Article Theme: Science Gateways: Accelerating Research and Education

Science Gateways and the Humanities: An Exploratory Study of their Rare Partnership

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Abstract—Researchers and educators in humanities such as computational linguists, digital humanists, and those doing historical reconstructions are increasingly heavy users of computational and/or data resources. Many know about activities, working groups, and initiatives around the FAIR (Findable, Accessible, Interoperable, Reusable) principles and are a driving force for improving the sharing of data and software. However, it seems humanities researchers are less aware of the science gateways community and the end-to-end solutions that science gateways could provide, therefore lacking a driving force for adoption of this technology. Some may be creating their own gateways outside the community; others may wish to use computational and data infrastructures but may perceive a lack of support or opportunities. Hypotheses about the reasons that humanities are not well represented as gateways builders and users include lack of funding and support by computer centers. This small-scale exploratory study will clarify some of the challenges and needs faced by computational researchers in the humanities that may explain their relatively low participation in the science gateways community. For this paper, we present the results of 19 interviews with 7 women, 11 men, and 1 non-binary individual from seven states and DC in the US with a range of professional backgrounds and roles.

The science gateways community is growing in several research domains, a fact made evident by the many new attendees every year at the Gateways conference and the European International Workshop on Science Gateways (IWSG). (Registration numbers and details collected by the Science Gateways Community Institute show 50% of attendees at both events are new [1]). The number of citations of science gateways (or short gateways) in publications has also increased since 2016. The rise of interest in gateways as a means for providing end-to-end solutions for computational methods and data management coincides with the rise of computational methods in the humanities, and yet humanities researchers are poorly represented in the gateways community. Although there are successful projects, such as FAIRsFAIR, Social Sciences Humanities Open Cloud, and Skills4EOSC in the European Union, eighty to ninety percent of attendees at the yearly US

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Gateways and IWSG events are from STEM (Science, Technology, Engineering, and Mathematics) fields, with only a small number of researchers from humanities and humanistic social sciences. In contrast, humanists represent a larger segment of active participants in initiatives around FAIR (Findable, Accessible, Interoperable, Reusable) [2]. FAIR is a natural fit for gateways, since gateways are designed to actualize the principles of FAIR by sharing data and software within a community and/or publicly. Despite this natural fit, relatively few humanities scholars have discovered or otherwise engaged in the community. The Gateway Catalog[1] includes gateways from humanities but it is not fully clear how many are taken up via the catalog or interactions in the community.

The Gateway Ambassadors – a group of community builders and science gateways enthusiasts – have undertaken a project to better understand the reasons for humanities scholars' minimal uptake of science gateways despite their increasing adoption of computational methods. Drawing from interviews with humanists, this paper explores the possible obstacles to this uptake as well as opportunities to foster such uptake in the future. Humanities comprises a broad spectrum of domains whose research practitioners include not only scholars but also librarians and information architects. From interviews of a representative sample of these stakeholders, we have identified some of the obstacles and opportunities for humanists in the gateways ecosystem.

Related Work

Examples in other community initiatives that connect scholars with computational solutions give reason to explore this topic. For instance, The Carpentries[2] teaches "foundational coding and data science skills to researchers worldwide" and has developed curricula that have succeeded in introducing technical solutions to humanists and especially to the librarians and data scientists who support them. Central to The Carpentries model is a train the trainers ethos, making the program scalable. While we are not aware of a Carpentries curriculum developed explicitly for gateways, some Carpentries cohorts have been exposed to gateways-related skills such as HPC familiarity, use of versioning tools or code repositories, and foundations of scientific software and data management. The results of this study may suggest where there are opportunities for new carpentry curriculum topics to build awareness of gateways solutions across this growing community.

Another area of related work bridging research needs with computational solutions is the NSF-funded Virtual Residency for research facilitators. The goal of this annual week-long workshop is to build a community of practice for those who facilitate research. It presents topics and best practices to spread and strengthen the capabilities of researcher facilitators supporting a variety of domains – including the humanities. Past sessions have included topics such as "Components/Design of an HPC Cluster" and "Deploying Community Codes," so building awareness of gateways could fit well in the Virtual Residency curriculum. The humanities use cases for gateways that this small-scale exploratory study may surface could become important additions to both the Virtual Residency and the Carpentries curricula.

Most gateway providers know that the uptake in the humanities of the gateway framework is lower than it could be, but the reasons are not fully understood beyond the need for more targeted outreach. Our study provides important insights into computational needs in the humanities.

Structure and Protocol of Interviews

Given that relatively limited prior work has been done at the intersection of science gateways and the humanities, we have taken a qualitative interviewing approach [4] to explore this emerging topic. Our interview protocol includes ten open-ended questions designed to (1) understand participants' professional backgrounds and day-to-day work; (2) understand their experiences with computational tools in the humanities; (3) evaluate knowledge of, access to, and/or funding for science gateways, as well as opinions about the collaborations (or lack thereof) between humanists and gateway developers; (4) discover barriers to and/or enablers of such collaborations; and (5) provide an open invitation for interviewees to freely share any other thoughts on the topic of science gateways and the humanities. The design of the interview protocol is intentionally semi-structured, allowing the interviewers to improvise the questions based on the conversation, and allowing the participants to share their journeys and experiences with the interviewers. This semi-structured design is well-suited for studying emerging topics, because the researchers' pre-designed questions may contain assumptions that could be shown to be invalid during the interviews, thus calling for flexible adaptations [5]. Prior to conducting the interviews, the research team

[1] https://catalog.sciencegateways.org//home
[2] https://carpentries.org/

obtained an IRB approval on the study (TTU IRB 2022-454), and the team members conducting the interviews also went through research ethics training to be IRB certified. According to Guest et al. [3], 12-15 interviews are sufficient data for an exploratory study. We conducted a total of 19 interviews, two of which were conducted in June 2022 as proofs of concept for the study, followed by 17 more interviews conducted in November and December 2022. After analyzing the interviews, we believe we have reached theoretical saturation, allowing us to conclude data collection for this paper.

The interview data included seven women, eleven men, and one non-binary individual. Their backgrounds included humanists (five faculty and two graduate students) who have positive and negative experiences pursuing computational methods; eight IT program directors; and four librarians. Participants came from CA (9), IN (3), NY (2), IL (1), NJ (1), YX (1), NC (1), and DC (1). The shortest interview was 19:05 mins, and the longest was 71:20 mins, averaging about 41:43 mins.

Analysis

The focus of our analysis is on the themes that surfaced in our interviews related to humanities research, computation, and gateways. We used Otter.ai, an AI transcription service, to generate a full transcription for the interviews. We then listened to the recorded interviews while concurrently analyzing the transcripts. We followed the grounded theory analysis approach used by Kee and colleagues [6] in a qualitative interviewing study of gateways. Specifically, we started with 'selective coding' to flag text related to collaboration between humanists and gateway developers. We then used 'open coding' to identify, compare and iteratively refine the themes. Finally, we used 'axial coding' to relate themes to each other in meaningful ways. To present our analysis, we have taken a problem-solution approach — first discussing an identified problem, and then pairing it with a potential solution. There are five pairs of problem-solution sets, which we elaborate in the next section.

Results

Our study surfaced the following five problem-solution sets: (a) not knowing what gateways are; improve learning experience, (b) the 'science' in 'science gateways'; use more open and inclusive language, (c) lack of time; have funders create incentives, (d) humanists getting discouraged; social modeling to inspire humanists, and (e) cultural traditions; introduce gateways without threatening cultural identity.

Not knowing what gateways are; improve learning experience

The first problem stems from the unclear definition of what constitutes a "gateway" and what is available to scholars. As potential examples of gateways, several participants brought up OSF[3], a free, open platform to support research and collaboration, with varying degrees of certainty. One participant from Indiana explained, "And they might not even think of what they do with a gateway as interaction with a gateway. They think of themselves as someone using something on the internet rather than benefiting from a gateway... they might not characterize or label it in that way" (P01). The experience of a participant from Texas aligns with such sentiment: "I might not have the name in terms of science gateway, but I do see my work with digital humanities absolutely aligning with these goals..." (P14). Even though initially this participant did not know what the term "science gateway" meant, after it was defined he acknowledged that his work actually includes several forms of gateways.

In other cases, as a participant from New Jersey stated, humanists struggle with "not knowing what's available" (P05). A participant from California shared that he did a campus wide survey and has data to back this up: "[W]e get a lot of feedback from folks in the humanities... that said – We don't even know what we don't know... We don't even know what's [offered on campus]" (P07). The tools may be available on campus, but the humanists do not know. While gateways providers may blame humanists for not seeking them out, this expectation may place undue burden on humanists, given the other challenges unique to humanities that we will discuss in the next few points. If lack of knowledge/awareness is the problem, this can certainly be addressed through outreach and education, including with the help of a bridging liaison. A participant from Indiana explained, "We try to provide onboarding for scholars at any career phase from undergraduate to tenured professor to help them adopt digital approaches that fit their research need[s]... Sometimes that collaboration between the humanities scholar and the gateway provider can only be bridged with education" (P01). Similarly, a participant from California said that they advocate for computational methods "to be built into the curriculum"

[3] https://osf.io/

of all humanities programs, especially at the graduate level, so budding scholars are even "aware that this is a possibility. And introducing the idea that they don't have to be experts in all of these tools, methods, approaches themselves. They can work with someone who has that technical expertise" (P17).

As a possible solution to this problem, librarians may act as important bridging liaisons to introduce the tools to humanities scholars, since humanists often turn to librarians in the initial stages of research projects. A participant from Texas said: "I can't say enough about libraries. Librarians are kind of really used to help[ing] you make these connections" (P14). A participant from California stated that librarians are not only excellent at pointing out resources and potential collaborations, but are now considered researchers in their own right: "Digital humanities librarians — like, we're scholars too" (P16). Thus, beyond just the role of librarian, it is the qualities perceived to be inherent to librarians of wanting to help and being genuinely curious that could improve the gateway learning experience for humanists.

The 'Science' in 'Science Gateways'; Use More Open and Inclusive Language

A lack of understanding of gateways is exacerbated by the term "science gateways" itself, in which the word 'science' signals to humanists that gateways are not relevant to their domain. A participant from New York explained, "[C]alling them 'science gateways' for example is like one sure way [for the humanists] to be like – Oh, that's not for me!" (P08). Another participant from Illinois concurred: "That when you have that term in the name science… a lot of folks in the humanities just assume that [it is not] for them" (P04). These participants believe that naming is key. Other participants noted that changing the name could be helpful. For example, the participant from Illinois said, "I noticed you're calling it a gateway now." She explained that by dropping 'science' and simply calling the tools 'gateways' could change the perception that these computational tools are not designed for humanists. A participant from New York provided an example of how she has addressed a similar example of 'Open Science:' "I've actually started saying 'Open Scholarship' instead of 'Open Science,' kind of as a nod to the humanities, because it has been something I've heard just kind of over and over" (P08). While no participants in our interviews suggested a specific name change, a similar strategy could be applied to 'science gateways' following brainstorming efforts in the gateway community.

Due to the nature of their expertise, humanists are highly attuned to language choices—thus, being aware of subtle exclusionary language that prioritizes scientific expertise may be key for better including humanists in the use of gateways. Some of our participants highlighted this sensitivity to terminology with other science-centric terms, where changing them has helped humanists feel more comfortable in a computational domain. For example, "data" is a commonplace term in computational methods with which humanists may perceive a barrier. If we are to better inform humanists about the tools available to them, we must pay attention to the terms we use to communicate about them.

Lack of time; Have funders create incentives

The third most important barrier to humanists' engagement with gateways is lack of time. Beyond the usual balancing of research plans with teaching and service demands, the relative lack of external grant funding compared to the sciences means research often gets pushed to the margins, leaving negative time for tried-and-true methods, never mind finding and learning how to use new tools. According to one participant from California: "It takes so much time to skill up. The faculty don't always have time to do it… They have to teach, they have to have all of these other responsibilities, and it… would be a real luxury for them to be able to just say, 'No, I'm only going to focus on learning this new set of skills and learning this new toolkit so that I can do this kind of analysis that I want to do.' I just don't know that everyone has the time to do that" (P16). While scholars in other disciplines such as the sciences may already have some computational backgrounds to lean on when they are busy, humanists often do not have time to learn what to them may be a completely new workflow. The learning curve for humanists to undertake new computational methods is also a deterrent, even for those who know about and would like to adopt gateways. It can feel like a risky investment of time in an unknown outcome. And, learning new technologies or working with computational experts is still not part of traditional humanities training. As a participant from Washington, DC explained, "And if there's a lot of learning curve, … that I'm going to be less inclined to continue to use it if I can't be successful like right away" (P03). Much better to go with the method already mastered in such cases.

Adding to the time scarcity problem, traditional humanities research methods are typically both solo and manual. As time consuming as these approaches may be, they are known approaches. A participant from

California explains, “They’re literally willing to do things manually... And sometimes I actually have to sell them on like – No, really, let me do this for you! – [They] know, they can get it done in a week, if they just, like, spend all day doing this manually” (P02). The draw to manually doing their research stems from two tendencies central to humanities scholarship: humanists’ distrust of technology, and their unwillingness to stand behind research in which they do not understand, and cannot interpret, the methodologies. A participant in California explained that humanists “... hate this idea of a black box algorithm that they can’t change,” craving control over their computational methods despite their frustrations at technological complexities (P16). Though slow, if their current approach still works and they can explain it, it is understandable that humanists do not have the time to learn a new method. One potential solution to this problem is to create an appealing reason to collaborate on gateways, perhaps through funders and funding solicitations. As detailed by a participant from Indiana: “So, funders can force collaboration... many of my past gateways projects, that collaboration was funder determined...” (P01). Essentially, by funders requiring grant recipients to use gateways, they would contribute not only to the financial needs, but also to the time constraints elaborated above.

Moreover, funding provides another incentive as it adds to a humanist’s academic reputation. A participant from New York explained, “[I]t’s a thing that everyone can put on [their] CV. And it’s a thing that says like, someone back this... There’s a big difference, like in terms of institutional respect. ... from a gateway provider perspective, if you could offer a few $1,000-summer fellowships... [with] the expectation that there’s a short paper of some sort, or research report or something published on the back end” (P11). Given the goal of gateways to increase access to computational methods widely, funding could incentivize humanities projects that involve reusability, thus reducing the time demands on scholars who can leverage an already existing tool and methodology. Importantly, incentivizing reusability in gateways involving the humanities may also help with the social modeling that may be needed to bridge the humanities/gateways gap, as described next.

Humanists getting discouraged; Social modeling to inspire humanists

One of the problems humanists face is that gateways developers, who have traditionally worked with scholars in the sciences, lack a ready understanding of how to develop for the domain-specific needs of humanists. This presents an uncomfortable collaboration experience for both gateways developers and humanists. One participant from California explained where the differences and expectations may have come from: “[P]eople [developers] who have done this kind of support for the sciences, who like to get great feedback from the science scholars, because they’re like – [The] system is amazing, and works exactly the way that [science] people expect – If you’re dealing with developers, who kind of have a successfully functioning system and feel good about their system. And are like – Oh, humanities, that’s probably easy! We’ll just add some features!” (P02). When a gateway that works well for STEM fields does not work well for humanists, there is frustration on both sides. Developers are confronted with both unhappy scholars and the need to refactor a successful gateway to adapt for humanities needs.

A participant from California recounted a personal experience after meeting with a couple of technologists at his campus’s research computing center: “That experience showed me where my limits are, and the difficulty of trying to do some of the things that I want to do... I hit the wall [when the technologists] say – Well, why do you want to do that? – that became frustrating... [T]here is a possibility out there, but I’m not going to be there” (P12). He concludes by saying, “I spent one or two years chasing software, which is just a stupid, stupid thing for an historian to do...” (P12). For this humanist, what could have been an opportunity to engage with computational methods instead became a moment of frustration and eventual disillusionment.

Instead of seeing possibilities in the use of gateways, too easily humanists instead see discouraging failures. After such experiences, as one California participant explained, humanists “quickly conclude they don’t have time for this shit. So they’ll go back to spending a week doing it manually, or like three days running it on their laptop...” (P02). Hearing about discouraging feelings only worsens the natural anxiety scholars accustomed to prestige and security may feel when delving into unknown areas. When facing computational methods, humanists may feel both a nervousness about looking incompetent and a sense of being misunderstood by technologists.

One possible solution to counteract discouraging stories and experiences is through social modeling to foster greater respect and trust for technology and computational methods. A participant from New York suggested: “I have always felt that simply seeing good disciplinary relevant published research that uses computational tools is the best way to get humanists on

board. In other words, to say – Yes, that research problem looks like a humanities research problem... That looks like a problem I understand... And I can see how you couldn't have gotten there without the computational piece" (P11). Success stories would be essential to get humanists to "begin to envision and imagine what could be possible" with gateways, as described by another participant from California (P17). Social modeling must aid in boosting humanists' ability to dream in computation for their humanities projects.

The development of such ambition and imagination in humanists could be encouraged through a collection of projects and examples of collaborations between humanities researchers and gateways. A participant from New Jersey suggests compiling "really interesting stories about other people that have done stuff with it... [A] collection of stories and even videos and recordings of how people have used the tools and the gateways in the past and what kind of outcomes they can get from it" (P05). These suggestions highlight the need to create resources with articles and videos that can be shared on a website asynchronously to reach a wide audience.

A participant from Indiana suggested taking social modeling to the next step, in this case pairing inspiration and training during a workshop. She noted that some hands-on workshops may be difficult for humanists to map to their situations. Instead, she suggests, begin the workshop with an inspirational success story to "prime" the humanists and model success before undertaking the hands-on experience. However, collaboration between disciplines is a two-way street—humanists also need a general appreciation for computational methods and how they pair with humanities knowledge before undertaking projects using gateways.

Cultural traditions; Introduce gateways without threatening cultural identity

As has been intimated in some of the preceding barriers we have identified, the fifth challenge for humanities/gateways collaborations is the misalignment of some cultural traditions in the humanities with gateways and collaborative research in general. Specifically, the humanities traditionally value scholarship done manually, by solo authors, as alluded to earlier [P17]. This solo tradition is also embedded in many humanities departments' tenure and promotion criteria. Also previously described, humanists have a healthy "distrust for the black box" in computational methods due to both research philosophy and a questioning of technology's systemic flaws that have harmed humanity (P16). Add to this that humanists are not trained traditionally (in terms of curriculum) to use computer analysis. As a result, there is a general deprioritization and suspicion within the broader humanities, whose practitioners are already disinclined to such methods. A participant in California noted: "Most humanities scholars and students are drawn to the humanities both because they enjoy reading and writing, and because they hate and are terrified of math" and "programming." I find those fears are often pretty parallel" (P17). Thus, cultural traditions against computational methods are embedded in the very identity and reputations of humanists, and must be overcome if these scholars are to engage with gateways.

Examples of perceptions of general distrust of computation in the humanities were scattered throughout the experiences of our participants. Another participant in California stated that computational methods are "often viewed with skepticism by your colleagues... Like, why didn't you just, like, read three books with your eyeballs and comment on them like normal people?" (P02). A participant from New York concurred: "And what they [humanists] almost inevitably find is that it's not as good as their own reading of Shakespeare... – This is crap... It's nice that you built a tool, but it tells me the wrong thing, or it tells me something that I already knew – ... [This] is usually true. I have yet to see a computational analysis tool that's better on any one book than a human ..." (P11). This comment stands out because it comes from a humanist who knows how to code and builds his own computational tools, and who can be assumed to value computational methods.

Another cultural barrier arises in cases where critical studies questions that are more common in humanities research are unfamiliar to and, at times, uncomfortable for computer science and collaborators. Finding the right and willing collaborators can be key to computational methods spreading in the humanities. Barriers in cultural traditions may be a matter of perception, and can be overcome through finding collaborators willing to translate their scholarly identities to different research contexts.

Another cultural contributor to the mistrust and misalignment of humanities and computational methods is that the Digital Humanities (DH), which is the most active area of humanities computation, is still at times viewed with suspicion in the broader humanities community, despite gaining incremental traction. In particular, publication venues still value non-computational methods in the humanities. As the participant from Texas shared, "I'm expected to have traditional research, as well as digital projects" in order to get

publications and still achieve tenure (P14). That being said, the participant also described getting his job and grant funding because of his digital humanities work, noting "it's a buzzword in the academy, looking at potentially even fellowships, postdocs and other grants and funding available for it" (P14). Another California participant noted that three large humanities organizations—the Modern Language Association, the American Historical Association, and American Studies Associations—have published professional standards on digital humanities work, indicating increased acceptance in the discipline.

For humanists, an important related insight is that using innovative tools and methods needs to be coupled with asking questions that are recognized as being important to the humanities. Innovative tools used without aims to further humanities knowledge and scholarship is not enough. As shared by one of the participants from California: "It [the disappointment around the efficacy of computational methods] hasn't lowered my overall commitment to some form of meaningful place of digital technologies in humanistic work. But it, at least for me, does question… the computational part of digital tools… that has been going on for 20 years has not led to, as far as I can see, any significant benefits… And many of the digital historians have said – You know, we've done all this work, but we're still not asking the questions that matter to history… This is why this is important, rather than this is why the tools have allowed me to do this…" (P12).

Instead, computational tools must contribute to the larger context and scope of humanities questions. A participant from California articulates that computational methods can better get at the "population level" of "cultural phenomena" analyzed by humanities scholars (P15). He goes on to describe an "interest in cultural phenomena that aren't just sort of reduced to, you know, great artists, or great authors, or, or sort of the sort of, effectively, the great white old men narrative of history… It's much more equitable, it's much more diverse, and it's much more accurate, to be honest" (P15). Therefore, much potential exists for computational methods to be compatible and necessary in humanities research, as long as the traditional interests of humanists are not threatened in the process.

Still another critical aspect of the humanities cultural traditions negatively impacting uptake of gateways solutions is the potential risk a humanist takes in one's career when pursuing computational work, if they are not fortunate enough to be in an environment supportive of such innovative methods. A participant from California elaborated:, "There are so few tenured professors who do this, like, literally, I can count them on one hand..." (P02). This same participant concluded their explanation with a very powerful reflection: "I think there's actually been times that I have had these sort of moral crises when it comes to my job. There was one time a junior faculty... she got her mid-tenure process review letter. And the message was very clear that she needed to stop doing DH stuff, because it was detracting from her traditional scholarship... I felt incredibly morally compromised, that my job, which they were paying for, might actually screw her over and make it so that she would lose her job. It's just a terrible position to be in as staff to realize that you might be screwing over your collaborators by working with them!" This is a powerful observation, and one that we take to heart in this study. While this paper was started with the intention to promote gateways to the humanities, we must account for the unintended negative consequences of promoting innovations.

Such strong cultural traditions that humanists must work with require a thoughtful approach that works from within the tradition so as not to jeopardize careers. In the long run, it may be simply a matter of time before digital humanities and computational methods will be more valued in the humanities for tenure and promotion cases. A participant from California shared that, as younger generations, so-called "digital natives," start becoming faculty members, using computers for research begins to seem "a little less foreign…" (P16). Still, she noted that this remains an overgeneralization, as some young humanists still reject work done with computational methods and "just do it [their work] by hand" (P16).

Conclusions

While the anticipated trajectory of computational methods in the humanities may seem muddled at the moment due to cultural barriers, current trends in student interest may indicate the several opportunities for gateways to spread in future humanities work. A participant from New York observed that, "[S]ome of the old guard also don't know a lot of this… So if you're having an advisor who's not doing computation, it would be very difficult… A lot of the students doing computational humanities work that I see come for help because it's something that their advisors can't provide. And it's either through lack of willingness or lack of experience. That said, there have been quite a few profs who have come in with students, which have been great to learn a lot of this, but it's not the norm, I would say" (P08). While this is not the norm at this point, the participant indicated that the new generation of students in the humanities are increasingly interested in computational

methods.

Why are graduate students in the humanities increasingly becoming interested in DH and computational methods? A participant from California explained that she initially stumbled upon DH while researching for her statement of purpose for her PhD application into Italian Studies. She explained that "I came across... an article... [from] a social media platform that some scholars published [their] research on how to use text analysis using Python to analyze the citations [in humanities literature]... I feel like wow... humanities scholars could research in this way. And I feel like – Oh, that's really exciting!" (P10). Now that she is in a PhD program, she shared, "because I'm trying to engage more deeply into digital humanities, so I trained myself; I learned how to program in Python, or Java in these programming languages. And also, I took some courses in NLP" (P10).

Similarly, other participants mentioned that digital humanities projects had been successful in getting undergraduate students from a wide variety of fields interested in the humanities and humanistic research questions. A participant from California mentioned seeing "students from across the campus" in digital humanities courses, "which is one of my favorite things" (P17). Such a trend may be a good further justification for why humanities scholars should partner with gateways developers as a way to overcome the more traditional, and arguably justified, suspicion of technologists. Yes, technologies designed poorly and without concern of human and societal impact have had disastrous impacts in the past. But, if the technologists of tomorrow are well trained in humanistic critical thinking, the technologies of the future may overcome such baggage.

Given our findings, a successful humanities gateway should provide easy and positive learning experiences, supported by many success stories and publications as exemplars, inclusive of humanities research techniques to enable users to ask meaningful humanities questions, and be incorporated into funding programs for continuing developments by future fundees. The most practical measure of success is by adoption and usage.

Finally, while many cultural barriers exist between humanities and gateways communities, we want to note the several overlaps in philosophy and scholarly need that may encourage future collaborations. First, both communities value openness and accessibility. Participants we interviewed mentioned deliberately choosing open source software for their digital projects to encourage reproducibility and accessibility to other scholars and students (P14, P17). In addition, the capabilities of gateways do have demand within the community. For instance, one participant from California described the technical roadblock of humanists carrying out research projects and encountering incomplete and incompatible datasets (P16). Gateway developers may be able to help such problems through computational methods. Other examples may exist as well within the humanities and gateways communities. In addition, further future scholarship could uncover specific tools and research methods that gateways could provide for humanists. We hope our paper offers a first step at uncovering the many possibilities of scholars and technologists moving in such a direction.

Outlook

This paper describes a preliminary study by the Gateway Ambassadors seeking to understand more about humanists' computational needs and their awareness and use of science gateways. Our goal has been to elucidate the reasons why humanists use or do not use gateways as part of their research practices. We have also offered suggestions on ways to tailor the solutions and/or adapt the community around gateways to help humanists realize the potential of gateways and the gateways community for their work.

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