Supporting Digital Tools for Humanists: Investigating Tool Infrastructure
Final Report: May 15, 2009
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1. Introduction: Questions and Goals

The original "Tools for Humanists" report (Nguyen and Shilton 2008) evaluated more than 30 digital tools designed for use by the humanities community. The report focused on the success of these tools not as measured by metrics of effectiveness or performance, but rather by the accessibility of tools. The report defined accessibility broadly. Could users easily discover, recognize, and begin to use tools built by U.S. Digital Humanities Centers (DHCs) and intended for digital humanists?

Early in the initial project, we identified institutional support—the DHC infrastructure under which a tool is built, mounted, and maintained—as a valuable factor in defining tool accessibility. The nature of institutional support for digital humanities projects such as digital tools was also an underlying question in *A Survey of Digital Humanities Centers in the United States* by Diane Zorich, from which the "Digital Tools for Humanists Project" originated.

This follow-up project, "Supporting Digital Tools for Humanists," seeks to understand the relationship between accessibility of digital humanities tools and tools' supporting infrastructure. This project asks the following research questions:

- What measures of institutional support over short and long terms appear on DHC sites?
- How well are successful tools supported?
- In what ways is support missing for unsuccessful tools, and what steps could centers take to improve support for their tools?

By answering these questions, the project:

1. Adds measures of longevity to metrics used in the initial research to evaluate tool accessibility;
2. Proposes new metrics for evaluating the infrastructure surrounding a tool;
3. Explores the relationship between infrastructure and accessibility, and;
4. Introduces and explicates a definition of tool *value* based upon a combination of support, longevity, and accessibility.

Section 2 of this report begins with a discussion of the digital humanities literature and suggests features and attributes that contribute to the tool's value to researchers in digital humanities. Among these attributes are longevity of, and institutional support for, digital tools. Section 3 defines metrics to evaluate the infrastructure supporting a tool. Sections 4 and 5 evaluate a sample of 38 tools according to the metrics, and compare the performance of these tools to measures of their accessibility assessed in the previous report (Nguyen and Shilton 2008).

Section 6 discusses implications of the findings and avenues for further research. The findings suggest that accessibility of tools and the quality of their supporting infrastructure are, in fact, correlated. A successful combination of accessibility, longevity and support add to the *value* of a tool to researchers. As researchers engage in projects over months or years, a tool maximizes its value by being findable, easily accessed or downloaded, and accessible over the long term. The observation that these qualities often reside side-by-side suggests best practices for tool developers.

2. Background and Definitions: Tool Value

In the original "Tools for Humanists" report, we defined tools as "as software developed for the creation, interpretation, or sharing and communication of digital humanities resource and collections" (Nguyen and Shilton 2008, 59). Tools are a critical component of the larger cyberinfrastructure supporting digital humanities research or e-Research. In *Scholarship in the Digital Age,* Borgman identifies digital tools as an important part of the "application space" (2007, 254) that supports digital research.

Our Cultural Commonwealth (American Council of Learned Societies Commission on Cyberinfrastructure for the Humanities and Social Sciences 2006) suggests a set of metrics with which to judge the success of a humanities cyberinfrastructure. The report advocates for broad public *accessibility*, long-term *sustainability* (measured by both ongoing funding and human capital), cross-platform and cross-repository *interoperability*, multi-researcher and multi-discipline *collaborability*, and ongoing *experimentability*.

The "Tools for Humanists" report took this argument linking tools to the broader attributes of the cyberinfrastructure quite seriously. We argued that tools must be visible and accessible over time in order to be an effective part of a humanities infrastructure. We wrote:

> Because tools provide the action (rather than the subject) of digital humanities research, digital tools are one of the most extensible assets within the digital humanities community. Researchers can share tools to perform diverse and groundbreaking research, making such tools a critical part of digital humanities cyberinfrastructure. If these are tools are not visible, accessible or understandable to interested researchers, they become less likely to be used broadly, less able to be built upon or extended, and therefore, less able to support and extend the research for which they are intended (2008, 59).

Tool value attributes

This project interprets accessibility, sustainability, interoperability, collaborability and experimentability not only as attributes of a larger humanities cyberinfrastructure, but also of the value of individual tools within that infrastructure. If each of these attributes can be interpreted as a component of tool value, how are we to measure such attributes for existing tools? *Our Cultural Commonwealth*'s focus on accessibility and sustainability raises several problems of definition. What factors contribute to the accessibility of a tool? What makes a tool sustainable, and what are appropriate indicators of institutional support for a tool?

Building on the previous work conducted with Lilly Nguyen, this project further develops the definition of value in tools for digital humanists. Our original report compared tool *accessibility* according to two factors: findability and clarity of use.[1] The original report rated seven tools as particularly successful in these areas; twenty-four tools as moderately successful; and eight tools as unsuccessful. This project concentrates on the second of the value attributes delineated in the *Our Cultural Commonwealth* report: sustainability. Sustainability is, in many ways, a time-oriented measure of tool accessibility. A tool is only usable by humanists if it persists: if it is consistently available to researchers to support research that may take years.

In the research for our initial report, we found numerous abandoned tools, but did not have time to delve into this phenomenon. This follow-up report therefore explores abandoned tools and takes

[1] For details on how we evaluated success on these factors, see Nguyen and Shilton 2008.

tool age and version to be an important indicator of sustainability. This research also explores the opposite of abandonment: thriving tools with concrete signs of long-term support and institutional investment as a predictor of sustainability. The support provided by a creator or host center for its tools is an important indicator of *potential* longevity.

Institutional support can be seen in a variety of indicators. Do DHCs have long-term funding plans for their tools? Do they clearly demarcate responsibility for the upkeep of tools? And importantly, do they let existing community resources bolster their efforts? As Zorich writes:

> There are worries about the prodigious amounts of digital production created by DHCs that remain untethered to larger, communitywide resources and preservation efforts (2009, 71).

This report begins to investigate this by examining whether DHCs who author tools take advantage of community resources such as open source development forums. It also investigates whether DHCs have visible maintenance and preservation plans for their resources.

Tool value, then, can encompass the measures of accessibility investigated previously as well as longevity and support. The table below outlines the dimensions and data sources for the four attributes of tool value discussed in this research.

Table 1: Mapping Tool Value Attributes

	Value Attributes	**Dimensions**	**Data Sources**
Previous Report: Accessibility Metrics	Accessibility	Word choice; visibility; placement on site; ease of access to download and/or upload.	Digital Tools for Humanists report
	Clarity of use	Clarity of function; clarity of user group; availability of preview; clarity of instructions for use	Digital Tools for Humanists report
Current Report: Infrastructure Metrics	Longevity of tool	Date tool was established; versioning information	DHC websites
	Support for tool	Website updates, release timelines, use of open standards, funding, demarcation of responsibility	DHC websites

Research limitations and assumptions

"Infrastructure" is a broad term, and time and resource constraints limit the aspects of infrastructure this project can evaluate. To restrict the scope of study, this project evaluates only aspects of infrastructure that could be assessed from examination of tools' public face: their websites. This project does not consider more subtle and intangible factors such as human capital, dedication, and institutional context as components of tool infrastructure. Software may be a pet project of one individual, or a major part of a center's identity and brand. Each situation has different repercussions for a tool's success and longevity, and further interview research could assess this relationship.

In addition, this project, like the "Tools for Humanists" project before it, focuses on only a few dimensions of tool value. Value here refers only to a tool's physical and longitudinal accessibility to humanities researchers. This report does not consider ease of use or utility to humanities research, both of which are important dimensions of tool value. For further discussion of, and research into, tool utility, see efforts such as Project Bamboo (Project Bamboo, n.d.).

3. Metrics: Tool Infrastructure Attributes

A first priority of this project was establishing criteria for infrastructural support: an institution's dedication to building, mounting, and maintaining a tool. A tool's ongoing reliance on its creators implies the importance of metrics to evaluate the nature of the supporting organization. Our previous research on digital humanities tools suggests variables that may differentiate tool success. For example, while some tools are products of a single digital humanities center, others are the result of collaborations between DHCs, or between a DHC and other academic departments. Does sharing the responsibility for a tool result in more, or less, successful accessibility and longevity for a tool? And what is the nature of shared responsibility for a tool? Are the responsibilities for tool creation, distribution, and stewardship clearly defined?

Cyberinfrastructure and e-humanities literature suggests further potential metrics of institutional support. Research by Diane Zorich (2008) suggests that tools authored solely or in part by humanities centers may have particular infrastructure advantages. Zorich's findings reveal that such centers often have relatively secure university-level funding, good branding, and experience with cross-disciplinary reach. Zorich's typology of humanities centers divides organizations into center- and resource-focused categories. Are resource-focused centers more adept at making accessible, long-lasting tools? Or do center-focused organizations prove just as successful?

Our Cultural Commonwealth also suggests that digital projects adhere to open standards (such as Encoded Archival Description, and Metadata Encoding and Transmission Standard) in order to be robust and modular. They write: "a great deal of tool building is done on a local scale, and this results in unnecessary redundancy of effort" (American Council of Learned Societies Commission on Cyberinfrastructure for the Humanities and Social Sciences 2006, 36). In addition, ACLS recommends that DHCs support their tools through open-source software development practices. They cite use of open-source development sites such as SourceForge.org as important to developing and supporting tools over the long term (American Council of Learned Societies Commission on Cyberinfrastructure for the Humanities and Social Sciences 2006, 36).

To pursue unanswered questions of tool longevity and support, I use a number of factors to evaluate ongoing institutional support for, and longevity of, a tool. These included a tool's birth date, version information, evidence of ongoing support such as website updates or release timelines, use of open source standards and development tools, type of funding, and the nature and demarcation of responsibility for the tool.

To compare tools according to these metrics, I assigned numerical rankings for each attribute, rating tools from worst to best practices. Across the board, worst practices provided no information on a tool's public website about a given factor. Best practices were those judged most sustainable for the long term. This might include funding a tool through an institutional budget rather than necessarily time-limited grant funding.[2] Other examples included opening the tool to a community of developers using widely available open source development tools, and providing clear delineation of staff responsibility for upkeep of the tool.

The table below summarizes the metrics I used to measure tool sustainability, as well as the dimensions, scores, and data sources I used to operationalize these measures.

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[2] Grant funding may be an excellent source for capital to launch the initial development of a tool, which can be an expensive and time-limited project. However, long-term institutional funding is needed to continue to support and update a tool.

Table 2: Tool Infrastructure and Sustainability Metrics

Metric	Dimensions	Score ranges	Data Sources
Age of the tool	Years	0 (no info)-10	Tool websites
Versioning information	Version number	0 (no info)-4.1	Tool websites
Evidence of ongoing support	No evidence, evidence that a tool is discontinued, or evidence that a tool is active	No evidence=0 Discontinued=1 Active=2	
Open source?	Yes/no	Unclear=0 No=1 Yes=2	Tool websites
Use of open-source development tools (SourceForge, etc.)	Yes/no	Unclear=0 No=1 Yes=2	Tool websites
Financial capital	Stability of funding source (grant, corporate, budget line item) Funding sustainability (short, medium, long term)	Unclear=0 Faculty time=1 Grant=2 Corporate=3 Budget=4 N/A – little evidence found	DHC websites
Backing organization(s)	Single center vs. collaborative effort	Single center=1 Collaborative effort=2	Tool websites
Responsibility for a tool	Are tool creator, distributor, and steward clearly defined and credited?	None defined=0 1 role defined=1 2 roles defined=2 3 roles defined=3	Tool websites
Focus of backing DHC	Center-focused DHC vs. resource-focused DHC		Zorich report

4. Methods

After outlining the infrastructure and sustainability metrics and the dimensions, I looked for information highlighting each dimension on both DHC websites and individual tool sites. *Age* of tools was estimated from any source available, ranging from initial copyright date to information about the launch of the beta or 1.0 version. *Version information* was usually found on the tool download page. *Evidence of ongoing support* included updated contact information, announcements about new versions, recent blog or news postings about the tool, a recent version release, an up-to-date listing of coming features, and recent website updates. Evidence a tool was abandoned included broken links, websites marked "archived" or no longer active, or sites last updated more than two years previously. *Evidence of open source standards* included licensing statements, links to source code, or access to developers' toolkits. Any funding or sponsorship information provided data on *financial capital*. Staff lists, contact lists, or credits provided data about *responsibility for a tool.* And the nature of the DHC supporting the tool was assessed both by looking for evidence of collaboration on the tool's website, and by cross-referencing data gathered by Diane Zorich (2008) for her report.

I used this data to rate the sample of 38 tools on each metric described above. Individual tools served as the unit of analysis, and the tool sample remained the same as the sample evaluated in the final report for the "Tools for Humanists Project," listed below.

Table 3: Sample of Tools

Tool	Digital Humanities Center
Collaborative Genealogy	Jenkins Collaboratory
Collaborative Timeline	Jenkins Collaboratory
Combinformation	Texas A&M
CommentPress	Institute for the Future of the Book
CUSeeMe Reflector	WVU
Digital Discernment	Georgetown
Edition Production Technology (EPT)	ARCHway Project
English to Greek Word Search	Perseus
English to Latin Word Search	Perseus
Greek Morphological Analysis	Perseus
Interactive Archaeological Knowledge System	MATRIX
Latin Morphological Analysis	Perseus
Media Matrix	MATRIX
Omeka	GMU
Poll Builder	GMU
Project Pad	MATRIX
Scholar Press	GMU
Scribe	GMU
SOPHIE	Institute for the Future of the Book
Survey Builder, GMU	GMU
Tech Ticker	Jenkins Collaboratory
The Poster Tool	Georgetown
Virtual Lightbox	MITH
Web Scrapbook	GMU
Zotero	GMU
Video Annotation System	HASTAC and Duke
HASS Grid Portal	HASTAC and UCHRI
Historinet	HASTAC and Stanford Humanities Lab
Syllabus Finder	GMU
History Engine	Virginia Center for Digital History
Ink	WIDE MSU
Literacy Resource Exchange	WIDE MSU
Token X,	U of Nebraska
Virtual Humanities Lab	STG Brown
vrNav	UCLA
CITRIS Collaborative Gallery Builder	HASTAC

After ranking each tool according to the metrics for infrastructure outlined above, I summarized the findings in the descriptions below. I also calculated Pearson's product-moment correlation (*r*)

for pairs of variables (e.g. overall accessibility ranking compared to stability of funding source) to evaluate which infrastructural metrics most closely associate with tool accessibility as measured in our previous report (Nguyen and Shilton 2008).

5. Findings

Age of tools: Nineteen tools (half of the sample) provided no information about their age. Of the nineteen tools for which I could discern a birth date or age, the mean age was 4.7 years – surprisingly old in the world of software (standard deviation was 2.7). Age of tools was estimated from any source available, ranging from initial copyright date to information about the launch of the beta or 1.0 version.

Tool versions: Twenty-three tools offered no version number. Of the fifteen tools providing a version number, the average was 1.5. For simplicity, versions labeled "beta" or "prototype" were given a version number of 0.5

Ongoing support: Evidence of ongoing support was sparse. Twenty-two tools offered no signs of ongoing support. An additional eight tools were marked as discontinued or abandoned. There were only eight tools where there was evidence of recent upkeep of the site or updates to the tool.

Open standards: Twenty-three tools had no clear information about open source or proprietary standards. Only four tools were clearly proprietary. Eleven promoted themselves as open source and made the source code available on their website. Of the open source tools, only five were explicit about the development resources they used to make their code accessible. These included use of SourceForge and maintaining a Google developer's group.

Funding source and sustainability: Eighteen tools had no clear funding source. Six depended upon faculty time to build and maintain. Eight were funded by grants, one had a corporate sponsorship, and five were funded straight from DHC budgets. Funding sustainability turned out to be a metric about which it was too difficult to find public information. Only one tool had information on funding sustainability on its site, and even this was outdated: the five-year-old tool had notice of a two-year (so presumably long-expired) grant cycle.

Nature of backing institution: Thirty tools were the products of a single institution, while only eight were the products of collaborations between institutions. Unfortunately, an analysis of center vs. resource-focused DHCs proved unhelpful. Only a handful of DHCs in Diane Zorich's original report met the criteria for resource-focused DHCs. Of these few DHCs, only one produced a tool found in our study sample. As this tool has been abandoned, I decided to exclude the center vs. resource-focused DHC factor from my analysis.

Responsibility for tool: Most DHCs had some demarcation of who was responsible for a tool's creation, distribution, or stewardship. Ten tools made no indication of responsibility; nine indicated at least one responsible person; eight indicated two responsible parties; and eleven indicated responsibility for all three.

Total sustainability score: In order to compare the tools' overall longevity and sustainability, according to all of the factors described here, I constructed a "total sustainability score." This is a sum of each tool's score on all of the variables described above. The lowest scores in each category were assigned to tools providing no information on a given factor. Mid-range scores were given to tools that provide information about a tool's discontinued or outdated status, or to tools with sub-optimal sustainability practices such as one-off funding efforts. The highest scores were awarded to open source tools that have information about long-term sustainability and evidence of ongoing support. Discontinued tools were automatically given a sustainability score of "0".

Tools ranked by sustainability score are as follows:

Table 4: Tool Sustainability Scores

Tool	DHC	Total Sustainability Score
Scribe	GMU	23.5
Virtual Lightbox	MITH	20
Web Scrapbook	GMU	18
Zotero	GMU	16
SOPHIE	Institute for the Future of the Book	15
Omeka	GMU	14.1
Collaborative Timeline	Duke Collaboratory	14
CITRIS Collaborative Gallery Builder	HASTAC	13.5
Scholar Press	GMU	13
Kora	MATRIX	12
vrNav	UCLA	12
Syllabus Finder	GMU	12
Interactive Archaeological Knowledge System	MATRIX	9.5
Virtual Humanities Lab	STG Brown	9
Tech Ticker	Duke Collaboratory	8
Media Matrix	MATRIX	7
Token X	U of Nebraska	7
History Engine	Virginia Center for Digital History	6
Collaborative Genealogy	Duke Collaboratory	6
The Poster Tool	Georgetown	5.1
HASS Grid Portal	HASTAC and UCHRI	5
Connex	MATRIX	4.5
Combinformation	Texas A&M	4.5
CommentPress	Institute for the Future of the Book	4.4
English to Greek Word Search	Perseus	4
English to Latin Word Search	Perseus	4
Greek Morphological Analysis	Perseus	4
Latin Morphological Analysis	Perseus	4
Poll Builder	GMU	4
Digital Discernment	Georgetown	3
Edition Production Technology (EPT)	ARCHway Project	0
Ink	WIDE MSU	0
Literacy Resource Exchange	WIDE MSU	0
Survey Builder, GMU	GMU	0
Historinet	HASTAC & Stanford Humanities Lab	0
Video Annotation System	HASTAC and Duke	0

Project Pad	MATRIX	0
CUSeeMe Reflector	WVU	0

I also used Pearson's product-moment correlation (*r*) to check for correlations between scores on each sustainability factor and the overall score of a tool on the "Tools for Humanists" report's accessibility ranking (Nguyen and Shilton 2008). The correlation between sustainability factors and original accessibility score is listed in the following table.

Table 5: Correlation between sustainability and accessibility

Age	Version info	Ongoing support?	Open source	Open source dev tools?	Funding source	Backing inst.	Responsibility for tool	Total Longevity Score
0.24	0.16	0.28	0.20	0.25	0.51	-0.28	0.42	0.57

Interestingly, the strongest correlation was between the total sustainability scores and the total accessibility scores. It appears that tools that score well on accessibility are slightly more likely to score well on sustainability. It is a weak association, but still demonstrable.

6. Discussion

One finding of this report is the diverse measures of institutional support that appear on DHC sites. DHCs can indicate their ongoing support for tools in a variety of ways, including version numbers, dates of website updates, release timelines, links to developer's toolkits or source code, indication of permission to alter the code under creative commons licenses, and clear delineation of the staff responsible for tool upkeep. All of these pieces of information serve as signals that tool user may rely on ongoing upkeep of the tool, and technical support if needed. Each of these features of a DHC site increases user confidence in a tool's long-term accessibility, and therefore, its value.

It is also of great interest that accessible tools, as evaluated in our original report, also scored well on sustainability. There seems to be a relationship between the infrastructure supporting a tool and its accessibility. This suggests a level of professionalism that may lead not only to long-term care for a tool, but also to good accessibility practices such as providing one-click access to tools and providing instructions for download and use.

Best practices

The link between sustainability and accessibility suggests a number of best practices for DHCs seeking to create and maintain valuable tools for digital humanities. *Website design* is an often overlooked but critical area for improving practices. This report shows that findability is not the only important factor in the mounting and display of a tool. Assuring researchers of a tool's support and longevity can be another important practice. Centers should keep users abreast of updates, new funding, and new staff. They should also make it easy to contact developers. These steps can assure scholars who may work with a tool for months or years that their work will not be in vain if a tool is abandoned.

Professionalism includes envisioning tools as more than just one-off programming projects, but instead as products to support rigorous and long-term scholarship. Professional tool development means dedicating staff not only to tool creation, but also to stewardship over time. Professionalism also means dedicating ongoing institutional funding to tool support. If a DHC uses grants to

support tool creation, it should consider a sustainability plan for the user support, repair, and updates a digital tool will undoubtedly require.

Of course, as open source development has proved, professionalism does not have to mean large budgets and corporate management. A tool with great potential for the humanities community, shared and edited widely, can improve and persist over time with the help of volunteers. The thriving Zotero community is just one example of this possibility. Fostering strong user communities around digital humanities tools, as Cohen et al. (2009) suggest, is critical to encouraging both accessibility and sustainability.

Tool abandonment

At the opposite end of best practices, this report discovered a variety of tools that have been abandoned in the year since the original "Digital Tools for Humanists" research. Some of these tools were replaced by commercial tools, such as GMU's Survey Builder and HASTAC's Video Annotation System. Others were replaced by an updated tool authored by the same DHC, such as GMU's Scribe. This is part of a natural evolution of tools, and is unavoidable and even necessary.

However, other tools seemed to disappear due to loss of interest, time, or funding. As Andreas Paepcke has pointed out (cited in Friedlander 2009), tools designed by investigators or their students during the course of research projects are often "good enough" prototypes that reflect the research questions that motivated the work rather than sustainable digital objects. Cohen et al. add to this challenge the continual staffing problems faced by digital humanities developers:

> A survey of the existing digital tools for data-driven scholarship shows a chasm between projects that appear to have been done with a professional development staff and more amateurish efforts. Many software projects begin with just one or a few developers but as they grow face the problem of attracting new developers to take the project to a production-ready stage (2009, para. 22).

High rates of abandonment point to the fact that the infrastructure supporting tools for digital humanists is far from being a complete and effective scholarly infrastructure. Effective infrastructures, write Jackson et al. (2007):

> …are above all accomplishments of scale, growing as locally constructed, centrally controlled systems are linked or assembled into networks and internetworks governed by distributed control and coordination processes (Infrastructural dynamics, para 2).

Effective infrastructures fade into the background: they are so seamless that they are prone to be forgotten. The cyberinfrastructure of digital tools for humanists has far to go to reach this point of seamless disappearance. But the components of a cyberinfrastructure for humanists are growing. This report provides quantitative measures to add to the literature evaluating how far the infrastructure has come, and how far the community of digital humanists has left to go.

Next steps

What are the next steps towards fortifying and completing the cyberinfrastructure that supports tools for digital humanities? There are at least three areas of research, development and funding that could help digital humanities cyberinfrastructure move towards a more sustainable future.

One area that needs research is an evaluation of the utility and fit of digital humanities tools. As Oard writes, the problem is that:

> …those who could build these marvels don't really understand what marvels we need, and we, who understand what we need all too well, don't really understand what can be built (Oard 2009, 34).

Projects such as Project Bamboo are beginning to fulfill this need, and their efforts should be supported.

Another area in need of research is imagining an institutional infrastructure to support the digital one. Perhaps maintaining tool visibility, interoperability and sustainability is not a job for Digital Humanities Centers alone. In their report "Tools for Data-Driven Scholarship," Cohen et al. suggest that:

> The National Endowment of the Humanities, the Institute of Museum and Library Services, and the National Science Foundation have been instrumental in funding digital tools for the humanities and social sciences and believe that some kind of curated infrastructure that supported sharing and reuse would help to make existing tools more widely available and new tools more viable and sustainable (2009, para. 12).

Imagining the components of a curated infrastructure is an important next step for digital humanities research. Would a SourceForge.org for digital humanities tool be a solution to ongoing issues of quality, sustainability, and longevity? Cohen et al. suggest perhaps that it would:

> What we imagine is a dynamic site similar in some ways to SourceForge ("ToolsForge"?) that consists of (1) a tools development environment; (2) a curated tools repository that provides peer reviewing and discovery functions; and (3) a set of community building and marketing functions. We are aware that this is a tall order… (2009, para. 37).

Cohen et al. suggest that there may be an equivalent, successful set of structures that currently encourage sustainable tool design in the e-science and open source software (OSS) communities. A systematic review of e-science and OSS development infrastructures could harvest lessons applicable to tools for digital humanities. I propose that a highly useful follow-up project could review primary and secondary sources in e-Sciences and OSS to find commonalities and best practices for a humanities cyberinfrastructure.

Finally, engaging tool designers with issues of accessibility and sustainability will help to strengthen the digital humanities cyberinfrastructure by training the people who drive it. I echo the call of the "Tools for Data-Driven Scholarship" (Cohen et al. 2009) report and encourage funders to finance "Train the Trainers" sessions for DHC affiliates interested in tool development. Knowing more about the tool landscape – both promise and weaknesses – can only improve future tool development.

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