of the site might not be all it could be due to a lack of features expected to belong to a digital image collection, such as a search bar. Even though Vadnal once attempted quite assiduously to add search functionality to the site, it would never materialize, and contemporary users definitely noticed its absence. "It could use more obvious heading text or better visual instructions, in addition to a search engine," one survey-taker proposed.[145] Indeed, the participants seemed to assume that a search bar or an global index would be useful, and perhaps even necessary, for a website such as this to be all that it could be. When asked if they would use the site in the future, one interviewee stated that: "I might…if I had a list of what was available on it, and if it was searchable." "Improve the search!" suggested another participant, when responding to the question of whether the site should be preserved for the long-term.[146] "Where's the search function? I was expecting a box," offered another individual.[147] However, although the absence of a search bar was widely remarked upon, some survey-takers preferred the simplicity of the site interface. "I think simpler is better," said one interviewee, "I don't want to spend a lot of time learning how to use it."[148] Whether stumping for a search bar or remaining satisfied with the features that MedArt currently offers, most users were focused on their own personal definition of "ease-of-access" to the information contained within MedArt's boundaries when assessing its overall utility.

Indeed, many of these interviewees' personal definitions of what constitutes "easy" seemed to have been strongly shaped by their use of Google. During our interviews, we asked participants to tell us what online tools they used, if not MedArt, to find images for their work. The answers to this question demonstrated that very few looked to professional-grade, library-held resources for this purpose—the primary tool used for this job on a daily basis was, hands-down, Google. Moreover, its use was not particularly relished. Participants were often quite reluctant to admit that they used Google to conduct image searches, expressing embarrassment either through tone or body language, or by saying things such as "I'm afraid that I do go to Google a lot."[149] This was such a prominent theme in the survey results that the research team has dubbed the effect "Google Shame." Google clearly emerged as a primary point of comparison for MedArt both in terms of the search features found lacking by so many of the participants but also in terms of these users' feelings of satisfaction and dissatisfaction with their own image-finding skills.

One of the biggest changes to the Web since MedArt's launch is undoubtedly the way that scholars find content on the Internet. There is little doubt that Google Search and Google Image search, introduced in 1998 and 2001 respectively, have fundamentally transformed the way academics search for images

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[145] Conference attendees (two participants), interview by Jackie Lombard, May 11, 2016, interview Wed-03jl, transcript.
[146] Conference attendee, interview by Aisling Quigley, May 12, 2016, interview Th-04aq, transcript.
[147] Conference attendee, interview by Aisling Quigley, May 12, 2016, interview Th-08aq, transcript.
[148] Conference attendee, interview by Jackie Lombard, May 11, 2016, interview Wed-01jl, transcript.
[149] Ibid.

online. To come across MedArt in 1996, a scholar would likely have had to have known about it from some other resource or site—the presence of the awards and badges on MedArt's early homepages are testaments to this period of time in the Web's history. Proactively searching for the site was almost impossible to do. Today, a simple Google search can reveal MedArt, but it can also offer an overwhelming number of images that have been associated by its algorithms to any given search string. Indeed, most—but certainly not all—of the content found on MedArt can now be found elsewhere on the Web. Many of the structures featured on the site have dedicated English language Wikipedia pages, while many others have dedicated websites run by nonprofit organizations. In 1996, MedArt may have been a critical resource for this information on the Web, but it no longer provides a main access point for otherwise inaccessible material.

However, using Google to sift through the huge number of images of medieval art and architecture currently available on the open Web was not seen as a perfect system by the interviewees. Indeed, Google was frequently seen as something closer to a "necessary evil" than an ideal solution. Searching for images on the Web could sometimes reveal images the interviewees had not known they were looking for, but more often than not, Google image search results were likened to a firehose of uncurated, and therefore less trustworthy, information. Looking at MedArt's carefully constructed collection, one user noted, "I can imagine the images here are curated in a way that Google might not be."[150] Another stated, "Google is faster but it turns up *anything*. It's not curated."[151] Moreover, the presence of the clear copyright status of MedArt's images again came to bear on the interviewees' assessments, "...half of the images that you find on Google don't have any attribution, you have no idea where they're from."[152] These responses suggest that, while most participants use Google to find the images they need for their work, they mourned the lack of authoritative curation and clear usage rights on the open Web.

To conclude these interviews, the team turned the participants' attention away from MedArt's utility and towards its preservation-worthiness. All but one interviewee felt that MedArt should definitely be preserved, but many placed caveats on their opinions. At points, these reservations were directly related to the site's dated aesthetic, "[Preserved] in its current form? I think it is usable but maybe aesthetically it could be upgraded. I don't think this site needs to be scrapped but needs to be aesthetically improved."[153] Others were enthusiastic about its preservation but noted that the ongoing utility of the site would depend, "on what resources are going into keeping it updated."[154] While the old-fashioned look-and-feel of the site was not a large detractor from the site's current *utility*, it was definitely implicated in the users' perception of its preservation-worthiness.

Many interviewees who had never previously heard of the project were also concerned about the site's preservation-worthiness precisely because of their lack of prior knowledge, "I think it could be [preserved], but I didn't know about it, so you know, I'm not sure if there would be funds to promote it to people, or to have it linked through something else."[155] Some participants also suggested that, while the content might be great, that may not mean that it ought to be preserved unless the site is accessible

[150] Conference attendee, interview by Kiana Gonzales Jones, May 13, 2016, interview Fr-04kg, transcript.

[151] Conference attendee, interview by Sarah Reiff Conell, May 12, 2016, interview Th-03sc, transcript.

[152] Conference attendees (two participants), interview by Jacqueline Lombard, May 11, 2016, interview Wed-03jl, transcript.

[153] Conference attendee, interview by Aisling Quigley, May 13, 2016, interview Fri-04aq, transcript.

[154] Conference attendee, interview by Jacqueline Lombard, May 12, 2016, interview Th-04jl, transcript.

[155] Conference attendee, interview by Jacqueline Lombard, May 11, 2016, interview Wed-04jl, transcript.

and well-known, "The question is whether people actually know about it enough to use it."[156] The users' personal awareness of the existence of this project seemed to affect their opinions about its perceived preservation-worthiness. It is possible that, once a digital project is out of sight, it not only goes "out of mind," its perceived utility can decline.

To summarize, MedArt, unlike Google, has acquired scholarly clout within this community not only by *appearing time-tested* but also by its association with a ".edu" domain and Alison Stones' name and copyright. The preservation-worthiness of the site was agreed upon by almost all participants, but while the dated look of the site was not a concern for the project's current, closely-contextualized usefulness, in future, users would expect an update to the interface that includes added functionality, such as a search bar. Moreover, some interviewees were concerned that, without a larger community of users surrounding the site to promote it, the project may lose its usefulness over time. One of the team's preliminary findings from this part of our research, therefore, is that creators of user-facing, Web-based humanities resources might do well to consider the ways that scholarly reputation and authority are demonstrated in their projects, and also the ways that they can increase their findability.

As user groups change over time—as we know that MedArt's did—digital projects would do well to consider carefully how they will respond, if at all, to meet their users' ever-changing needs. Even though Stones, Vadnal, and Maye did not survey their users or change their project in relation to those users' needs, we know that MedArt expanded well beyond its original, intended user base of students in the classroom. Indeed, this expansion into unexpected user communities might even be considered one of the project's most prominent markers of success. According to the small-scale findings made possible by this set of interviews, if MedArt were to undergo a massive update and/or overhaul, its project team would profit from listening directly to their current users' needs and design their changes accordingly. This would be one of the key ways that the site could stay integrated within the scholarly conversation, increasing its name recognition and making sure that the work remains relevant and prominent. However, given that new user groups bring new needs, their aforementioned role as "change agents," may also move the project into unintended, or even undesirable, new contexts, if their feedback is taken without due consideration of the overall goals of the project.

In What Form Should We Sustain MedArt?

At the end of the day, the Sustaining MedArt research team reached the conclusion that, while the interviewees were (a) almost unanimous in their agreement that MedArt has current utility, and (b) their reasons for reaching this conclusion were strongly associated with the way that MedArt looks, our initial hypothesis had it backwards. It was not that the old-fashioned look-and-feel of this site was decreasing its utility, instead its clear venerability and connection with Alison Stones were actually main *sources of* its utility. And, given that Stones and Maye were also not actively desirous for a major MedArt update, all of these stakeholders leaned to the side of preserving MedArt just as it is.

We have concluded that MedArt has become a time capsule of sorts. The site's dated appearance is not a disadvantage to the project, it is, in many ways, its very calling card. For many of the interviewees, the site was a testament to the way the Web used to be, and a reminder of a different time and place. If sufficient funding were raised, a major overhaul of the site could certainly be accomplished by replacing the old scans with newer, more vibrant images, and replacing the hand-coded HTML with a new, modern content management system with all of the possible technological bells and whistles. Such

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[156] Conference attendee, interview by Jacqueline Lombard, May 12, 2016, interview Th-07jl, transcript.

changes might even be welcomed in some corners. But, if *Images of Medieval Art and Architecture* were to become "just another" image database, the team concluded that MedArt would simply cease to be MedArt.

Current Resources of the Project's Steward

With the needs and desires of MedArt's original project team and current user community having been considered, the resources available to the project's stewards can also be productively brought to the fore. The current plan for sustaining MedArt is to leave it as the time capsule as it is, maintaining what needs to be maintained, but not performing any transformative upgrades or changes.

As mentioned previously, *Images of Medieval Art and Architecture* is under the stewardship of the Visual Media Workshop (VMW) in the Department of the History of Art and Architecture at the University of Pittsburgh. Alison Langmead, the Principal Investigator of the Sustaining MedArt project, is currently the director of the VMW, and has, as part of her responsibilities, this stewardship project. In addition to Langmead, the VMW is currently staffed by two graduate student researchers, one drawn from the doctoral student cohort from the Department of History of Art and Architecture and one drawn from the doctoral student cohort from the Department of Information Culture and Data Stewardship in the School of Computing and Information. A number of other graduate and undergraduate students also work in the VMW from time to time, sometimes doing independent study research, sometimes performing grant-funded work. This system of staffing could change dramatically at any time, should the departments and schools that support it decide that their priorities lie elsewhere. In addition, each student is assigned to the VMW at most for three terms in succession and the number of students—and their scholarly interests—can change dramatically from term to term.

Langmead is the only member of the staff who works in the VMW year over year and, while she has the technical skills to maintain this site on her own, she cannot devote a large portion of her hours to the project of sustaining MedArt. Because the rest of the VMW's staffing is so changeable, and the stewardship of MedArt is not the VMW's only obligation, any ongoing sustainability plans for this project will need to take into consideration that the sustainability team will not stay constant one year to the next and therefore, each year, the team will be comprised of different knowledges and technical skills. In terms of garnering additional human resources, the budget of the VMW is vanishingly small and cannot bear the costs of any labor associated with, say, a major update or overhaul to MedArt's interfaces. Volunteer help is also no longer an option, as it has become VMW policy that all labor in the space must be adequately compensated, whether by money or academic credit. Any grants that could be submitted would, of course, be time-based, allowing for only a fixed amount of attention to be given the project of sustaining MedArt over the long term.

In terms of the technological sustainability of the project, the version of *Images of Medieval Art and Architecture* that is currently served to the Web has been safely and securely housed on Pitt's Enterprise Web Infrastructure since August 2010 and can remain there for as long as the university supports that service. Pitt has no current plans to sunset the initiative to our knowledge. The technologies in current use on the site—HTML and JavaScript—will all be supported by the EWI infrastructure for the medium to long term. It has also been our assessment that, with no further interventions, the JavaScript components added by Phil Maye are likely to be the technological components that fail first because of obsolescence, due to the near-constant upgrade path of that technology.

But we are also aware that is not only through such forms of degradation that sustainability fault lines can occur. As noted above, the link between MedArt's Chartres pages and the Digital Research Library's collection of images from the Chartres project has already been broken due to the Library's choice to transition to a new content management system. This change has rendered a number of pages on MedArt's side of the collaboration almost useless.[157] Major failures of sustainability such as this one, fortunately, are not likely to proliferate across the site, as this link between the DRL and MedArt had always been directly identified as tenuous, technologically speaking, and there are no such remaining dependencies of note. The Visual Media Workshop team is in conversation with the Digital Research Library to discuss the extent to which the original functionality of the Chartres pages can be restored without fully redesigning the pages. As noted above, it has been decided that *Images of Medieval Art and Architecture* is currently in a state of ongoing maintenance, but no transformative updates or reworking of the code base is currently on the table. Until further resources appear, any changes planned for the site must be nominal. The negotiation therefore centers around something close to the traditional conservation principle of "minimal intervention."[158]

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[157] For example, see "France: Chartres (Cathedral of Notre-Dame) Exterior," *Images of Medieval Art and Architecture*, updated October 20, 2005, http://www.medart.pitt.edu/image/France/Chartres/Chartres-Cathedral/Architecture/Exterior/Diagram/Chartres-Exterior-Main.html.

[158] For a discussion and critique of the principal of minimal intervention within the field of art conservation, see Caroline Villers, "Post Minimal Intervention," *The Conservator* 28, no. 1 (2004): 3-10, http://doi.org/10.1080/01410096.2004.9995197.

Theme 4: Toward a Sustainable Digital Humanities

Looking back at MedArt through the details culled from our forensic analysis, our oral interviews, and our broader contextual research, has provided an instructive account of what it takes to sustain digital scholarship over almost a quarter of a century. In particular, we have seen the inevitable complications faced by a team when managing an integrated network of people and technology, as relations and situations inevitably change. In our consideration of the ways that *Images of Medieval Art and Architecture* has been sustained over the years, it has also become clear that a relatively technologically uncomplicated website with a clear initial mission can still face an array of challenges in its effort to remain available, useful, and legible over time. The project has seen large sustainability threats such as the severance of the link between MedArt and the DRL Chartres image collection and the transfer from the early server warrens to the EWI site, and it has also seen small changes to the team that also impacted its ongoing sustainability needs, such as the addition of new team members like Phil Maye who brought different skills and different technologies to the project. This network of people, decisions, technologies, and infrastructures are still present to this day and are performing a constant tug-of-war with one another, pulling the contours of the system into new shapes every year that the project team must maintain.

Lessons Learned from Sustaining MedArt

A number of broad, overarching themes—and lessons learned—about the practice of digital sustainability emerged from our work on Sustaining MedArt. Some of these are clearly tied to the history of the site, while others arose during the very act of performing this research. Above all, the Sustaining MedArt project team has found that **effective, ongoing project sustainability relies on effective, ongoing project management**. That is, the role of mindful project management, especially basic recordkeeping, is critical to every single of the following findings:

- Proactively deciding how long you wish your project to endure is the first step in the process of creating sustainability plans.
- Knowing the current intellectual goals of your project is critical to the identification of effective sustainability goals.
- Identifying your desired audience and learning about the needs of your actual audience will help you ascertain your sustainability requirements.
- Because digital projects tend to have many moving parts that can change independently, not all components of a project will necessarily have the same sustainability goals.
- Staffing and technologies *will* change over time. Such changes activate sustainability risks. These risks can be mitigated by reality checks and forward planning.
  - Knowing who is on your staff, what skills they have, and how long they are funded to stay on the project is critical for sustainability planning.
  - Knowing what technologies are being used on your project, who on your team has the skills to support them, and how long you plan on using those technologies is critical for sustainability planning.
- Keeping good, basic records can also mitigate the risks associated with change over time, as the project's memory of the goals, desired audience, and critical features of a project then reside in places outside in the minds of staff, individuals who are not always available to the team, whether past, present, or future.

- Given that the intellectual goals, audiences, technologies and staffing of a project change over time, sustainability planning needs to be an iterative, ongoing project management process.
- Becoming familiar with the basics of professional digital preservation practices is a critical step in the process of making educated decisions about what technological changes will have the greatest impact on sustainability practices over time.

The ways that these themes are related to the work of Sustaining MedArt, both in terms of its historical findings and its ongoing workflow, can be made clearest by grouping them into four larger categories: Project Goals, the Importance of Recordkeeping, Staffing + Technologies, and Functional Digital Preservation Strategies.

Project Goals
- Proactively deciding how long you wish your project to endure is the first step in the process of creating sustainability plans.
- Knowing the current intellectual goals of your project is critical to the identification of effective sustainability goals.
- Identifying your desired audience and learning about the needs of your actual audience will help you ascertain your sustainability requirements.
- Because digital projects tend to have many moving parts that can change independently, not all components of a project will necessarily have the same sustainability goals.
- Given that the intellectual goals, audiences, technologies and staffing of a project change over time, sustainability planning needs to be an iterative, ongoing project management process.

As the VMW team prepared to work on this project, they asked the question: "What features and affordances of MedArt is it important to sustain?" Because the site (like its hard drives) had become a palimpsest of intentions and desires, the answer was impossible to identify completely without (1) learning about the history of the site; (b) interviewing the remaining members of the originating project team about their impressions of the project's past and future; (c) talking to the current users of the site to see what utility they find in it; and (d) looking at the sustainability resources the stewards have at our disposal.

We learned that, over the course of MedArt's 25+ years of existence, the objectives of the project had shifted and changed over time. While the project had always been focused on active learning principles and on the investigation of how technology can be integrated into pedagogy, MedArt began as a resource founded on Alison Stones' collection of 35mm slides, but eventually supported something as radically different as a large-scale, image-based, proactive documentation project of Chartres Cathedral. As the team shifted and changed, the central goals of the site also seemed to move along with them—something demonstrated by the way the Chartres pages' functionality, features, and appearance transformed after the team's trip to France. The addition of Phil Maye and the Digital Research Library to the project team shifted forever the way those particular images were stored, served to, and displayed on MedArt.

We have seen that it is very difficult to maintain a reliable project vision over time without ongoing project documentation, as the team becomes beholden to a communal memory—basically an oral history—to keep track of their overall goals. Such a state of affairs can be a sustainability risk, as a common, central understanding of what a project is trying to accomplish overall is critical to decisions about what particular features are fundamental to sustain and which might be dropped. Similarly, familiarity with project's actual and desired users are also important to successful sustainability plans, as

user needs, in turn, shape the overall goals of a project. Identifying any and all features that help support these overall objectives are central to the effort of deciding what parts of a project ought to be sustained in their current forms and what others might be left aside, revamped, or transformed into something new.

From what we have observed, the original MedArt team did not give any advance thought to how long their project would last on the Web. This is not an unusual state of affairs for such projects—there tends to be a default assumption that all humanities projects, including digital ones, all ought to last "for as long as books do."[159] However, digital sustainability is a very different process than paper sustainability. It is an ongoing process, and if no proactive thought is given to a project's likely end date, this places great pressure on the project team to preserve their work "forever." Knowing how long you want your project to last is not about aiming for forever and neither is it about giving up on the idea of forever. It is about being able to use mindful decisions about the future of the project when making decisions for today.

With that said, given how quickly digital technologies change and become obsolete, and also how quickly staffing, especially student-based staffing, can turn over in an academic environment, we also came to the conclusion during our research that, not only should projects decide how long they want their project to last, but they should also revisit their sustainability plans every three years to make sure they stay up-to-date and viable.

Indeed, it has been the experience of the Sustaining MedArt team that it is beneficial to think of digital projects as existing in successive "contexts of sustainability." In the early years of MedArt, for example, the biggest pressures on the project's sustainability came from the lack of sufficient server space, but as the project aged, different pressures came to bear, such as the relationship with the DRL. Each successive phase brought with it different contexts for sustainability such that any plans that may have been made at the beginning of the project would not apply well to the team's situation just a few years later, much less twenty years later.

Moreover, these contexts of sustainability do not end when the project ceases to be actively updated. The VMW is the steward, not the active creator, of *Images of Medieval Art and Architecture*. And yet, over the course of our research and our direct work with the site, it has become quite evident that, as a web-based, user-focused project, MedArt will *always* be active in some form or another, no matter how the project team perceives its role. Working down in the trenches, it is clear to us that MedArt will always be alive, always needing sustenance, until the very day that the project team (whoever that might be) decides to allow it to fully wither away where it stands, or to proactively remove it from the Web.

Staffing + Technologies

- Staffing and technologies *will* change over time. Such changes activate sustainability risks. These risks can be mitigated by reality checks and forward planning.
  - Knowing who is on your staff, what skills they have, and how long they are funded to stay on the project is critical for sustainability planning.
  - Knowing what technologies are being used on your project, who on your team has the skills to support them, and how long you plan on using those technologies is critical for sustainability planning.

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[159] The project team has dubbed this particular expectation of longevity, "BookTime."

Over the years, the MedArt team added to and refined the site's content—uploading new or higher resolution photographs, adding additional cathedrals, updating maps, and creating new interfaces for the images. On the one hand, this is one of the chief advantages of a web-based digital reference source: it can be updated continuously without being beholden to paper-publishing timetables and expenses. On the other hand, it is easy to underplay the reality that to craft, produce, and mount these updates, the amount of human time and energy was just as great for this web-based resource as it would have been for any other mode of intellectual communication—if not *more*. The people who created MedArt's content, after all, were also usually responsible for its technological implementation. Creating effective websites is not akin to writing an essay and hitting "send," so to speak. While the "middleman" of the paper-based publishing industry has been removed from this new ecosystem of scholarly communication, with it has gone the contribution of their labor as well.

Moreover, as the members of MedArt project team changed over time, so did their skills, abilities, and even their desire to maintain the work of their previous teammates. Each team member was allowed to use whatever technology suited them best at the time, and this created a hodgepodge of technical sustainability requirements. In addition, most of the team worked as volunteers, so their ability to provide labor over time was inconsistent. Furthermore, logistical issues also abounded in the history of MedArt. Finding funding for the site's technological infrastructure, especially server space in the early years, was an ongoing issue for the project, and the result was a difficult-to-sustain maze of different "server warrens," each containing part, but not all, of MedArt's data. Knowing what was stored where was a job for Jane Vadnal's memory for much of the history of the project.

Today, none of the members of the original MedArt team are actively working on the site—from Stones, Vadnal, and Maye, down through the legions of students and volunteers that contributed over the years. Given MedArt's current goals, each one of these people left traces on the project that might need to be sustained, and it is the job of the stewardship team to ascertain which. Because of a lack of direct project documentation, we could only discover this information through our research and analysis. We needed to discover what technologies existed on the site, and which of them supported the features of MedArt that have become the most essential to its ongoing sustainability. Then, once we were familiar with these technologies, we needed to make sure that there was a member of our team that could support them over time. If we want technologies to remain operational, there needs to be a person whose job it is to make sure it is so.

To sustain a project over time—even for the next three years—it is therefore important to know the complete picture of both the staffing and technologies used (and those that will be needed in the near future) by a project. Current staff members who have the appropriate technical skills (or who are assigned to learn such skills) should then be mapped to the needed technologies, and given the direct responsibility to maintain them. This socio-technical mapping need not be perfect. There could certainly be times in a project's life where there is no team member who knows how to support a given technology. However, if the socio-technical mapping has been done, this becomes a known sustainability risk, and knowing what the hazards are is a much better place to be, sustainability-wise, than remaining ignorant and hoping for the best.

The Importance of Recordkeeping
- Keeping good, basic records can also mitigate the risks associated with change over time, as the project's memory of the goals, desired audience, and critical features of a project then reside in

places outside in the minds of staff, individuals who are not always available to the team, whether past, present, or future.

Because of Langmead's previous involvement in the 2010 server transfer, the Sustaining MedArt team knew at the beginning of our work that we would have access to a number of historical documents associated with the project. The information from VRCOLL and the old AFS server had been safely copied, to a local hard drive called, "Last Chance."[160] We also knew from the records survey made by the HAA Server Project team that these files and folders would be a hodgepodge of information, from personal records, to long-lost subdirectories containing past incarnations of the site, to never-published information such as the images from Germany and Italy. Working our way through this information, while fascinating, was more like reading an unprocessed archival collection than gleaning critical evidence from well-organized primary source material. A number of the members of the project team are trained archivists, and processing this information proceeded in a professional manner, but working with unprocessed hard drives is difficult. That there were no primary sites of project documentation for us to rely upon to find the information that the previous project team found critical to their work may have heightened our sense of excitement when discovering important information, but it truly hindered our research process.

We were also pleased to find some unexpected, but key, peripheral documentation contextualizing MedArt as a critical and scholarly project. The most helpful resources in this regard were Stones' own publications. We were quite fortunate that Stones was the type of scholar to publish self-reflective activity relatively frequently. We also, of course, spoke to her directly a number of times during the research process, but having access to her synthetic writings from the time helped us understand the initial history of MedArt in ways that were not reliant wholly on hindsight. Stones' most self-reflective article describing MedArt was published in 1999—five years after the site was initially conceived—and, while it does not provide an in-depth, technical account of MedArt's creation, it does offer critical insight into to the ways that Stones contextualized this project in terms of her own pedagogical interests.[161] Through a footnote in this article, for instance, she makes the connection between MedArt and her previous interest in experimenting with technology in the service of providing new types of effective pedagogy. This led us to more research on Stones' publication collaboration regarding previous experiments in "active learning." Much of the other relevant peripheral documentation we uncovered during our research were record-keeping sources related to the University, such as the University of Pittsburgh's own institutional archive, yearly reports, and back issues of the faculty and staff newspaper, "University Times." These were helpful in allowing us to substantiate the timeline of University of Pittsburgh's early connections with the World Wide Web and discovering the fact that Stones and Vadnal first finished a prototype of the project in 1995.

That being said, this research process has revealed the fact that the way that MedArt appears on the Web does not adequately reflect its conditions of creation and ongoing persistence. While Stones' name appears in the form of copyright notices throughout the site, Vadnal's appears only in footers and scattered other locations. However, in our research, we came to realize the immense role that that Vadnal played in the production of the site. As she was not available to interview, many of the precise

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[160] However, due to the fact that the final copies were made in a moment where there were no plans—even by Langmead—to perform a historical accounting of *Images of Medieval Art and Architecture*, no efforts were made to preserve the creation/modification timestamps on the files. Much useful temporal information was lost by this decision.
[161] Stones, "Three Sites."

details regarding her contributions and motivations will remain unknown. What we do know about Vadnal and her work comes from our interviews with the other principal contributors to the site and the tidbits of documentation revealed on the archival hard drives in the course of researching this project. From what we have come to understand, while the site itself was always overseen by Stones, in practice it was largely constructed and maintained by Vadnal. Thanks to the palimpsest of material left behind and Stones' oral history, we were able to clearly recognize that the site simply would not have existed without her. However, without direct access to Vadnal today, we remain unable to ascertain basic points about when and why certain decisions were made in regards to its creation and maintenance between 1995 and 2006, when Phil Maye joined the team. And, indeed, even if she were available for meetings, she may not be able to remember.

Part of the lesson we can draw from this experience with the records of MedArt—that were at once spotty and scattered and overly detailed and personal—is the importance of proactively documenting and communicating the process of creation and maintenance in order to allow others to understand it. Here we do not mean simply mean keeping records solely for the sake of "posterity," we also mean for the sake of your current and future team members. The ad-hoc way that the MedArt team kept their records affected the way that Phil Maye worked when he joined the team. His introduction to the site was made by a form of hands-on apprenticeship with Vadnal. While this is not a bad way to go about learning about a project, it is difficult to scale and relies on the continued presence and institutional memory of certain key team members, who may or may not be available to you at the time you need help. Simple, shared, team-focused recordkeeping practices could have helped the project run smoothly in the past, and, as a happy side effect for the Sustaining MedArt team, would have told the history of the work more clearly.

Functional Digital Preservation Strategies

- Becoming familiar with the basics of professional digital preservation practices is a critical step in the process of making educated decisions about what technological changes will have the greatest impact on sustainability practices over time.

Four of the five members of the Sustaining MedArt research team are trained information professionals, and of these, two (Langmead and Gunn) have a primary or secondary research focus in digital preservation in particular. Because of this depth of knowledge, we had assumed that the formation of MedArt's actual sustainability plans would be a matter of applying what we know so well to this particular case study. And, while we were not entirely incorrect in our assumptions, we were very surprised to find out that when we were asked to look at the professional digital preservation literature from the point-of-view of an active steward of a live website and not the custodial steward of inactive digital files, this material suddenly became much *less* legible and useful than it had seemed before.

That is, we discovered that there was a lack of legible, professional-level, humanist-facing resources to help with the creation of practical sustainability plans for an active project. While digital preservation professionals have a long-standing and robust set of tools and techniques at their fingertips, the research team found that—in our roles as stewards of a project that is in need of ongoing maintenance—such approaches are difficult to implement in the daily work of digital humanities projects. Existing digital preservation guides are also often intimidating in scope and assume a great deal of preexisting knowledge. And, finally, the professional digital preservation literature is almost entirely designed around a custodial point of view that assumes that the project's creators are no longer in control of their assets and/or that those assets are no longer in active development. We could quite clearly see how difficult it would be for digital project managers who work outside the information

professions to extract even the key components from this literature that would be applicable to their work in all of its various phases and active incarnations.

In the course of researching best practices and strategies for Sustaining MedArt, our team looked to the following existing digital preservation frameworks, conceptual models, and published preservation guidebooks.

Conceptual Models and Frameworks

The Open Archival Information System (OAIS) reference model is a conceptual framework that has been incorporated into many preservation systems and programs, and has had a wide-reaching and longstanding influence on the digital preservation landscape.[162] Within this model, the OAIS is the organization or technological system responsible for the long-term preservation of digital information, and is the central part of a model that also includes the ingest of records and subsequent dissemination to users. For our purposes with this project, it is particularly noteworthy that the OAIS reference model emphasizes user access and the importance of preserving a project's significant properties for future use by its designated communities.[163] In this respect, it is undoubtedly socio-technical, as it supports the flow of digital information from its producers to its users, including the individuals responsible for managing it within the OAIS. However, its focus is on the custody of inactive records within a dedicated archival repository, and as a result, it de-centers both the creator and the user.

The Digital Curation Centre (DCC) Digital Curation Lifecycle Model takes an iterative, cyclical approach to preserving digital simple digital objects (such as text files, images, and associated metadata) as well as complex digital objects (meaning digital objects created by combining multiple simple digital objects, such as websites).[164] Like OAIS, this model emphasizes the importance of access and use. The lifecycle framework, notably, advocates for a perspective in which preservation is not a final or static endpoint, but rather another phase in the life of a digital object which contributes to other phases, such as access, use, and further transformation. In this respect, the Digital Curation Lifecycle Model is more easily adapted to non-custodial settings than some other professional digital preservation frameworks.

The National Digital Stewardship Alliance (NDSA) Levels of Preservation was a conceptual approach to digital preservation that our team found particularly helpful, and in fact, ultimately adapted and incorporated into the STSR. The NDSA Levels consist of a set of tiered recommendations in six topical areas: Storage and Geographic Location, File Fixity and Data Integrity, Information Security, Metadata, File Formats, and Access. Within each of these areas are four levels of cumulative actions that can be taken to sustain digital objects over time. They are designed such that they be used by individuals and small groups seeking to develop tailored digital preservation strategies as well as by larger institutions

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[162] For the best overview of OAIS, see RLG-OCLC, *Trusted Digital Repositories: Attributes and Responsibilities* (Mountain View, California: RLG, Inc., 2002). https://www.oclc.org/content/dam/research/activities/trustedrep/repositories.pdf. This document is commonly known as "OAIS Lite," and contains a highly-technical summary of the OAIS model.

[163] Brian Lavoie, "Meeting the Challenges of Digital Preservation: The OAIS Reference Model," *OCLC Newsletter* No. 243 (January/February 2000):26-30, http://www.oclc.org/research/publications/library/2000/lavoie-oais.html.

[164] "DCC Curation Lifecycle Model," Digital Curation Centre, accessed March 30, 2018, http://www.dcc.ac.uk/resources/curation-lifecycle-model.

seeking to rethink or improve existing workflows.[165] The ability to customize a digital sustainability action plan in accordance with the characteristics and priorities of a specific project was particularly suited to our needs. As with other frameworks surveyed, the NDSA Levels are designed for a custodial setting, and so a degree of adaptation and translation was required to meet the needs of managers of actively developing digital humanities projects.

Published Preservation Guidebooks

The Digital Preservation Coalition's (DPC) *Digital Preservation Handbook* is an online, open, peer-reviewed resource for "all those involved in the creation and management of digital materials."[166] Originally developed by Neil Beagrie and Maggie Jones in 2001, it is now maintained and updated by the DPC, with input from 45 digital preservation practitioners. This resource provides detailed information about a number of the sustainability factors that were important to Sustaining MedArt, including file format standards, information security, dependency upon cloud services, and fixity information.[167]

Notably, the *Handbook* provides extensive resources for implementing institution-wide digital preservation policies and workflows in addition to providing technical information about specific preservation tools and solutions. While there is much to be gleaned from this robust resource, individual project managers looking to support discrete projects must sift through the organizational and institutional resources to determine the appropriate takeaways for their work. The concepts and information provided within the Handbook can still be useful to individuals, but much of this resource is geared toward information professionals charged with advocating for or implementing digital preservation procedures within an institutional setting.

Digital Preservation Management (DPM): Implementing Short-term Strategies for Long-term Problems is another instructional resource made freely available online, in this instance by Cornell University Library and MIT Libraries. Like the STSR, the DPM is both an online resource and a facilitated workshop, and thus occupies a hybrid space. Because the workshop has also been made available as a self-guided online tutorial, it is being evaluated as a published online resource. The DPM is structured in accordance with two guiding documents: the Reference Model for an Open Archival Information System (OAIS) and Attributes of a Trusted Digital Repository (TDR), which gesture toward the workshop's custodial orientation.

The DPM introduces users to digital preservation terms and concepts, providing definitions and links to further readings on archival concepts and frameworks, including OAIS, Trusted Repositories Audit & Certification (TRAC), PREservation Metadata: Implementation Strategies (PREMIS), and the Final Report of the Blue Ribbon Task Force on Sustainable Digital Preservation and Access.[168] It then walks users

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[165] Megan Phillips, Jefferson Bailey, Andrea Goethals, and Trevor Owens, "The NDSA Levels of Digital Preservation: An Explanation and Uses," *National Digital Stewardship Alliance*, 2013, http://www.digitalpreservation.gov/documents/NDSA_Levels_Archiving_2013.pdf.

[166] "Home," *Digital Preservation Handbook, 2nd Edition*, Digital Preservation Coalition, 2015. https://dpconline.org/handbook.

[167] "Technical Solutions and Tools," *Digital Preservation Handbook 2nd Edition*, https://dpconline.org/handbook/technical-solutions-and-tools.

[168] Ibid.

through detailed accounts of various preservation threats, from format and media obsolescence to theft or human error.[169]

The DPM is particularly useful for orienting those completely new to digital preservation to its theoretical and practical foundations. It provides a high-level overview of the various challenges of digital preservation, from selecting material to be preserved, to developing a preservation plan, to physically preserving the bits of digital objects. This resource, like the DPC's Handbook, depends upon a solid grasp of archival principles and custody of inactive objects, but is ultimately more oriented to the true beginner than other comparable training programs.

Our prior work on Sustaining MedArt had demonstrated to us that sustainability planning is most effective when it happens as an ongoing, iterative project management process beginning as early as the initial planning phases, as opposed to being addressed only during the final stages of a project's lifespan. And yet, digital preservation resources tend to be designed for custodians who work with projects at the end of their lives. Few were designed specifically for the creators and managers of active projects who wished to plan for the ongoing sustainability for their work. Given that this overview of the salient, professional digital preservation literature was so strongly oriented towards a custodial point-of-view, our research revealed what we perceive to be an important gap in the current digital preservation landscape. There is a need to translate professional-level digital sustainability practices to new audiences, not by diluting them, but by guiding non-expert communities through these ideas step-by-step, making sure that each stage was useful to digital humanities stakeholders along the way.

Developing the Socio-Technical Sustainability Roadmap

To help other digital humanities projects utilize the findings of the Sustaining MedArt project, they have all been integrated into an online, publicly-accessible resource—The Socio-Technical Sustainability Roadmap (STSR)—that leads digital project teams through the process of creating sustainability plans for their work. The STSR is a structured, process-oriented workshop, inspired by design thinking and collaborative learning approaches. As recommended by Sustaining MedArt's findings, it proactively positions sustainability within a scaffold of effective project management, and ultimately, suggests that the ongoing persistence of a project is as dependent upon sustainable staffing as it is upon technological infrastructure. It is designed so that it can be run either as a larger-scale, facilitated workshop or as a small, self-guided project audit.

Arranged in three thematic sections—Project Survey, Staffing and Technologies, and Digital Sustainability Plans—the workshop offers a series of hands-on modules that directly guides participants through the practice of creating effective, iterative digital sustainability strategies addressing the needs of both the social and technological infrastructures supporting their projects. The collaborative working sessions include topics such as identifying a project's scope, expectations of longevity, sustainability priorities, documentation practices, and the team members responsible for the project's technological infrastructure. Participants are also introduced to professional-grade digital preservation practices that have been adapted to meet the needs of active project creators. Finally, at the conclusion of the Roadmap, participants leave with an actionable digital sustainability plan. The complete set of workshop materials are available on the Socio-Technical Sustainability Roadmap website (http://sustainingdh.net), and will also be presented in further detail below.

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[169] "Obsolescence and Physical Threats," Digital Preservation Management Workshop, accessed March 30, 2018, http://dpworkshop.org/dpm-eng/oldmedia/index.html.

The decision to produce the Socio-Technical Sustainability Roadmap as an interactive workshop was informed by the fact that, as noted above, the Sustaining MedArt project revealed that one of the core issues to effective sustainability was the creation of effective project management strategies. A workshop would allow for the participants to experience first-hand how the practices of identifying project goals and audiences would impact—on the spot—their decisions about what parts of the project are more likely to be needed for extended periods of time, and in what form. To craft the structure of the STSR, we first looked to existing digital preservation workshops and trainings, including the "Preserving Digital Objects With Restricted Resources Institutes" (Digital POWRR) and the Ithaka S+R workshop series. While this pair of resources is fantastic, and filled with exceptional information, we felt that they were potentially overwhelming to digital project creators with little training in the information sciences, and also mainly geared again towards a custodial point-of-view.

The Digital POWRR Project began in 2012, and has since offered two of five digital preservation training institutes, with the support of the Institute of Museum and Library Services. These institutes are designed to allow librarians and archivists from small and mid-sized institutions to establish or strengthen digital curation and preservation skills. As stated on the project website, the POWRR Institutes are designed for information professionals in "boots on the ground roles" who have "been exposed to basic digital preservation concepts, but who [have] struggled with moving from theory to practice."[170] Specifically designed to make digital preservation training and expertise available to information professionals working in smaller, less-resourced organizations, the POWRR Institute presentations and tutorials are made openly available online as well. These workshops offer valuable practical experience with open source preservation tools and software, including Data Accessioner, Bagger, Archivematica, and Webrecorder, as well as information about digital preservation frameworks, standards, and scholarship.[171]

The Digital Preservation 101 section of the POWRR website also features a useful section on Personal Preservation, an area not explicitly covered by other large-scale digital preservation workshops. Resources in this section include techniques for preserving personal digital materials, such as downloading social media data or preserving messages from Gmail in a local email client.[172] Efforts to preserve relatively personal or individualized research projects like Sustaining MedArt may benefit from some of the more bespoke sustainability practices used in personal digital archiving, but overall fall somewhere between preserving one person's data and implementing institution-wide digital preservation policies.

Ithaka S+R's workshop, "Managing a Portfolio of Digital Resources," is designed to help project stakeholders determine how long to support digital projects, and how do design exit strategies for projects which should no longer be supported.[173] The related publication "Sustaining the Digital Humanities: Host Institution Support Beyond the Start-Up Phase" addresses a number of the concerns of Sustaining MedArt, though as the workshop's title suggest, it does this through the lens of asking how

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[170] "POWRR Institutes," Digital POWRR, accessed March 30, 2018, http://digitalpowrr.niu.edu/institutes/.

[171] "I Survived a POWRR Institute," Digital POWRR, last updated November 29, 2017, http://digitalpowrr.niu.edu/survived-powrr-wkshp/.

[172] "Personal Preservation," Digital POWRR, last updated March 25, 2013, http://digitalpowrr.niu.edu/digital-preservation-101/personal-preservation/.

[173] "Workshops," Ithaka S+R, accessed March 30, 2018, http://www.sr.ithaka.org/services/workshops/.

institutions can support digital humanities projects developed by staff and faculty over time.[174] This workshop is perhaps most thematically close to the STSR, but its materials have not been made available online.

To this end, we produced the Socio-Technical Sustainability Roadmap as a bridge between professional digital preservation practices focused on the needs of custodial stewards, such as Digital POWRR and Ithaka S+R's workshop, and the ongoing project management needs of active project creators. By drawing on the valuable work already done in digital preservation scholarship, the STSR has developed a guiding set of flexible, customizable practices for managers of and contributors to both active and legacy digital humanities projects. We focused on taking the NDSA Levels of Preservation as our starting point, because we felt that it was the professional project that provided areas of focus and a customizable framework that suited the objectives of the STSR best. As noted above, the NDSA Levels were also originally designed with archival objects in a custodial setting in mind, but it was the project closest to the one we would like to have used to guide the creation of the participants' sustainability planning, and so we took it as the basis for our adaptation to suit the needs of managers of digital humanities projects in the active development or ongoing maintenance phases. The original NDSA levels, along with the STSR adaptations, can be found in Appendix B.

The NDSA Levels consist of a set of cumulative recommended actions in six topical areas: Storage and Geographic Location, File Fixity and Data Integrity, Information Security, Metadata, File Formats, and Access. In the STSR, we transformed the NDSA "Storage and Geographic Location" area into "Backing Up Your Work." The original actions specified by this area remain relatively intact in our adaptation, with only minor adjustments made to be more inclusive of the needs actively changing projects, such as removing references to archival storage systems. The title change was implemented because it resituates the actions of this level within a context that is more easily understandable by our user communities. "File Fixity and Data Integrity" became "Data Integrity." The removal of file fixity from the title reflected our decision also to deemphasize the concept of fixity in the grid for this NDSA area, as this approach to bit-level integrity is likely to be of less significance in projects that are being actively created and whose files are likely to be undergoing constant change. "Information Security" became "Permissions." The actions in this NDSA area were altered to emphasize some of the project management and documentation activities recommended by the findings of Sustaining MedArt, such as identifying which project members have access to which files and documenting access authorizations and restrictions. "Metadata" remained "Metadata" in the STSR, and changes to this area consisted primarily of rearranging the order of the NDSA's suggested activities to prioritize automatically generated metadata in earlier levels and push more custodially-minded transformation and preservation metadata to later levels. We also defined the various types of metadata included in this NDSA area in order to make them more easily understood to those new to the concept of metadata.
The "File Formats" area also retained its original name and received only minor rephrasing. It is the NDSA area that saw the fewest adaptations to be successful this new context. "Access" remained "Access," but focuses now on providing access to active user communities such as providing publicly-available user guides, and removing references to actions that are specifically archival, such as creating finding aids or ensuring security in reading rooms.

In addition to these changes, the STSR team also made an effort to align sustainability actions that were repeated across multiple areas such that aiming for Level 1 sustainability practices in the "Metadata"

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[174] Nancy L. Maron and Sarah Pickle, "Sustaining the Digital Humanities: Host Institution Support Beyond the Start-Up Phase," *Ithaka S+R*, June 18, 2014, http://www.sr.ithaka.org/publications/sustaining-the-digital-humanities/.

area, for example, "Backing Up Your Work" would also allow users to reach Level 1 sustainability practices in another, related area, in this case, "Metadata." We also made efforts to integrate the work that the participants will have produced during the Roadmap into the sustainability levels themselves. This Level 1 sustainability practice shared between "Metadata" and "Backing Up Your Work," reads, "Document your reliable sites of project documentation including a description of their contents," which is an exercise that the participants will have completed in Module A5.

Embedding Sustaining MedArt within The Socio-Technical Sustainability Roadmap

The Socio-Technical Sustainability Roadmap is organized into three sections, each of which contains modules that address specific concepts relating to digital sustainability through both narrative information and team-oriented activities. It not only attempts to bridge the perceived gap between digital preservation scholarship and the needs of active and legacy digital humanities projects, it also integrates all of the other major findings from the Sustaining MedArt project into its modules. For example, the Sustaining MedArt team has argued that project managers must know the structure, goals, and scope of their project in order plan for its ongoing persistence. This information is elicited from participants in "Section A: Project Survey." The team has also found that project managers must consider the skills, funding, and availability of their project team members alongside the needs of their technical infrastructure to create a comprehensive approach to the problem of sustainability. This information is discussed in "Section B: Staffing and Technologies." The project leaders should also be introduced to professional sustainability practices that have been carefully translated from their original custodial context in ways that allow them meet the needs of active project managers. "Section C: The "Sustaining MedArt" presents this information and also guides participants through the process of creating a detailed, actionable sustainability plan using these adapted professional preservation practices as a scaffold.

Below please find a brief overview of the modules and activities designed for the STSR. The descriptions for each section also contain a bulleted list of the findings from the Sustaining MedArt project that are integrated into those particular content areas and exercises. For the complete text of the workshop, please visit the live site at http://sustainingdh.net.

Introduction

To situate users of the Roadmap within the project's expectations, the team created an introductory section containing the contextual and logistical information needed to understand what the STSR is for. These four prefatory essays orient the participants to the work ahead and address topics such as, "Welcome and Getting Started," "Overview of the STSR Modules," "Possible Workshop Schedules," and "What will I take away from the STSR?"

That the STSR is designed to be run every three years is covered by the introductory texts, as is the fact that effective sustainability practices and effective project management are intimately intertwined. The presence of this information directly speaks to the following finding from the Sustaining MedArt project:

- Given that the intellectual goals, audiences, technologies and staffing of a project change over time, sustainability planning needs to be an iterative, ongoing project management process.

Section A: Project Survey
The Project Survey is designed to lead participants through the process of articulating their project's vision, goals, and audience, and sustainability priorities. This section also involves the difficult but critical work of deciding how long a project will ideally last, recognizing that many digital projects are inherently ephemeral, and that indefinite preservation is not always the most desirable outcome.

Section A addresses the following findings from the Sustaining MedArt project:

- Proactively deciding how long you wish your project to endure is the first step in the process of creating sustainability plans.
- Knowing the current intellectual goals of your project is critical to the identification of effective sustainability goals.
- Identifying your desired audience and learning about the needs of your actual audience will help you ascertain your sustainability requirements.
- Because digital projects tend to have many moving parts that can change independently, not all components of a project will necessarily have the same sustainability goals.
- Keeping good, basic records can also mitigate the risks associated with change over time, as the project's memory of the goals, desired audience, and critical features of a project then reside in places outside in the minds of staff, individuals who are not always available to the team, whether past, present, or future.

Module A1: What is the scope of your project?
The STSR begins by asking participants to consider the full scope of their project. In order to do this, we ask them to identify the various creative outputs or trajectories that comprise their work. These might include public-facing websites, datasets, or any number of different publication formats. We then ask participants to select one of these outputs for the remainder of the workshop. The necessity of focusing on only one output or trajectory at a time will become clearer in the following modules, where answers to each question may be different for different outputs.

Activity
Working as a group with a designated facilitator, or on your own if you are working solo, make a list of your project's different creative outputs, using the following questions to get you started:

1. Where are the access points for your project? Is there only one? Where there are different access points, there are often different creative outputs.
2. Have you created different project deliverables to serve unique purposes or reach specific audiences? Different deliverables can signal different manifestations of your project.
3. What different workflows do you have on your team? Do they correlate with different creative outputs?
4. How do the intellectual goals of your project manifest themselves? Do they appear together in one creative output, or are they distributed across many?
5. How does your data flow through your project? Is it analyzed and presented in a single way, or a variety of ways? As the data changes shape, it can signal different manifestations of your project.

Once you've made an exhaustive list, determine which of your creative outputs you will be considering in this instance of running the Roadmap.

Module A2: How long do you want your project to last?
We begin this module by asking participants the difficult question of how long they would like to sustain their project. It is important to consider this question carefully, as the default longevity for digital humanities projects is often assumed to be, "for as long as books last." However, given the opportunity to reflect, many project leaders will select a different lifespan for their digital work. Recent scholarship on sustainability issues in digital humanities research has emphasized some of these options, including embracing the ephemerality of digital projects, and actively planning for a project's end.[175] This decision will have impactful ramifications on their sustainability plans.

> **Activity**
> Working individually, consider each of the project lifespans and project phases described in Module A2. Then take some time to write down answers to the guiding questions provided below. Please note that if you are finding that your chosen creative output has two different expectations of longevity or inhabits two different phases of development, you are probably working with more than one creative output, and might productively revisit your work in Module A1 with this in mind. After about 5 minutes of work, reconvene (if applicable) and discuss your selections and reasons. Then, as a group, determine consensus-based responses to the questions.
>
> 1. How long do you want your project to last, that is: what is your anticipated digital project lifespan?
> 2. Why have you chosen this lifespan? Intellectual goals? Financial reasons? Staffing reasons? Technical reasons? Other reasons?
> 3. What phase of development would you currently say your project is in? How long has it been in this phase? How long do you project that it will continue in this phase?
> 4. What is the next phase of development you foresee for this project? When do you think that the project will enter this phase?

Module A3: Who is the project designed for?
This module takes is heavily informed by the OAIS framework's concept of "designated communities," which are those groups that a project hopes to serve and that the project's creators keep in mind when making decisions. OAIS documentation notes that a designated community may be made up of multiple user groups, both known and imagined.[176] Understanding who uses a project and what their needs are is critical to discussions of sustainability, and in particular, to the work of the next module on sustainability priorities.

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[175] Andy Schocket, "Embracing Ephemerality in the Digital Humanities," February 2, 2016, http://www.andyschocket.net/2016/02/02/20160202embracing-ephemerality-in-the-digital-humanitiesembracing-ephemerality-in-the-digital-humanities/; Geoffrey Rockwell, et al., "Burying Dead Projects: Depositing the Globalization Compendium," http://digitalhumanities.org:8081/dhq/vol/8/2/000179/000179.html.
[176] Rhiannon S. Bettiva, "The Power of Imaginary Users: Designated Communities in the OAIS Reference Model," *ASIST 2016* (2016), http://onlinelibrary.wiley.com/doi/10.1002/pra2.2016.14505301038/epdf.

Activity

Spend 5 minutes writing down each of your imagined user groups on individual post-its or index cards, employing the following questions as prompts for description:

- Who do you imagine using your project?
- Why do you imagine they use it? What needs do they have?
- What do you imagine they get out of it?

Once this is completed, spend an additional 5 minutes doing the same exercise for your known user communities. Note: you definitely have at least one, the project team itself!

- Who uses your project?
- Why do they use it? What needs do they have?
- What do you imagine they get out of it?

Using the cards and post-its you've made as springboards for discussion, take a few minutes to sort through and arrange the cards in logical groups. Come to a consensus (if applicable) about who your imagined and actual users communities are, and then decide together what needs they have of your project, and how your project satisfies those needs. These will be your designated communities. You can have many such user communities, but keep in mind you'll want to ensure you can support their needs sustainably (You'll work more on what this decision implies in Module A4).

Here are some prompts for discussion:

1. If you have chosen the "general public" for one of your designated communities, could you be more specific about the types of people you feel constitute that group?
2. How does your project meet the needs of your users, whether actual or imagined? What skills and knowledges do you assume your users have that would allow this interaction to succeed?
3. Have you done usability studies to find out how your users engage with your project?
4. Who might you have as unanticipated users? What other publics have access to your work?

Module A4: What are the project's sustainability priorities?

This module also incorporates a concept from OAIS: that of "significant properties," which are those traits or characteristics of their work which are most critical to the intellectual and technical goals of the project. Scholars have found that there are still fundamental questions about which aspects of projects should be preserved.[177] This module proposes that a project's significant properties are most likely to be its highest sustainability priorities.

Activity

Break into groups of two and spend 10 minutes answering the questions listed below which cover issues relating to your project's content, context, and structure. If you are running the Roadmap solo, you can, of course, do this individually.

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[177] Henry M. Gladney, *Preserving Digital Information* (Berlin: Springer, 2007). http://doi.org/10.1007/978-3-540-37887-7.

- What is your project's narrative, argument, or mission? Where and how do your intellectual goals unfold?
- What information is your project intended to convey? How does it convey it?
- How do you define your project's institutional context? What are its contours and features?
- What are the structural components of your project?
- What about your project's chosen technologies and/or digital interactivity is most salient to you? What forms does it take?

Then, reconvene as a group (if appropriate) to discuss your answers for a few minutes before focusing on these final questions, which help you identify your project's significant properties, the roles they serve on your project, and the designated communities they serve.

- Of all the things you have listed so far in this exercise, what are the features without which your project simply would not be your project?
- Which seem utterly essential to your overall intellectual and technological goals?
- And, recalling your work in Module A3, which of these characteristics seem most essential to your designated communities?

Also be sure to retain a list of those properties that you proactively deem to be non-essential—this is also valuable information.

Module A5: Project Documentation Checklist
This module focuses on assembling the documents, ideas, and themes from the preceding modules into a coherent narrative for each project. It guides participants through a set of best practices for organizing project documentation–including the very documents generated in the course of running the STSR–with an emphasis on how recordkeeping facilitates sustainability. This is done in part through the introduction of the concept of "reliable sites of project documentation," that is, those recordkeeping locations that are not only trustworthy, but also accessible to, and used by, all appropriate team members.

Activity
If you are working with a group, choose a discussion leader to guide your conversation. Spend 10 minutes and generate a list of every single one of the places where your project documentation lives, and what sorts of records reside there. Think long and hard about this. You may use the Excel spreadsheet we have provided to create this list, or if you prefer, create your own brainstorming diagrams, charts, or maps. Examples of locations and record types are:

- Working drafts in Google Docs;
- File folders in Dropbox;
- File folders on a university server;
- Data visualizations on a web server;
- Documentation in GitHub repositories;
- Communication in email accounts or Slack;
- Printed documents in filing cabinets.

After creating an exhaustive a list as possible, take the remaining 15-20 minutes to determine which of the many sites you use to store your project documentation are to be considered *reliable sites of project documentation*.

Section B: Staffing and Technologies

The Staffing and Technologies section leads project teams through the process of coordinating the available staffing with the desired technological infrastructure. This involves a detailed mapping of the project team and their roles within the project to the specific technologies used and the actions required to maintain them.

Section B incorporates the following findings from the Sustaining MedArt project:

- Staffing and technologies *will* change over time. Such changes activate sustainability risks. These risks can be mitigated by reality checks and forward planning.
    - o Knowing who is on your staff, what skills they have, and how long they are funded to stay on the project is critical for sustainability planning.
    - o Knowing what technologies are being used on your project, who on your team has the skills to support them, and how long you plan on using those technologies is critical for sustainability planning.

Module B1: Who is on the project team and what are their roles?

This module asks participants to identify and list all stakeholders, both internal and external, who contribute to their project, making note of each contributor's responsibilities to the project, as well as the sources and duration of their funding. A 2014 report by Ithaka S+R assessed institutional support for digital humanities projects beyond the startup phase and found that factors that contributed to successful, sustainable projects included gaining support from senior administrators, developing partnerships with libraries and information technology departments, and clearly communicating project pathways and requirements to faculty.[178] Understanding that sustainability requires institutional and financial support in addition to skilled staff, a reliable digital sustainability plan sees project management as imperative, not only for obtaining funding or beginning a project, but for communicating to stakeholders the resources required for long term preservation.

Activity
Take 5 full minutes to make an exhaustive list of everyone you believe to have a stake in your project, and what you feel their stake is. If there are enough of you, please break up into groups of 2. If there are fewer than 4 participants, do this work individually.

Your analysis might start with the people who are participating in this workshop, and should extend to include the larger corporate entities who are contributing stakeholders to your work (e.g., Google, GitHub, Reclaim Hosting, etc…). Please also include any *user* groups that contribute directly to your work (via crowdsourcing, for example). The job is to brainstorm every single person or corporate body that does work for your project.

When complete, regroup (if appropriate), compare notes, and make a final accounting of what constitutes the entire set of project stakeholders, abiding by the consensus of the group. Spend

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[178] Maron and Pickle, "Sustaining the Digital Humanities: Host Institution Support Beyond the Start-Up Phase."

the rest of your allotted time doing this part of the exercise. It is best to do this work in the Excel spreadsheet template we provide for this module which asks you to identify:

- Project members and their affiliations
- Their responsibilities on the project
- The source(s) and duration of their funding on the project

In addition to working from the module spreadsheet, visualizations and mind-mappings are heartily encouraged.

Module B2: What is the technological infrastructure of the project?

Just as the previous module asked participants to identify their complete project team, this module asks for a similarly exhaustive list of the technologies used in the project, the function those technologies serve, and the sources and duration of their funding. Project teams must take into consideration the many technologies upon which their work depends. If a service such as website hosting, for example, is provided by a third party for a fee, its sustainability is directly linked to both its technological infrastructure and its funding in ways that are easily apparent. The same is also true for technologies which are made freely available to users. While these may not necessarily seem to be dependent upon funding, they are still dependent upon the long-term viability and availability of the service. Project documents stored in GitHub, for example, are stored "at the pleasure of GitHub." In developing the STSR, we have emphasized the importance of these service providers, who act as a type of extra-institutional partner.

Activity
Please take a full 5 minutes to make an exhaustive list of every piece of technology used in your work. If there are enough of you, please break up into groups of 2. If there are fewer than 4 participants, do this work individually.

We would like you to think broadly about the technologies used on your project. They may include communication tools, local servers, hosting and storage services, as well as any number of applications and platforms.

When complete, regroup (if appropriate), compare notes, and make a final accounting of what constitutes your full technological infrastructure, abiding by the consensus of the group. Spend the rest of your allotted time doing this part of the exercise. It is best to do this work in the Excel spreadsheet template we provide for this module, which asks you to identify:

- Technologies used;
- The function of each technology in your project;
- The sources and duration of their funding;
- The length of time the technology will be needed for your project.

You may realize, in the course of doing this work, that you forgot to include someone as an important team member in the previous module (B1), and that's totally fine! Just go over to that worksheet and add them now. In addition to working from the module spreadsheet, visualizations and mind-mappings are heartily encouraged.

Module B3: Socio-Technical Responsibility Checklist
This module brings together the work done in the previous two B modules and provides participants with an understanding of how their project team and technologies map onto one another. Attendees are asked to document which team members are responsible for which technologies, taking into account how, and for how long, both the staff and the technologies are funded. The result of this module, and of Section B, is a spreadsheet that clearly expresses this socio-technical mapping.

> **Activity**
> As a group, or individually if you are working solo, fill out the Excel spreadsheet provided for this module. While doing this work, please refer to the spreadsheets you created for the two previous modules, and, as a group, identify which technologies are connected with which team members. You should be able to copy-and-paste between Excel spreadsheets if you have been using them all along. You may find that you do not incorporate all of the project stakeholders listed in Module B1, but you should include all of the technologies listed in Module B2. Your mapping for this module will include:
>
> - Technologies and their function on the project;
> - Staff member(s) who are responsible for each such technology;
> - Source and duration of funding for staff ;
> - Source and duration of funding for technologies;
> - Length of time the technology will be needed for your project.
>
> As you go along, you'll want to consider how the sources and duration of funding for your staff compare with those for the technologies they maintain, keeping in mind that funding discrepancies may require special considerations for contingency plans to ensure uninterrupted maintenance.

Section C: Digital Sustainability Plans
Having completed the modules in Section A and Section B, participants are now prepared to craft a digital sustainability plan, complete with concrete actions to be taken, in accordance with their own sustainability goals. The STSR uses the NDSA Levels of Preservation as a topical framework to guide participants through this process.

Section C covers the following finding from the Sustaining MedArt project, and also draws the results of all previous findings together into the creation of an actionable, ongoing sustainability plan for the STSR participants:

- Becoming familiar with the basics of professional digital preservation practices is a critical step in the process of making educated decisions about what technological changes will have the greatest impact on sustainability practices over time.

Module C1: Adapting the NDSA Levels of Preservation
Of the existing digital preservation frameworks surveyed, the NDSA Levels of Preservation resonated the most strongly with the findings of the Sustaining MedArt project and the goals of the STSR. The six sustainability areas identified in the NDSA Levels are relevant to managers of digital humanities projects, whether they are in active development, ongoing maintenance, or retirement. However, because the NDSA Levels are designed for digital preservation professionals working in a custodial setting, significant

adaptation was required to make them scalable for managers of both beginning and legacy projects.[179] This module introduces participants to the original NDSA Levels of Preservation and outlines reasons and strategies for adapting them to a digital humanities audience. There is no activity associated with this module.

Module C2: Access & Backing Up Your Work
This module addresses the relationship between providing access to a project and its sustainability, focusing on the techniques that make a project usable as well as the backup activities required to maintain access to digital information over time. These areas are adapted from the NDSA's preservation areas Access and Storage & Geographic Location. Access is a field added more recently to the original five NDSA Levels.[180] It was also one that the STSR team considered to be most important, as the STSR is designed specifically for user-facing DH projects. For this reason, Access appears first in our adaptation. For each of the remaining C modules, participants are provided with a worksheet that helps them decide what level of sustainability they wish to achieve, emphasizing that a right-sized, viable level is the goal—not necessarily the highest level.

> **Activity**
> As a group (if appropriate), read through the sustainability levels offered by this module and then determine:
>
> - How high a priority this area is for your project;
> - Your current level of sustainability practices;
> - Your desired level of sustainability practices (as a goal to be achieved within the next *three years*);
> - The resources and actions that will be required to meet your desired level.
>
> Your current level may be a "Level 0" for these areas, and that is absolutely fine. It may even be the case that your *desired* level for a given area is "Level 0." Keep in mind that very few projects need to be at Level 4, and that this is not necessarily the central goal. Depending upon the specific traits, objectives, and resources of your project, it is likely that you will have different desired levels of effort across many of the sustainability areas presented by the Socio-Technical Sustainability Roadmap. Please focus on choosing your levels of sustainability mindfully and in harmony with your project's resources and desired longevity.

Module C3: File Formats & Metadata
This module focuses on creating work in stable, sustainable formats, and also making sure that these formats, as well as the rest of the project, are well-documented. These are adapted from the NDSA areas File Formats and Metadata, and retain those original titles.

> **Activity**
> As a group (if appropriate), read through the sustainability levels offered by this module and then determine:

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[179] Side-by-side comparisons of each of the original NDSA Levels of Preservation and its STSR counterpart can be found in Appendix B of this report.
[180] Shira Peltzman, "Expanding NDSA Levels of Preservation," Library of Congress, *The Signal Blog*, April 12, 2016, https://blogs.loc.gov/thesignal/2016/04/expanding-ndsa-levels-of-preservation/?loclr=blogsig.

- How high a priority this area is for your project;
- Your current level of sustainability practices;
- Your desired level of sustainability practices (as a goal to be achieved within the next *three years*);
- The resources and actions that will be required to meet your desired level.

Your current level may be a "Level 0" for these areas, and that is absolutely fine. It may even be the case that your *desired* level for a given area is "Level 0." Keep in mind that very few projects need to be at Level 4, and that this is not necessarily the central goal. Depending upon the specific traits, objectives, and resources of your project, it is likely that you will have different desired levels of effort across many of the sustainability areas presented by the Socio-Technical Sustainability Roadmap. Please focus on choosing your levels of sustainability mindfully and in harmony with your project's resources and desired longevity.

Module C4: Permissions & Data Integrity
The sustainability areas discussed in this section focus on protecting and maintaining the integrity of the project's work over time, from the platform level down to the bit level. These are adapted from the NDSA levels Information Security and File Fixity & Data Integrity.

Activity
As a group (if appropriate), read through the sustainability levels offered by this module and then determine:

- How high a priority this area is for your project;
- Your current level of sustainability practices;
- Your desired level of sustainability practices (as a goal to be achieved within the next *three years*);
- The resources and actions that will be required to meet your desired level.

Your current level may be a "Level 0" for these areas, and that is absolutely fine. It may even be the case that your *desired* level for a given area is "Level 0." Keep in mind that very few projects need to be at Level 4, and that this is not necessarily the central goal. Depending upon the specific traits, objectives, and resources of your project, it is likely that you will have different desired levels of effort across many of the sustainability areas presented by the Socio-Technical Sustainability Roadmap. Please focus on choosing your levels of sustainability mindfully and in harmony with your project's resources and desired longevity.

Module C5: Digital Sustainability Action Plan
The final STSR module guides participants through the process of aggregating the documents, findings, and ideas created and addressed by the workshop as a whole. Participants are guided through the process of creating a detailed, actionable sustainability plan using the adapted NDSA Levels of Preservation as a scaffold. A provided spreadsheet template helps participants identify a series of targeted viable sustainability actions, mapped both to specific technologies and to specific team members who will be responsible for carrying out those actions. As a reminder, these sustainability plans are intended to guide participants through the next three years of managing their project, at which time, if the project is to continue for longer than three years, the STSR will be revisited and conducted again.

Activity
As a group (if appropriate), work through the Excel spreadsheet provided for this module. Please refer to the spreadsheets you created for Modules A5 (Project Documentation Checklist) and B3 (Socio-Technical Responsibility Checklist), as well as the worksheets you completed for each of the sustainability areas introduced in Modules C2, C3, and C4. Even if you do not wish to use the provided spreadsheet, please detail the following pieces of information for each of the six sustainability areas detailed in the STSR:

- Your chosen level of sustainability for that area and the rationale for your decision;
- The anticipated timeframe for attaining that sustainability level;
- A catalog of individual actions you will take to reach your chosen level;
- Specific team members who will be responsible for each of these sustainability actions;
- A timeframe for completion of each action (should be fewer than three years).

It is worth noting that when you construct your catalog of sustainability actions, you should be aiming for tasks that are achievable within the next three years—that is, in the period before you run the STSR again, *or* your project reaches retirement, whichever comes first. The point of this exercise is to develop an ongoing relationship with sustainability practices that will last for as long as you would like your project to persist.

Moving Forward

From all these experiences, the Sustaining MedArt project team has concluded that, since digital projects inherently involve an interconnected network of humans and technologies, ensuring both a consistent flow of project management information and a solid understanding of digital preservation fundamentals is critical to the creation of effective sustainability strategies. Indeed, the research team found that it is the mindful attention to project management that generates the foundation for a set of viable, ongoing sustainability actions, ones that can be tied intelligently and directly to the known needs of the project and the resources it has at its disposal.

Members of the Visual Media Workshop team have been focusing their efforts on disseminating these findings of Sustaining MedArt project by both presenting scholarly talks and also facilitating instances of the Socio-Technical Sustainability Roadmap for various groups. Since the completion of the final draft of the Roadmap in Fall 2017, the team has presented this work at the 2017 National Digital Stewardship Alliance conference, at a 2017 colloquium at the University of Pittsburgh, and at a 2018 Digital Humanities Symposium at Oklahoma State University. Between Fall 2017 to Spring 2018, we have also facilitated instances of the STSR workshop for the Art Tracks project team at the Carnegie Museum of Art, for the project teams at the Maryland Institute for Technology in the Humanities, and for a number of internal projects housed in the Visual Media Workshop at the University of Pittsburgh.

And, finally, we feel that the Socio-Technical Sustainability Roadmap has passed its initial drafting and testing phases, and is ready to reach an even wider audience. To this end, in February 2018, we applied to the NEH ODH Institutes for Advanced Topics in the Digital Humanities program for funding to staff and facilitate five instances of the Socio-Technical Sustainability Roadmap at regional digital humanities hubs distributed across the country. Because the STSR has been designed to reach the widest possible audience, we will be making proactive efforts in both the wording and distribution of our calls for participation to attract attendees who may have little to no direct access to local, regional, or national

digital sustainability infrastructures. We also hope in many instances to be able to "train the trainers" during these sessions, and inspire and encourage participants to facilitate their own instantiations of STSR workshops in future.

The Socio-Technical Sustainability Roadmap is live and online at http://sustainingdh.net. With all of the lessons learned from the Sustaining MedArt project standing behind it, we sincerely hope that any and all interested digital project creators will gain valuable guidance—and a practical sustainability action plan—from this workshop exercise.

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Appendix A: Survey Instrument Used for Usability Analysis at the International Congress of Medieval Studies, Kalamazoo, Michigan (2016)

The purpose of this research study is to determine the usability of a website you might know, "Images of Medieval Art and Architecture." The interview should take no longer than 10 minutes. If you are willing to participate, we would like to voice-record the interview. At the end of the survey, we will ask you if you wish to give your name and email address for follow-up interview purposes, which you are free to refuse. Your participation is voluntary, and you may stop the interview at any time.

Q1 Have you visited this website before?

Q2 If so, what did you use it for?

Q3 Please respond to the following statement:

	Extremely comfortable (1)	Moderately comfortable (2)	Neither comfortable nor uncomfortable (3)	Moderately uncomfortable (4)	Extremely uncomfortable (5)
How comfortable are you with web technologies? (1)	○	○	○	○	○

Q4 Please respond to the following statement:

	Extremely familiar (1)	Very familiar (2)	Moderately familiar (3)	Slightly familiar (4)	Not familiar at all (5)
How familiar are you with medieval art and architecture? (1)	○	○	○	○	○

Q5 I'm now going to ask you to perform a task. So far as you feel comfortable, please narrate your decision-making process and walk us through what you are thinking as you perform this task. **Please find images of Canterbury Cathedral on the website starting from the homepage.**

Q6 Please respond to the following statement:

	Extremely easy (1)	Moderately easy (2)	Neither easy nor difficult (3)	Moderately difficult (4)	Extremely difficult (5)
How easy or difficult was it for you to accomplish this task? (1)	○	○	○	○	○

Q7 Please elaborate.

Q8 For those of you who have visited the site before, please respond to the following statement:

	All (1)	Some (2)	None (3)
How much of your previous experience with the site did you use to accomplish this task? (1)	○	○	○

Q9 If you like, please feel free to elaborate.

Q10 Please respond to the following statement:

	A considerable amount (1)	A small amount (2)	None (3)
How much subject expertise would you say you used to accomplish this task? (1)	○	○	○

Q11 If you like, please feel free to elaborate.

Q12 Please respond to the following statement:

	No (1)	Somewhat (2)	Yes (3)
Do you feel like you succeeded in completing this task? (1)	○	○	○

Q13 If you like, please feel free to elaborate.

Q14 Please respond to the following statement:

	No (1)	Somewhat (2)	Yes (3)
Did you find the website usable? (1)	○	○	○

Q15 If you like, please feel free to elaborate.

Q16 We recognize that this task and these technologies were simply handed to you today. If you weren't constrained to using MedArt, how would you find images of medieval art and architecture? What tools or technologies might you use?

Q17 How would you compare this imagined experience to the one you accomplished today in looking for Canterbury Cathedral on the *Images of Medieval Art* site?

Q18 Do you think the MedArt site should be preserved for the long-term?

Q19 If you'd like, please provide your name and email address for follow-up information and the potential to participate further.

Appendix B: STSR Adaptations of the NDSA Levels of Preservation

Access: Original NDSA Version

	Level 1	Level 2	Level 3	Level 4
Access	Determine designated community Ability to ensure the security of the material while it is being accessed. This may include physical security measures (e.g. someone staffing a reading room) and/or electronic measures (e.g. a locked-down viewing station, restrictions on downloading material, restricting access by IP address, etc.) Ability to identify and redact personally identifiable information (PII) and other sensitive material	Have publicly available catalogs, finding aids, inventories, or collection descriptions available to so that researchers can discover material Create Submission Information Packages (SIPs) and Archival Information Packages (AIPs) upon ingest	Ability to generate Dissemination Information Packages (DIPs) on ingest Store Representation Information and Preservation Description Information Have a publicly available access policy	Ability to provide access to obsolete media via its native environment and/or emulation

Access: STSR Adaptation ("Access")

	Level 1	Level 2	Level 3	Level 4
Access	Determine designated communities Create and make available descriptive metadata, such as title, abstract, keywords, or other information that is useful for discovery	Have publicly available documentation, user guides, or other materials that make your work legible to users	Have a publicly available access and use policy	Provide access to the parts of the project that have become obsolete or difficult to access via a native environment and/or emulation

Storage & Geographic Location: Original NDSA Version

	Level 1	Level 2	Level 3	Level 4
Storage & Geographic Location	Two complete copies that are not collocated For data on heterogeneous media (optical disks, hard drives, etc.) get the content off the medium and into your storage system	At least three complete copies At least one copy in a different geographic location/ Document your storage system(s) and storage media and what you need to use them	At least one copy in a geographic location with a different disaster threat Obsolescence monitoring process for your storage system(s) and media	At least 3 copies in geographic locations with different disaster threats Have a comprehensive plan in place that will keep files and metadata on currently accessible media or systems

Storage & Geographic Location: STSR Adaptation ("Backing Up Your Work")

	Level 1	Level 2	Level 3	Level 4
Backing Up Your Work	Document your reliable sites of project documentation including a description of their contents Maintain two complete copies, stored separately Reduce to a minimum data stored on heterogeneous types of media (hard drives, flash drives, etc.)	Keep an inventory of storage media and systems used and their technical requirements Maintain three complete copies, with at least one copy in a different geographic location Transfer all data from heterogeneous media (hard drives, flash drives, etc.) to a central storage system	Of the three copies, keep at least one in a geographic location with a different disaster threat Routinely monitor your storage systems and media for obsolescence	Keep three copies in separate geographic locations, each with different disaster threats Have a comprehensive plan in place to keep files and metadata on currently accessible media or systems

File Formats: Original NDSA Version

	Level 1	Level 2	Level 3	Level 4
File Formats	When you can give input into the creation of digital files encourage use of a limited set of known open file formats and codecs	Inventory of file formats in use	Monitor file format obsolescence issues	Perform format migrations, emulation and similar activities as needed

File Formats: STSR Adaptation ("File Formats")

	Level 1	Level 2	Level 3	Level 4
File Formats	When possible, create files using a limited set of known open file formats	Maintain an inventory of all file formats used in your project	Routinely monitor your file formats for obsolescence issues	Perform format migrations, emulations, and other updating activities as needed

Metadata: Original NDSA Version

	Level 1	Level 2	Level 3	Level 4
Metadata	Inventory of content and its storage location Ensure backup and non-collocation of inventory	Store administrative metadata Store transformative metadata and log events	Store standard technical and descriptive metadata	Store standard preservation metadata

Metadata: STSR Adaptation ("Metadata")

	Level 1	Level 2	Level 3	Level 4
Metadata	Document your reliable sites of project documentation including a description of their contents	Keep an inventory of file types and sizes Create and make available descriptive metadata, such as title, abstract, keywords, or other information that is useful for discovery	Store administrative metadata, such as when files were created and with what technologies	Store transformative metadata, such as a log of how files have been altered over time Store standard preservation metadata

Information Security: Original NDSA Version

	Level 1	Level 2	Level 3	Level 4
Information Security	Identify who has read, write, move, and delete authorization to individual files Restrict who has those authorizations to individual files	Document access restrictions for content	Maintain logs of who performed what actions on files, including deletions and preservation actions	Perform audit of logs

Information Security: STSR Adaptation ("Permissions")

	Level 1	Level 2	Level 3	Level 4
Permissions	Identify which project members have login credentials to accounts and services used Identify which project members have read, write, move, and delete authorization to individual files	Restrict authorizations to only necessary team members Document access restrictions for services and files	Maintain logs of who performs what actions on files, including deletions and preservation actions	Perform routine audits of activity logs

File Fixity & Data Integrity: Original NDSA Version

	Level 1	Level 2	Level 3	Level 4
File Fixity & Data Integrity	Check file fixity on ingest if it has been provided with the content Create fixity info if it wasn't provided with the content	Check fixity on all ingests Use write-blockers when working with original media Virus-check high risk content	Check fixity of content at fixed intervals Maintain logs of fixity info; supply audit on demand Ability to detect corrupt data Virus-check all content	Check fixity of all content in response to specific events or activities Ability to replace/repair corrupted data Ensure no one person has write access to all copies

File Fixity & Data Integrity: STSR Adaptation ("Data Integrity")

	Level 1	Level 2	Level 3	Level 4
Data Integrity	Identify which project members have login credentials to accounts and services used Identify which project members have read, write, move, and delete authorization to individual files	Be able to replace/repair corrupted data Create fixity information for stable project files	Check fixity of stable content at fixed intervals	Check fixity of stable content in response to specific events or activities