Devious Design: Digital Infrastructure Challenges for Experimental Ethnography

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As diverse disciplinary communities engage in designing systems to support their work—communities characterized by varying theoretical and methodological commitments—they are challenged with figuring out how to translate these commitments into material form. This paper addresses instances when the infrastructures available to designers—the existing tools and materials that designers employ when building new systems—do not align with the commitments of these communities. Such challenges become particularly salient when designing with digital infrastructure. Digital infrastructure is complex, often composed of many other infrastructures that each carry its own history, forms of control, and affordances, and these factors affect how diverse users engage with them.[1] In this paper, I focus on how existing digital infrastructure both enables and structures how disciplinary communities design new digital systems to support their work. I then introduce a design practice that leverages the affordances of digital infrastructure in devious ways.

In the community within which I work—the digital empirical humanities—designing digital platforms that can both support our work styles and embody our commitments is a significant challenge.[2] Digital infrastructure has opened an array of opportunities for engaging with humanities work, supporting the archiving of empirical materials, new engagements with collaborative analysis, and new forms of digital publication.[3] Yet, many base components of digital infrastructure that humanists must leverage to build digital systems (e.g., databases and algorithms) have themselves been built with cultural assumptions that differ drastically from those of humanistic inquiry.[4] As Johanna Drucker writes:

> Positivistic, strictly quantitative, mechanistic, reductive, and literal, [digital] techniques preclude humanistic methods from their operations because of the very assumptions on which they are designed: that objects of knowledge can be understood as self-identical, self-evident, ahistorical, and autonomous.[5]

1 Hanseth and Lyytinen define digital infrastructure as shared, open, heterogeneous, and evolving socio-technical systems, composed of information technology capabilities and the user and design communities that leverage them. See Ole Hanseth and Kalle Lyytinen, "Design Theory for Dynamic Complexity in Information Infrastructures: The Case of Building Internet," *Journal of Information Technology* 25, no. 1 (March 20, 2010): 1–19, doi:10.1057/jit.2009.19.

2 Hanseth and Lyytinen distinguish digital platforms from information infrastructures. Platforms, they suggest, have more centralized control and are composed of a discrete set of IT capabilities. Ibid, 3.

3 See, e.g., Matthew K. Gold, *Debates in the Digital Humanities* (Minneapolis, MN: University of Minnesota Press, 2012); and Anne Burdick et al., *Digital_Humanities* (Cambridge, MA: The MIT Press, 2012).

4 Such concerns lead Alexander R. Galloway to ask of digital humanities scholars: "Having inherited the computer, are we obligated to think with it?" Alexander R. Gallloway, "The Cybernetic Hypothesis," *Differences* 25, no. 1 (January 1, 2014): 126.

5 Digital Scholarship," in *Debates in the Digital Humanities*, ed. Matthew K. Gold (Minneapolis, MN: University of Minnesota Press, 2012), 85–6.

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On the contrary, humanistic methods tend to be interpretive and qualitative; they aim to historicize and contextualize objects of knowledge. In adopting digital infrastructure to support humanistic inquiry, we have had to learn how to recognize the logics that undergird its architecture and to consider how these logics shape a resistance against our efforts to design digital platforms that embody the commitments that guide our work.

In this paper, I recount the process of designing the Platform for Experimental Collaborative Ethnography (PECE)—a digital platform that seeks to provide a space for collaboration among geographically dispersed researchers working in the spirit of experimental ethnography. Experimental ethnographic methods emerged explicitly during cultural anthropology's reflexive turn in the 1980s, marked with the writing of seminal texts, such as *Writing Culture and Anthropology as Cultural Critique*.[6] Informed by feminist and postcolonial movements, the turn stands as a moment in the history of critical anthropological scholarship when academics were called upon to re-evaluate their discursive practices and experiment with their ethnographic methods in ways that could challenge hegemonic categorizations. Responding to this call, PECE has been designed around a series of *design logics*—design directives informed by critical theoretical commitments that we aim to translate into digital terms.

Scholarship outlining critically reflective design practices has encouraged designers to attend to the assumptions and habits that guide their design practice. It has suggested that, through reflection on their own practice, designers can configure materials to challenge the assumptions about the role design plays in society. In this scholarship, designing critically happens through the critical employment of tools and the critical assembly of materials. However, scholarship in Science and Technology Studies (STS) has shown that tools and materials themselves are far from neutral; instead, they are shaped according to the values and politics of their designers and the societies in which they are embedded, and they come to embody those values and politics.[7] In acknowledging that dominant discourses shape the infrastructures available to designers just as much as they shape design practice, I argue that the notion of critical design reflection should be expanded to consider design infrastructure. Designing critically should involve accounting for and disrupting the logics that are pre-embedded in the infrastructures available to designers. I call this design practice *devious design*—a practice where designers not only "make do" with the infrastructure available, but also leverage that infrastructure in ways that challenge its underlying logics.

6 James Clifford and George E. Marcus, *Writing Culture: The Poetics and Politics of Ethnography: A School of American Research Advanced Seminar* (Berkeley, CA: University of California Press, 1986); and George E. Marcus and Michael J. Fischer, *Anthropology as Cultural Critique: An Experimental Moment in the Human Sciences* (Chicago: University of Chicago Press, 1986).

7 An overview of how STS scholars approach design and its issues is offered in Edward Woodhouse and Jason W. Patton, "Design by Society: Science and Technology Studies and the Social Shaping of Design," *Design Issues* 20, no. 3 (Summer 2004): 1–12.

The PECE design team has approached PECE not only as a critical design project in the digital humanities,[8] but also as an experimental research project—one that considers how best to leverage digital infrastructure in building a platform that realizes our design logics. True to our own methodological commitments, we have approached this research project with methods situated in the humanities and informed by experimental ethnographic theory. We have learned to "read" digital infrastructure and critically analyze its logics. This paper outlines what we have learned about critically designing digital systems as a result of this research, while introducing the concept of *devious design*.

Critically Reflective Design Practice

Scholarship describing critically reflective design practices prompts designers to develop an awareness of how their assumptions and habits shape design process. This theme is featured prominently in Philip Agre's work on "critical technical practice" and in the work of Phoebe Sengers et al. on "reflective design."[9] Agre describes how designers undertaking a "critical technical practice" have to take on a "split identity"[10]—with one that focuses on design and another that reflects on and confronts the assumptions that structure the design practice. Narrating his struggle to adopt a critical eye in the field of artificial intelligence (AI), Agre suggests that a critical technical practice requires "waking up" and recognizing how one's own assumptions and habits inflect how one approaches design practice.[11]

Sengers et al. draw on Agre's concept and on Donald Schön's work on "reflection-in-action" to suggest that reflection on the assumptions guiding design in human–computer interaction (HCI) should be undertaken concomitant to design.[12] For Sengers et al., "reflective design" involves drawing attention not only to the assumptions and habits that guide a designer's own thinking, but also to values and practices that tend to guide HCI design as a whole. Reflective design calls on designers to rethink their role in the design process and their relation to the technologies they produce. Sengers et al. suggest that moments of surprise arising in the design process disrupt the designer's tendency to configure perfunctorily and thus establish opportunities to provoke the designer to build with critical reflection. Designers should thus "intervene" in status quo design, establishing opportunities for surprise that trigger reflection. In this sense, reflective design encourages designers to rethink the dominant values and logics that guide design practice.

These insights are integral to experimental ethnographic research design. Experimental ethnographic methods were introduced in cultural anthropology at a time when feminist and postcolonial scholars were drawing increasing attention to how

8 The PECE design team includes Lindsay Poirier (lead platform architect), Dominic DiFranzo (lead computer scientist), Luis Felipe Murillo (lead open knowledge developer), Brian Callahan (open knowledge design), Brandon Costelloe-Keuhn (open knowledge design), Kim Fortun (principal investigator), and Mike Fortun (principal investigator).

9 Philip Agre, "Towards a Critical Technical Practice: Lessons Learned in Trying to Reform AI," in *Social Science, Technical Systems, and Cooperative Work: Beyond the Great Divide*, ed. Geoffrey Bowker et al. (Milton Park, Abingdon: Psychology Press, 1997), 131–57; and Phoebe Sengers et al., "Reflective Design," in *Proceedings of the 4th Decennial Conference on Critical Computing: Between Sense and Sensibility* (New York: ACM, 2005), 49–58, doi:10.1145/1094562.1094569.

10 Agre, "Towards a Critical Technical Practice," 155.

11 Ibid, 144.

12 Sengers et al., "Reflective Design," 52–3. See also Donald A. Schön, *The Reflective Practitioner: How Professionals Think in Action* (New York, NY: Basic Books, 1983).

"writing culture" provoked power relations that tended to marginalize those being represented.[13] Critical anthropological scholarship thus calls on ethnographers to be reflexive—to design traditional ethnography in new ways, confronting and resisting the hegemonic assumptions that tend to shape particular depictions of culture.[14] Thus, "waking up" to the discursive habits that shape anthropological research design is one of experimental ethnography's chief methodological commitments. In fact, designing experimentation to be a "generator of surprises" has more recently become an important theme in writing on experimental ethnographic method.[15] Thus, the type of design practice that Agre and Sengers et al. call for should be intricately woven into the way we practice design.

We have come to think of the logics that guide our design practice as *design logics*. More specifically, design logics are critical directives, informed by a design community's habits and assumptions about language, and by its philosophical commitments, which direct the architecture and arrangement of content in the systems they produce. As design logics shape the way digital systems are designed, the resulting material infrastructure comes to embody the designer's worldviews.

This articulation of design logics is notably distinct from the way that "logic of design" has been characterized in design studies. In seeking to capture the logic of digital design in the field of architecture, Rivka Oxman looks to revisit theories, such as "design thinking" and "designerly ways of knowing," in light of new digital design methodologies.[16] She calls attention to the changing theories, models, and processes of digital design, how they shape particular material configurations in the digital design of architecture, and how they can inform new pedagogical design frameworks. "Logic," in this sense, refers to that which unifies distinct approaches to design. Delineating design logics, on the other hand, is about outlining that which diversifies them. Design logics emerge from the assumptions, habits, and commitments of diverse disciplinary communities, each with its own diverse "design thinking" or "designerly ways of knowing."

For the PECE design team, designing and building a digital platform was its own form of experimentation, and as such, we treated it as both a critical design project and an ethnographic research project. In engaging the design of the platform as a research project, we confronted our own set of surprises: that the logics of many digital infrastructure components were resistant to our attempts to design critically. Scholarship in STS has argued that all artifacts—including infrastructures with and on which designers build—are inscribed with politics and values.[17] In employing existing infrastructures while designing, designers configure new technologies with the logics *already embedded* in

13 Particularly salient at this time was the work of Edward W. Said, who argued that written depictions of the non-Western world provoked new forms of colonial power. See Edward Said, *Orientalism,* 1st ed. (New York: Vintage, 1979). See also Clifford and Marcus, *Writing Culture,* 25.

14 Kim Fortun writes, "...ethnography, like other technologies, can be designed in different ways—to draw out what is, the state of things, or to show what is at odds with extent theory.... Ethnography, like other technologies can also be designed to challenge and change existing order, provoking new orderings of subjectivity, society, and culture...." Kim Fortun, "Ethnography in Late Industrialism," *Cultural Anthropology* 27, no. 3 (August 1, 2012): 450.

15 Kim Fortun and Mike Fortun, "Scientific Imaginaries and Ethical Plateaus in Contemporary U.S. Toxicology," *American Anthropologist* 107, no. 1 (March 1, 2005): 47. Fortun and Fortun use this term in reference to Hans-Jorg Rheinberger's explication of experimental systems in Hans-Jorg Rheinberger, "Experimental Systems, Graphematic Spaces," in *Inscribing Science: Scientific Texts and the Materiality of Communication,* ed. Timothy Lenoir (Palo Alto, CA: Stanford University Press, 1998), 285–303.

16 Rivka Oxman, "Digital Architecture as a Challenge for Design Pedagogy: Theory, Knowledge, Models and Medium," *Design Studies* 29, no. 2 (March 2008): 99–120. For design thinking, see Kees Dorst, "The Core of 'Design Thinking' and Its Application," *Design Studies*, 32, no. 6 (November 2011): 521–32. For designerly ways of knowing, see Nigel Cross, "Designerly Ways of Knowing: Design Discipline Versus Design Science," *Design Issues* 17, no. 3 (Summer 2001): 49–55.

17 David F. Noble, *Forces of Production: A Social History of Industrial Automation* (Piscataway, NJ: Transaction Publishers, 1984); Langdon Winner, "Do Artifacts Have Politics?" in *The Whale and the Reactor: A Search for Limits in an Age of High Technology* (Chicago: University of Chicago Press, 1986), 19–39; Judy Wajcman, *Feminism Confronts Technology* (University Park, PA: Penn State Press, 1991); and Woodhouse and Patton, "Design by Society," 6.

these infrastructures. With this progression in mind, our efforts to design PECE critically demanded that we reflect not only on our design practice, but also on the design infrastructure available to us. We needed to recognize when the logics of digital infrastructure components were resistant to our attempts to realize our own design logics. In the face of such infrastructural constraints, we worked to leverage the affordances of the infrastructure in devious ways, aiming not only to work around incommensurable logics, but also to undercut their hegemonic force. The first step toward a "devious design" practice involves learning to "read" digital infrastructure, questioning the types of design engagements that its logics afford.

Reading the Design Logics of Digital Infrastructure

How does a design community recognize when the logics of digital infrastructure are resistant to its design logics? Such recognition involves being able to draw out logics of digital infrastructure — the ways in which its arrangements and configurations have been guided by design directives, along with the social and material conditions of its design. In other words, it involves asking what the infrastructure enables, what it constrains, and the extent to which these affordances are shaped by the logics of the design communities that assembled it.

Several tools for analyzing how technologies come to embody a designer's commitments—how the meaning and form of technologies are shaped by their designers' directives—have been developed in the field of STS. Lucy Suchman refers to these directives as "ordering devices"; ordering devices are the configurations, scripts, plans, standards, and categorizations that are meant to tune a user toward a particular use.[18] Grint and Woolgar have called one such ordering device "configuring a user"; in configuring a user, the designer sets the parameters for how the user should interact with the machine and evolves the machine toward these parameters.[19] They suggest, in recognizing that any technology can be interpreted flexibly, that technologies are written like a text that users can then "read" in diverse ways.

Another ordering device that has been cited more prominently in Design Studies literature is the technological script. Madeleine Akrich has argued that designers, when defining the affordances of an innovation, form an imagination for their technology's future users—the users' "specific tastes, competences, motives, aspirations, [and] political prejudice," and designers "assume that morality, technology, science, and economy will evolve in particular ways."[20] Throughout the design process, they "inscribe" the technology in accordance with this vision. The product thus comes to represent an instruction manual or recipe for a user that eventually adopts the technology. In "de-scribing" a technology, a user can either adhere to or veer from its script.

18 Lucy Suchman, *Human-Machine Reconfigurations: Plans and Situated Actions,* 2nd ed. (Cambridge: Cambridge University Press, 2006).

19 Keith Grint and Steve Woolgar, *The Machine at Work: Technology, Work and Organization* (New York, NY: John Wiley & Sons, 1997).

20 Madeleine Akrich, "The De-Scription of Technical Objects," in *Shaping Technology/Building Society: Studies in Sociotechnical Change,* ed. Wiebe Bijker (Cambridge, MA: The MIT Press, 1992), 207–8. Notable examples of script analysis include Marit Hubak, "The Car as a Cultural Statement: Car Advertising as Gendered Socio-Technical Scripts," in *Making Technology Our Own? Domesticating Technology into Everyday Life,* Merete Lie and Knut H. Sørensen, ed. (Cambridge, MA: Scandinavian University Press North America, 1996), 171–200; and Nelly Oudshoorn, Els Rommes, and Marcelle Stienstra, "Configuring the User as Everybody: Gender and Design Cultures in Information and Communication Technologies," *Science, Technology & Human Values* 29, no. 1 (January 1, 2004): 30–63.

21 Kjetil Fallan, "De-Scribing Design: Appropriating Script Analysis to Design History," *Design Issues* 24, no. 4 (Autumn 2008): 65.

22 Lucy Suchman, *Human-Machine Reconfigurations,* 187.

23 Hanseth and Lyytinen, "Design Theory for Dynamic Complexity in Information Infrastructures," 4.

24 Michel Foucault suggests that to understand dominant discourses, we need to interrogate the "genealogies" of language: the historical and structural conditions that have shaped discourse in the present. Here, I suggest that we need to study infrastructure in a similar way. See Michel Foucault, *The Archaeology of Knowledge* (New York: Vintage, 1982).

25 Hayden White, a historian and literary critic, demonstrates how verbal structures (e.g., genres, metaphors, and tropes) used in the writing of historical work shaped their narratives and arguments, structuring our knowledge of history of the past today. Hayden White, *Metahistory: The Historical Imagination*

Scholars have gone on to elaborate "script analysis" as a methodological tool for delineating technological scripts. Conducting script analysis on a particular technology involves interrogating the designer's imagination for the technology's users, the material and socio-cultural conditions of the technology's production, its resulting affordances, and the conditions of its use or consumption. Drawing on Akrich's concept to contextualize design history, Kjetil Fallan describes script analysis as considering both the physical scripts and the socio-technical scripts that are written into technology. The former refers to the physical form or interface of a technology, and the latter refers to "the transportation and transformation of a product's symbolic, emotional, social, and cultural meanings."[21]

These tools for analyzing ordering devices are notable for their attempts to get at meanings that have purposefully been inscribed into technology, but, as Suchman notes, they tend to overemphasize the extent to which an imagination of future users and use of the technology is accessible to the designer.[22] This critique is particularly significant when considering digital infrastructure, which is composed of evolving, heterogeneous components (often designed in different communities that have different commitments) and a highly distributed user base.[23] In delineating the design logics of a digital infrastructure, the PECE research team has sought less to characterize the designers' imaginations for future users and more to characterize the "genealogies" of designer assumptions about the way language works,[24] the way knowledge is represented, and the ontological organization of the world that, through language, gets embedded in infrastructure.

The methods we have used to distinguish a digital infrastructure's design logics are much like script analysis but are informed more by our methodological commitments to a form of literary criticism that questions why and how texts get structured the way they do.[25] We have developed a series of questions to ask of digital infrastructure that helps us get at its underlying logics—in other words, to capture the complex interplay of designers' assumptions, habits, and commitments; how they are translated into material form; and how users leverage or manipulate the resulting affordances.[26] Some of these questions are shown in Figure 1.

In asking questions that look at a digital infrastructure from such a wide variety of perspectives, we emphasize that the translation of a designer's logics into material form is not a simple or linear process. Symbolic meaning and materiality cannot easily be disentangled. In his description of script analysis, Fallan notes that physical and socio-technical scripts should not be considered dichotomous, but instead "entangled and reciprocal."[27] In this sense, "scripting" a technology involves a constant translation of user cues into and out of material form.

in Nineteenth-Century Europe (Baltimore, MD: JHU Press, 1975). This book has had a particularly influential impact on writings about experimental ethnographic research methods.

26 This approach is perhaps characterized best in Marcus Jahnke, "Revisiting Design as a Hermeneutic Practice: An Investigation of Paul Ricoeur's Critical Hermeneutics," *Design Issues* 28, no. 2 (Spring 2012): 30–40. Jahnke rethinks Schön's "reflection-in-action," describing design practice as a dialogue with a design situation. He suggests considering design practice from the perspective of Paul Ricoeur's "critical hermeneutics" (as an alternative to "the pervasive metaphor of problem solving") to capture how a designer interprets, responds to, and generates new meaning in design situations. In developing analytics to ask about digital infrastructure as we design, we have explicitly positioned critical hermeneutics as a key component in our design practice.

27 Fallan describes that, for Akrich and Latour, form and meaning are woven together in significant ways. Noting how semiotics has been accused of reducing everything to text and ignoring materiality, they respond that "semiotics is not limited to signs: the key aspect of the semiotics of machines is its ability to move from signs to things and back." Madeleine Akrich and Bruno Latour, "A Summary of a Convenient Vocabulary for the Semiotics of Human and Nonhuman Assemblies," in *Shaping Technology/Building Society: Studies in Sociotechnical Change* (Cambridge, MA: MIT Press, 1992), 259; quoted in Fallan, "De-Scribing Design," 63–4.

Creation and Maintenance

Who built the system, with what skills, and with what kinds of social or commercial commitments?

What is the business model?

Who responds to issues/ breakdowns/bugs?

Design Logics and Dependencies

What assumptions about language and knowledge are built in? What assumptions about ontology are built in?

What other systems, platforms, or modules does the system rely on? Do other systems, platforms, or modules rely on it?

How are data moved through or by the system?

Use: Actual and Intended

What pathways are users directed to take through the system?

How is the system actually used, and what accounts for divergence between intended and actual use?

To what extent is the work done on the system visible or transparent? What processes appear to be hidden?

Figure 1
Sample questions for reading digital infrastructure.

In a similar way, realizing design logics involves a constant translation of design directives into and out of material form. A designer's logics are constantly "reconfigured" through engagements with base infrastructures, just as base infrastructures are reconfigured through design.[28] Also embedded in larger socio-technical systems, designers are further reconfigured by market forces, laws, the environment, skill sets, and other factors. In this sense, infrastructure does not necessarily reflect a designer's logics but instead iterates from them. Notably, using a hermeneutic approach to analyze how design logics manifest in digital infrastructure enables a researcher to capture and thickly describe the complexity of this translation. In what follows, I show how we've leveraged this hermeneutic approach in the critical design of PECE.

Designing an Information Architecture for PECE

Designing a digital platform that can support the critical theoretical commitments of experimental ethnography poses challenges. In this section, I describe how we have recognized and approached these challenges in the design of PECE.

PECE: Aims and Features

The idea for PECE resulted from work on an experimental ethnographic project called *The Asthma Files*, initiated by Kim Fortun and Mike Fortun. *The Asthma Files* sought to create a digital space for geographically dispersed ethnographers to collaborate around the global asthma epidemic. A key design goal of the project was that it would embody and advance the logics and methodologies of experimental ethnographers. Accordingly, the research team devised design logics for the platform that steered the design process.[29] Examples of such logics included: (1) "explanatory pluralism,"[30] which aimed for multiple articulations and perspectives to form around a single piece of data; (2) "pursuing noise," or an overabundance of data, in recognition that "the signal" might only become identifiable at a later date; and (3) facilitating chance encounters by "juxtaposing" disparate data to surprise a researcher and shift habitual modes of thinking. We aimed for PECE to embody an experimental system—one that not only reliably produces knowledge, but also leaves space for shifts and displacements in the analytic process.[31] This design logic we refer to as (4) the "pursuit of differential reproduction."

The platform offered several features significant to a collaborative ethnographic project. In syncing the site with the open-source reference management platform, Zotero, a shared bibliography could be developed. Content, including field notes, photographs, or interviews (in the form of documents, images,

28 Lucy Suchman, *Human-Machine Reconfigurations,* 261–8.

29 Kim Fortun et al., "Experimental Ethnography Online," *Cultural Studies* 28, no. 4 (2014): 632–42.

30 Using these design logics, we draw from the work of Sherry Turkle and Seymour Papert, "Epistemological Pluralism: Styles and Voices Within the Computer Culture," *Signs* 16, no. 1 (1990): 128–57.

31 Rheinberger, "Experimental Systems, Graphematic Spaces," 287.

audio, or video), could be added to the site as *artifacts*. Any researcher could comment on an artifact by responding to a *structured analytic*—a shared yet evolving set of questions that was attached to an artifact. Eventually, artifacts could be pulled together to create various types of essays, such as photo essays or timeline essays, offering multiple ways of looking at the data. Providing multiple avenues for contributing and curating data, along with mechanisms for constant and diverse reflection on the significance of the data, the platform aimed to offer new arrangements for envisioning and articulating knowledge about asthma.

As *The Asthma Files* developed and the potential significance of a theoretically inflected digital platform became clear, the research team began the development of PECE, aiming to produce a packaged version of the platform that any research team, studying any topic in the spirit of experimental ethnography, could download and install to launch its own digital project.[32] Trained in both ethnography and Web Science, I served as a platform architect on PECE's design team, translating the digital needs of ethnographers into technical language. Because PECE relies on several existing digital infrastructures to carry out its technical functions, my role involved configuring existing digital infrastructures in accordance with the research team's design logics. However, in doing so, we encountered several instances when the logics of these infrastructures directly conflicted with the goals of the research team and the aims of the platform.

Reading the Logics of Content Management Systems

One of the earliest technical decisions we were required to make in the development of PECE was the selection of a content management system (CMS). A CMS is a Web application that facilitates publishing, storing, editing, and deleting content according to a pre-defined workflow. CMSs quite literally manage how content moves through a system, taking the burden of developing robust functionality for data storage off of site developers. Initially, we narrowed our options to two CMSs: Plone and Drupal.[33] In "reading" these CMSs, we discovered that their designers also build on top of base infrastructures into which "foreign" commitments are pre-embedded, as do the designers of the base infrastructures, and so on. In other words, characterizing the infrastructure's "genealogies" was particularly important to understanding the infrastructure's logics.

To illustrate, when Alexander Limi and Alan Runyan founded Plone in 2000, they chose to build the system on top of the Zope Content Management Framework. That same year, the PythonLabs team moved to the Zope Corporation,[34] and Zope accordingly is written in Python—an object-oriented programming language that affects how data gets organized in Plone.

32 To make the logics that have guided our design of PECE explicit in the platform, we have encoded descriptions of the design logics into the data model. We consider our design logics "metadata" for the digital infrastructure; any research group that downloads and installs PECE also adopts our commitments to experimental ethnography.

33 Both of these systems met our initial criteria: Both were free and open source, distributed under the General Public License (GNU) , and maintained robust developer communities.

34 "Welcome to Python.org," *Python.org,* https://www.python.org/download/releases/2.7/license/ (accessed May 19, 2016).

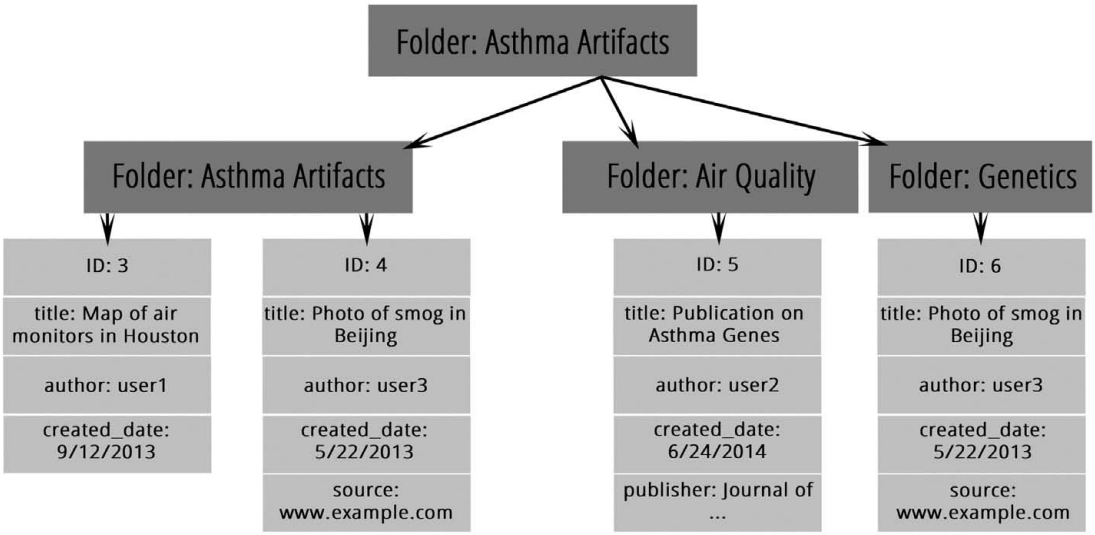

Figure 2
Plone Schema for artifacts in *The Asthma Files.*

In other systems, coding procedures are written apart from the data they manipulate; in object-oriented systems, data objects themselves are coded to have properties and perform actions. They earn their place in the system based on how they relate to other objects. Proponents for object-oriented systems suppose that they better reflect how things are organized in the "real world" (even if this organization comes at a cost to computational efficiency). However, as David Golumbia writes, this thinking is part of a "computationalist order":

> Each object is defined hierarchically by where it fits into the larger scheme of objects; each object belongs in a class and does not belong in other classes; classes ([except] for some exceptional instances) do not overlap. ...but... the material world does not fit so neatly into the categories our scientific programs prefer. In the world of computers, though, objects do fit into hierarchies neatly, even if it is conceptually clear that the fit is poor.[35]

Built on top of Zope, Plone prods users to organize content much like the folder structure on an operating system. In fact, in its documentation, Zope describes folders as its basic building blocks. Objects, or folders, must be defined at the outset, and content is added as files into a folder. Folders cannot overlap. Files cannot contain folders or be associated with more than one folder (see Figure 2). In this case, content added to the site is organized hierarchically and separated into categories; relationships are marked with strict ontologies. This structure sanitizes data, allows for only singular explanatory perspectives, and largely shuts down the possibility for shifts and displacements in the analytic process.

35 David Golumbia, *The Cultural Logic of Computation* (Cambridge, MA: Harvard University Press, 2009): 210.

Figure 3
Comparison of structure of the Drupal Information Architecture (left) vs. the Plone Information Architecture (right).

Meanwhile, the Drupal Framework is much less object-oriented than Plone. Around 2000, Dries Buytaert decided to write Drupal in the scripting language PHP because of its simplicity; he wanted to develop a system that amateur Web developers could leverage.[36] At the time of Drupal's development, PHP did not support many object-oriented constructs; instead, it enabled users to script code that referenced and manipulated data stored elsewhere—in relational databases. Accordingly, Drupal still does not make much use of "classes"—structures for defining object types, properties, and actions in object-oriented systems.[37]

Nodes, which are considered to be the basic building block of content in Drupal, are not defined as discrete objects, each with its own properties and actions. Instead, nodes are stored as rows in a relational database table. Each column of the table then marks a data attribute, such as the data's unique identifier, title, author, or date of creation (see Figure 3).

Notably, setting up container-like structures in relational databases is much less straightforward than doing so in object-oriented systems. Rows in different tables can reference each other, but they cannot contain each other. Thus, in Drupal, rather than organizing data into folders, users organize data with taxonomies or tags. Tags can be added or removed from a data point at any time without compromising the platform's information architecture.[38] In addition, a data point can have more than one tag, allowing it to be organized in two places simultaneously. Thus, as illustrated in Figure 4, nodes in Drupal do not need to be organized into categories or folders from the outset. The connections between data points can *emerge,* and this process of becoming is an essential characteristic to the form of experimental ethnography, as Steven Tyler argues.[39] Drupal's information architecture allows for content to *become* meaningful through evolving content configurations. It allows for the shifts and displacements of analysis called for by our design logics.

36 Dries Buytaert, "Why PHP (and Not Java)?," http://buytaert.net/why-php-and-not-java, April 28, 2006 (accessed on May 17, 2016).

37 Ranelpadon et al., "Drupal 6/7 Programming from an Object-Oriented Perspective | Drupal.org," https://www.drupal.org/node/547518, April 4, 2005 (accessed May 17, 2016).

38 This affordance also has a genealogy. In his early writings on relational database models, E. F. Codd, set theorist and inventor of the relational model for database management, notes that, with previous database models, such as tree-based models and network models, changing data values without breaking the database was extremely difficult. Each row in a relational database table, meanwhile, is isolated from other rows; their ordering is "immaterial" to the data's storage and retrieval. E. F. Codd. "A Relational Model of Data for Large Shared Data Banks," *Communications of the ACM,* June 1970.

39 Stephen Tyler, "Post-Modern Ethnography: From Document of the Occult to Occult Document," in *Writing Culture: The Poetics and Politics of Ethnography: A School of American Research Advanced Seminar,* ed. James Clifford and George E. Marcus (Berkeley, CA: University of California Press, 1986), 122–40.

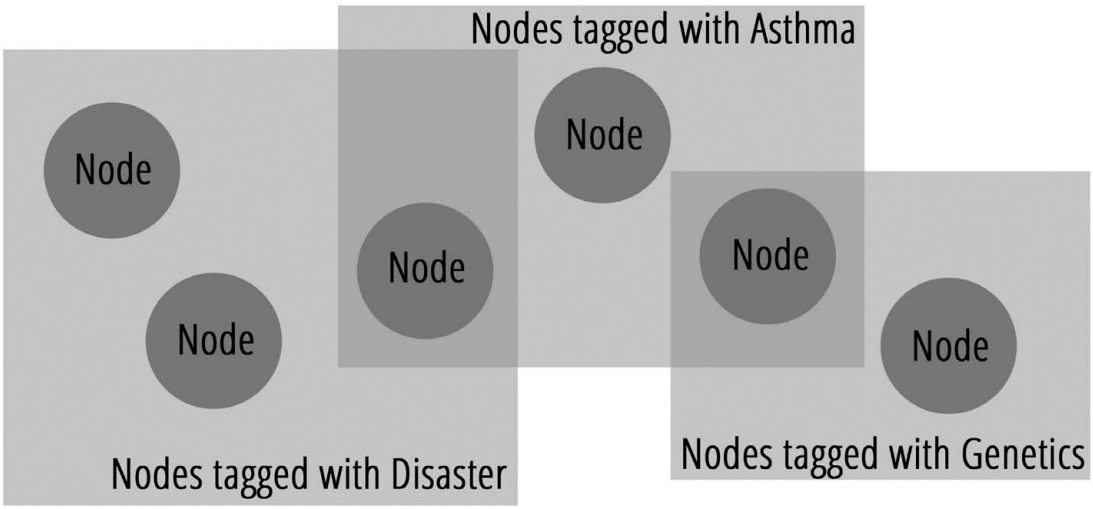

Figure 4
Organization of Drupal nodes.

Drupal was ultimately selected as the content management system for PECE. Yet even Drupal held directives incongruent with our design logics. Because relational databases store data in a tabular structure, every piece of data has the same potential attributes, marked by the table's columns. On the other hand, in Plone, every object is defined individually and thus can have its own properties. Tabular property schemas prioritize data's sameness over its difference; they prioritize structure over play. With these priorities in mind, Tara McPherson writes that relational databases misalign with feminist logics—logics that shun characterizing the world according to strict and stable schemas.[40] Yet we came to recognize a limit: Leveraging digital infrastructure without conforming to some data structure is impossible. Our challenge was thus figuring out how to enable iterations of difference *within* these structures designed for sameness—how to build in opportunities for shifts and surprises in a rigidly rectangular space.

Designing Deviously with Drupal

Drawing on Claude Lévi-Strauss's characterization of a "bricoleur"—that is, someone who cobbles together materials with available tools—Panagiotis Louridas has described today's design practice as "bricolage."[41] According to Louridas, today's designer, however skilled, still "makes do" with a finite set of materials and tools. Unlike a "scientist" or "engineer," who is constantly trying to build outside the limits of infrastructure, bricoleurs and designers work within the limits that infrastructures impose. They do so out of necessity; building new infrastructure out of nothing is impossible.[42] Under such constraints, the bricoleur "uses devious means compared to those of a craftsman."[43]

40 Tara McPherson, "Designing for Difference," *Differences: A Journal of Feminist Cultural Studies* 25, no. 1 (Spring 2014): 178–88.

41 Panagiotis Louridas, "Design as Bricolage: Anthropology Meets Design Thinking," *Design Studies* 20, no. 6 (November 1999): 517–35. Louridas draws on Lévi-Strauss's work in Claude Lévi-Strauss, *The Savage Mind* (Chicago: University of Chicago Press, 1966).

42 Arguing that all production—both of infrastructure and of meaning—stems from cobbling together from what already exists, Derrida claims that the "engineer" is nothing more than a myth that the "bricoleur" dreams up. Jacques Derrida, "Structure, Sign, and Play in the Discourse of the Human Sciences," in *The Languages of Criticism and the Sciences of Man: The Structuralist Controversy*, ed. Richard Macksey and Eugenio Donato (Baltimore, MD: Johns Hopkins University Press, 1970), 247–65.

43 Lévi-Strauss, *The Savage Mind*, 16–17.

As digital infrastructure imposes limits on how digital systems can be designed, a designer with clear commitments must use devious means. Devious design is a strategy invoked in instances when the logics of digital infrastructure are out of sync with a designer's logics, yet that same infrastructure is necessary for building a digital system. More than making do, a devious designer adopts digital infrastructure out of necessity and then also "uses devious means," leveraging the infrastructure in ways that compete with its underlying logics.

In designing the information architecture for PECE, I have taken cues from Teresa de Lauretis to tackle this challenge. De Lauretis argues that in instances when dominant discourse structures an immobility, "the only way to position oneself outside of that discourse is to displace oneself within it":

> Strategies of writing and of reading are forms of cultural resistance. Not only can they work to turn dominant discourses inside out (and show that it can be done), to undercut their enunciation and address, to unearth the archaeological stratifications on which they are built; but in affirming the historical existence of irreducible contradictions for women in discourse, they also challenge theory in its own terms, the terms of a semiotic space constructed in language, its power based on social validation and well-established modes of enunciation and address; so well-established that, paradoxically, the only way to position oneself outside of that discourse is to displace oneself within it—to refuse the question as formulated, or to answer deviously (though in its words), even to quote (but against the grain). The limit... is thus the contradiction of feminist theory itself, at once excluded from discourse and imprisoned within it.[44]

Responding to the language assumptions embedded in PECE *deviously* meant figuring out how to foreground the multiplicity of ways that ethnographic data can be defined, while leveraging a digital infrastructure that stores all data into tables and with the same properties.[45] The best example of how we've revealed this multiplicity is in the design of PECE's *structured analytics*. We've designed the system so that all commentary on an artifact must be written up in response to a shared question; in responding to several shared questions, researchers produce an *annotation* of an artifact. Like a table, all annotations are defined with the same set of properties; every researcher uses the same analytics to annotate any artifact in the system. However, as multiple researchers respond to the same analytics for a given artifact, the divergence

44 Teresa de Lauretis, *Alice Doesn't: Feminism, Semiotics, Cinema* (Indiana University Press, 1984), 7.

45 Notably, establishing stable schemas for data is particularly important in many of the sciences, where an aim is for data to be reproducible. Without stable schemas, different researchers would have difficulty reproducing the same data points. However, in PECE, we aim for "differential reproduction" of data, where each researcher brings a slightly different interpretation of a data point so that data iterates rather than reproduces.

in their responses illustrates that there is always more than one right way to depict a piece of data. Although the tabular structure of Drupal is designed in such a way that each data point is characterized in the *same* way, we have designed structures not just for data, but also for enabling collaborative hermeneutics of that data. In doing so, we have leveraged the tabular structure to multiply the ways in which data gets characterized.

Because these analytics are shared between researchers, PECE enables the juxtaposition of each of the responses to a question, illustrating "explanatory pluralism"—that is, different people responded differently to the same question in response to the same artifact. Under the constraints of Drupal, this pluralism could best be illustrated by leveraging the tabular structure in ways that require users to leverage the same set of analytics to articulate their response to an artifact. Notably, to keep the structure malleable—to prevent the structure from closing out emerging questions and articulations—a researcher could add a question, which then becomes part of the set of analytics researchers can use to read an artifact. They also, at any time, could ignore a question.

Conclusion: Deviously Addressing the Limits of Design

In articulating the challenges the PECE design team faced in building a digital platform for experimental ethnography, I have shown that disciplinary design communities aiming to design digital systems according to clear commitments must pay attention not only to their design practice and their design thinking, but also to the design infrastructures with which they work. Leveraging infrastructure that has already been designed according to incongruent logics poses the risk that design, however critical or reflective, continuously reproduces the same logics. A key challenge for designers in diverse disciplinary communities is to acknowledge the limits that dominant logics impose on design practice—to recognize the ways in which genealogies of assumptions, habits, and commitments become innate in digital infrastructure and how this inheritance places constraints on how infrastructures can be configured when designing new systems. As James Clifford notes in the introduction to *Writing Culture:*

> The writing and reading of ethnography are overdetermined by forces ultimately beyond the control of either an author or an interpretive community. These contingencies—of language, rhetoric, power, and history—must now be openly confronted in the process of writing. They can no longer be evaded.[46]

46 James Clifford, "Introduction: Partial Truths," in *Writing Culture: The Poetics and Politics of Ethnography: A School of American Research Advanced Seminar,* by James Clifford and George E. Marcus (University of California Press, 1986): 25.

The resistance we confronted in designing PECE helped us see these forces—the forces of language, rhetoric, power, and history—in the infrastructure on which we design. I have thus suggested that using hermeneutics to read digital infrastructure can elucidate when digital systems are designed according to logics that do not align with the commitments of a designer.

Devious design, then, can be considered a strategy for engaging the limits that constrain the process of critically designing digital systems. Recognizing that all design work involves leveraging existing infrastructures, embedded with logics defined by distant communities, the concept of devious design is founded on the acknowledgement that "the only way to position oneself outside of that discourse is to displace oneself within it." Devious design involves leveraging the affordances of digital infrastructure in devious ways to create friction in the presence of incongruent logics. Expanding the scope of reflection in design practice to consider design infrastructures calls for a new type of critical design practice—one that not only challenges what designers bring to their own work but also challenges the legacies of design commitments that get embedded in infrastructures.

My hope is that this work can help design communities that have clear commitments to approach their design practice with strategies for configuring design infrastructures toward alternative ends. Yet a great deal of research remains to be done in this area. In particular, we need a better understanding of the types of devious design strategies that can best undermine the logics that digital infrastructures harbor. Such research can help disciplinary design communities confront the genealogies of assumptions and commitments that make designing critically so challenging.

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