

ABSTRACT

REID, GWENDOLYNNE COLLINS. *Digital Writing in the Disciplines: Imagining Possibilities for Scholarship in the Context of Digital Media*. (Under the direction of Dr. Carolyn R. Miller and Dr. Chris M. Anson).

In the quarter century since the establishment of the graphically browsable World Wide Web, academic composers and publishers have experimented with the range of affordances presented by networked digital media—affordances such as modularity, interactivity, multimodality, dynamism, associativity, etc. This experimentation, along with the increasingly widespread use of information and communication technologies and digital media across social contexts, has transformed academic rhetorical environments, presenting scholars with new possibilities and constraints. This transformation has substantially complicated the rhetorical knowledge and literacies necessary for scholarly communicators to operate effectively. This transformation, however, is still an emerging phenomenon, with ongoing experiments that continue to alter the genres and sociotechnical relationships that comprise scholarly work. In the last decade, for example, publisher Elsevier launched digital “Article of the Future” prototypes in several of its journals, while several publishers, universities, and organizations have worked to produce platforms for academic publishers and academics to more easily publish born-digital scholarship. The emerging nature of this changing scholarly landscape provides an exigence and opportunity for understanding scholars’ lived experiences of composing during a moment of transition, and specifically for understanding the forces that shape how and why they take up the multiple affordances presented by digital media.

This dissertation takes up that exigence, focusing on disciplinarity as a force unique to and particularly influential in academic contexts and asking how scholars' digital and multimodal composing shapes and is shaped by disciplinarity. This question is addressed through two case studies of research teams developing work for digital journal publication, one in the field of rhetoric and composition and the other in evolutionary biology. These cases were developed using a naturalistic, qualitative methodology, combining an ethnographic framework with textual analysis of writers' process-related documents and artifacts. Data were collected over a period of twenty-four months and analyzed inductively using techniques from grounded theory, specifically constant comparison, combined with content and rhetorical analysis of documents. Each case was examined through the three compositional lenses of mode, medium, and genre, three interrelated dimensions of communication relevant to understanding digital writing, with categories developed inductively for each lens.

Results for the compositional lens of mode revealed three distinct strategies for multimodal composing—*meaning compression*, *meaning expansion*, and *meaning attention*—which writers used according to their epistemological orientations and goals. For example, all three of these strategies were present for the rhetoric and composition case, an epistemologically pluralistic disciplinary area, while the evolutionary biology team primarily employed a meaning compression logic, reserving meaning expansion and meaning attention for public audiences. Results for the compositional lens of medium revealed that some disciplinary digital composing is characterized by *hypermediacy* (Bolter & Grusin, 1999),

drawing attention to media, with others characterized by *immediacy* (Bolter & Grusin, 1999), rendering media transparent and invisible. Both hypermediacy and immediacy were evident in the rhetoric and composition team's composing, though choices characterized by hypermediacy came primarily from the member of the team with the most hermeneutic, rather than empirical, approach. The evolutionary biology team's composing was marked by immediacy, maintaining transparency for their use of media. Based on these two cases, the distinction seems to correspond to disciplines for whom digital media are both *subject of* and *tool for* inquiry and those for whom digital media are solely a *tool for* inquiry. Finally, the compositional lens of genre brought both mode and medium together and tied them to the teams' social contexts, specifically their disciplinary contexts. This lens revealed that the rhetoric and composition team was writing a generically hybrid text, blending two disciplinary genres, the empirical research report and the hermeneutic scholarly webtext, highlighting the epistemological plurality of this disciplinary context and the challenges and generative potential of collaboration across epistemological traditions. The evolutionary biology case, however, also innovated at the level of text, composing textual elements for anticipated recomposition, but with the express purpose of creating intergeneric and interdiscursive change. Many of their innovative digital composing decisions, including those related to citizen science, were motivated by perceived disciplinary exigences for reaching across discourses, whether toward public audiences or interdisciplinary audiences, suggesting that the way disciplinary writers perceive and take up the affordances of digital media for

their composing is affected by a combination of the discipline's explanatory goals and approaches and the social dimension of this disciplinary work.

Together, these two cases suggest that disciplinarity influences how the affordances of media and modes are seen and taken up. They also suggest that the rhetorical possibilities presented by digital media, when taken up by scholars, amount to changed ways of participating in disciplines, and therefore can affect the constitution of those disciplines. The results have implications for academic publishing, suggesting that publishers need to pay attention to disciplinarity when developing platforms and formats for digital journals since the ways digital affordances are taken up vary widely. The results also provide evidence for attention to mode and media in academic writing curricula, including the epistemic uses of each for disciplinary inquiry.

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Digital Writing in the Disciplines:
Imagining Possibilities for Scholarship in the Context of Digital Media

by
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DEDICATION

To Jerry, Simon, and Oliver.

This is your dissertation too.

BIOGRAPHY

Gwendolynne Reid is a teacher and scholar of writing and rhetoric. Her scholarship focuses on digital and multimodal composing practices with the goal of helping prepare students to write for today's complex rhetorical environments. Her research interests include writing across the curriculum, writing in the disciplines, genre studies, digital writing, multimodality, and writing program administration. Using qualitative research methods, Gwendolynne seeks to produce "thick data" to understand the lived experiences of writing for contemporary media environments, particularly in academic and professional contexts. Her interests stem largely from her time teaching undergraduates about disciplinary writing and research. Her writing can be found in *Across the Disciplines*, *WPA-CompPile Research Bibliographies*, and several edited collections: *Composition, Rhetoric, and Disciplinarity*; *Scientific Communication: Principles, Practices, and Methods*; *Twenty Writing Assignments in Context*; and *Contingent Faculty Publishing in Community*. She regularly presents her work at national conferences, such as the Conference on College Composition and Communication, the Rhetorical Society of America, the Council of Writing Program Administrators, and the Computers and Writing Conference. Before beginning her doctoral studies, Gwendolynne taught academic writing and research as a lecturer for almost a decade in North Carolina State University's Department of English, ending her time there as the First-Year Writing Program's Assistant Director of Program Development. Gwendolynne earned two master's degrees in 2005: a degree in English with a concentration in rhetoric and composition from North Carolina State University and a degree in film studies and screen writing from Hollins University. She holds bachelor's and associate's degrees in intercultural studies and languages from Bard College at Simon's Rock, one of the nation's first early colleges. A dual French and American citizen, Gwendolynne was born in Bordeaux, France, and moved to Augusta, Georgia, in 1982. She will be

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Chapter 1

Academic Writing in the Context of the Digital

As we find ourselves feeling overwhelmed by the Internet and the deluge of digital data that emerges from the saturation of everyday life with digital technologies, and as the whole thing becomes ‘too big to know’ ... and apparently amenable only to big data approaches that process on an industrial scale, it becomes all the more important to tell stories about how that feels, to explore the consequences and unanticipated connections that arise, to record what is happening from both central and marginal perspectives, and to enable interventions.

—Christine Hine, 2015, p. 182

“At this point, we have to be digital da Vincis. We have to write to other scientists, write to the public, code, make videos, produce data visualizations on par with the NY Times. If we don’t, our science doesn’t go out into the world, we don’t get funding, we can’t successfully do science.”

Summer and I were meeting at a coffee shop midway between my office and the biology lab where she worked. I had prepared a few questions designed to get a sense of her contributions to the Heartbeats Project, the project I was starting to study, but I could have

come without a single question. Summer spoke with intensity and without prompting. These issues were clearly part of what she thought about every day—an urgently important part of doing science today and something she wanted to talk about.

“Not that long ago, it was enough to communicate as specialists to other specialists. But it seems like science has come full circle. Da Vinci was eclectic, diverse, multi-talented—the prototypical Renaissance man. And that’s what we have to be.” She laughed.

Summer described her surprise when the NY Times editor responsible for their highly successful ScienceTake videos visited the lab and revealed that the video footage was provided by the scientists themselves. The NY Times added contextualizing information for the videos, but the footage came from researchers.

“That means, if we want to get our work out there, we have to be able to make videos!”

On top of all the time it takes to become an expert in a scientific area, doing science successfully and sustainably today means spending time becoming proficient in things like programming and video production too, she explained.

I could hear how challenging and intense this state of affairs was to navigate. The lab she worked for was doing an exemplary job of navigating it, but the need to get their work out and the technical, artistic, and communicative expertise necessary to do this was obviously omnipresent for them. And the issues they encountered while doing so were not always predictable.

After spending many hours creating an interactive graph of the data they had gathered so far for the Heartbeats Project to put on their website, for example, they had

changed their mind at the last minute about making it publicly available. I'd seen her lab colleagues congratulating her on her work at a public talk the lab PI had given the week before, but after the excitement of their initial success, they came to the realization that they didn't have the expertise to encrypt the data sufficiently so that someone couldn't grab their code and get their data. As an ongoing project that hadn't yet been published in a scientific journal, they needed to hang on to the data for now, though making it available later was a possibility. So instead of Summer's interactive graph, they'd finally opted for a static version that would have to be updated manually.

Writing and Scholarship in a Digital Age: Twin Exigences

As with most extended projects, this dissertation responds to more than one exigence, though these can be traced to the new communicative environments made possible by the widespread use of networked digital media. To say that digital media and the Internet have changed the ways in which we communicate is, at this point, axiomatic. The last quarter of a century since the World Wide Web became publicly available in 1991 and browsable by the public in 1993 (Geisler, 2011, p. 252) have been a time of rapid communicative innovation and change across all sectors of society, academia included. Networked digital media are so embedded in our lives that, as Doug Eyman and Cheryl Ball (2014) have observed, “at this historical moment, nearly all composition is digital composition” (p. 114). Networked digital media play a role in the composition of most texts, even those that seem to merely reproduce “extant” print genres (Shepherd & Watters, 1998), or those that we interact with in print and other analog media.

Together, the force of the widespread use of information and communication technologies (ICTs) and of digital media have become a constraint and opportunity nearly all composers must account for, much as the aggregated use of technologies like the telephone came to influence individual communicative choices (Fischer, 1992). In academic contexts, the cumulative force of this aggregated use has gradually and not so gradually created new rhetorical environments that scholars like Summer,¹ in my opening narrative, must contend with. This narrative, an excerpt from my field notes after an interview with Summer, provides a glimpse of a changing scientific communication environment and the challenges that accompany those changes. For Summer and her colleagues, digital media have offered many new possibilities for communicating, but those possibilities are not inert. They require new and diverse resources, expertise, and practices, practices that change what it means to “do science.” To those attempting to navigate this environment, the range of competencies required speak loudly that their scientific expertise and even their ability to participate competently in traditional scientific genres may not be enough anymore. From Summer’s vantage point, they’re going to need to be “digital da Vincis.” A tall order indeed.

While this is a glimpse of one scientist in one lab in one scientific discipline—evolutionary biology, in this case—digital media have by now become a significant (if emerging) part of scholarship across disciplinary contexts, though not necessarily in identical ways. The changes tied to digital media in disciplinary work add up to shifting rhetorical landscapes that deserve attention. As ethnographer Christine Hine (2015) puts it in my

¹ “Summer” is a pseudonym, as are participant and project names throughout.

epigraph, the pervasiveness of digital technologies throughout our lives and the naturalized invisibility that often accompanies this pervasiveness makes it “all the more important to tell stories about how that feels, to explore the consequences and unanticipated connections that arise, to record what is happening from both central and marginal perspectives, and to enable interventions” (p. 182). Hine would likely categorize disciplinary work as a central rather than marginal perspective on digitality, or at the very least a privileged one. Yet as those in writing in the disciplines (WID), social studies of science, rhetoric of science, and other related areas of scholarship recognize, disciplinary communities, as communities with a great deal of societal influence, merit scholarly attention, even as we simultaneously pay attention to less privileged perspectives. One exigence for my work, then—work that consists of two ethnographic case studies of disciplinary digital composing—is simply, as Hine puts it, to “record what is happening” as scholars negotiate these rapidly changing disciplinary communicative landscapes and to “explore the consequences and unanticipated connections that arise” (p. 182).

Part of this negotiation, and therefore a related exigence, connects with the ongoing experimentation in academic publishing. Scholars have been experimenting with digital publication of academic work since the beginning of the Web, with online journals across disciplines cropping up rapidly in the years after 1993, and even some before.² A well-known example in rhetoric and composition, for example, is the journal *Kairos*, which began in 1996 and continues today. Publishers, authors, and readers, however, quickly ran into

² Cheryl Ball (2016) dates the first issue of *Postmodern Culture*, an online humanities journal started at North Carolina State University, to sometime in 1990 (p. 55).

challenges associated with the sustainability of these early digital publishing practices and infrastructures, including those related to accessibility, archivability, and usability (Ball, 2015b). For this reason, many of those first efforts have disappeared (Ball, 2016). The period after what is commonly called Web 2.0,³ however, has seen renewed experimentation, both in formal and informal scholarly communication. Much of that experimentation has related to what George Veletsianos and Royce Kimmons (2012) call “networked participatory scholarship,” which they define as, “the emergent practice of scholars’ use of participatory technologies and online social networks to share, reflect upon, critique, improve, validate, and further their scholarship” (p. 768). Some of this has also related to the affordances of digital media for multimodal texts that include modes that are difficult or impossible to include in print-based media. Interactive data visualizations, for example, combine the interactive affordances of Web 2.0 with its affordances for multimodality. While some lament the ubiquity of remediated print genres in the form of PDFs and the slow, halting movement toward widespread truly born-digital scholarly publications (e.g. Eyman & Ball, 2015; Stone, 1998), when set against the history of scholarly publishing, which we can date to the first issue of the *Journal des Sçavans* in January 1665 and to that of the *Philosophical Transactions* in March 1665 (Brown, 1972), the zigzagging communicative change of the

³ The demarcation between Web 1.0 and Web 2.0 is fuzzy, since features and practices associated with Web 2.0 have been present since the early Web (e.g. website guest books). The concept, however, is still useful for denoting a historical moment in the Web and the achievement of a critical mass of features and cultural/design practices related to interactivity in the early 2000s. The widespread use of the term is generally attributed to Tim O’Reilly, who intended it to denote the renewed rise of the Web after the 2001 dot-com bubble crash (O’Reilly, 2005). The date of the first Web 2.0 Conference (now the Web 2.0 Summit), 2004, marks a useful reference point as the logic of the more interactive, collectively-driven Web-as-platform was arguably in place by that year and we see the start of numerous social media sites like Facebook around that date.

last quarter century appears downright rapid. Writing on this subject and particularly the sense of failure and inertia garnered by experiments that end up shutting down, Kathleen Fitzpatrick (2011) sounds a cautiously optimistic note:

Highly public declarations of ‘failure’ in key publishing experiments ... too often allow us to dismiss the prospects for change, generalizing one situation to a blanket sense that some new way of doing things simply cannot work. As Clay Shirky (2009) argues, this is what revolutions look like: ‘The old stuff gets broken faster than the new stuff is put in place.’ ... Change is coming to scholarly publishing, one way or another—but what form that change will take, and whether it will work for or against us, remains to be seen. (p. 195)

To illustrate the unabated pace of innovation, just in the last decade or so, academic publishers have put into motion several large-scale projects for developing scholarly digital publishing platforms. In 2009, for instance, after several years of development, the publisher Elsevier launched two of its “Article of the Future” prototypes in *Cell* and later in several of its other journals (Elsevier, 2011; Pérez-Llantada, 2013). These prototypes were built around three panes that incorporated elements such as “interactive figures/tables with the key findings of the article” and contextualizing “embedded videos,” as well as hyperlinks to sections of the articles, related articles, and supplementary materials such as datasets (Pérez-Llantada, 2013, p. 222). More recently, several publishers, universities, and organizations have collaborated to produce platforms that academic publishers and academics could use to more easily publish born-digital scholarship (Johnson, 2016). These include platforms such

as editoria,⁴ fulcrum,⁵ Manifold,⁶ Omeka,⁷ Scalar,⁸ and Vega.⁹ This last platform, Vega, is being developed in part by *Kairos* editor Cheryl Ball through an Andrew W. Mellon Foundation grant with the goal of providing journal editors with a “turn-key” platform that will allow them to benefit from the digital publication processes developed at *Kairos* (Ball, 2015a). In a recent article on scholarly webtexts, as born-digital scholarly texts are called at *Kairos*, Ball (2016) lists several other journals that also publish these types of media-rich digital scholarly texts: *Computers and Composition Online*,¹⁰ *Vectors: Journal of Culture and Technology in a Dynamic Vernacular*,¹¹ and the *Journal for Artistic Research*¹² (p. 55), to which I would add *Audiovisual Thinking: The Journal of Academic Videos*,¹³ *JoLLE: Journal of Language and Literacy Education*,¹⁴ and *Enculturation’s Intermezzos*¹⁵ (“longer than an article, shorter than a book”) as innovative born-digital scholarly publications. Digital media’s affordances, however, extend in directions other than multimodality, and so in the sciences many born-digital journal innovations have centered on their affordances for enabling open science. PLOS (Public Library of Science), for example, has been a leader in the open science movement, publishing open access scientific research since 2003 (“The

⁴ <http://www.ucpress.edu/blog/tag/editoria/>

⁵ <https://www.fulcrum.org/>

⁶ <http://staging.manifoldapp.org/browse>

⁷ <https://omeka.org/>

⁸ <http://scalar.usc.edu/scalar/>

⁹ <https://vegapublish.com/>

¹⁰ <http://cconlinejournal.org/>

¹¹ <http://vectors.usc.edu/>

¹² <http://www.jar-online.net/>

¹³ <http://www.audiovisualthinking.org/>

¹⁴ <http://jolle.coe.uga.edu/>

¹⁵ <http://intermezzo.enculturation.net/>

PLOS Story,” 2015). More recently, publications like *F1000Research*¹⁶ have experimented with taking this logic further by providing an “open research” platform that features open access, open peer review, and open data sets.

This by no means comprehensive list of recent initiatives in digital academic publishing demonstrates the current atmosphere of innovation in formal scholarly communication. These initiatives represent substantial investments in designing a future of scholarly publishing that takes advantage of the possibilities offered by digital media. A decade ago, Christine Borgman (2007) posited that that was “an opportune moment to think about what we *should* be building” in terms of a digital scholarly information infrastructure (p. xvii). Clearly, many have taken up her call, though as she also pointed out, more than the technologies in their most discrete sense, “the underlying social and policy changes ... will have the most lasting effects on the future scholarly environment” (p. xvii). The media and technologies involved in this state of flux, after all, are best thought of as shorthands for complex sociotechnical systems, with the sociocultural and technological acting reciprocally. Borgman’s argument that academic social systems play a central role in this story, in fact, reinforces the need to account for the role of disciplines, as academic social entities with important and distinct histories and practices, in the development of digital scholarly publications. Disciplines, however, as social structures, are only ever “instantiated in action” (Giddens, 1984, p. 377), one disciplinary act at a time. They do not exist “out there” in the world, but instead are continually (re)constituted through human action. As such, disciplines

¹⁶ <https://f1000research.com/>

can be meaningfully studied through individuals' actions, including their rhetorical ones (Miller, 1984, 1994), as I do in this dissertation, a point I will elaborate on as I describe my conceptual framework. The ongoing changes to academic publishing that the digital age has precipitated, then, form an important exigence for examining the lived experience of scholars doing disciplinary work in a period of transition, both for understanding the period itself and for potentially influencing the direction of the future we are building.

Writing Programs & Pedagogies: Two Additional Exigences

Two exigences closer to home for those who study rhetoric and composition, however, are the pedagogical and administrative implications of these changing academic rhetorical environments. Colleagues across disciplines are quite cognizant of the rapid communicative changes afoot and, just as they have consulted their colleagues in rhetoric, composition, and writing on teaching print literacies, are reaching out to them for advice on supporting students with digital literacies or for their curricular contributions to students' digital literacies development. Heidi Harris and Jessie Blackburn (2014), for example, note that "increasingly, new literacies instruction falls within the pedagogical realm of the composition classroom" with writing program administrators often "responding to pressures for reform from within and outside their institutions" for contributions in this area (n.p). The general sense among educators at this point is that we must prepare students for communicating effectively in the digital age, though the visible state of flux and the rapid pace of change makes it difficult to form consensus on what that preparation ought to look like. As the IText Working Group pointed out in 2001, the fact that texts play such a central

role in digital environments has well positioned “researchers and scholars concerned with producing and receiving texts” to “contribute to a robust theory of electronic communication,” including related to teaching and learning (Geisler et al., 2001, pp. 270, 295). Whether through writing centers, writing across the curriculum programs, writing programs, or writing-related textbooks, handbooks, scholarship, and resources, the general expectation is that writing experts should be contributing to students’ development and to instructors’ pedagogies related to digital literacies.

And in many ways, that train has already left the station, and thankfully so. Rhetoric and composition scholars have been engaged with the work of understanding digital composing and the relationship between writing and technologies since well before the establishment of the World Wide Web. The first meeting of what would later become the annual Computers and Writing conference, after all, convened in 1982 (Gerrard, 1995). The first issue of the *Computers and Composition* journal (then a newsletter) was published in 1983, with the editors framing the journal’s scope around pedagogical questions, starting with “Can the computer be put to work in helping us teach composition? If so, how and in what areas?” (Selfe & Kiefer, 1983, p. 1). Most of the earliest works on writing and technology, including influential articles like Gail Hawisher and Cynthia Selfe’s (1991) “The rhetoric of technology and the electronic writing class,” and Cynthia Selfe and Richard Selfe’s (1994) “The politics of the interface: Power in its exercise in electronic contact zones,” were related to pedagogy. As reflected in its title, the exigence for the founding of the journal *Kairos* in 1996 was clearly tied to pedagogy. The journal’s original title was *Kairos: A Journal for Teachers of Writing in Webbed Environments*, which was later

broadened to *Kairos: A Journal of Rhetoric, Technology, and Pedagogy*. As with the mandate for the field of rhetoric and composition, the initial goal for most of its work on digital composing has been to support teaching and learning, a focus that has since expanded to other explanatory goals while continuing inquiry on pedagogy.

While multimodality is a separate phenomenon from digitality, a point persuasively made by scholars like Jason Palmeri (2007, 2012) and Jody Shipka (2011), this expansion has included attention to multimodal composing, in part because contending with digital media has sensitized scholars to modes and in part because the evolution of digital technologies and culture has turned towards multimodal and multimedia texts. The early influential texts in this area have had pedagogical exigences, such as the New London Group's (1996) "A pedagogy of multiliteracies: Designing social futures" and New London Group member Gunther Kress's (2000) chapter "Multimodality" in *Multiliteracies: Literacy learning and the design of social futures*. For those in the rhetoric and composition community not attuned to the conversation on multimodality, Kathleen Blake Yancey's (2004) CCCC Chair's Address, "Made not only in words," brought this to their attention, putting it squarely in the context of writing pedagogies. Yancey paralleled the development of the "reading public" in the nineteenth century to contemporary shifts in communication technologies that created an imperative to help students "develop as members of a writing public," including attention to digital technologies and multimodality, or risk becoming "anachronistic" (pp. 298, 302, 311).

These defining calls have contributed to increasing attention to multimodality and digitality among writing teachers, administrators, and researchers, including new courses,

programs, and centers, as well as attention to designing effective assignments, supporting students' processes, responding to student work, and assessing these assignments (e.g. Anderson et al., 2006; Carpenter, Selfe, Apostel, & Apostel, 2015; DeVoss, McKee, & Selfe, 2009; Herrington, Hodgson, & Moran, 2009; McKee & DeVoss, 2013; Neal, 2011; Selfe, 2007; Sheridan & Inman, 2010). The question of how the need to address digital and multimodal literacies reshapes existing writing program learning outcomes has resulted in both local and national conversations among writing experts (Behm, Glau, Holdstein, Roen, & White, 2013; Dryer et al., 2014), as well as a renewed sense that writing courses need to articulate more effectively with the efforts of librarians on developing students' information literacy (Artman, Frisicaro-Pawlowksi, & Monge, 2010; D'Angelo, Jamieson, Maid, & Walker, 2016). This collective work has given those of us who study and teach rhetoric and composition much to offer colleagues in other disciplines when they look to us for guidance on integrating digital and multimodal assignments and approaches in their courses. Those working in rhetoric and composition and allied fields have been tackling and continue to tackle the need to help students develop effective digital literacies. Though there is more work to do, we are well on our collective way toward helping students participate effectively as members of "writing publics."

Harkening back to my opening narrative with Summer, however, it is also likely that effective participation in many disciplines and professions will or already require people to be "digital da Vincis," able to digitally compose for epistemological purposes flexibly and fluently. This study responds to this particular exigence under the assumption that we need more fine-grained accounts of how disciplinary experts are negotiating current

communicative opportunities and constraints in order to support instructors who are cultivating students' rhetorical development in this direction. My earlier survey-based study of this subject, in fact, supports the reality both that those teaching specifically *academic* writing are still struggling with the implications of integrating digital, multimodal projects in their pedagogies, and that faculty across disciplines routinely compose multimodally over the course of their disciplinary work (Reid, Snead, Pettigrew, & Simoneaux, 2016). While that study found existing scholarship on disciplinary multimodality, it also found space “for work more explicitly in conversation with theories of multimodality, as well as for inquiry on how digital media and mobile technologies may be changing communication in the disciplines” (n.p.). Our findings underscored, “how rich a research space multimodal communication in the disciplines may be,” potentially “bring[ing] to light previously unexamined uses of and relationships between modes that may differ from what has already been found in other [communicative] contexts, enriching both theories and practices of multimodality and ‘across the curriculum’ programs and curricula” (n.p.). My dissertation builds on this work, seeking to complicate what we know about digital, multimodal composing by disciplinary experts in order to enrich teaching and learning of academic digital literacies.

Much as we know there is no such thing as uniform “academic writing,” we also know there is no such thing as uniform “digital academic writing,” or, for that matter, a singular “digital literacy” (Lankshear & Knobel, 2008). These are shaped by and shape context, including, in the case of academic writing, disciplinarity. As the rich literature on disciplinary writing suggests, we cannot assume that digital writing in the disciplines will develop identically. Without sufficient research in this area, however, it can be quite

tempting to rely on “best practices” tips for multimodal composing, such as “fill the slide to the edges,” “advice [that] is decontextualized and highly abstract” (Moran & Herrington, 2013, n.p.). If, in interactions with colleagues outside our discipline, we are to avoid imposing our disciplinary bias or inadvertently offering a single model of good digital writing, we need research on disciplinary writing that makes digitality an element of focus. Elizabeth Allen (2013) makes much the same point about multimodality in laying out the exigence for her study of the architecture “design crit” as a multimodal genre. In her words,

If we fail to consider how multimodal composition is actually practiced in undergraduate courses in other disciplines—particularly those that do not assume that the verbal mode is predominant—then we risk being viewed by our colleagues as offering a model of ‘good’ writing (this time expanded to include non-verbal modes) that does not fit their disciplinary culture's values and expectations. (n.p)

She reminds those who study writing, not to “take for granted that our perspectives on written, oral, visual, digital, or multimodal communication are shared by other disciplinary cultures, nor that our preferred rhetorical strategies will be compatible with their discipline-specific values and practices” (n.p.). While Allan’s focus is exclusively on multimodality and on undergraduate assignments, this logic extends to digital disciplinary writing by experienced disciplinary writers, a focus that can yield an important view of how epistemological traditions shape the use of modes and media. An exigence my work responds to, then, is the need for empirical writing in the disciplines (WID) research on digital writing to combat any assumptions that scholarly digital writing practices will evolve independently

of disciplinary cultures and goals, and to document the diverse ways these practices are evolving during a period of transition.

A Research Question

Together, these multiple interacting exigences form the impetus for this dissertation, two twenty-four-month case studies of separate groups of scholars producing peer-reviewed, born-digital texts for disciplinary purposes: one in evolutionary biology and the other in rhetoric and composition. In the analysis that follows, my cases are called the “Heartbeats Project” (evolutionary biology) and the “Webtext Project” (rhetoric and composition).¹⁷ My study was organized around a single research question: *How does disciplinarity shape scholarly digital and multimodal composing?* As mentioned earlier, I see the social as “instantiated in action” (Giddens, 1984, p. 377), including rhetorical action (Miller, 1984, 1994), with that action recursively structured by and structuring the social. Rhetorical actions, including multimodal, digital texts, are shaped by the “rules and resources” carried in the “memory traces” of a social group, in turn shaping the evolution of those rules and resources and (re)producing the social system (Giddens, 1984, p. 377). This means that rhetorical events, including acts of composing, offer a useful view of the social context they engage with and help form, shaping and being shaped by it. Another way to phrase my

¹⁷ While disciplines and departments are related concepts, they are also distinguishable, with their own exigences and histories, something both cases illustrate. None of the participants in either case worked in a department bearing the name of the discipline of the text I followed. The principal investigator for the Heartbeats Project worked in an ecology department and the majority of the Webtext Project participants worked in an English department, a not unusual arrangement for scholars in rhetoric and composition (see Reid & Miller, in press for a more extended discussion).

research question, then, is, “How is disciplinarity shaped by and how does it shape scholarly digital and multimodal composing practices?” For scholars of rhetoric and composition, the theory of social structuration I have briefly outlined here will be familiar to them as one that has informed rhetorical genre theory, helping explain how genres help (re)produce the social (Berkenkotter & Huckin, 1993; Miller, 1994). I therefore see my research question as a genre question: genre ties individual texts to prior texts and to the social, and therefore helps us see individual composing decisions in the context of disciplines as social entities with their own histories, traditions, values, etc.

My case studies followed a naturalistic, qualitative methodology (Denzin & Lincoln, 2011; Lindlof & Taylor, 2011), combining an ethnographic framework with textual analysis of writers’ process-related documents and artifacts. In order to bring my research question into focus, I applied three compositional lenses to my analysis of the team’s composing—mode, medium, and genre—which I describe below after a brief review of the existing literature on digital and multimodal writing in the disciplines. Because these three dimensions of communication can be difficult to disentangle, considering each in turn proved useful for understanding their relationships to each other and to disciplinarity.

Digital Writing in the Disciplines: The Existing Literature

I have situated this research in writing in the disciplines (WID), a research area allied with the writing across the curriculum (WAC) movement and often referred to together with it as WAC/WID. While WAC focuses on the pedagogical role and integration of writing across university courses, usually framed as writing to learn, WID focuses on the study,

teaching, and learning of writing in the context of disciplinary work—disciplinarily distinctive written communication. Chris Anson (2015) has pointed out that the most fundamental threshold concept for WAC/WID scholars “defin[es] writing as a disciplinary activity” (p. 205). In other words, writing *is* disciplinary work and shapes and is shaped by the discipline’s epistemological goals and tradition. Charles Bazerman’s (1981) early work examining three disciplines and their writing was influential in establishing texts as serving a vital role in accomplishing disciplines’ epistemological goals, connecting “reality, mind, tradition, and society in complex and varying configurations” (p. 379). Examining how disciplinarity shapes and is shaped by digital and multimodal composing is a logical extension of this research tradition.

While WID scholars have produced extensive research on disciplinary writing over the last several decades, they have produced less on the role of digital media and modes in that writing. Instead, most of the attention to digitality and multimodality has taken place in the WAC literature, focusing on pedagogical spaces. Karen Lunsford’s (2009) introduction to a special issue of *Across the Disciplines* on writing technologies, for instance, focuses on four major areas of change: course management systems, archives, intellectual property, and multimedia/web 2.0. Outside the issues of intellectual property and open access, the articles in this issue report on pedagogical and administrative research, with much less attention to how the digital may be contributing to changing scholarly communication practices across disciplinary contexts. Lunsford cites Donna Reiss, Dickie Selfe, and Art Young’s (1998) edited collection, *Electronic Communication across the Curriculum*, as an early touchstone work in this area. The collection, however, focuses on technological literacy and the role that

might play in university “across the curriculum” programs, with much less attention to the role digitality might play in the work of scholars across disciplines. In a subsequent article, Donna Reiss and Art Young (2001) maintain a similar focus on the role of technology in WAC pedagogy and program-building, a role they argue will be influential enough to merit the distinct designation of ECAC (Electronic Communication Across the Curriculum) (Reiss & Young, 2001). The acronym, however, has not had a lot of traction.

While strictly WAC/WID journals have not published much work explicitly on digital writing in the disciplines, such scholarship does exist in journals across rhetoric, composition, and allied fields (e.g. Bahls & Wray, 2015; Buehl, 2014). Other relevant work exists in disciplinary journals and publications themselves (e.g. Fitzpatrick, 2011; Scheinfeldt, 2012). And an impressive volume of work exists in journals devoted to publishing, library science, and education (e.g. Costa, 2014; Frandsen, 2009; Hedlund, Gustafsson, & Björk, 2004; Owen, 2006; Pearce, Weller, Scanlon, & Ashleigh, 2012; Stewart, 2015; Veletsianos & Kimmons, 2012; Vrana, 2011; Xu, Liu, & Cong, 2011; Zudilova-Seinstra, Klompenhouwer, Heeman, & Aalbersberg, 2014). Other contributions come from scholars in literacy studies (e.g. Goodfellow, 2013; Goodfellow & Lea, 2013), and those in computers and writing (Ball, 2010, 2012, Eyman & Ball, 2014, 2015; Gresham & Aftanas, 2012; Journet, Ball, & Trauman, 2012; J. P. Purdy & Walker, 2010; J. Purdy & Walker, 2012; Ridolfo & Hart-Davidson, 2015; S. G. Taylor, 2013). Research on writing in the disciplines, however, has less frequently included digital media as an object of focus important for understanding contemporary disciplinary discourse.

Focusing more specifically on the question of multimodal composing, a phenomenon that many have argued has increased through the influence of digital media, the existing “across the disciplines” literature focuses primarily on classroom genres and the curricular (Anson, Dannels, & St. Clair, 2005; Bridwell-Bowles, Powell, & Choplin, 2009; Childers & Lowry, 2005; Duffelmeyer & Ellertson, 2005; Fordham & Oakes, 2013; Morton, 1990; Mullin, 2005; Orr, Blythman, & Mullin, 2005; Stein, 2008; Whithaus, 2012). While some WID research engages explicitly with multimodality in disciplinary communication (Allan, 2013; Reid et al., 2016), most relevant research is, again, situated outside explicitly “across the disciplines” conversations with a good portion of this research focused on the visual (Elkins, 2010; Fahnestock, 2003; Ford, 1992; Medway, 1994; Mishra, 1999; Pauwels, 2006; Robin, 1992; Walsh & Ross, 2015; Wickman, 2010, 2015). Many disciplines have conducted their own research on particular modes relevant for their epistemological goals. For instance, ethnographers have debated the role of visuals in their work (Alfonso, Kurti, & Pink, 2004; Pink, 2001; Schwartz, 1989). As Elizabeth Allan (2013) points out, however, the “bias toward the verbal” is quite strong in WAC/WID research and has often been inadvertently reinforced in our research designs. Allan reminds us that “Early WAC/WID studies of college students’ writing in fields that we now associate with visual and numeric modes, such as the sciences or engineering, paid scant attention to the non-verbal features of those students’ texts, even when their analytical framework was explicitly social (McCarthy, 1987) or rhetorical (Herrington, 1985; Winsor, 1996)” (n.p.). Her review of the literature reveals that even today this verbal bias has been difficult to overcome.

Relevant work on multimodality also exists on writing in the professions. Patrick Dias, Aviva Freedman, Peter Medway, and Anthony Paré (1999), in their book *Worlds Apart: Acting and Writing in Academic and Workplace Contexts*, observe that workplace communication routinely occurs across modes and that modes may be used “more flexibly and diversely” in workplace contexts than in academic ones (p. 39). Anne Beaufort (2006), in her review of literature on writing in the professions, identifies a number of studies that account for multimodality in the workplace (pp. 228–229). Scott Graham and Brandon Whalen (2008) provide a nice illustration of this type of inquiry, reporting on the rhetorical decision-making regarding mode, medium, and genre that a designer must regularly make in his professional work (Graham & Whalen, 2008). More recently, the research center MODE at the University College London has published several studies on communication in surgical operating theaters, providing insights into the role of touch and gesture for communication and learning in that workplace context (e.g. Bezemer, 2014; Bezemer, Cope, Kress, & Kneebone, 2014). While space remains for more such work in professional writing, it is important to acknowledge the valuable work on multimodality this area has produced and continues to produce.

Researchers in professional writing also have a rich tradition of accounting for the role of technology and digital media in professional discourse (e.g. Halpern, 1985). Beaufort (2006) points this out in her review as well, describing how this research has yielded insight into changing writing processes, social roles, and genres in workplace contexts (pp. 222–225). She cites, for example, Joanne Yates’s (1989) study of the emergence of the memo and the role of new technologies like vertical files and typewriters on the development and use of

the genre (Yates, 1989). Research in this area continues to pay attention to technology and digital media, examining such questions as the role of technology on invention during document design (C. Lauer, 2015), the rhetorical challenges of using content management systems in global, multilingual contexts (Batova & Clark, 2015), and the role of social media in business interactions (Lillqvist & Louhiala-Salminen, 2014; Shin, Pang, & Kim, 2015). Research in this area has done much to add diversity to our understanding of how technology and digital media affect how and what we write, and what we think about as we make writing decisions.

Conceptual Framework: Three Compositional Lenses

Because mode, medium, and genre are interrelated dimensions of communication, they can be difficult to disentangle. By mode, a term with many meanings, I am referring specifically to what Gunther Kress (2010) has defined as “semiotic resources” or “cultural technologies of representation” (pp. 6 & 31)—cultural resources such as gesture, image, alphabetic text, sound, spoken language, etc. that we use to make signs and meaning (semiosis). For Kress, representation “focuses on my *interest* in my engagement with the world and on my wish to give material realization to my meanings about that world” (p. 49). This meaning making, however, is never outside others’ prior meaning making—it is always a re-presentation, a transformative “remaking” (p. 53). It is part of “the ceaseless chain of semiosis, which we reshape in our signs and texts, but reshape within the limitations set by that chain” (p. 53). The chain becomes a set of both enabling and constraining meaning making resources.

In contrast, Kress frames media as “cultural technologies of dissemination” (p. 30), such as the book, the journal, the film, the blog. In part because certain media instantiate and disseminate specific semiotic modes particularly well and become culturally associated with them over their histories of use (e.g. images and alphabetic text with the printed page), there can be considerable slippage between the concepts of mode and medium. To add to this, media, like modes, are also sites of cultural meaning, both in the representational work they instantiate and in the meanings they come to acquire, including the social processes they are part of. Raymond Williams (1985), attributing this idea to Theodor Adorno, frames a modern concept of mediation as a “direct and necessary activity between different kinds of activity and consciousness” that has, through medium, “its own, always specific forms” (p. 206). A medium has a material form, but is constituted by and mediates through activity. To compound this already complex view of media and mediation, David Bolter and Richard Grusin (1999) have pointed out that at this historical moment, “all mediation is remediation” (p. 55). By remediation, they mean “the representation of one medium in another” (p. 45), such as a newspaper in a video game, or a board game in a video game. Examining media, then, is a complex enterprise as we are sometimes confronted by distinct media used together and at other times one medium absorbing another one as part of its evolution. Finally, by genre, I am referring to how it is understood by rhetorical genre theorists, as “typified rhetorical actions based in recurrent situations” (Miller, 1984, p. 159). This definition indexes typical formal and substantive elements of a genre—including mode and medium—to rhetorical situation and the social. It is what ties form and meaning making to rhetorical acts that intervene in, constitute, and are shaped by social context. In order to aid a more precise

analysis of disciplinary digital composing, I have applied each of these analytical lenses in turn to my two teams' composing processes, with the recognition that these are interdependent aspects of communication. The following three sections describe each of these and establish the key theoretical concepts I draw from in my case studies.

Mode

As I highlighted briefly above, when referring to modes, I am referring to the social semiotic theory of multimodality as described and elaborated on by Gunther Kress (2010) in his book *Multimodality*. In this theory, modes are understood as cultural resources for making meaning—such as images, alphabetic text, sound, gesture, etc. These can be, but are not necessarily, tied to particular media, though certain media offer more affordances for certain modes than others. For example, we see alphabetic text in film and photography as well as books and newspapers, although books and newspapers afford a greater range of meaning making options for alphabetic text, including longer passages of text that readers can engage with at their own pace. When thinking about modes, it is important to note that many see *all* composing processes and texts as multimodal (e.g. Baldry & Thibault, 2010; Kress, 2010; Kress & Van Leeuwen, 2001; Prior, 2007). Even alphabetic texts combine linguistic semiotic resources with visual semiotic resources through typography, white space, etc. A face-to-face conversation is likely to include a combination of meaning making resources like oral language, gesture, facial expression, non-linguistic interjections, etc. Scholars like Jason Palmeri (2007, 2012) and Jody Shipka (2011) provide compelling reminders that multimodality is not strictly a digital phenomenon and that those studying

composing and texts have actually attended to the multimodal dimension of texts for many years, if with different vocabulary and lenses. That said, for a variety of reasons digital media have become strongly tied to multimodality, making it important to attend to in a study of digital composing. I have therefore included it as a compositional lens separate from medium in order to pay attention to multimodality as an interrelated but separate dimension of digital composing.

A common approach for examining modes is to consider their defining qualities and what they afford for communication. In his influential article “Gains and losses: New forms of texts, knowledge, and learning,” Kress (2005) offers an analysis of what might be gained or lost as our culture moves from what he sees as a primarily writing-based to image-based communication. As part of this analysis, Kress makes use of the notion of modal *affordances* to understand the “distinct potentials and limitations for representation of the various modes” (p. 12). Kress argues that the logic of the image is “spatial and simultaneous,” with the logic of speech “temporal and sequential” and written language expressing that temporality and sequence through linearity (p. 14). Anne Frances Wysocki (2005), responding to Kress’s argument, illustrates how spatiality is also part of written meaning making, arguing that we must be careful not to fall into overly dichotomous thinking in our analyses, but instead that we ask “how our materials have acquired the constraints they have and hence why, often, certain materials and designs are not considered available for certain uses” (p. 56). Wysocki also warns against using the concept of affordance in a way that becomes deterministic (p. 59), pushing those interested in multimodality to consider why certain designs and uses of modes have become “unavailable” through cultural histories of practice. While Kress stresses

the cultural dimension of modes as semiotic resources shaped by their histories of use, Wysocki provides a useful reminder to avoid essentializing modes and to keep our minds alert to how cultural history shapes what we see as our available semiotic resources through convention.

In my study, applying this compositional lens means paying attention to participants use of modes other than (but including) the linguistic in their texts and in my observations. In observational notes, for example, I describe gesture, body postures, and intonation, in addition to language. Because of my focus on how disciplinarity might be shaping or shaped by multimodal composing, I also attend to the multimodal strategies used in participants' meaning making and how these connect with their disciplinary work, including consideration of disciplinary histories of use, epistemological traditions, and explanatory goals. Finally, applying a multimodal lens to composing brings into view how the texts participants produce connect with a wide array of communication media and genres.

Medium

In the context of composing, media, those “cultural technologies of dissemination” (Kress, 2010, p. 30), offer material affordances and constraints to composers, privileging certain types of semiosis, rhetorical interaction, cognition, and activity. In disciplinary contexts, we must remember that media also enable certain types of epistemologies. In his influential work on communication, Harold Innis (1950; 1951) makes the argument that certain media have “biases” that affect the character of communication, knowledge-making, political systems, economies, etc., a concept we might connect with the concept of

“affordances” now. For example, he argues that certain types of media are time-biased, preserving and communicating over time (e.g. stone), while others are space-biased, traveling and communicating across space more easily (e.g. papyrus). These two media biases could lead to different types of political economies and empires. According to Innis’s model, digital media, because they travel nearly instantly across huge distances, are space-biased and favor centralized empires, but do not favor permanence. This approach to media—examining the types of communication they afford according to their defining material characteristics, persists today. As James Zappen (2005) has pointed out, a recurrent approach among studies of digital media has been to identify and examine their affordances and constraints, along with the communication and social processes they enable. Laura Gurak, for example, identifies “speed, reach, anonymity, and interactivity” as defining characteristics of digital media (as cited in Zappen, 2005, p. 321). In contrast, Lev Manovich eschews “digital media” for “new media” and identifies “numerical representation, modularity, automation, variability, and transcoding” as defining characteristics (as cited in Zappen, 2005, p. 321).

In composing, we see a similar approach to medium in attempts to define the formal characteristics of digital writing in distinction with writing in other media. The original name for the journal *Kairos*, for example, included the phrase “webbed writing” as a characteristic of digital writing. This idea of modular, associatively connected writing as characteristic of digital composing can be seen later, as in Stuart Selber’s (2004) discussion of the characteristics of hypertext:

There are three dominant metaphors that define and describe the basic components of the hypertext medium: (nonlinear) texts, (modular) nodes, and (associative) links. (p. 168)

As digital technologies and infrastructures have developed to create, transmit, and display larger audiovisual files more quickly, the multimodal affordances of digital compositions have been more frequently cited as important characteristics, though this is often collapsed with the concept of multimedia.¹⁸ For example, in a scholarly webtext pedagogy, the WIDE Research Center Collective listed the inclusion of “multiple media elements” as part of their definition of digital writing:

Digital writing is the art and practice of preparing documents primarily by computer and often for online delivery. Digital writing often requires attention to the theories and practices of designing, planning, constructing, and maintaining dynamic and interactive texts—texts that may wind up fragmented and published within and across databases. Texts that may, and often do, include multiple media elements, such as images, video, and audio. Digital writing also reminds us of the very physical elements and interactions required to write. Digits not only refers to the zeros and ones that float in cyberspace and create online spaces, but also refers to the fingers we use to craft the writing translated to zeros and ones and then retranslated and fed to

¹⁸ Kress (2010) takes issue with the use of the term “multimedia” to mean “multimodal,” arguing that multimedia, much like the term “horseless carriage” for the car, names “new givens in terms of old frames, thoroughly lodged in a previous environment” (p. 30). For him, using “the term *multimedia* is to confuse past practices with present givens; to confuse the cultural technologies of *dissemination*—radio, newspaper, TV, etc.—with the cultural technologies of *representation*: writing, speech, image, etc.” (pp. 30-31). In so doing, it “effectively blocks the path to clear analysis and thinking” (p. 31).

the screen through the software we use to interface digital spaces. ... Finally, we use the term digital writing because we would argue that today all writing is digital, and most writing requires weaving text, images, sound, video—working within and across multiple media, often for delivery within and across digital spaces. (Hart-Davidson et al., 2005, sec. [popups/popup_digital.html](#))

In addition to multimodality (though not yet named as such), we see enumerated in this description a number of affordances of digital texts—dynamism, interactivity, modularity—as well as defining elements associated with them: code, networks, interfaces, but also humans.

These affordances and elements are recognizable, for example, in Alison Warner's (2007b) "Constructing a tool for assessing scholarly webtexts" (based on her dissertation), within which she identifies seven dimensions along which web-based online texts often deviate from print-based online texts in "their use of hypertextual and/or hypermedia allowances of the medium": structural design, form/content relationship, navigational design, link strategy, node strategy, visual design, multimedia incorporation (sec. [tool/cat-b/index.html](#)). Under structural design, for example, she lists four types of structures webtexts might follow, ranging from the more "print-based" and "print-like" webtext structures to the "minimally multilinear/web-based" and "fully multilinear/web-based" webtext structures, with this last structural category described as "multilinear with multiple non-guided navigational choices" (sec. [tool/cat-b/design.html](#)). Her "multimedia incorporation" feature defines "the ability to incorporate multiple media within a text" as, "without question, the most significant allowance of the online medium that cannot be

replicated in print” (sec. tool/cat-b/multimedia.html). Within the section of the assessment tool for this category, she places digital texts “comprised of texts and graphical elements (images, tables, graphs, etc)” and whose “primary means of making meaning” is “textual with multimedia (audio, video, animation) that enhance the meaning” in an intermediate category between the most print-based and web-based categories (sec. tool/cat-b/multimedia.html). The most web-based digital texts are “comprised of text and/or graphical elements with multimedia such as video, audio, animation” and make meaning primarily through “a combination of textual and multimedia (audio, video, animation)” (sec. tool/cat-b/multimedia.html). Warner’s tool for scholarly webtexts reflects many of the affordances of digital texts identified by other scholars, particularly modularity/nonlinearity, linking, and multimedia/multimodality (which are not distinguished in the tool). In many ways, digital texts that make the most extensive use of these affordances to make meaning are interpreted here as being more thoroughly digital than those that only use a few of these, underscoring how important this way of thinking about digital writing has become.

In addition to material affordances, however, media scholars remind us to also look at media as hybrids (or assemblages, networks, or ecologies—the metaphors vary) comprised of more than their immediate material forms. Bolter and Grusin (1999), for example, point out that media are hybrids that network social, technological, economic, and aesthetic systems together (p. 19). As such, newly introduced media technologies do not involve “simply inventing new hardware and software, but rather fashioning (or refashioning) such a network” (p. 19), including systems of production, circulation, reception, use, storage, disposal, meaning, etc. Texts made in different media also participate in different

sociotechnical systems. As Shawn and Kristi Apostel (2009) have pointed out, for example, our composing and pedagogical choices have real environmental consequences at the level of disposal systems as old technologies are discarded and newer technologies adopted.

Similarly, anthropologist Gabriella Coleman (2010) notes the “meager” attention in the literature on digital cultures to issues of waste and the environment related to digital media:

Companion studies critical of informational capitalism attend to some of the most intractable and long-lasting by-products of digital media: the toxic waste of screens, computers, cell phones, and other electronics, which, despite its undeniable materiality and ubiquity, has received meager scholarly or journalistic attention. (p. 493)

These perspectives help us pay attention to the ways texts and compositional practices are embedded in larger social and material processes and the far-ranging sociotechnical and environmental changes that often accompany genre change.

In the context of my study, attention to the role of digital media in my participants’ composing requires a range of considerations. These include observing the digital affordances and tools participants use, as well as those they choose not to use, something made easier by contrasting cases. These also include attention to how participants understand and talk about those affordances and tools. I also pay attention to the larger social systems these tools and media are connected with, including academic ones. Finally, I consider how disciplinarity might be shaping or shaped by participants’ digital composing—how their media use shapes and is shaped by their disciplinary participation. My goal here is to

understand what is distinctive about their digital composing and to put this in the context of disciplinary participation

Genre

Because it accounts for the relationships between texts and contexts, rhetorical genre theory has a rich history in WAC/WID research, which seeks to put writing in the context of disciplinarity. In defining genre as a form of recurrent social action, Carolyn Miller (1984) made genre a rhetorical concept and one that helped demonstrate the constitutive function of not only texts but also the cultural knowledge *about* them as meaningful social categories of possible rhetorical action. Later putting genre theory in conversation with Giddens's structuration theory, Miller (1994) argued for the important constitutive and reproductive role of genre for communities, including those, like disciplines, that are spatially and temporally dispersed: "genres not only help real people in spatio-temporal communities do their work and carry out their purposes; they also help virtual communities, the relationships we carry around in our heads, to reproduce and reconstruct themselves, to continue their stories" (p. 75). As the sedimentation of prior texts and situations, genre is simultaneously, in Anis Bawarshi's (2000) words "the 'con' and the 'text'" (p. 357). Echoing this observation, Anne Freadman (2012) argues that, "the distinction between text and context cannot be maintained" (p. 557). For her, "genre is just the nexus of text and context" (p. 557). Genre, therefore, is an important form of cultural knowledge.

Just as cultures are not static, genre is also dynamic and evolving, a point made by Catherine Schryer (1993): "All genres have a complex set of relations with past texts and

with other present texts: Genres come from somewhere and are transforming into something else” (p. 208). As such, they are only ever “stabilized-for-now” (p. 204)—a way of doing in a particular historical, cultural moment, with genre and cultural change acting on one another. This reciprocal movement means that genre change, which changes a way of doing, can lead to cultural change, just as cultural change can lead to genre change. In the context of disciplinarity, genre change can shape and be shaped by disciplinary change, something Carol Berkenkotter and Thomas Huckin (1995) have applied Anthony Giddens’s “duality of structure” to describe (p. 4). Genre change can come from many places (Miller, 2017), but the fact that they change at all is a reminder that writers make choices about their texts, which are never outside genre (which would be like being somehow outside of history, culture, and language), but which are also never fully in it either (no textual instantiation *is* the genre—it is a form of cultural knowledge).

One of the ways that genres change is through individual innovation (e.g. Agre, 1998; Liestøl, 2009), a fact that raises questions about individual creativity and constraints—particularly important in a study of composing. The literature on genre tends to frame genre as offering individuals regularized, but flexible resources for communicating. Berkenkotter and Huckin (1995b), for example, characterize genres as “dynamic rhetorical structures that can be manipulated according to the conditions of use” (p. 3). Catherine Schryer (2002), drawing on Pierre Bourdieu, writes that “genres can be seen as constellations of regulated, improvisational strategies triggered by the interaction between individual socialization or ‘habitus’ and an organization or ‘field’” (p. 84). Similarly, Anne Herrington and Charles Moran (2005) view genres as “flexible guides for the invention and social action within a

given discourse community” (p. 10). Amy Devitt (2004), in her book *Writing Genres*, treats the subject of creativity at length, arguing that “genre necessarily and simultaneously both constrains and enables writers and that such a combination of constraint and choice is essential to creativity” (p. 138). She observes that “without variation, it would not be possible to perceive standardization” (p. 149). From variation, in fact, “comes the potential for change, for critique, and for creativity” (p. 161). Genres not only serve as “heuristics to creativity” but “require creativity”: “Like variation, creativity inheres in genres” (p. 151). In part through this dualistic enabling and constraining structure, “genre both empowers and subjects to power” (p. 162). This latter point, in fact, that genres are ideological and help cultures reproduce ideologies, epistemologies, social relationships, chronotopes, and power, is also one that recurs throughout genre scholarship, though it is leavened with observations such as Devitt’s that genres can also provide means of creativity and potential resistance.

In recent years, scholars have found genre theory particularly useful for understanding digital communication, in part because it connects such communication to prior communication and attends to both stability and change. As we all have grappled with how society and communication are changing in the digital age, this theory has proven particularly useful for understanding these dynamics and their implications (e.g. Giltrow & Stein, 2009; Lomborg, 2011; Miller & Kelly, 2017; Miller & Shepherd, 2004; Shepherd & Watters, 1998). Reciprocally, the changes related to new media and technologies have also provided valuable cases for better understanding genre more generally (e.g. Dannels, 2010; Graham & Whalen, 2008; Miller & Shepherd, 2009; Yates & Orlikowski, 2002, 2007).

In the context of my study, applying genre as a compositional lens proves useful as a way for connecting formal and thematic choices—including medium and mode—to situation and the multiple contexts these choices are imbricated in for my participants.¹⁹ Genre also provides perspective on participants’ decisions to innovate or follow convention, helping me to consider when authors choose to deploy familiar strategies or to deviate from the familiar and conventional. Finally, genre theory allows me to put participants’ composing in the context of disciplinarity and to consider the “duality of structure” (Giddens as cited in Berkenkotter & Huckin, 1995b, p. 4) at work in how disciplinarity might shape and be shaped by their digital and multimodal composing.

Dissertation Overview

With the exigences, research question, and conceptual framework for my dissertation established, I will proceed as follows. In my second chapter, “Studying Digital Writing in the Disciplines,” I begin by describing my methodological framework, putting rhetorical genre theory in conversation with the ethnographic tradition, including how this tradition has confronted the challenges presented by the routine embeddedness of the Internet in everyday life. This section also explains my rationale for studying the production of digital texts rather than printed work. From this point, I introduce my two cases, the Webtext Project and the

¹⁹ I distinguish situation from context here, reserving situation for rhetorical situation as theorized by Lloyd Bitzer (1968) and later rhetorical scholars who have complicated and enriched the concept (e.g. Vatz, 1973). In Bitzer’s theory, rhetorical situation is marked by exigence, a concept taken up by Carolyn Miller (1984), who theorizes genre as “typified rhetorical actions based in recurrent situations” (p. 159) and describes exigence as “the core of situation” (p. 157). In contrast, I see context as a broader, more loosely theorized concept that may include many rhetorical situations. A social context like a disciplinary community, for example, includes many recognizable, recurrent situations and genres.

Heartbeats Project, describe my data collection methods (interviews, observations, texts/artifacts, and connective ethnography), and conclude with my methods for data analysis (analytic memoing, coding, genre mapping, and textual analysis).

My third and fourth chapters describe the results from my two case studies, beginning with the Webtext Project (rhetoric and composition) and proceeding to the Heartbeats Project (evolutionary biology). Each of these chapters begins with an introduction to the case and chapter and a narrative description of my ethnographic engagement with the authors (*narratio*) before moving into analysis of my results. This analysis is organized by compositional lens, ending with genre as the final compositional lens that brings all the interrelated dimensions of composing together and finally a summary of my case study's findings (*recapitulatio*).

I conclude my dissertation with a final, fifth chapter that begins by taking up the complex concept of discipline before putting the findings of my two case studies in conversation with one another to answer my motivating question, "How is disciplinarity shaped by and shaping scholarly digital and multimodal composing practices?" I then consider my study's limitations and make suggestions for future research in this area, before closing with the implications of my work for academic publishing and for academic writing pedagogy.

Chapter 2

Studying Digital Writing in the Disciplines

The world is not experienced one medium at a time.

—Christine Hine, 2015, p. 186

The Internet needs ethnography, but those very factors that make it fascinating are also challenging for ethnographers, as they seek to find coherent ways to carve out a researchable object from the mass of temporal and spatial complexity and the interweaving social and cultural processes that create the Internet and embed it in everyday life. The Internet is inherently diverse, flexible, and heterogeneous, and thus demands an adaptive, situated, methodological response.

—Christine Hine, 2015, p. 13

This chapter describes my methodological choices for studying digital writing in the disciplines. My study includes two cases of scholars producing digital texts for disciplinary purposes, with participants defining digital texts in their disciplinary contexts. My research

employs a naturalistic, qualitative methodology (Denzin & Lincoln, 2011; Lindlof & Taylor, 2011), combining an ethnographic framework with textual analysis of writers' process-related documents and artifacts and working inductively to construct meaning. This combination allows me to view participants' compositional choices and processes in context of their sociorhetorical meanings, with an emphasis on disciplinarity. I received human subjects approval²⁰ for the project and all participants provided consent for participation. Participants and their projects are referred to throughout using pseudonyms, with projects strategically disguised to protect participant confidentiality (Bruckman, 2002).²¹

Methodological Framework

An assumption guiding my methodological choices is that the moment words are inscribed on paper or screen is both the most and the *least* important moment for studying writing (or composing, a more capacious term that can be more apt when attending to multimodality and media). That moment exists at the nexus of histories and influences, and

²⁰ North Carolina State University IRB Protocol #5535.

²¹ While I followed the conventions of human subjects ethical practice as well as emerging practice in Internet research (Bruckman, 2002) to protect participants' confidentiality, several participants in the Heartbeats Project expressed the preference to have their identities known and have their work openly cited. After consultation with my IRB office, I determined that this was not possible due to the vulnerability of younger researchers on the team who were at the beginning of their careers and might not feel comfortable expressing disagreement. My sense is that in this disciplinary context, which does not regularly conduct human subjects research, reflexive disciplinary work (e.g. analysis of publication patterns) is typically conducted in the open with citations and data sets made available in publications (i.e. in a data repository). The research genres my work took up were strange to them and possibly disappointing as we were not able to publicize our work together in the way they would have liked. For the Webtext Project participants, the research tradition I engaged in was quite familiar and so they raised fewer questions about common practices like pseudonyms. In order to accurately describe my research role, however, I found it necessary to more lightly disguise my relationships and connections with them and with their disciplinary context. Participants in each case were given the opportunity to comment on their respective chapters, both to check for accuracy and to adjust data disguising for their comfort.

can be understood as having been a long time coming. As Ron Scollon points out, researchers of literate activity work at the intersection of “pathways and trajectories of texts, actions, practices, and objects, of people and communications across time and space and multiple modes” (Scollon as cited in Roozen, 2009, p. 141). For the individual writer, the attitude or state of mind leading to the inscription of words or symbols—Kenneth Burke’s (1969) “incipient act” or “preparation for an act” (p. 20)—may have brewed for many years and is imbued with what Mikhail Bakhtin (1986) has called the “dialogic overtones” of all language—the “echoes and reverberations of other utterances” that fill our own utterances (p. 91). Studying composing, then, requires more than attention to discrete moments of inscription. This, in fact, has been recognized by rhetoric and composition scholars and accounts for a rich tradition of qualitative and ethnographic research (e.g. Beaufort, 1999; Bishop, 1990; Chiseri-Strater, 1991; Heath, 1983).

Even for those who would restrict their view of composing to the discrete act of inscription, digital media and the Internet have vastly complicated this possibility, rendering its partiality ever more visible. When writers collaborate on a cloud-based document like a Google Doc, for example, which perspective should the researcher examine? Should she restrict her observation to an embodied perspective or does she also need to include engagement with the digital space? If so, from whose vantage point? That of her account? One of the writer’s accounts? All of the writers’ accounts? As ethnographer Christine Hine (2015) put it in my epigraph, “The world is not experienced one medium at a time” (p. 186). The Internet—and the digital spaces and practices it has enabled—is at this point, she argues “an embedded, embodied, and everyday phenomenon” (p. 13). So how can researchers

account for this embeddedness and the routine hybridity of experience and space it creates when studying composing? How does a composition researcher who seeks to account for networked digital media “carve out a researchable object from the mass of temporal and spatial complexity and the interweaving social and cultural processes that create the Internet and embed it in everyday life” (Hine, 2015, p. 13)?

Perhaps, some might argue, studying the production of a text isn't even necessary to examine disciplinary writing in context of changing media environments. Perhaps analyzing a set of published texts would suffice. As enlightening, however, as this sort of textual analysis can be (e.g. Hyland, 2000), it can make texts appear inevitable and occlude the struggle and ingenuity behind composers' choices—the possibilities and constraints they faced and creative solutions they devised for rhetorical problems. John Swales (2004) points out the important-but-missing “not-said” and “discoursal silences” from such accounts (p. 86), later citing Thomas Huckin's observation that those interested in culture and genre need to study silences (p. 96). Studying in-progress work, in fact, provides access to writers' iterative construction of their rhetorical situations, which can also seem overly neat and existing *a priori* when examining published work (e.g. Berkenkotter & Huckin, 1995; Myers, 1985a, 1985b). Much as with accounts of technological progress, accounts of genres and genre change that focus solely on finalized, published texts can make their evolution and attendant sociorhetorical and material relations appear inevitable. Charles Bazerman's (1999) account of Thomas Edison's rhetorical work in bringing the technology of electric light into being and widespread use is a case in point. The electrification of America was not inevitable, but rather contingent on changes to “the discourse and the representational

meaning systems of the time” that required Edison’s perception of rhetorical possibilities and ingenious, creative rhetorical work in negotiating those possibilities (p. 350). Looking at the *fait accompli* occludes this difficult rhetorical work.

Similarly, the evolution of genres, including the typification of media and modes in those genres, is not inevitable, but created one author and text at a time through the creative negotiation of their rhetorical situations, conventions, and resources, including their sociomaterial conditions. As Bazerman (1984) put it in his work on the evolution of the scientific experimental report,

Although conventions help define the possibilities of a piece of writing, they do not absolutely constrain; for conventions change, and the *change occurs particularly through the nonconforming choices made by a series of writers that then become the new norm*. The forces and motives behind these changes may be various, ranging from changing social conditions to changing intellectual conditions, from self-interest to reason. (p. 165, emphasis added)

As I described in my introduction, I understand the question of how disciplinarity shapes and is shaped by digital and multimodal composing as a genre question. No compositional choice is made in a vacuum. No text exists outside its relation to other texts—to those “pathways and trajectories” Roozen (2009) cited. In Jacques Derrida’s (1980) words, “there is no genreless text” (p. 65). Studying the production of texts inherently engages with genre histories and futures, operating at the nexus of these trajectories. History is always in the room. The question of which media and modes to use and how will always be made in

context of the choices made by others before us and will influence the interpretations and choices made by those who come after us.

My methodological choices are therefore informed by this theoretical frame. Rhetorical genre studies, by drawing attention to *recurrence* inherently brings social and discursive histories into focus. As Bawarshi (2000) has pointed out, genre is simultaneously “the ‘con’ and the ‘text’” (p. 357). As the sedimentation of prior texts and situations, genre operates both at the level of the rhetorical environment we find ourselves in and at the level of specific texts we produce or encounter. Including attention to genre, then, helps solve the problem of how to both account for and constrain those potentially infinite pathways of history and influence. Genre theory also helps address the question of the individual in a social context, since genre is a social category and part of how intersubjective reality is achieved. The social is present as the individual composes and can be learned about as the individual composes. A methodology informed by genre theory helps account for the force of others, the weight of prior discourse, in composers’ rhetorical choices. Each text-in-the-making is an opportunity to examine the mediation of “private intentions and social exigence” through composition (Miller, 1984, p. 163). As Amy Devitt (2004) points out, genre theory is also useful for perceiving individual writers’ innovations and creativity as they negotiate the rhetorical resources and constraints presented by prior discourse. In her words, genres are not only “heuristics to creativity,” but “require creativity”—“Like variation, creativity inheres in genres” (p. 151). This makes genre theory a particularly useful lens for analyzing writers’ inventional work and composing choices.

Attention to genre, as a social, emic category and the mediation of “private intentions and social exigence” (Miller, 1984, p. 163), also provides a good reason to include ethnographic engagement with participants and their social worlds. James Spradley (1979) describes the ethnographic tradition as one of “learning from people” and seeking to understand “the meaning of actions and events to [those] people” (pp. 3–5). Ethnography, particularly in its more recent postmodern permutations, acknowledges that “fieldwork is not just a personal but rather an intersubjective experience wherein both the ethnographer and her [research participants] are affected by the research process and products” (Chiseri-Strater, 2012, p. 202). For the ethnographer, the interview is less “a data collecting exercise” than “a shared conversation through which new ways of knowing are produced” (Pink, 2011, p. 271). Ethnographic meaning is a mutual achievement. Ethnographic engagement seeks, through interaction with participants and their social worlds, to better understand their social meanings, including those at work in their composing, while acknowledging that the meaning constructed about those social worlds is collaboratively created. With this framework in mind, the meaning generated by my case studies can be understood as cooperatively constructed, with my perspective moving recursively between the emic and etic and between induction and deduction (Gold, 1997).

While the ethnographic tradition has historically stressed embodied engagement with people and cultures, it has recently found promising ways to extend its methodological sensibilities to including engagement with mediated cultural practices, such as those mediated in full or in part by the Internet. This is methodologically quite relevant and useful for studies of digital writing. Having complicated the notions of the “field” and “site” for

many decades now (e.g. the complication of field as more than geographic in Gupta & Ferguson, 1997), contemporary ethnographers have been grappling with how to conduct ethnography of communities that are highly distributed and interconnected with other communities (including in the context of the Internet and digitality). Many of these strategies are quite promising for researchers interested in digital writing and in academic communities, since these have been and continue to be highly distributed—they are Diana Crane’s “invisible colleges” (Crane, 1972). Christine Hine (2015), in *Ethnography for the Internet*, builds on ethnographers’ complication of the notion of field to develop a “connective ethnography” in which “the notion of prolonged immersion” has been “rearticulated to encompass the experience of mediated forms of engagement and to involve following connections rather than assuming physical co-presence in geographic space” (p. 56). Hine reminds ethnographers that “the field site is an artful construction rather than something one simply ‘finds’” (p. 60). Hine’s ethnography for the internet is “itinerant” and “networked, following connections such as artifacts, sites, and institutions participants have identified as meaningful, with the implication that “the field as an object of study is emergent, impossible to specify in advance, and the product of a creative engagement between ethnographer and participants” (p. 64).

The methodological choices I describe in the following sections are informed by these theoretical and methodological frames and are grounded in the assumption that something useful can be learned about the role of disciplinarity in scholars’ digital and multimodal composing by studying the production of a text. My choices are also grounded in the belief that studies of composing benefit from ethnographic engagement beyond the moment of

inscription and that digital writing in particular benefits from a connective ethnography prepared to follow connections across online and offline spaces important to participants. Finally, my choices reflect the assumption that understanding participants' lived experiences and meaning making requires a flexible, adaptive, purposive engagement with the field and co-presence with participants that is situated, responsive, and therefore emergent. Because both case studies were conducted with the same methodological framework and approach, the emergent, co-constructed nature of the field and of the field relationships—as well as important differences in participants' practices—resulted in some variation in the final form of each field.

Sampling

In keeping with my ethnographic and genre-based framework, both of which emphasize the value of emic perspectives, my cases and participants were selected in part through participants' own definitions of “digital writing” in their disciplinary contexts. While my connective approach resulted in itinerant, multi-sited ethnographies (Hine, 2007b, 2007a, 2015; Marcus, 1995), both began through conversations at my own institution, a public, land-grant, research institution in the Southeastern United States. This site served as the central hub from which I extended my field as engagement with participants suggested connections to follow.

While following a “sociological sampling” logic, which includes participants in the sampling strategy based on the assumption “that the people whose society is to be studied are the very best source of information on how to put together an empirically grounded,

representative sample of that society” (Gold, 1997, p. 390), I combined this with a criteria-based sampling strategy to ensure that my cases would be relevant for my object of study: digital writing in the disciplines. These criteria were used to select the two texts I followed, but were not used to delimit the participants relevant to understanding those texts, since actors not directly composing the texts turned out to be relevant to their production (see Appendix D for my “consultants” interview protocol and Appendix E for my “community informants” interview protocol). Chosen cases needed to (1) be engaged in disciplinary writing intended for submission to a peer-reviewed publication; (2) be engaged in digital writing; (3) include an expert member of the discipline being written for; (4) be collaboratively written by groups with varying levels of expertise with the genre being composed. In addition, the two cases were chosen to maximize disciplinary differences by drawing on scholars in disciplines generally seen as differing in their objects of study, epistemological traditions, and even funding models: the sciences and the humanities and social sciences. The goal in selecting such contrasting cases was to put disciplinarity in relief and better understand both where digital practices and experiences were shared and where they diverged as a function of disciplinarity. This sampling strategy resulted in a case study in evolutionary biology and one in rhetoric and composition.

I chose to select for experience and collaboration (criteria 3 and 4) based on my genre-based frame. Because I was studying disciplinarity and how it is enacted through medium, mode, and genre, I found it important to study writers who understood how to participate in the discipline, including genre knowledge. I selected cases that included collaboration by scholars of varying levels of genre experience, because expert writers’ genre

knowledge tends to “become tacit and hard to access” over time, while working with less experienced writers of the genre provokes a natural exigence for making this genre knowledge “more overt and open to scrutiny” (Schryer, Lingard, Spafford, & Garwood, 2003, p. 71). Collaborative writing provided an unobtrusive mechanism to make visible otherwise tacit aspects of genre and rhetorical decision-making, since coauthors needed to negotiate their choices with each other.

In their own ways, both cases were atypical cases, in that the scholars in each case with the most experience in digital writing for their disciplines were innovative outliers who were actively pushing the boundaries of both genre and disciplinarity. As Bent Flyvbjerg (2006) explains, “Atypical or extreme cases often reveal more information because they activate more actors and more basic mechanisms in the situation studied” (p. 229). Deanna Dannels (2010) makes such use of extreme case sampling in a study of genre, using it as a “method of uncovering rich problematics, contributions to theoretical conversations, context-specific details, and intense understanding of a phenomenon” (p. 11). Similarly Greg Myers finds atypical cases useful for studying scientific genres, in one instance focusing on atypical authors and the other atypical publications for authors (Myers, 1985b, 1985a), arguing that “atypical subjects may provide the best means of reexamining received ideas about behavior” (Myers, 1985b, p. 240). In the context of research on disciplines, in which power and influence are unevenly distributed, studying atypical cases of experts actively pushing the boundaries of convention provides a vantage point on both genre change and the typified aspects of the genre being pushed against.

Cases and Researcher Role

While I extended my ethnographic engagement beyond this site, the two cases described here both began in a university setting and were meaningfully grounded in that institutional setting since most participants had strong ties to it, either through employment, education, or both. The institution, a public, land-grant research university in the Southeastern United States, employs approximately 9,000 faculty and staff and educates 34,000 students per year. The university is divided into ten colleges, representing the full range of academic fields, but, in keeping with its land-grant origin, with a strong emphasis on STEM and applied fields. In addition to its research and teaching mission, the university stresses extension and work that benefits the citizens and economy of its state.

As part of its research focus, the university emphasizes graduate education, with 60 doctoral programs and 160 master's programs. At the time of writing, the program I was enrolled in was one of five doctoral programs offered through the humanities and social sciences college. An interdisciplinary program jointly offered through the English and communication departments, my program was the only doctoral program for either of these departments. My ties to English were quite extensive, however, as I had received my master's degree there a decade earlier and had worked as a lecturer and administrator in its first-year writing (FYW) program in the interim. I believe this personal history played a role in my research, since I was able to relate to the Webtext Project participants tied to English as a former colleague they trusted. This longstanding affiliation with FYW may have also played a role with my biology participants as it helped frame my interest in their writing. The undergraduate researcher in biology, Jada, frequently referred to her experiences in English

classes and in FYW, knowing that this would be a special interest of mine. Finally, my status as a doctoral student likely played a role in both cases, generating goodwill from participants, either because they identified with my endeavor (e.g. the postdoc in biology), or because they felt invested in my success through their role on campus (e.g. the faculty on campus)..

While, as a fellow member of the discipline and someone with professional ties, I had a strong membership role with my rhetoric and composition case (i.e. membership in the discipline, with my project contributing to it as well as their own), my research role for both cases was best described as participant observer, with my role including some degree of participation, but with “both field worker and informant ... aware that theirs is a field relationship” (Gold, 1958, p. 220). Because of my student status and, in the case of my biology case, nonspecialist status, I was able to begin with an “apprentice” or learner role, which encouraged participants to teach me “how things work around here” (Lindlof & Taylor, 2011, p. 147) and make practices, conventions, and choices more explicit for me. My identity as a woman and writing teacher, both culturally understood as nurturing roles, may have also reduced potential face threats for participants and made them more willing to share shortcomings with me. Because of my membership role in rhetoric and composition, my role with those participants was at times more collaborative, with the team occasionally turning to me for input (e.g. of what the IRB implications of their project might be), but my student status kept me in a learner role and encouraged them to make tacit knowledge explicit for me.

Rhetoric and Composition: The Webtext Project

My first case consists of a project I'm calling the "Webtext Project," which continued a line of research on flexible writing classrooms begun by a rhetoric and composition scholar named Tara. Tara had begun this research as a doctoral student in conjunction with an administrative initiative to redesign one of the first-year writing program's classrooms completed with the program's director, Joy. This administrative collaboration had also led to a few collaborative publications, including a digital chapter that a colleague, Mark, had helped them code to make a publication deadline. Joy and Tara had considered using WordPress, but Mark had offered to code it in HTML for them, which he did in less than 24 hours. Mark self-identified as a rhetoric and composition scholar, but his work was strongly digital and had previously published an award-winning "scholarly webtext," as born-digital scholarly texts are called by *Kairos*, a leading online journal in rhetoric and composition. When it had come time to submit the digital chapter, Joy and Tara had faced the question of how to acknowledge Mark's work. Scholars in rhetoric and composition have increasingly recognized the intellectual contributions of design, often framing writing as design, and from Joy's and Tara's perspectives Mark had made a significant contribution to the organization and design of the chapter through his work. Mark, however, felt putting the text in HTML had not changed the text measurably enough to warrant an authorship claim. He suggested, however, that they might collaborate on a future project where his contributions to the design would shape the text and argument substantially enough to warrant being counted as a coauthor. Tara and Joy were happy with this arrangement as it gave them an opportunity to reciprocate. The Webtext Project I studied was the result.

My work on the Webtext Project began in fall 2014 through a series of conversations I had with Joy, a faculty member I had worked with in various capacities over the years. She knew I was interested in digital writing and rhetorical genre theory and graciously agreed to the idea that I follow their webtext's development when I suggested it. Both Tara and Mark were amenable to this idea as well when Joy proposed it to them. That fall, a fourth coauthor from another university, Christopher, also joined the project, also agreeing to my role. Christopher published regularly in WAC/WID journals and attended rhetoric and composition conferences, but was a professor of mathematics. My participants for the project, then, comprised of four faculty coauthors. In the following descriptions, I try to use participants' own terminology in describing themselves and their work, including the use of the singularized "rhet/comp" for rhetoric and composition:

Tara. A veteran writing teacher but more junior scholar in the field, Tara described herself as both a rhet/comp scholar and learning spaces researcher. Tara brought qualitative research and learning spaces expertise to the project. Initially at a nearby private college, she accepted a teaching-track assistant professor position at my institution mid-way through the project.

Joy. A tenured professor, Joy described herself as a generalist rhet/comp person and social science empirical researcher. She took on the roles of "resource collector" and "data collection person" on the project, though she also often coordinated

communication and logistics for the team. Joy began the project while at my institution and accepted a position in another state mid-way through the project.

Mark. A tenured associate professor, Mark described himself as a rhet/comp scholar with a focus on digital rhetoric and digital writing. Having won awards for his digital writing, he brought a combination of theoretical, design, and programming expertise to the project. Mark was located at my institution.

Christopher. An associate professor in mathematics, Christopher also regularly participated in WAC/WID and rhetoric and composition research. He brought his mathematics expertise and his interests in writing and teaching to the project. Christopher was located at another public institution several hours away.

The general thrust of the project was to examine the role of students' diverse backgrounds and preparation on their experiences of flexible classroom spaces. During the first phase of the project, the team explored a range of student factors they might look at, including college writing preparation, (dis)abilities, and multilingualism. At the beginning of Tara and Joy's collaboration with Mark on the webtext, they had already collected a substantial amount of data from multilingual students taking writing classes in one flexible classroom space and had presented their findings at several conferences. The question they tried to answer during this phase was how the affordances of a webtext, including interactivity, might further this line of inquiry. The second phase of the project included

bringing Christopher on board and beginning to explore the option of having the webtext collect data from readers. At this stage, Mark built a prototype of an interactive digital classroom using Flash with ActionScript based on materials Tara provided. During the third phase of the project, the team explored how this interactive classroom could be used as a data collection tool and what role it would play in the webtext. The team also began refining the focus of their research and making decisions about research sites, questions, protocols, and procedures. They also started the steps necessary for getting IRB approval and permission to conduct research in their chosen site. I concluded data collection for my dissertation during this phase of the project in spring 2017 for a total of twenty-eight months of data collection.

Evolutionary Biology: The Heartbeats Project

What I'm calling the "Heartbeats Project" is one project of many in a biology lab focused primarily on entomology. While writing a popular science book, the principal investigator, Soren, had asked members of his lab to locate literature related to the "billion beats rule," the well-known observation that on average mammals' hearts beat one billion times per lifetime. Finding that the "rule" was based on limited data, Soren conceived of the Heartbeats Project, a project that would locate additional heartbeats and lifespan data in order to test whether the original correlation held up, and potentially extend the research to other biological classes like birds and reptiles. In part to speed up the process of gathering heart rate data from the scientific literature, the lab created a citizen science project webpage where citizen scientists were invited to search for relevant data and submit it to the lab. Soren's lab had a strong commitment to public science and experience running citizen science projects,

with some of those projects reaching participation in the tens of thousands of citizen scientists. At the time of writing, the Heartbeats Project had garnered contributions from only a little over 100 citizen scientists. The contributions, however, were sufficient to help address the limited data of the original research in this area and to develop a manuscript on the mammals data set—my focus in this dissertation—with plans for more manuscripts later. Once Soren and the team had designed and seeded the project with some initial data, leadership for the project was turned over to Clay, a postdoc in the lab and the person who became my main contact.

My work with the Heartbeats Project began in fall 2014 with a series of conversations with Sara, a digital curator and science education specialist working in Soren's lab who I knew through other connections. After several emails with Sara, Soren, and Georgia (the lab manager at the time), I was invited to attend a weekly lab meeting as an informational scene-casing visit. Once I received IRB approval, this visit grew into a series of conversations to negotiate access, and finally to being matched with the Heartbeats Project as a project at an early enough stage and including enough digital writing for my research purposes. The team running the Heartbeats Project consisted of five core people, though other members of the lab and campus resources were tapped as needed:

Soren. A tenured professor of ecology and evolutionary biologist, Soren was the PI for the lab and project. Soren was committed to public science and regularly wrote for both public and scientific audiences.

Clay. A postdoc and entomologist specializing in ants, Clay led the Heartbeats Project and was the first author on the manuscript I followed. In addition to his scientific expertise, Clay also had a background in music and design.

Jada. An undergraduate researcher in the lab, Jada was assigned to the Heartbeats Project and assisted in data collection and management. After a change of majors, Jada moved to a psychology lab midway through my data collection.

Summer. A lab manager and research associate, Summer worked primarily on other lab projects, but was involved in creating an interactive graph for the Heartbeats Project webpage.

Rachel. An alumna of the lab and assistant professor at another university, Rachel was tapped for her statistical expertise.

In addition, I interviewed a campus public information officer at Clay's recommendation, since he played an important role in publicizing their work, including the Heartbeats Project:

Brendan. A campus public information officer, Brendan was particularly interested in the relationship between public science communication and the scientific community. Brendan was tapped early on to publicize the Heartbeats Project.

During the first phase of the project that I followed, the citizen science project was launched and an initial manuscript draft developed based on preliminary data. During this phase, members of the team communicated with the public and other scientists about the project through several venues like science cafés and poster presentations. In the second phase of the project, Clay made the decision to stop collecting mammal data and begin vetting and analyzing it more carefully while data collection for other animal groups continued. Public communication about the project continued but slowed. In the third phase, Clay began a new draft of the mammal manuscript based on the new data set and communicated with Rachel about completing the final data analysis for the mammal manuscript. I concluded data collection for my dissertation during this phase of the project in spring 2017 for a total of twenty-eight months of data collection.

Data Collection

My methods for data collection were based on the assumption that understanding how disciplinarity shapes digital and multimodal composing requires ethnographic engagement beyond the moment of inscription as well as methods that account for the embedded nature of networked digital media (Hine, 2015). They were also based on the assumption that understanding participants' experiences and rhetorical choices would require a flexible, adaptive, purposive engagement with them that would result in a co-constructed ethnographic field. These methods were therefore situated, responsive, and emergent, including a combination of observations, interviews, texts/artifacts, and connective ethnographic observation/engagement. My engagement with the two projects began in fall 2014 and data

collection for this dissertation ended in spring 2017 for a total of twenty-eight months of engagement.

Table 2.1. List of Ethnographic Data, Within Team and Beyond Team

Webtext Project	
Within Team	Beyond Team
12 Interviews (12 hours)	Citational Connections (3 articles)
5 Observations ²² (5 hours)	Digital Tool Observations (3 tools)
Drafts & Writing Samples (10 texts)	Conferences/Symposia (11 events)
Digital Object/Software (1 version)	Listserv Subscriptions (e.g. WPA-L, TechRhet) (3 listservs)
Digital Object Output (4 screencaps & data samples)	Digital Work Tenure & Promotion Guidelines (6 texts)
Survey Protocols & IRB Materials (2 drafts)	Born-Digital Books, Chapters, Webtexts (15 works)
Emails (11 threads)	Journal Submission Guidelines & Editor Writing (7 texts)
CVs & published profiles (6 texts)	Flexible Classroom Teaching/Learning & Study (6 events)
Heartbeats Project	
Within Team	Beyond Team
16 Interviews (18 hours)	Citational Connections (204 articles)
10 Observations (20 hours)	SciStarter Observations (4 projects)
Drafts & Writing Samples (12 texts)	Database Observations (e.g. AnAge) (5 databases)
Project Data Spreadsheets (20 spreadsheets)	Digital Tool Observations (5 tools)
Project Website/Lab Blog Posts (14 posts)	Journal Submission Guidelines (5 texts)
Emails (262 threads)	Twitter #CitiSciChat Events (3 events)
CVs & Published Profiles (4 texts)	CitSci Listserv Observations (270 listserv posts)
Media Coverage of the Project/Lab (12 articles)	Citizen Science Participation (3 projects)
Lab Social Media Account Subscriptions (3 platforms)	Local Citizen Science Events (3 events)
Participation in the Heartbeats Project (1 submission)	NSF Documents and Databases (4 documents)
	Citizen Science Association Website and Blog (2 site visits)

Interviews

Data collection with each participant began with an initial, semi-structured “grand tour” interview, with questions designed to get a sense of their writing histories and their project-related goals, choices, and practices (see Appendix A for the interview protocol). I

²² Raymond Gold (1958) addresses the gray line that can develop for those taking on a participant-observer role, with the researcher at times “observ[ing] formally, as in scheduled interview situations; and at other times . . . observ[ing] informally—when attending parties, for example” (p. 220). This is a particular challenge when some of your participants are from within your own community, as in the case of the Webtext Project. For my purposes, I have limited what I define as an observation to a formal, scheduled observation, though my analysis was influenced by informal interactions and observations as well. This also accounts for the lower numbers for the Webtext Project relative to the Heartbeats Project, since I was already embedded in the community and case and did not need to schedule as many formal interactions with participants in order to immerse myself.

then scheduled periodic “check in” interviews with coauthors to get a sense of where they were in the process and any choices or problems they were confronting (see Appendix B for a sample check-in interview protocol). Check-in interviews were informed by my constant comparison method, with data collection proceeding simultaneously with data analysis (Charmaz, 2003; Glaser, 1965; Glaser & Strauss, 1967). As each project progressed, I also conducted periodic discourse-based interviews during which participants talked me through their draft explaining their writing choices and during which I asked questions about possible alternatives that were or were not pursued (see Appendix C for a sample discourse-based interview protocol) (Odell, Goswami, & Herrington, 1983). Discourse-based interviews are a systematic method for eliciting “the kinds of world knowledge and expectations that informants bring to writing tasks and to discover the perceptions informants have about the conceptual demands that functional, interactive writing tasks make on them” (Odell, Goswami, & Herrington, 1983, p. 228). This method presents participants with linguistic alternatives to features of their written text in order to elicit the tacit knowledge behind participants’ writing choices. Because of my focus on digital and multimodal composing, I extended Odell, Goswami, and Herrington’s (1983) method for discourse-based interviews to include digital “texts,” such as the software Mark built. For example, I found it necessary here to inquire about visual and interactive design alternatives rather than linguistic alternatives. Finally, when participants pointed me to consultants who assisted with the development of the project in some way, I conducted semi-structured interviews with those participants in order to understand their work and perspective on the project.

Observations

Observations included observations of composing, meetings, and presentations. Some of these were in-person observations and some took place in mediated formats like video conferencing platforms such as Skype or Zoom. The Heartbeats Project participants, for example, invited me to observe face-to-face meetings in their lab, while the Webtext Project team met through video calls more often due to their distributed team. While observing, I took field notes and, in keeping with my participant observer role, asked and answered questions. During one Webtext Project meeting, for example, the conversation turned to the types of questions IRB would ask of the interactive classroom software Mark was building at which point I was also asked for my opinion. Observations were recorded, either through an audio recording app or through screencasting software for later transcription and analysis. Observations of public talks also included field notes and recordings, with any talk by anyone who was not one of my participants omitted from transcription and analysis.

Texts/Artifacts

As each project progressed, I collected related documents, drafts, and artifacts from participants. For example, the Webtext Project yielded texts and artifacts such as the Flash-based digital software, sample data produced by the software, a draft survey instrument, and emailed interactions between coauthors, and the coauthors' prior work that informed the project. The Heartbeats Project yielded, among other things, manuscript drafts, data spreadsheets, instructions for citizen scientists, a project webpage, a poster, project references, etc. In order to understand participants' disciplinary participation, I also collected

prior published work by each coauthor. In addition, observations and interviews yielded photographs of workspaces, devices, and software.

In order to understand genre from an emic perspective, genre theory suggests paying attention to “genre talk” (Miller, in press), or explicit discourse about genres, including the names users give to them (Miller, 1984; Todorov, 1976). In addition, Jason Mittell (2001) argues that researchers studying genre should move beyond the “production-reception continuum,” instead also “gather[ing] as many diverse enunciations of the genre from the widest possible range of sources” (p. 9). For these reasons, I paid particular attention to how participants talked about the genres they were producing and interacting with and also collected documents and artifacts that would help me understand how the purpose and significance of the genre for its community of users. While, for example, neither project progressed to the journal submission stage, both teams targeted specific publications leading me to documents such as journal submission guidelines and journal mission statements. I also collected other texts on the genre in question, including blog posts, award criteria, other published analyses, etc. These informed my connective ethnography, suggesting important sites and directions to connect to my analysis, helping me fill out my understanding of their disciplinary worlds.

Connective Ethnography

Examining composers’ rhetorical situations from both emic and etic perspectives is important for understanding their compositional choices, but this can be difficult to achieve. In addition, the embedded nature of networked digital media, which are often used to interact

with those who are not co-present with us, has made it critical that researchers account for the routine hybridity of daily experience, finding ways to move beyond the online/offline divide in their work (Burrell, 2009; T. L. Taylor, 1999; Turkle, 2011; Tutt, 2008; Wittel, 2000). For these reasons, I drew on Christine Hine's (2015) methodology of "connective ethnography" as a way to study highly mediated, distributed practices and contexts, such as academic disciplines. This involved actively pursuing connections, both that participants explicitly mentioned and that I discovered through processes of indwelling,²³ in order to construct a field for each case that included its digital and multimodal practices and its disciplinarity. As described above, following the connection "target journal for submission," for example, led in one case to including the journal submission guidelines for the online journal *Kairos*, an inclusion that led to a combination of technical and rhetorical guidelines and values that provided insight on what disciplinary participation and digital writing in this

²³ Pamela Maykut and Richard Morehouse (2002) argue that indwelling, which they view as an important posture for qualitative researchers to take vis-à-vis the social worlds they study, requires "exist[ing] as an interactive spirit, force or principle ... literally mean[ing] to live within" (p. 23). It is an empathetic posture that seeks to understand participants' lived experiences in their own terms, and therefore is best coupled with reflection, in a cycle that continually moves the researcher from being "part of the investigation as a participant observer" to "remov[ing] him/herself from the situation to rethink the meanings of the experience" (p. 23). This posture is related to the "human-as-instrument" concept, which Maykut and Morehouse trace to Yvonna Lincoln and Egon Guba and that postulates that the human "is the only instrument which is flexible enough to capture the complexity, subtlety, and constantly changing situation which is the human experience" (p. 24). Maykut and Morehouse attribute the term itself to Michael Polanyi who, in *Knowing and Being*, posits that "knowing is an indwelling" (as cited in Maykut & Morehouse, 2002, p. 23). In a discussion of the diverse empirical epistemologies that exist among composition researchers, Carol Berkenkotter (1989) connects indwelling with *verstehen* (literally "understanding"), the goal sociologists such as Max Weber put forward for social researchers (p. 72). One way to achieve this, Elliot Eisner writes "is to 'indwell,' to empathize; that is, to imaginatively participate in the experience of another," something predicated on the researcher's "ability to imaginatively project himself [sic] into the life of another in order to know what that person is experiencing" (as cited in Berkenkotter, 1989, p. 72). While I do not see complete *verstehen* of others' lived experiences as possible, I do see empathetic engagement with their lifeworlds as an important and meaningful way to get closer to it, particularly when coupled with self-reflexivity. As important parts of the lifeworlds I was studying were highly mediated and distributed, I found it necessary to interact empathetically with them before moving to reflexive and analytical postures.

context looked like. It also led to field notes and analytic memos on a plenary given by the editor of *Kairos* at the 2015 annual conference of the Council of Writing Program Administrators, which helped me put the scholarly webtext genre in context of the larger discipline. The data collected from this connective approach to constructing each case's field included documents and artifacts (e.g. submission guidelines, IRB guidelines, scientific articles, screenshots of websites) as well as field notes and analytic memos (e.g. of conference presentations).

Hine, in fact, sees connective ethnography as particularly suited to studying disciplines, since these are highly distributed—Diana Crane's (1972) "invisible colleges." In an earlier article describing her connective approach for understanding e-science, for example, Hine (2007a) details the ethnographic affordances of extending the multi-sited ethnographic approach to include mediated spaces and artifacts, including scientific databases:

New potential field sites also come into focus, as science is practiced not just in laboratories, but in computer science departments, across networks, within distributed databases and via information infrastructures. Identifying appropriate field sites and exploring the connections among them may require some imaginative strategies on the part of ethnographers, who will need to accept that a hyperlink in a database, just as much as a conference presentation or a conversation over the microscope, constitutes a form of scientific practice. (Hine, 2007a, p. 619)

In fact, later, Hine (2015) describes her engagement with the literature in biological systematics as "a form of ethnographic engagement" since a discipline is "constituted

through its literary practices as much as through the embodied work of practitioners,” therefore making it “important for an ethnographer to engage with the print culture as well as interacting with practitioners face-to-face and observing their work through co-presences” (p. 133).

For my two cases, taking a purposefully connective approach was a useful way to engage ethnographically with them outside the observations and interviews described above, and helped me construct fields for each case that included spaces, artifacts, and interactions across media—e.g. embodied, print, digital. This sometimes meant following connections between my participants’ digital writing and the literature they cited (particularly in the Heartbeats Project, which takes its data from the prior literature), the digital tools they used (e.g. the software Mathematica for the Webtext Project), prior writing that they mentioned (e.g. Mark’s award-winning webtext in the Webtext Project), public events or exhibits they identified as part of their process (e.g. Clay’s public talk on the Heartbeats Project), databases they identified (e.g. the AnAge Animal Ageing and Longevity Database for the Heartbeats Project), spaces that were meaningful to their work (e.g. the flexible classrooms for the Webtext Project), websites they pointed me to (e.g. the public page for the Heartbeats Project), and sites all of these are connected to in some way (e.g. SciStarter and the CitSci listserv for the Heartbeats Project).

In her chapter on her connective ethnography of the discipline of systematics, Hine (2015) also points to the importance of making connections with related regulatory frameworks, institutional structures, material culture, and even public talk (including related cultural events and trends). One example for my study has been the IACUC (Institutional

Animal Care and Use Committee), the counterpart of the IRB for the use of animals in research, which is a regulatory framework more familiar to and relevant for participants in the Heartbeats Project—though their citizen science practices have raised questions about whether the IRB might not also be relevant for their work, depending on the role citizen scientists are understood to take. In the case of the Webtext Project, institutional guidelines on tenure and promotion, as well as guidelines and position statements on digital publications put out by professional associations like the MLA and CCCC, were part of engaging with this case.

Data Analysis

My data analysis proceeded inductively, drawing on techniques from grounded theory (GT), specifically constant comparison (Glaser, 1965), and coupling these with textual analysis techniques, particularly content analysis and rhetorical analysis (Bazerman & Prior, 2003). One guiding principle of GT is that data collection and analysis are ongoing and cyclical rather than linear, with each driving the other (Charmaz, 2003; Glaser & Strauss, 1967). This cyclical movement is meant to keep analysis and theory accountable to the data and oriented toward participants' experiences and understandings rather than primarily toward my own—to develop theory that is “grounded.” Barney Glaser (1965) explains that “the constant comparison method is designed to aid analysts ... in generating a theory which is integrated, consistent, plausible, [and] close to the data” (p. 437). It is “*not* designed (as methods of quantitative analysis are) to guarantee that two analysts working independently with the same data will achieve the same results; it is designed to allow, with discipline, for

some of the vagueness and flexibility which aid the creative generation of theory” (p. 438). He goes on to describe four stages of the method, with the reminder that “previous stages remain in operation throughout the analysis and provide continuous development to the following stage until the analysis is terminated”: “(1) comparing incidents applicable to each category, (2) integrating categories and their properties, (3) delimiting the theory, and (4) writing the theory” (p. 439). The “comparison” at the heart of this method is at first the researcher’s comparison of observed incidents with each other to generate categories and then the researcher’s comparisons of incidents with the developing category to refine it (p. 440). Through simultaneous data collection and analysis, the researcher is also able to continually compare the social context with the emerging theory and to pursue relevant categories as they emerge (Charmaz, 2003). For example, theoretical insights developed while analyzing one interview informs the questions asked at the next interview.

So while this section describes data analysis separately from my data collection, both occurred cyclically and simultaneously. The four main data analysis techniques I employed were analytical memoing, coding, genre mapping, and textual analysis. In addition, I participant-checked my manuscript with all coauthors on the Webtext Project and the three main coauthors on the Heartbeats Project to ensure that I was representing their experiences accurately.

Analytical Memoing

As Johnny Saldaña (2009) points out, frequent memoing is a way to engage with research sites and to generate analytical insights (Saldaña, 2009). Glaser (1965) describes this

as an important component of the constant comparison method, as a way to “tap the initial freshness of the analyst’s theoretical notions and to relieve the conflict in thought” (p. 440). Memos are a way to facilitate reflexivity and to generate insights that can lead to additional, focused data collection. They are also a mechanism for documenting field experiences and impressions that recordings may not fully capture. Throughout both case studies, I wrote frequent analytical memos in two dedicated Word documents, with these totaling approximately 15,000 words for each. These memos yielded possible codes, theoretical insights and descriptions, questions for check-in interviews, and leads for textual analysis. They also served as a mechanism for capturing my engagement with online spaces as part of my connective ethnography. In cases when I handwrote memos while away from my computer, I later typed these memos into my Word files.

An example of an analytical memo that reflects on textual analysis and then guides subsequent data collection in the field comes from my December 1, 2015, memo preparing for Clay’s public talk on the Heartbeats Project at a science café. As part of my preparation, I collected and analyzed Clay’s blurb²⁴ from the science café series’ public website, noting that it provided more evidence of a focus on engaging the public with scientific inquiry over scientific findings:

One thing I’m noticing about Clay’s blurb is that it stresses DISCOVERY and MYSTERY. Rather than stressing the FOUND, it opens up scientific inquiry and

²⁴ I do not provide the text of the blurb here, since, as text published online and available through any search engine, that would compromise confidentiality. This is an issue I addressed by disguising my data throughout, while keeping enough of the substance to make sound connections between form, substance, and situation, including disciplinarity (Bruckman, 2002).

makes that the focus. Out of seven sentences in the blurb, three are questions (S2, S5, S6), one topicalizes question asking (S1), one uses a hedge to open up the inquiry and create mystery (S5), and the final sentence topicalizes inquiry with “surprisingly” and “unstudied” (S7), which function to emphasize the lack of existing inquiry on the subject thereby creating an open field of inquiry and scientific imagination. Only one sentence (S3) makes a claim about scientific knowledge and fact. This seems to reinforce the theme I’m seeing so far of using public science communication to cultivate INQUIRY over FINDINGS.

Later, I imported my analytic memos into my qualitative data analysis software in order to include them in my coding.

Coding

My coding proceeded simultaneously with data collection and analytic memoing. To facilitate this process, I used the qualitative data analysis software MAXQDA, which allowed me to import memos, field notes, transcribed interviews, texts, visuals, webpages, etc. for coding. MAXQDA supports audio files, visual files, video files, PDFs, and spreadsheets, as well as Twitter feeds, making it a flexible system for working with cases that include artifacts across many modes and media. An early and important decision I had to make was whether to create separate MAXQDA files for each case or to code both cases in a single file, which could allow me to compare the cases more easily and share codes between them. In order to help me account for each case’s distinctive dynamics, including its disciplinary dynamics, I opted for separate files. This contributed to different categories, insights, and fields for each

case, for example, leading me to examine the relationships *between* genres in the Heartbeats Project as a meaningful aspect of their digital composing. My simultaneous work on these two cases, however, led to reciprocal influence between the two and coherence for the project as a whole. My research question also lent analytic coherence, particularly during my second cycle coding.

My first cycle of coding proceeded inductively using a combination of *in vivo*²⁵ and initial²⁶ coding (Saldaña, 2009). This allowed dynamics and insights to emerge through my engagement with the data and field (including simultaneous data collection), leading to numerous codes that were grounded in the data, but not necessarily theoretically integrated. During second cycle coding, I conducted a combination of focused²⁷ coding for modes, media, and genre to ensure my research question would be answered and axial²⁸ coding to refine my codes and create relationships among them. At this point, modes, media, and genre became compositional lenses, helping me see a different dimension of each team's composing. Throughout, I employed the constant comparison method, gradually moving my point of comparison "*from* comparison of incident with incident *to* incident with properties of

²⁵ *In vivo*, which means "in that which is alive," refers to codes developed "from the actual language found in the qualitative data record" (Saldaña, 2009, p. 74). It is often used in "studies that prioritize and honor the participant's voice" (p. 74).

²⁶ Initial coding, also known as open coding, is often used in the first cycle of coding as way to begin making sense of data while staying open to multiple analytic possibilities (Saldaña, 2009, p. 81). Codes at this stage "are tentative and provisional" (p. 81) and can "alert the researcher that more data are needed to support and build an emerging theory" (p. 82). It is therefore a useful component of the constant comparison method.

²⁷ Focused coding is a second cycle coding technique conducted after more inductive first cycle coding approaches. At this stage, the researcher has made decisions about which codes are most analytically relevant and important and recodes the data with a focus on those codes (Saldaña, 2009, p. 155).

²⁸ Axial coding is a second cycle coding technique during which researchers reconcile and "reassemble" data that may have been separated into different (perhaps redundant) codes during initial coding. In explaining this type of coding, Saldaña cites Kathy Charmaz, who describes that axial coding "relates categories to subcategories" (as cited in Saldaña, 2009, p. 159).

the category which resulted from initial comparison of incidents” (Glaser, 1965, p. 440). This led to my final categories, which I coupled with my genre mapping and textual analysis to answer my research question. Saldaña cautions that the “mere numeric frequency of a code or category from data analysis and memos is not necessarily a reliable and valid indicator of a central/core category,” urging researchers to “be conscious of a code's *qualities* as well as its quantity”—“In some cases, less is more” (p. 166). For this reason, the codes presented for each case are the central codes with the most explanatory power for each team’s digital and multimodal composing processes and are not presented quantitatively (see Appendix F for my final coding scheme).

Genre Mapping

As I worked with the Heartbeats Project, it became apparent that the relationships between texts were particularly important for understanding their digital composing. While studies of individual genres have yielded important insights into a range of rhetorical communities and events, a number of genre theorists have found it productive to expand their focus to *groups* of genres, or “constellations” of genres (Swales, 2004), such as genre sets, systems, and networks, for a fuller account of the processes at work in the production of events, texts, and communities (Bazerman, 1994; Berkenkotter, 2001; Devitt, 1991; Swales, 2004). In this same vein, the concept of “intertextual chains” has been of use (Fairclough, 1992; Linell, 1998), though once routinized into fairly predictable, recurrent patterns of relationships between genres, these might best be thought of as “genre chains” (Swales, 2004).

My analysis of the Heartbeats Project drew on both of these forms of textual relationships, with intertextuality affording a view of the relationships between individual texts, and genre chains affording a view of recurrent patterns of communication. To map the intertextual relationships between the team's developing manuscript and other texts, I focused specifically on the concept of recontextualization to draw relationships between texts as I discovered them. Per Linell (1998) defines recontextualization as, roughly, "the extrication of some part or aspect from a text or discourse, or from a genre of texts or discourses, and fitting of this part or aspect into another context" (p. 145). This can involve direct quoting or reworking of material for another context, as well as "vague influences" between texts (p. 148). Linell explains that recontextualization, which is similar to Erving Goffman's notion of "reframing" (p. 145), is not restricted to written language and can be intratextual, intertextual, and interdiscursive (p. 146). Because of my research focus on the development of each team's digital text, I restricted my focus to intertextual recontextualization. For my purposes, this meant drawing connections between texts when I saw the overt citing or reworking of material, as well as when my participants spoke of less overt influences.

To map the relationship between genres, I focused on the rhetorical action of genres the team used. Here, I drew on J. L. Austin's (1962) concept of *uptake*, particularly as it has been put into conversation with genre theory by Anne Freedman (2002), who theorizes that "a text is contrived to secure a certain class of uptakes," and that "the uptake text confirms [the first text's] generic status by conforming itself to this contrivance" and responding in the expected way (p. 40). While warning against the impulse to systematize these utterance-

uptake relationships into rigid sets of rules, Freedman offers a rationale for looking at pairs of texts (and ultimately genre chains) as a productive way to understand both the relationships between genres in a given context and, through this, the social actions of individual genres. While genre chains focused on utterance-uptake relationships and intertextual chains focused on recontextualized material constitute different types of relationships between texts, both can become routinized and typified into recurrent relational patterns that can be usefully mapped. In the Heartbeats Project, genre mapping provided a useful analytical tool for mapping the pragmatic, rhetorical relationships between their texts, using the team's genre talk to help me map these relationships. For example, Clay spoke of the acceptance of a manuscript by a journal typically leading to a press release by Brendan, with the hoped-for uptake of this press release by the news media in the form of science news articles, interviews, blog posts, etc.

Textual Analysis

As I illustrated in my description of my memoing practices, textual analysis, specifically content analysis and rhetorical analysis (Bazerman & Prior, 2003), formed an ongoing part of my engagement with these cases and a recursive part of developing analytical insights and guiding my data collection. Textual analysis of drafts, for example, helped guide discourse-based interviews and prompted analytical memos that helped me develop theoretical insights. The example given in my section on memoing, for instance, illustrates content analysis meant to better understand the Heartbeats Project, how the team understood it, and how they presented it rhetorically to public audiences. As Thomas Huckin (2003)

explains, “Content analysis is the identifying, quantifying and analyzing of specific words, phrases, concepts, or other observable semantic data in a text or body of texts with the aim of uncovering some underlying thematic or rhetorical pattern running through these texts” (p. 14). Uncovering patterns through content analysis informed my later data collection, including my check-in interviews with team members. Similarly, I analyzed drafts and other relevant texts for their rhetorical moves (Selzer, 2003), like establishing exigence, which helped me understand how participants understood and negotiated their rhetorical situations. For instance, comparing rhetorical analyses of the Heartbeats Project team’s citizen science webpage with their research article manuscript draft helped me see how they constructed exigence differently for public and disciplinary audiences and therefore helped me understand how they conceived of and participated in disciplinarity. I also drew on intertextual analysis (Bazerman, 2003) in order to trace recontextualization between texts as described in my section on genre mapping. Finally, because disciplinary multimodal meaning making is part of my motivating question, my analysis of texts included “transcription” of multimodal texts, paying attention, in this transduction of meaning from multiple modes to my written language, to how modes created meaning together as “composite products” (Baldry & Thibault, 2010, p. 18). This process both made the non-verbal modes more codable in verbal terms and provided a mechanism for attending to how they operated semiotically and rhetorically. These transcriptions and the analytic memos they led to became part of my coding and led to my theory of differing multimodal practices based on disciplinary-epistemological traditions.

Together, the co-constructed data from my interviews, observations, text/artifacts, and connective ethnography along with my ongoing, simultaneous analysis through memoing, coding, genre mapping, and textual analysis provided rich views of the role of disciplinarity in each team's digital and multimodal composing, helping me develop situated answers to the question of how disciplinarity shapes and is shaped by scholarly digital and multimodal composing. Because of the emergent, co-constructed nature of each case's "field" and the important differences in participants' practices, the two chapters that follow differ somewhat in their presentation though they are informed by the same guiding principles and methodological framework.

Chapter 3

The Rhetorical Imagination at Work: Productive Rhetorics of the Classroom, Scholarship, Text, Disciplinarity

I submit for your consideration the following hypothesis: a text cannot belong to no genre, it cannot be without or less a genre. Every text participates in one or several genres, there is no genreless text; there is always a genre and genres, yet such participation never amounts to belonging.

—Jacques Derrida, 1980, p. 65

This chapter tells a story of digital writing in rhetoric and composition, a disciplinary context with much to say on the subject. Kathleen Blake Yancey's Chair's Address at the 2004 Conference on College Composition and Communication may have most explicitly called the field to action in embracing and addressing the "tectonic" shifts afoot in literacy and communication. Yancey's address, however, pulled together and was made possible by threads already present in disciplinary conversations and contexts spanning several decades: for example, a 1982 meeting of scholars interested in computers and writing at the University of Minnesota (Gerrard, 1995); a 1994 meeting of educators concerned about the future of literacy instruction in New London, Connecticut (Cope & Kalantzis, 2000); a meeting to begin work on a new online journal named *Kairos* at the 1995 Computers and Writing

Conference in El Paso, Texas (Lucas & Strain, 2006); a discussion of the relationships between texts and communication technologies at the 2000 biennial meeting of the Rhetoric Society of America in Washington, D.C. (Geisler, 2011; Geisler et al., 2001), and many other moments and discussions besides. Yancey's address connected these threads in a way that galvanized many in the field to fully embrace the role of rhetoric and composition in helping students develop as members of a 21st century "writing public" (p. 300), with renewed attention to the exigences created by shifting (and interconnected) technological, communicative, and educational landscapes. Ignore those shifts at our peril, Yancey warned. Ignore those shifts at the risk of becoming (or perhaps already being) "anachronistic" (p. 302). The present and future of rhetoric and composition, then, are closely bound to digitality, to "digital writing" and to the dramatically changed sociotechnical writing environments brought about by the widespread uptake of digital media (Grabill & Hicks, 2005, p. 304).

Speaking at the 2015 annual meeting of the Council of Writing Program Administrators, Cheryl Ball, longtime editor of the now twenty-year-old journal *Kairos*, reminded her listeners that future-oriented as the field may currently be, "The future of writing studies, my friends, arrived decades ago and has already settled in" (2015b, p. 1). The future and past Ball referred to was the development and publication of scholarly webtexts—a term used for born-digital scholarly publications among scholars in rhetoric and composition—at journals like *Kairos*, *Enculturation*, and *CCC Online*. While the field of rhetoric and composition has a long history of, to invoke Cynthia Selfe (1999), "paying attention" to the role of technology in literacy, its digital publications have played a

particularly important part in furthering that inquiry and expertise. As those in rhetoric and composition have embraced digitality as central to their disciplinary mission, many of the scholars tapped for their expertise in digital writing and digital rhetoric have developed and shared that expertise through the production of scholarly webtexts. Through the not-inconsiderable efforts of editors and authors like Cynthia Selfe and Cheryl Ball, scholarly webtexts have increasingly gained acceptance and value in contexts like tenure and promotion, perhaps also benefitting from parallel developments in digital publication across multiple disciplines related to the digital humanities. This acceptance, however, has been hard won, with debates over the value and sustainability of scholarly webtexts a recurrent theme over their twenty-year history—a history, it is worth noting, that almost exactly corresponds to the history of public access to the World Wide Web. And yet, despite the many challenges and false starts that dot that history (*Kairos* is the only online journal named above that has been publishing continuously since its start in 1996), both *Kairos* and the scholarly webtext have persisted, serving as a model and inspiration for other digital publication initiatives both in rhetoric and composition and beyond.²⁹

As digital writing moves to a more central position in the disciplinary work of rhetoric and composition, the scholarly webtext offers a useful window into the nature of that disciplinary expertise. To use Harold Innis's (1950) terminology, digital media are spatially biased, transmitting information across huge distances nearly instantly. This speed and

²⁹ Cheryl Ball, for example, is using the expertise gained through her work on *Kairos* to help shape the Vega Academic Publishing System, a free platform for open access academic publishing that will support “rich media publications” and “freedom in presentation” and that is slated for release in 2018 (Ball, 2015a; “Vega Academic Publishing System,” 2017).

seeming simultaneity encourage the perception that people use digital media identically across the globe, that there is something universal about digitality. Yet anthropological accounts of the way digital media are embedded in cultural spaces, practices, and technologies reveal incredible diversity (Coleman, 2010). Digital media practices among scholars in rhetoric and composition, then, are one set of practices among diverse practices across both scholarly and popular contexts. Examining the disciplinary values, goals, and constraints of those practices is useful for understanding both the expertise rhetoric and composition's practitioners offer students, as well as the lenses and biases we bring with us as our scholarship examines digital writing in other contexts, both disciplinary and otherwise. Much as Elizabeth Allan (2013) has pointed out on rhetoric and composition's disciplinary assumptions about multimodality, part of my intention here is to resist the notion that digital writing exists outside situated, cultural practices and interrogate how our disciplinary culture shapes and is shaped by our digital writing practices. Allan warns scholars of writing not to "take for granted that our perspectives on written, oral, visual, digital, or multimodal communication are shared by other disciplinary cultures, nor that our preferred rhetorical strategies will be compatible with their discipline-specific values and practices." Implicit in this is the idea that scholars of rhetoric and composition participate in a disciplinary enterprise that will inevitably play a role in their research and pedagogical practices, and in cross-disciplinary interaction. Examining those practices through the lens of disciplinarity, as I do here, then, can contribute to reflexivity on the tacit knowledge and values those in rhetoric and composition bring to their digital writing research and pedagogy, and shed insight on the present and future of that disciplinary enterprise.

The scholarly webtext is a useful point of entry for this sort of inquiry, because it has persisted as a named and recognizable type of publication over two decades despite numerous challenges and alternatives, demonstrating that it meets a recurring need for the rhetoric and composition disciplinary community. The fact that the community has developed a name to distinguish scholarly webtexts from other digital publications supports the idea that they can usefully be considered a genre and analyzed as such. One challenge to this is that scholarly webtexts seem to lack formal typification, but analyses of scholarly webtexts suggest that they are indeed typified, though in ways that depart from those of texts more closely related to their print-based antecedents (Basgier, 2011; Warner, 2007a, 2007b). Scholarly webtexts' typification may reside more in the typical relationship of formal elements to substantive and situational elements in a given text than in the recurrence of specific formal elements and their relation to each other. Taking a genre theory approach to scholarly webtexts provides a theoretical basis for understanding the recurrent "social motive" they enact, and "cultural rationality" they embody (Miller, 1984, pp. 158, 165). In genre theory, these become material indexes and mediators of social logics, forces, and processes that can otherwise seem ephemeral and inaccessible.

As material indexes, genres are tempting to analyze on a primarily formal basis even with a genre theory framework that valorizes the social. Analyses of published webtexts, such as Alison Warner's (2007a, 2007b) and Christopher Basgier's (2011), tend to take this approach, which can and have yielded important insights, such as Warner's identification of nodes (or "chunks") and linking as important formal strategies, or Basgier's insight that "the scholarly webtext specifically *calls attention* to the collaborative relationship between author

and user, a relationship that most print texts, and even some other new media genres, tend to render invisible” (p. 156). What is less accessible to such analyses, however, is the “not-said,” the “discoursal silences” that authors make decisions about as they develop their texts and that are such rich insights into the social matrix genre mediates (Swales, 2004, p. 86). Equally inaccessible are authors’ iterative constructions of their rhetorical situations (e.g. Berkenkotter & Huckin, 1995; Myers, 1985a, 1985b) or, to use Jenny Edbauer’s (2005) terminology, rhetorical ecologies. The access it provides to the “not said” forms part of the rationale I have established for focusing on a developing a scholarly webtext to shed light on how disciplinarity shapes and is shaped by the genre, and particularly the digital and multimodal practices connected with it.

The case examined in this chapter centers on the Webtext Project, a project worked on intermittently by four faculty collaborators over approximately two and a half years, though the formal engagement with the project I report on here is twenty-four months. The project continued a line of research on flexible writing classrooms begun by one of the scholars, Tara, but this time as a scholarly webtext, with hand-drawn conceptual maps and static diagrams of classrooms remediated as an interactive digital classroom. The programming and design expertise of a third collaborator, Mark, was critical to this process, and Christopher, a mathematician, was brought on as the fourth collaborator to aid with the quantitative analysis of data generated by users’ interactions with the digital classroom. While the first three collaborators self-identified primarily as scholars in “rhet/comp,” as rhetoric and composition is often shortened to, Christopher’s primary disciplinary identity was in mathematics, with WAC/WID and honors pedagogy/administration secondary

research areas for him. So although *Kairos*, as the target publication for the team, is a journal oriented toward scholars in rhetoric and composition, the collaboration had an interdisciplinary aspect to it, both within the team and in the audiences they anticipated reaching.

During the twenty-four-month period I report on here, the Webtext Project changed shape and direction a number of times, including several dormant periods and then revivals. Working in the scholarly webtext genre seemed to provoke both a sense of possibility for the team and a certain sense of trepidation. Digitality is many things, with layer upon layer of code and programming languages and technical devices building and interacting with each other to create the interfaces we use, and with long histories of social meanings and practices exerting their force on each of these. For most of us, our routine experience of the digital is highly structured, if invisibly so. Although we may feel incredible freedom in navigating digital spaces and constructing digital texts, we don't realize how structured those experiences are until a few layers of those structures are taken away. It is possible that the Webtext Project's numerous false starts were related to collaborative and interpersonal dynamics, professional and institutional factors, personal intrusions, or technical barriers. That said, participation in a genre that deliberately removed structure seemed to present the greatest inventional challenge for the team. While a number of structures, both technical and sociorhetorical, remain in composing a scholarly webtext, the freedom offered by the genre, and by *Kairos* specifically, seems akin to the exhilaration and trepidation felt by many when presented with a blank sheet of paper. In this case, however, the scholarly webtext genre not only presented the authors with a blank sheet of digital paper, but first invited them to

construct that sheet out of a range of possible materials. After all, apart from its wiki section, *Kairos* offers authors very few formal constraints or preexisting structures, instead encouraging them to be creative in their use of digital affordances for scholarly purposes (Kairos, 2016b).

In an early interview, Mark, the most experienced writer of scholarly webtexts, admitted that he doesn't "really play well with the genre term very much," not finding it to be "a very useful term." This instance illustrates the challenge of studying the writing practices of people in your own discipline. My genre theory lens was one familiar to him as a theory used by many in rhetoric and composition, but was not one he used himself or found theoretically useful. For Mark, the scholarly webtext afforded an opportunity to break convention and draw attention to it, to make, in the Russian formalist tradition, the ordinary "strange." Genre felt antithetical to this enterprise, perhaps because he associated it with an impulse to regularize and systematize writing. At the risk of offending Mark's sensibilities, however, I would submit that it is difficult to understand his transgressive purpose without genre. And indeed, this goal of "making strange" is reminiscent of Tzvetan Todorov's (1976) response to French literary theorist Maurice Blanchot's assertion that, for literature, genre was a thing of the past, with modern work breaking free from convention. Todorov's response is worth quoting directly:

The fact that a work "disobeys" its genre does not make the latter nonexistent; it is tempting to say that quite the contrary is true. And for a twofold reason. First, because transgression, in order to exist as such, requires a law that will, of course, be

transgressed. One could go further: the norm becomes visible—lives—only by its transgressions. (p. 160)

Todorov anticipates Jacques Derrida's (1980) related observation in this chapter's epigraph that "there is no genreless text; there is always a genre and genres" and "yet such participation never amounts to belonging" (p. 65). For transgression to occur, for making strange to occur, some kind of ordinary and typical, some kind of typification, must exist. And that transgression can itself become recurrent and typified. Transgression needs genre and can become genre.

The Webtext Project's development as a scholarly webtext, then, is productively understood through genre. Specifically, while previous analyses of the scholarly webtext have characterized it as a genre defined by its rhetorical *enactment*—its best examples formally enact their arguments—my own analysis of best examples coupled with my ethnographic work pushes me to go further. The scholarly webtext is characterized by *reflexive performativity* in the service of a hermeneutic hypermediacy³⁰—a hypermediacy that draws attention to mediation, modality, genre, and composition as part of the disciplinary project of rhetoric and composition, a project increasingly focused on digitality. As a "dappled discipline" that has been pluralistic since its beginnings (J. M. Lauer, 1984), rhetoric and composition also has a strong empirical tradition that has interplayed with the humanistic in generative ways (Berkenkotter & Huckin, 1995b). The findings I highlight in

³⁰ Hypermediacy is a term coined by Bolter and Grusin (1999) to describe a cultural logic that "multiplies the signs of mediation" and "makes us aware of the medium or media" as a way to try to "reproduce the rich sensorium of human experience" (p. 34). They put this logic in opposition to immediacy, with hypermediacy creating "opacity" and immediacy, "transparency."

this chapter demonstrate that while the scholarly webtext genre provoked the exploration of inventive possibility—of classrooms, of text, of scholarship, and even of disciplinarity—its generic invitation to explode convention and genre, to deliberately transgress, in the service of reflexive performativity presented enough of a rhetorical challenge to encourage these experienced writers to fall back on familiar forms of disciplinary participation. Instead of focusing on the hermeneutic forms of disciplinary participation typified in the scholarly webtext genre, Tara, Joy, and Christopher focused on the empirical possibilities afforded by digital media, experimenting with the interactive digital classroom Mark prototyped for them in Flash and ActionScript as a data collection tool. These results highlight both the generative potential of rhetoric and composition's pluralistic traditions for digital practices and scholarship, and the immense difficulty of forming productive collaborations between members of the discipline who participate in its different epistemological traditions. For rhetoric and composition, mode and media are both subject of inquiry and tool for inquiry and the interplay between the two can lead to unpredictable outcomes that are disciplinarily distinctive.

In the sections that follow, I begin with a brief description and history of the scholarly webtext to orient those unfamiliar with it before proceeding to a narrative overview of the case in my *Narratio* section. I then proceed to my first compositional lens, mode, analyzing the multimodal dimension of the team's composing and identifying several distinct strategies for their use of modes. My next section takes up my second compositional lens, medium, examining in particular the role of digital media in the team's composing. Finally, I use my third compositional lens, genre, to tie my analysis together and connect the team's

multimodal and digital composing practices with the social context of their discipline. I include a brief conclusion section, *Recapitulatio*, at the end of the chapter to summarize my analysis of the case.

A Short History of the Scholarly Webtext

For those unfamiliar with rhetoric and composition's scholarly webtexts, this section provides a brief outline of the genre and its history.³¹ The year 1996 marks a significant point in this history. In rhetoric and composition, this year was marked by the establishment of two major venues for online scholarly publication: the journal *Kairos* (Kairos, 2014) and the online version of the existing journal, *Computers and Composition* (Computers and Composition, n.d.). The following year continued this movement with the establishment of another native digital journal, *Enculturation: A Journal of Rhetoric, Writing, and Culture* (Enculturation, n.d.), as well as *Kairos*'s Best Webtext Award (Kairos, 2014).

As described earlier, this trend was not limited to rhetoric and composition. Other academic disciplines responded to the opportunities presented by the World Wide Web similarly, founding other online journals, such as, in literature, *Romanticism on the Net* in 1996 (now known as *Romanticism and Victorianism on the Net*) (Sinatra, Felluga, Gidal, & Goodlad, 2012). A number of articles across disciplines examining the state of and potential of scholarly publishing online also appeared around this time, such as Stone's (1998) article examining this issue for anthropology. Stone's assessment about the state of social science

³¹ Readers familiar with the scholarly webtext may wish to move directly to my narrative description of the case in the *Narratio*.

web-based scholarship offers a glimpse of the web at that time. He finds that, “most journals have Web ‘shopfronts’ with tables of contents and information for authors,” and that “Some now have full text of articles, and some journals exist only online” (p. 4). He points out, however, that, “In the overwhelming majority of cases, this new medium is used to propagate scholarship differing little or not at all in form from conventional printed work” (p. 4). Stone paints a vision of a digital scholarship that makes full use of the affordances of digital media and networks: “Web-based scholarship provides opportunities for qualitatively different kinds of scholarly products, embodying enhancements that range from the convenient to the revolutionary” (p. 4). A similar interest is evident in a 1998 article in *Romanticism on the Net*, with the author discussing how, “we continue to discover [electronic media’s] great potential for education, scholarship, and communication of various kinds” (Thomson, 1998, para. 3).

The number of new digital journals and of articles exploring the potential of digital scholarship between 1996 and 1998 point to this as an “occasion” or kairotic moment for genre innovation driven by technological change. While the Internet had been open to the public for several years already, this seems to have been something of a tipping point in how widely the Internet was used, reminiscent of Fischer’s (1992) work on the history of the telephone and how individuals’ choices to use the technology could, together, become aggregated into a larger structural constraint (or opportunity) for other users. The existence of a new technology may not be enough in and of itself to drive generic change, but when combined with extensive social use seems to become a significant force for change. In the

case of digital scholarship, the combination of new web-based media and extensive social use of those media for academic publishing seems to have created this kairotic moment.

Kairotic moments, however, still require individuals to define and respond to them. The story behind the 1996 founding of *Kairos*, whose name clearly gestures at the opportune moment created by digital media and the browsable Internet, supports this idea. In an interview in honor of the journal's 10th anniversary, Mick Doherty, its founding editor, explains that, "The journal's origin was in fact one of revolution" in academic publication (as cited in Lucas & Strain, 2006). In an earlier essay, Doherty (n.d.) describes how as a graduate student interested in writing and technology, he saw web-based scholarly publication as a way to "push many envelopes—of theory and pedagogy, of technology, of composition, and of professional scholarship," and to contribute to the momentum of this area of writing studies. In the same set of 10th anniversary interviews, the journal's first managing editor, Michael Salvo, also reflects on how they perceived that moment in academic publication, particularly, "the inability of print publication to realize what we were learning to do with composition in new media" (as cited in Lucas & Strain, 2006). Salvo describes "how traditional print production was growing increasingly expensive and untenable" and how, "Rather than wait around for someone—anyone—to create a 'proper' digital journal (whatever that might mean) we decided to do it ourselves, without adult supervision as it were, and just make something, see if we could make something fly." The digital scholarship Doherty and his collaborators developed and that they dubbed "scholarly webtexts" was deliberate and self-conscious in using digital media for scholarly work that could not be reproduced in print—work that was self-consciously *born-digital* scholarship.

Twenty years later, *Kairos* and its scholarly webtexts continue, while many other digital journals begun during the same time period have disappeared (Ball, 2015b). In her 2015 plenary at the Council of Writing Program Administrators annual conference, Cheryl Ball (2015b) attributes this to careful planning on the original editors' parts to build "the technical infrastructure of the journal to withstand the whims of the Internet." She lists three main guidelines *Kairos* has put in place to promote sustainability, including that webtexts cannot include elements hosted on third-party sites, that authors try to make use of non-proprietary formats like HTML5 and CSS rather than propriety media like Flash, and that embedded media must be provided to *Kairos* for archiving and editing. The fact that *Kairos* includes technical guidelines for authors related to mark-up languages stands out from other journals and underscores how different their approach to born-digital scholarship has been from the more usual PDF-based print genre remediations seen elsewhere. *Kairos's* submission guide invites authors to "think carefully about what unique opportunities the Web offers" and does not "suggest an ideal standard" (Kairos, 2016a). Their style guide creates certain benchmarks related to accessibility, usability, and sustainability, including that "all non-wiki submissions require an HTML page," but also conveys a commitment to technical flexibility, with rhetorical considerations dominating: "We *strongly encourage* authors to use standard, non-proprietary formats (HTML5, CSS, etc.) rather than Flash or other embedded proprietary media or template engines" (Kairos, 2016b, emphasis added). The guide conveys a sense of technical and scholarly rigor, but also an openness to editorial persuasion—with the right rhetorical and scholarly reasons, authors are free to experiment in ways rarely found at other journals. Drawing a connection between the journal and the more recent digital

humanities movement, Doug Eyman and Cheryl Ball (2015) point out how much *Kairos* stands out even from this crowd noting that in most online DH journals, “you will find only print-like articles talking *about* media, not *with* and *through* new media” (p. 69). Digital humanities projects that resemble scholarly webtexts as published at *Kairos*—such as John Wall’s (2014) Virtual Paul’s Cross—certainly exist, but generally outside the auspices of a serial scholarly publication like a journal and the credibility and sustainability such an association generally confers.

At *Kairos*, scholarly webtext authors are encouraged to make deliberate design choices fitted to their scholarly arguments (see Figure 3.1), something authors have become more and more sophisticated about over the course of *Kairos*’s history.



Figure 3.1. Erin Anderson's (2011) award-winning scholarly webtext, “The Olive Project”
 Erin Anderson’s (2011) “The Olive Project,” for example, a webtext that that was recognized with a *Kairos* Best Webtext Award, examines oral history and memory as forms of

composition, particularly the “irreconcilable gap between a life lived and a life narrated,” raising questions about sequentiality, authority, and agency through its nonlinear, multimodal design. Notably, the project does not reproduce the visual conventions associated with most websites—there are pointedly no banners, buttons, drop-down menus, or navigation bars. Instead, to navigate the project, the reader must hover her mouse over one of the three images, allowing her to enter the “read,” “watch,” or “scrolling archive” portion of the project. The disorienting experience of having to find navigational paths and create one’s own sequence and order seems to be part of the point.

Indeed, Eyman and Ball (2015) explain that “Since its first issue, the mission of *Kairos* has been to publish scholarship that examines digital and multimodal composing practices, promoting work that *enacts* its scholarly argument through rhetorical and innovative uses of new media” (p. 66, emphasis added). This idea of enactment or performativity recurs throughout conversations of *Kairos* scholarly webtexts, including on the journal’s website and in scholarship that analyzes the digital composing it encourages and supports. In her own webtext, for example, Allison Warner (2007b) describes some of the rhetorical features *Kairos* webtexts commonly exhibit based on her analysis of *Kairos* Best Webtext Award winners up to 2006, offering a rubric of features that review committees could use to assess digital scholarly work. She splits the rubric into two parts, print-based and web-based conventions, offering the range of variations that might be seen in scholarly webtexts for those conventions. Among the web-based conventions, she includes “Form/Content Relationship,” explaining that “A formal or form-based enactment of the content occurs when the organizational structure of the web-based text demonstrates and/or

reinforces the content of the text” (sec. /tool/cat-b/form-content.html). This seems to imply that print-based genres do not enact their arguments formally, though what Warner, Ball, Eyman, and others seem to be underscoring with the concept of formal enactment is that webtexts *draw attention to* how form performs argument in ways that other genres do not, since those form/content relationships tend to have become naturalized for both authors and readers through typification. Christopher Basgier (2011), in an analysis informed by genre theory, in fact points this out, calling it the scholarly webtext’s “formal reflexivity,” a rhetorical action he situates in a culture of elaborationism that achieves its cultural values in its texts in part by creating what Craig Stroupe calls an “awareness of the medium itself, whether visual or verbal” (as cited in Basgier, 2011, p. 154). This culture of elaborationism, a term Basgier borrows from Stroupe, is one they both argue operates in English Studies more broadly, situating scholarly webtexts within a larger tradition of literary practices that “value complexity, irony, connotation, and deferred meanings” in service of critical consciousness of text, reading, writing, and now, design (Stroupe as cited in Basgier, p. 154).

In addition to formal enactment, Warner’s (2007b) analysis reveals that scholarly webtexts make use of certain conventions that are recognizably derived from print-based scholarly genres, including conventions related to content, arrangement, documentation, and tone. Among the web-based conventions she identifies, she includes structural design, navigation design, link strategy, node strategy, visual design, and multimedia incorporation. James Purdy and Joyce Walker (2012), similarly analyzing *Kairos* Best Webtext Award winners, also include formal enactment as one of the ways scholarly webtexts achieve their arguments, but add four other rhetorical strategies that are sometimes achieved in ways

connected to traditional scholarly genres and sometimes achieved in distinctly digital ways: explicit argument; speculation; implicit association; dialogic exchange; and formal enactment. Adding to these analyses from her experience as editor of *Kairos*, Cheryl Ball (2016) outlines five features of webtexts that she sees as most descriptive of them and most stable over the twenty years *Kairos* has been publishing:

- Authors design their own webtexts, either individually or in collaboration with co-authors or designers.
- The design of the webtext must convey the author's scholarly argument and not be gratuitous.
- A webtext's purpose is to convey new knowledge in a discipline through the presentation of research. It is not meant to function as a primarily aesthetic method of conveying creative practice, such as with examples of electronic literature or interactive multimedia for artistic effect.
- Websites can incorporate any number of design elements and media appropriate to the World Wide Web (e.g., java script, links, graphics, and, more recently, streaming media, etc.), as long as that inclusion is rhetorically in line with the scholar's argument.
- A webtext cannot be printed without losing its argument.

(Ball, 2016, p. 55)

Ball's list of features begins to get at the disciplinary function of scholarly webtexts for those who participate in rhetoric and composition by contrasting them with webtexts in other disciplines that may have primarily aesthetic, creative aims. For Eyman and Ball (2014),

scholarly webtexts as practiced at *Kairos* serve the disciplinary purpose of providing a “deeper engagement with [the] very rapid shift in modes, genres, and media of textual production” and for “building literacies and research in writing and writing studies” (p. 114). The fact that webtexts, with their reflexive attention to modes, media, and genres, can function as both method of inquiry and subject of inquiry for those studying rhetoric and composition may help account in part for *Kairos*’s persistence over its twenty years, though Ball’s account of the spotty publication record of other born-digital journals in rhetoric and composition suggests this is only part of the story (Ball, 2015b, 2016), a story she and Doug Eyman have illuminated with their attention to the scholarly, social, and technical infrastructures scholarly webtexts are embedded in (Eyman & Ball, 2014, p.114).

Narratio

From: Mark Hirsch <mhirsch@xxx.edu>

Date: Sun, Dec 14, 2014 at 5:33 PM

Subject: Classroom > Almost done

To: Joy Tobias <joy_tobias@xxx.edu>, Tara Janosik <tjanosik@gmail.com>

Joy and Tara,

I'm close to finished. All I need to do is to create a database table to save the data that users submit. I think it's time for you to get me in touch with your mathematician (Christopher?), so he can tell me how I can structure the data for his convenience. I'm leaving for the holidays next Monday, fyi.

I've attached a screenshot, so you'll understand the data list below. You'll notice that for each piece of furniture placed in the classroom you get its x, y, and rotational values. You also know if they deleted any pieces along the way. I assume that's good enough for now?

I still have to add submit/reset buttons and write a little more explanatory text. If you click on a piece of furniture, you can then drag it around. If your mouse is hovering over a piece, you can use the left/right keys to rotation it and the "r" key to delete it.

Here's the data for the screenshot:

1.

Type: Tablet Arm Chair

X position: 637

Y position: 489

Rotation: 90

2.

Type: Tablet Arm Chair

X position: 633

Y position: 401

Rotation: 90

3.

Type: Tablet Arm Chair

X position: 633

Y position: 316

Rotation: -90

4.

Type: Instructor's Lectern

X position: 723

Y position: 256

Rotation: 0

[...]

In recent years, rhetoric and composition has greatly expanded its understanding of what constitutes composing. Many of us would readily understand the email exchange quoted above as part of composing. As an email between coauthors about important decisions regarding the composition of a text—a text that produces data and requires computation and interaction, but a text. This is not to say that an expanded, multimodal understanding of composing is without debate: Steven Krause, for example, expressed misgivings about expanding the discipline's focus to composing multimodal texts in 2004 (as

cited in Palmeri, 2007, p. 8), and again about three-dimensional objects in 2011 (Krause, 2011), both times citing misgivings about disciplinary expertise and about the displacement of pedagogical attention from alphabetic literacies. Krause's misgivings are certainly not his alone. That said, the field as a whole has greatly shifted its definition of composing beyond what Krause calls "words in a row" literacy in recent years. Jason Palmeri (2007), for example, noted a decade ago that it was already "rare" at that point "for scholars to publish formal articles opposing digital multimodal composing" (p. 9).

But how do we understand this in context of what we know about disciplinarity? Palmeri's (2007, 2012) work has put the issue of multimodal composition in the context of rhetoric and composition's disciplinary history, finding that while the terminology and theoretical basis for the field's attention to multimodal composition has changed, the recent attention continues a longstanding thread running at least as far back as the 1960s. Multimodal composing, however, is not synonymous with digital composing, something stressed by both Jason Palmeri and Jody Shipka (2011). As the requirements of digital media for disciplinary work become more significant and as born-digital writing becomes more routine, it seems prudent to turn the same sort of attention to how these function in rhetoric and composition's disciplinarity, both to make explicit the expertise the discipline brings to understanding digital writing and to reflect on the disciplinary assumptions we may bring as we teach digital writing or work with faculty across disciplines to integrate digital writing in their teaching.

I received the email reproduced above toward the beginning of my work with the Webtext Project. I had been in conversation with its authors about the project for three

months or so, with official data collection begun for just over a month and was starting to get my bearings on what the coauthors were trying to compose. Though, of course, what they were trying to compose was, as it is for most if not all writing, a work in progress. In the email quoted above, we see Mark sharing the first iteration of a program he had written using Flash/ActionScript with Joy and Tara, the two authors who had initiated the project. The work the project originated in centered on classroom design and flexible classroom spaces, work Joy and Tara had approached empirically and administratively and that had included the design of two flexible classrooms in the writing program Joy administered. The Webtext Project was envisioned as a continuation of that work as a webtext. The iteration Mark shared here was of a program that would present users with an interactive diagram of a classroom they could design with a set of furniture provided. Composing for this context was new for Joy and Tara and brought with it an unfamiliar set of possibilities and constraints, including how to decide on the role this program would play in the final webtext. For Mark, an experienced writer of webtexts and computational objects, the more unfamiliar aspect of the work was the empirical. While all self-identified as members of rhetoric and composition, the three spoke remarkably different languages and drew on remarkably different types of expertise.

But the diversity of the coauthors did not end there. Earlier in the fall, Joy had presented some of the empirical findings of the larger flexible classrooms project at a regional writing program administration conference. During this presentation—an informal affair with presenter and audience seated together around a conference table cobbled together from several small tables found in the mountain lodge’s rec room—Joy had discussed the

next step for the project, the interactive webtext, confessing self-deprecatingly that “If it’s not in Wordpress, then I don’t know how to do it. I’m not very adept at coding.” She did, however, lay out a vision for how the webtext could help gather more data about student and faculty perceptions of flexible classroom spaces, potentially adding demographic data that would shed insight on how prior educational experiences might influence responses to the space. She and Tara had conducted ethnographic research on multilingual students’ experiences of the space and they were both eager to extend that research to other groups. One thought was that the webtext might go beyond *presenting* data in an interactive way, but actually *collect* data from readers on their conceptualization of classroom spaces and feed that data back into the study and webtext. This possibility, in fact, caught Christopher’s attention during Joy’s presentation. Christopher, a mathematician at another state university, had a strong interest in writing and frequently attended rhetoric and composition conferences and published in its journals. The potential for collecting spatial data from readers’ interaction with the webtext and the problem of how to analyze that data, which was potentially dynamic and therefore doubly difficult and fertile, was an interesting problem that combined his areas of expertise well. As the administrator of an honors program and someone devoted to pedagogy, the subject of learning spaces and the possibility of intervening in administrative conversations on learning spaces was also quite attractive. All this led Christopher to linger after Joy’s presentation, ultimately offering his help on the data analysis portion of the project.

On 15 December 2014 at 21:26, Joy Tobias <joy_tobias@xxx.edu> wrote:

Hi Mark! I'm copying Christopher on this email, too, so that he can weigh in. Thank you for all of the work that you've done on this!

Christopher, is there any background info you need to respond to Mark's question about how to structure the data?

Joy

All three coauthors had welcomed Christopher's offer, equally eager about the prospect of feeding analysis of dynamic user data back into the project and of having someone on board with the expertise to do that. After Christopher's offer to join the project, Joy and Tara had shared some of the conceptual maps of classrooms they had collected from an earlier phase of the project—maps that participants had created by taping pieces of furniture onto paper diagrams of a classroom and that they had analyzed qualitatively. Not intending to analyze them statistically, they had not considered the analytical constraints imposed by paper, but instead focused on its affordances for participants, in freeing them from overly constrained design options, and on the lower barrier to access for their research budget. Joy remorsefully recounted how “when Christopher [had] wanted to go through and statistically analyze some of the aspects of these maps, he actually had to hand code it and enter it in.” Luckily the data set was small. By the time of the quoted December email exchange, then, Christopher had a good sense of the study and the kind of spatial coordinates he would need to provide data that would be usable in his statistical analysis program.

*From: Christopher Tanner <christopher.tanner@gmail.com>
 Date: Tue, Dec 16, 2014 at 9:44 AM
 Subject: Re: Classroom > Almost done
 To: Joy Tobias <joy_tobias@xxx.edu>
 Cc: Mark Hirsch <mhirsch@xxx.edu>, Tara Janosik <tjanosik@gmail.com>*

Dear Mark,

This looks fantastic! Thank you so much for putting this together.

I'm not sure I completely understand the data...it looks like a single piece of furniture might be represented more than once? Or perhaps each piece's intermediate locations are recorded as well? I think it would be best to have just a single (x,y,r) stored for each piece, maybe corresponding to the piece's end location...setting it to $(0,0,0)$ if the user deletes that piece?

The application I'll be using to process, presumably, is Mathematica, which should be able to handle most basic representations of data, but if it's placed in a Mathematica-friendly format from the get-go, that would be great. Mathematica would handle a list of lists particularly well, maybe listing each piece in an arrangement as a 4-tuple, the first entry corresponding to the type of furniture it is (e.g., 1 = "mobile white board," 2 = "tablet arm chair," etc.). Then we'd have the dataset above represented

$\{\{2,637,489,90\},\{2,633,401,90\},\dots\}$

for instance.

Does this make sense?

Thank you again for helping put this together!

Take care,

Christopher

While Joy and Tara had provided the visual resources needed for Mark to design the interactive classroom, drawing on the visuals from Tara's dissertation on flexible classroom design, which had originated in AutoCad and then been further manipulated in PowerPoint, Mark needed Christopher's statistical expertise in order to make decisions about the numeric data that would be gathered from users. This is also where our conceptualization of the

project as a text starts to stretch a little, and perhaps for some, to break. We are not accustomed to this particular type of interactivity from texts. Texts are interaction—utterances in Bakhtin’s “chain of semiosis,” “social actions” in Carolyn Miller’s (1984) theory of genre, or “literate actions” in Charles Bazerman’s theory of textual interaction—but traditionally, texts do not also gather data from readers. Readers respond through utterances and uptakes of their own (perhaps as text), but texts do not typically record data from readers (or users?) in a systematic, designed way that returns to the author. That is not what is conventionally meant by text as interaction.

From: Mark Hirsch <mhirsch@xxx.edu>

Date: Tue, Dec 16, 2014 at 10:18 AM

Subject: Re: Classroom > Almost done

To: Christopher Tanner <christopher.tanner@gmail.com>

Cc: Joy Tobias <joy_tobias@xxx.edu>, Tara Janosik <tjanosik@gmail.com>

Hi Christopher,

I understand what you are asking about. From my standpoint, you want a 2d array. The data in that sample are the last x,y, and r for each piece of furniture, so we're on the same page. I'll start working on this tomorrow evening and be in touch by Thurs. I think I might have to write stuff to a flat file because of security issues w/sql calls over http to servers on our campus. I'll write it a .txt file in the curly-based way you mentioned, no problem.

Mark

As the collaboration proceeded, most communication took place through email and video conferences since Christopher was at another institution and Joy moved to another institution after their first academic year working on the project. I regularly met with individual members of the team to check-in with their progress and had access to materials that were developed and stored in Google Drive, but group meetings were infrequent. While each

member of the team was enthusiastic about the Webtext Project, which seemed to offer so many innovative possibilities, what excited them about it and the approaches they brought to developing it was colored by their disciplinary backgrounds and made collaborating both exciting and difficult. By July 2015, little progress had been made and a Skype meeting was called to better define their goals and plans for moving forward. Christopher, as the mathematician, brought up his excitement about the possibility for crowd-sourcing a large data set through the published interface:

Christopher: I would love more data. A larger data set that could yield statistically significant data. The small data sets that I've gotten so far are ... are too small to really notice any trends, any statistically significant trends. I mean, the two sorts of data that I can think of would be just sort of a crowd-sourced *Kairos*-like project where we are getting data from some large body of people, whether it's the readers of *Kairos*, who are more than likely on the instructor end. Or if there's some way of gathering data from students.

While Christopher expressed some interest in gathering data from students and willingly aided his coauthors once the decision had been made to focus on students, the possibility the interactive classroom afforded for collecting data dynamically and on a larger scale seemed to interest him the most.

Mark, on the other hand, at this same video meeting expressed willingness and interest in facilitating this data collection, but seemed more excited by the interactivity of the piece and what that interactivity would offer readers and potentially other teachers presumably wishing to use it to provoke discussion and reflection on learning and classroom

space with their students or with colleagues. Identifying statistically significant trends was of less interest:

Mark: The audiences for academic journals are so small in the grand scheme of things. ... For all the work that we're going to be doing toward this thing, I kind of like the idea that it would—that the revision of the software program would serve two purposes. One, it would be an interactive piece within the *Kairos* publication that people could add their data to and whatnot. But also it could be an open-source software project that could be available to any instructor.

After the meeting, Joy emailed the group with a summary of the action items identified in the video conference call, which had concluded with a decision to move forward with collecting data from students who had had writing classes in flexible classrooms, potentially at both Joy's new institution and at Mark and Tara's institution. Because both Joy and Tara had a great deal of expertise in student-based classroom research, this decision seemed to be the most comfortable for them and to make the task of defining the webtext's focus and composition more manageable since it would report on existing data, allowing them to draw on their extensive genre knowledge of empirical research articles. Dynamically-collected data, while attractive, made the task of composing the webtext more daunting since it could draw less on empirical genres designed to report on *completed* data collection and analysis, and would instead require them to invent written solutions to the problems created by dynamic and ongoing data collection.

*From: Tobias, Joy <tobias@email.newuniversity.edu>
 Date: Wed, Jul 29, 2015 at 12:57 AM
 Subject: Following up on call today
 To: Tara Janosik <tjanosik@gmail.com>, Mark Hirsch <mhirsch@xxx.edu >, Christopher Tanner <christopher.tanner@gmail.com>
 Cc: Gwendolynne Reid <gcreid@ncsu.edu>*

Thanks, everyone for hanging in there while we figured out the problem with my Skype call! And I apologize for my clear inability to set up a call on my own. Ha! Thanks for saving the day, Christopher.

Next steps:

- Develop review of literature and guiding research questions*
- Write survey Questions: Christopher, Tara, and Joy (develop survey questions for students—and teachers?—when we are collecting data)*
- IRB: Get IRB approval from [university names omitted] for data collection from students (Tara and Joy)*
- Collect more data: Once IRB approval is secured, begin collecting data*
- Software: Rewrite the software program so that it is in a web interface, accessible anywhere (probably would take a month to create the front end and tie it into a database for collecting data; Mark could potentially start on this the third week of September)*
- Kairos webtext: Start thinking about what aspect of the project the webtext might focus on*

Feel free to edit/add to this. I just wanted to capture some of what we talked about so we can keep moving forward. It was great to talk to you all today!

Joy

During the fall of 2015, Christopher, Tara, and Joy worked together in a shared Google Doc to draft research questions and survey questions and to think through their sampling. They then scheduled another group video conference call for November 2015 to evaluate what needed to be done. Unfortunately, Tara was struck with an unexpected and serious illness and was in the hospital during this meeting, which ran considerably shorter than their July meeting. While they had made some progress over the fall, working across epistemological

traditions meant some disciplinary tools, vocabulary, and assumptions needed to be explained and made it harder to assess what had been done and what more needed to be done. Mark, for example, had had a busy fall and had not made progress converting the Flash/ActionScript prototype to a web-based version and was clearly still trying to understand where and how his work fit within their empirical work. The methodological vocabulary his collaborators enlisted did not seem to cue the same sorts of knowledge and activity for Mark as for his coauthors (e.g. instrument, pre- and post-test), and while he ended up using those terms after his coauthors did, he seemed less comfortable doing so. During the November video meeting, for example, we see Mark coming to the realization that “instrument” refers to the interactive classroom he is coding and explaining some of the constraints he is working with in converting the Flash/ActionScript prototype to a web-based version using HTML/CSS/JavaScript:

Mark: So, um, I've got a deadline that ends this month and then after that I can put whatever time we need into creating—I'm assuming when you say “instrument,” you're talking about me. I mean, not “me,” but, you know, “the thing.” So I can make the instrument, you know, however we need it, starting December 1st and have it done pretty soon after that. I'm thinking about bringing in one of the [graduate] students to help me with the CSS side of things, you know, with the markup side. The technical—technically, the project breaks down into two layers, so to speak, really well, and it lends itself to bringing in a student to get some experience and opportunity.

Christopher: Awesome.

Mark: Frankly, I don't really know CSS that well. I can do the JavaScript really well, but the CSS ... So, if that's okay with you all, um, once this deadline passes at the end of this month, I can check in with you to see what kind of specs you're coming up with for what you want out of the instrument and then I can make sure it's cool to go find a student with whom to work.

Defining the interactive classroom as an “instrument” for classroom-based research took it squarely outside of Mark’s usual compositional practices, which came out of a humanistic, hermeneutic tradition, and perhaps led him to volunteer less of his genre knowledge about scholarly webtexts, since it seemed his coauthors were more interested in an empirical approach. Focusing on students’ experiences of classrooms also cued common classroom research practices like pre- and post-tests, which Christopher had some experience with, since he regularly engaged in Scholarship of Teaching and Learning, but which Mark seemed less familiar with:

Christopher: No, I don't know that, I don't know that we discussed that [when to collect data]. I don't know. It's the sort of thing that we could do pre- and post-, because, I mean, actually, I think students might have some very different conceptions about what they would be doing at the start of the semester, then actually having done it, uh, will respond differently. I think one of the workers is at my door. I apologize. I'll be right back. I'll mute my end... [walks off screen]

Joy: Okay. So what I was thinking, and the reason I asked that [when they should collect data], Mark, is I was trying to figure out if it would matter if they [Tara and Christopher] want to actually use the app pre- , like at the beginning of the semester, then we might want to pilot it in December with a few students. But if we wouldn't actually be collecting data in that way until the end of the semester, then we have a little bit more time. I don't—but I'm not sure exactly what they were thinking of. I can see reasons for doing the pre- and post- and reasons not to.

Mark: If the, like, let's say you were thinking, like, December 15th you want to do some pre-, um, collection. I mean, if I can nuance the Flash version for that and, yeah, I think I can do whatever we need within the two weeks, but, um, yeah, to do the HTML5 version, which is really what I think we want, big picture, I think more realistically it would like early January with vacation and travel time and all that baked in. ... While Joy is putting in that comment, I've got a question, Christopher, for you regarding your IRB stuff? Is IRB going to want a working prototype of the data collection instrument in order to approve IR— or approve things?

Considering how his software would fit into the IRB's concerns was clearly novel for Mark, who was not sure whether they would want to see it or what sorts of questions they would ask about it (e.g. regarding data collection, transmission, and storage). So while framing the interactive classroom as a data collection instrument enlisted genre knowledge and activities that were more familiar for his coauthors, easing some cognitive burden, for Mark this added

many layers of complication since most of his previous work did not fall under the U.S. Department of Health and Human Service's Policy for Protection of Human Research Subjects, which defines research as "a systematic investigation, including research development, testing and evaluation, designed to develop or contribute to generalizable knowledge" (Department of Health and Human Services, 2009). Because his work tended to be interpretive and designed to create critical reflection in his audience, the IRB did not consider it research with human subjects and so he had not had to consider these sorts of questions.

For a variety of reasons, the project did not progress very much in spring 2016. One complication was that, with Christopher and Joy at other institutions, they could not help as much as they would have liked with gaining IRB approval from the institution they intended to collect student data from. Tara also encountered a new policy from the first-year writing program at that institution that required them to submit information similar to their IRB application to the program for approval to collect data from students. This complicated matters, since it meant submitting a research proposal to the program with the possibility that they would ask for changes before they could then submit the project for IRB approval (a process that could take many weeks).

Joy, Tara, and Christopher attended the Council of Writing Program Administrators summer conference in July 2016, giving them an opportunity to meet in person to update each other on progress and make some decisions. Mark's differing relationship to rhetoric and composition shows here, since this is a conference he does not attend and therefore he did not participate in this meeting. Joy, Tara, and Christopher therefore took the opportunity

to make decisions about which students to sample, deciding to restrict it to students taking classes in the flexible classroom that Mark's interactive classroom was based on. They also made the decision to include both a pre- and post- survey and worked together to refine the questions they had already drafted. Because of the institutional procedures they would need to follow (IRB, program approval), they revised their goal to collecting data in spring 2017. Fall 2016 resulted in some moderate progress on their research design and more specific guidelines from the first-year writing program about what their research request should look like, but not enough progress to submit to either of those bodies. The data and analysis reported on in this chapter ends with a series of emails on this issue from November 2016, though my own engagement with the project continued beyond this point.

Mode: Composing Multimodal Disciplinary Meaning

I turn my attention now to my analysis of the Webtext Project case and to my first compositional lens: mode. The case has been made compellingly that all composing processes and all texts are multimodal (Baldry & Thibault, 2010; Kress, 2010; Kress & Van Leeuwen, 2001). Even a seemingly monomodal alphabetic text combines linguistic semiotic resources with visual semiotic resources through typography, white space, etc. That said, much insight can be gleaned about disciplinary knowledge construction from careful analysis of both the specific modes used and the manner they are used in disciplinary composing. Studies of scientific texts, for example, have shed light on how these “have always combined and integrated language and visual images in the making of specialist meanings of scientific discourses,” with scientific writing conventions not assuming “that language has necessary

priority over the visual” (Baldry & Thibault, 2010, p. 70). Scientific meaning making and knowledge construction is enabled by the “meaning compression” and “concomitant process of greater abstraction in representation” that this partnership between the visual and verbal (along with linguistic practices like nominalization) allows (p. 60). A study of the development of a scholarly text, however, can also account for the multimodality at work in the research that is part of the process. This section, then, begins with analysis of the multimodal meaning making the Webtext Project originated in—Tara’s empirical research—and then moves to how that disciplinary meaning was remade in other modes during composition. The collaborative aspect of composing the Webtext Project, however, revealed distinct multimodal practices related to epistemological orientations, something I take up in my last two sections on mode.

Tara’s Empirical Traversals

Analysis of the Webtext Project coauthors’ multimodal practices reveals a few important operations at work, the first of which is *traversal*. Jay Lemke (2002) developed this term as a way to understand readers’ meaning making as they “travel” across elements of hypertexts, journeys with “many possible trajectories” and that involve making meaning “on a time- and text-scale” (p. 300). Elaborating on this further, Lemke (2009) links readers’ traversals to the notion of *timescales*, arguing that “the use or function of every media work is not just to link a producer and a user, but to link across the timescales of production, circulation, and use” and that “It matters to the meanings made and the experiences had with media works what these timescales are and how they are connected or integrated (or not)” (p.

143). As readers traverse both elements of a single work and “the boundaries between works, media, genres, sites, institutional contexts, activities, etc.,” they are “construing and cumulating [meaning] across timescales” (p. 145). In addition to the rich vocabulary we have for describing how meaning is made across modes and media, then, traversal adds a way to describe meaning making that connects discrete times and spaces.

The traversals readers construct, however, are not quite the same as those of scholarly composers. The traversals researchers must engage in in their composing are influenced by their knowledge-constructing goals and their disciplinary epistemologies. In an article on the use of video data for learning sciences research, Lemke (2007) tackles this disciplinary meaning making, tying his approach and the notion of traversal to Bruno Latour’s (1987, 1999) work on the “chains of translations of inscriptions” that scientists create as they move “from data collection and analysis to published results and claims” (p. 46). Learning researchers who use video data are, in Lemke’s view, creating a traversal “across at least two distinct attentional spaces; that of our office or lab and its activities, and that of the events in the virtual world in the video,” attempting to “make a translation between these two worlds, to forge an enduring connection between them that will ultimately support the claims or interpretations we will want to make about what the video ‘shows’” (p. 47). Here Lemke primarily addresses the traversals of *empirical* researchers and the traversals they must often make between experiences of spaces (“the field”) at a given moment in time and the data produced from interaction with the field (a product of meaning making itself) at a later time and in a different embodied space. Later, in their offices, for example, empirical researchers construct new traversals when interacting with the product of this embodied analytical

moment, whether by producing a set of codes, code definitions, and coded data segments, an analytic memo, or a chart, table, or figure of some sort. Empirical research, in fact, hinges on the ability to connect spaces across time.

In the Webtext Project, we see this quite clearly in Tara's traversals (Figure 3.2). Tara's empirical research on learning spaces, some of which was done in collaboration with Joy, formed the basis of the Webtext Project. Looking at the previously published work on learning spaces that she drew on to help design the Webtext Project, it becomes clear how critical the ability to forge meaning making connections between times and spaces are for empirical researchers and the significant role multimodality plays in this meaning making process. Her empirical traversals, for example, begin with the bring-your-own-technology (BYOT) classroom that she and Joy chose as a good candidate for a redesign. The BYOT classroom had solved one problem for the teachers and students who used it (eliminating old and constraining technology that was costly to maintain and that many had stopped even using), but created another (immobilizing tables and chairs into a single configuration in order to provide sufficient power outlets on each table). Tara's study of learning spaces, then, began with this BYOT classroom (Figure 3.2: A), using photographs and AutoCAD diagrams of the space to help draw empirical links between that time and space for the classroom and another time and space: its transformation into a flexible classroom (Figure 3.2: B). The photographs and diagrams mediated Tara's empirical meaning making, helping her forge connections across times and spaces that could be used empirically. In order to study the flexible classroom as a learning space, Tara made another traversal, drawing a connection between these prior timespaces for the classroom and the learning that happened

in them to her time conducting to a classroom ethnography of a class using the redesigned space for a semester (Figure 3.2: C). In order to forge connections between embodied ethnographic engagement in the space of the classroom and analysis taking place in other embodied spaces at later times (her office, home, coffee shops, etc.), Tara generated many artifacts during her ethnography, including photographs, field notes, videos, drawings, and maps. Tara's development of analytical insights about the teaching and learning taking place in the flexible classroom required that she forge meaning making connections across time, space, interactions, texts, and artifacts through purposeful use of multiple modes, such as the spatial, visual, linguistic, and gestural. Continuing her empirical study of the flexible classroom as a learning space, Tara expanded her meaning making with other methods. One of the methods Tara used to try to understand the teacher's and students' experiences of and expectations for the space was conceptual mapping, with participants drawing maps of their ideal writing classroom space (Figure 3.2: D). Tara and Joy found this method so productive that their collaborative inquiry on learning spaces extended it to teachers and students beyond Tara's classroom ethnography. Tara's meaning making traversal as a researcher, then, also included forging connections between embodied ethnographic experience of the flexible classroom and these mental landscapes participants produced using paper and markers (Figure 3.2: D). Ultimately, all of the forged connections between these times and spaces became empirical meaning in Tara's dissertation and in two digital chapters (Figure 3.2: E).

all the other moments, spaces, and processes that played a role in the meaning she developed along the way. Artifacts she made and collected along the way accumulated meaning and forged the semiotic connections she needed to develop empirical analysis and theory about the learning going on in the classroom. Notably, her traversals were not restricted to any single mode, with her ability to forge semiotic connections between these disparate times and spaces enabled and enriched by multimodality.

Empirical Transduction and Scientific Meaning Compression

Many of Tara's traversals operate through a process that Gunther Kress (2010) defines as *transduction*, a "process of moving meaning-material from one mode to another," for example "from speech to image; from writing to film" (p. 125). This is a process that we engage in routinely as we go about our lives and that inherently involves interpretation as we move "meaning-material" from the materiality and available "vocabulary" of one mode to another, remaking meaning each time. For instance, we might transduce instructions handwritten for one child into images for a pre-literate child, or we might transduce an idea developed in written notes to a mathematical equation or musical notation. These can occur on the same sheet of paper or notebook and so do not necessarily include a change of medium, but rather of mode. In Tara's work, this is most visible in the spaces between the labeled points of Tara's traversals (Figure 3.2). For example, between the BYOT classroom (Figure 3.2: A) and the redesigned flexible classroom (Figure 3.2: B), Tara moved meaning from the embodied space and interactions of the classroom to photographs and diagrams of the space, with her meaning-making activity and material moving once more to an embodied

space during the redesign of the classroom (itself based on the meaning made with those photographs and diagrams and likely much talk, writing, and gesturing during collaboration with the design team). Similarly, Tara's ethnographic work included transduction of meaning-making material from the embodied space of the classroom to Tara's drawings, maps, photographs, videos, audio recordings, and field notes, and then later, in order to analyze this ethnographic meaning making, transduction of the meaning made with these heterogeneous modes to a smaller set of modes through transcription and coding, and then writing. These latter modes seem primarily linguistic, but actually included the numeric and mathematical, following a journey of transduction that echoed scientific meaning making in some important ways. Like scientific meaning making more broadly, Tara's qualitative research is clearly what Jay Lemke terms a "semiotic hybrid," a practice that he argues has a multiplicative effect for scientific meaning making (Lemke, 1998, p. 93). Tara's ethnographic research is integrally multimodal and includes the use of varied semiotic modes for empirical *traversal* across times and spaces deemed salient to the object of her research and for empirical *transduction* across modes to facilitate analysis and communication of the data her research has generated.

The movement of this transduction, like in the natural sciences, seems, at first inspection, to lean toward greater abstraction, allowing Tara to explore abstract relationships between classroom space, students, instructions, writing, and learning. Through transduction, Tara represented material processes and activities in increasingly abstract ways using linguistic, visual, and mathematical resources, resources that allowed her to examine their relationships in ways that would otherwise be difficult, if not impossible. Lemke (1998)

explains that in the natural sciences mathematics as a semiotic mode affords greater abstraction and manipulation of data:

Mathematical functions abstract these patterns from the data and even the variables, the thematic items, the measured phenomena among which they are the patterns. In scientific theory, patterns are generated from assumptions. Initially these are verbal-semantic statements, then they are mathematical expressions and/or graphical images or imagined or displayed dynamical simulations, but always primarily of quantitative patterns and covariations, the very things language has not evolved to present very well. (p. 102)

Similarly, he describes how visuals become progressively abstract as part of scientific meaning making, a process that echoes Tara's transduction of spatial meaning making from embodied space to photographs, drawings, and AutoCAD diagrams: "A photograph can be abstracted into a drawing (with third-dimensional perspective or without), and from the drawing it is only a few more steps to the abstract diagram" (p. 102). While Tara's research made limited use of mathematics, her processes of diagramming and coding and her use of statistical tests of inter-rater reliability echo multimodal processes of abstraction that characterize scientific meaning making.

This transductive movement toward abstraction is also related to what Anthony Baldry and Paul Thibault (2010) have termed "meaning compression." Focusing on the scientific page, Baldry and Thibault point out how scientific meaning is constructed and communicated through compression of meaning, which they see as achieved in two ways: (1) "the greater integration of visual and verbal resources" (the "semiotic hybrid" Lemke

characterizes science as) and (2) “the often concomitant process of greater abstraction in representation that brings about a collapsing of the different time scales” relevant to the experiment (p. 60). While Baldry and Thibault focus on the multimodal aspect of this compression, those accustomed to analyzing scientific language will recognize this same compression of meaning at work in the routine nominalization seen in scientific writing, a linguistic operation that compresses an entire activity or process to a single noun (Lemke, 1990). Meaning compression affords greater economy and efficiency in constructing and communicating specialist meaning making, but also contributes to how difficult to read scientific writing can be for anyone outside a given specialty, since reading compressed meaning requires mentally unpacking or “de-compressing” an entire scientific process or operation while reading.

Meaning compression is useful for understanding the multimodal dimension of the Webtext Project authors’ digital writing because it is a documented feature of specialist meaning making and can be seen in several of the coauthors’ work, particularly those who engage in empirical research (Tara, Joy, and Christopher). Tara and Joy’s coauthored digital chapter on students’ hand drawn conceptual maps of their ideal writing classrooms, for example, demonstrates the use of meaning compression through the integration of numeric, linguistic, and spatio-visual resources in order to communicate their findings economically (Figure 3.2: E). It is also useful, however, for the perspective it gives on multimodal meaning making as both material and *social* (Kress, 2010, p. 62). Scientific meaning compression practices have developed and changed over time, with, for example, scientific texts increasing their verbal and visual integration over time (Baldry & Thibault, 2010, p. 91). This

suggests that the use of particular modes to make meaning will be culturally informed and that the use of multiple modes together will be culturally informed as well, something Anne Wysocki (2005) has raised in context of the use of the term “affordance” to consider modal properties and potentials. Disciplines, as both intellectual and social categories, include cultural histories and habits of meaning making. This, indeed, is what analysis of the Webtext Project coauthors’ multimodal writing practices suggests as well, since closer inspection of the authors’ uses of modes shows some disciplinarily distinctive ways of using them for knowledge construction.

Qualitative Meaning Expansion

Tara’s work, in fact, continues to serve as a useful object of focus for understanding these disciplinarily distinctive ways of using modes. Rhetoric and composition has long been considered a “pluralistic” discipline (Goggin, 1997; J. M. Lauer, 1984), enlisting methodologies and work from other fields “according to its own pragmatic principle” (Phelps, 1986, p. 191). Against this heterogeneous backdrop, Tara identified herself to me as a qualitative researcher and ethnographer. This research tradition can often be at odds with the epistemologies of the natural sciences and of experimental social sciences that tend to be nomothetic—seeking to discover generalizable laws about the world and behavior—rather than idiographic—seeking to describe and understand specific, contingent, subjective experience and phenomena. This idiographic sensibility, in fact, is evident in Tara’s multimodal composing practices, which, while occasionally employing the meaning

compression characteristic of the natural sciences, more often follows an idiographic logic tied to her ethnographic sensibilities.

As ethnographer Sarah Pink (2011) explains in an article on “Multimodality, Multisensoriality and Ethnographic Knowing,” the ethnographic tradition does not conceptualize ethnographic knowledge about a social context as existing “out there” for a researcher to discover, but instead as produced *with* participants through ongoing, situated interaction and participation (p. 272). It recognizes the inherent embodied subjectivity of researchers and participants and the holistic, integrated, multisensorial nature of experience and cultural meaning. For ethnographers, artifacts and modes like images and narratives are part of evoking “the sensory and affective dimensions of location as experienced through the subjectivity of the research participant and as brought into a public domain through the mutual engagement of the researcher and participant” (p. 272). Ethnographers generally seek approaches that will help them “move *through* and be *in* and *part* of an environment with the participant,” which is “different from the perspective of *looking at* and reading from video-as-data from which cultural meanings can be interpreted/read” (p. 273). Compressing meaning for greater abstraction and manipulability is somewhat at odds with this project, then, with ethnographers keenly aware of the subjectivity and partiality of the meaning they co-produce, as well as the inherent change of meaning that takes place in processes of transducing meaning from one semiotic mode to another or of moving cultural artifacts out of their original contexts into new contexts.

For ethnographic researchers like Tara, the use of semiotic modes for disciplinary work is less about meaning compression and more about *meaning expansion*. While meaning

compression seeks to communicate specialist meaning as economically and efficiently as possible, ethnographers seek to *expand* their own and other's understandings of social meaning, often operating through what Clifford Geertz (1973) termed "thick description" (p. 6). Taking up Geertz's notion, Norman Denzin (1989) explains it as going "beyond mere fact and surface appearances," instead presenting "detail, context, emotion, and the webs of social relationships that join persons to one another," as well as "emotionality and self-feeling," "significance," and "the voices, feelings, actions, and meanings of interacting individuals" (p. 83). While thick description tends to be a set of linguistic practices (Denzin, for example, describes eleven types), visuals have long played a role in evoking context, relationality, emotion, materiality, etc.

In my interviews with Tara—always conducted comfortably ensconced in her couch, with tea cup at hand and her inquisitive young Jack Russell observing—she regularly discussed her current or prior projects, with the modal affordances of digital publishing a frequent topic. Describing, for example, a digital chapter based on her classroom ethnography that she had recently submitted, Tara focused on the possibility of including audio of her research participants directly in the text, explaining that, "because that was an ethnographic study, some of the things that were important to me to have in that chapter were the audio files of some of those instructor interviews." For Tara, including audio of her participants provided another means to "capture those voices" and share them with readers in a way that transcribed text could not replicate. While we have developed many ways to convey tone, intonation, force, etc. through written language, these will always miss nuances of pitch and dynamic and rhythm and tempo and even of silence and ambient sound that are

part of the embodied experience of ethnographic interaction (and that we must resort to a musical vocabulary to describe). While she regularly included transcribed text from her interviews in all of her research writing, including presentations (as I have here), Tara found the possibility of allowing readers to “hear the voice” exciting because “when you can actually hear the voice, to me, there’s something about that that is powerful and makes it real.” Adding audio would allow her to add another slice of the embodied, material experience of this social world that would, together with her written description and explanations, expand readers’ understandings of it.

Similarly, Tara’s use of photographs and other visuals in her research writing operates through meaning expansion to help communicate participants’ embodied experiences and uses of classroom space. This is not a naïve use that assumes photography will document a singular, unified experience of space, but rather one that seeks to enrich readers’ understandings of the space, students, and teachers through the interplay of varied artifacts from and representations of it. Her use of visuals, while in service of a multimodal thick description, is also accountable to an ethnographic participant-centeredness and a pedagogic student-centeredness (Tara is very much a “teacher’s teacher” and has taught both high school English and college writing for many years). Specifically, she seeks to communicate her participants’ lived experiences to administrators who make decisions about classroom space, but don’t necessarily spend time in these spaces with teachers and students. She explains that,

Yes, I will show you lots of pictures and I will show you pictures of people in the space, because I feel that that is also incredibly important. Because from the things

that I've gathered over the course of several years, a lot of these decisions on the classroom design are made without talking to people who use them. So any time I have an opportunity to show an audience people, actual users in this space, and emphasize that, that's extremely important to me.

Her use of visuals, then, and particularly of visuals like photographs that have an indexical relationship to participants and the space, is meant to expand stakeholders' understandings of writing students and teachers and their relationships to classroom space. Rather than compressing her ethnographic knowing and their social worlds, she seeks to expand it and render it as multidimensional as possible, using a range of modes and artifacts.

Likely because of rhetoric and composition's extensive engagement with the written word as itself multimodal—both linguistic resource and visual resource—Tara is also sensitive to text itself as visual. And so even though her participants' voices are most often moved from one mode to another through transcription, Tara thinks about the resulting text visually, considering how to present it in a way that will preserve voices and meaning. Discussing the use of quotes from participants on presentation slides, for example, Tara explains that despite common wisdom against reproducing lengthy quotes on slides, her ethnographic sensibility compels her to include fairly extensive quotes:

I excerpt it, if it's a larger quotation. I really want them to hear the voice of the student or the instructor. So I typically will shorten, excerpt the larger quotation—maybe introduce it and read some of that, but then put up the parts and I will emphasize particular keywords that I think really were, that I was noticing as I was

collecting that data. To me that visual is...the text itself *is* the visual because it's the voice of the actual individuals who have used the space.

Tara's use of direct quotes illustrates how guidelines for best practices related to multimodal genres like research presentations interact with disciplinary "accountabilities" (Bazerman, 1988, pp. 60–62) to produce distinctive formal results. In this case, Tara's ethnographic approach makes her accountable to her research participants, and particularly to giving voice to their lived experience and meaning making. As she is engaged in an empirical enterprise, she is also accountable to maintaining (and communicating) a clear connection between "the field" and her conclusions regarding that social world, though this empiricism is mediated by decades of work complicating it through complications of the field, of ethnographic representation, of unitary cultures, etc. Tara's work, then, is highly reflexive about the interpretation and subjectivity at work in all qualitative research, with the use of multiple modes serving to render a more multidimensional account with more ties to participants' experiences and meaning making. By diversifying the modes she uses, Tara seeks to expand the perspectives and understanding of a social space and get slightly closer at honoring and communicating the lived reality of her participants.

Humanistic Meaning Attention

While Tara provided useful perspective on the qualitative research tradition at work in the team's multimodal composing, a research tradition Joy and Christopher regularly contributed to as well, Mark represents another thread in rhetoric and composition's pluralistic epistemological tradition: hermeneutics. Rather than interpreting texts, however,

Mark focuses on digital writing and objects, and increasingly sees alphabetic text as of limited rhetorical interest, extending his hermeneutic focus to physical computing.

In an early interview, Mark explained that his approach to hermeneutics corresponded roughly to Stephen Ramsay's (2011) definition of the digital humanities as an enterprise centered on building (and hence his work as firmly humanistic): "Building is, for us, a new kind of hermeneutic—one that is quite a bit more radical than taking the traditional methods of humanistic inquiry and applying them to digital objects" (p. 244). According to Ramsay, scholars who find their way to the digital humanities as Mark has share a commonality that "involves moving from reading and critiquing to building and making" (p. 243), in large part because the "process of creation yields insights that are difficult to acquire otherwise" (p. 244). Ramsay cites Geoffrey Rockwell to explain how building, or critical making as it has also been called, makes forms of knowing outside the discursive particularly important, specifically what Rockwell calls "thing knowledge," "the tacit knowledge of fabrication and its cultures" (p. 244). In critical making, "poiesis (knowledge of making) itself cannot easily (and shouldn't have to) be put into words" (Rockwell, as cited in Ramsay, 2011, p. 244).

In describing his typical approach to his digital scholarship, Mark explains that it is most often an attempt to "allegorize" experiences, particularly experiences of digital media and computing. Allegorizing, for Mark, means creating an immediate experience with digital media and technologies for his audience that also serves as a metaphor for broader relationships with digital media and technologies. His goal is to draw attention to these and allow for critical reflection:

I always enjoy trying to kind of, in that Russian formalist way, of making things a bit strange. Which means that my critical interrogation of culture and society is to make some aspect of a conventional experience show up objectively in a way that's going to be strange, because it's out of context, so that it can be critically experienced—it can be reflected on critically.

In his making projects, which range from scholarly webtexts to physical computing objects and installations, Mark tends to use technology and media in order to help his audience “see” what they might not otherwise see about themselves, their culture, their relationship to digital artifacts:

For me, [my goal is] using technologies that might otherwise support a conventional experience of life in slightly skewed ways, so that some aspect of that conventional experience comes out separate and distinct and leads to a moment of reflection—or a moment of critical concern.

Mark seeks to draw attention to our culture’s changing relationship to computation and networked digital media, such as the Internet’s increasing embeddedness in our spaces, on/in our bodies, and in our daily practices (e.g. through wearable technologies and the Internet of things). While the objects of his hermeneutic focus are not literary, his goal of helping his audience see beyond the conventional is reminiscent of the special topos of “appearance/reality” that Jeanne Fahnestock and Marie Secor (1991) identified in their corpus of literary criticism (p. 84), particularly the “dualism” it is predicated on in its “perception of two entities: one more immediate, the other latent; one on the surface, the other deep; one obvious, the other the object of search” (p. 85). Indeed, they point out that

“the appearance/reality topos is the fundamental assumption of criticism, since without it there would be no impetus to analyze or interpret literature” (p. 85), something that might also be said of Mark’s interpretation of technologies, which is similarly predicated on the appearance users conventionally experience through user interfaces and the reality behind that appearance that can be plumbed by making visible (and “strange”) the layers of programming and physical computing at work behind it. Similarly, this hermeneutic endeavor is founded on an “assumption about the complexity of [its object]” (p. 90) and the critic’s ethos of erudition and virtuosity, both over its subject matter and the medium it takes. Fahnestock and Secor (1991) point out that “we seem to prize the very casualness that reaches out to a wide range of knowledge and pulls it into significance, creating the ethos of an alert and well-stocked mind” and that we similarly prize “the artistry of [the critic’s] language,” which demonstrates “virtuosity with the very medium they analyze” (p. 91). While Fahnestock and Secor’s analysis was of literary criticism, many of their insights resonate with Mark’s approach to digital rhetoric and arguably connect his work more closely with the epistemological approaches of many of his English Department compatriots in literature than with Tara and Joy’s empirical approaches. Indeed, the necessary virtuosity with the medium being interpreted that Fahnestock and Secor point out explains Mark’s technical proficiency and his need to build as part of his hermeneutic work, since it both constructs his disciplinary ethos and performs his arguments (just as a virtuosity with language does so for literary critics).

Those arguments tend to center on the ubiquity of computing in our lives and the hybridity this constructs, an argument evident in his individual projects, but also central to how he approached the collaborative Webtext Project:

We are so used to a PC era where the virtual is behind that screen and it is barely accessible through keyboard and mouse. Increasingly we are all kind of in these hybrid realities because of smart technologies and because of natural user interfaces like touch. And, you know, and I think even if I am not working at physical computing project, like when I'm working on this project, what I want to do is make it so that the user feels like the virtual is kind of insinuated itself a little bit more into their way of engaging with things, so that they just feel like there is something a little bit new and interesting going on.

While Tara's qualitative approach uses modes to illuminate and expand participants' lived experiences of classroom spaces, amplifying them for stakeholders and decision-makers who may otherwise not attend to them, Mark's use of modes is driven by the hermeneutic goal of drawing attention to the conventional (to "appearance") in order to provoke critical reflection on the complex reality below. And so while Mark is happy to use his technical expertise to facilitate his coauthors' empirical goals, this hermeneutic end guides the compositional choices he sees and gravitates toward:

I feel like what I'm bringing is a way of doing data collection that is somewhat novel, and that also just kind of highlights, just kind of allegorizes what they're trying to accomplish, you know.

While he is interested in the data generated by readers' interactions with the interactive digital classroom he coded, he is also interested in their affordances for allegorizing and for prompting critical reflection. The data collection he seeks to facilitate has the potential to "allegorize" or draw attention to empirical data collection and analysis, as well as reader-writer-text relationships in digital empirical writing. However, in his view it primarily draws attention to conventional relationships with classroom space:

So, [in] this kind of project I think I'm enabling—I'm using the digital medium to allegorize the process that people go through when they're putting together this kind of spatial arrangement of the classroom.

He seeks to make readers' assumptions about classrooms, about students, about teachers, about space and learning visible to them for critical reflection. One compositional choice he contemplated for accomplishing this was making prior readers' classroom configurations available to later readers:

But somebody else can come after that and get a list of all these different people and click on any one of them who has put up the design and watch the entire process, and maybe even overlay other processes. Like one thing that we could do, which would be interesting and to me this is where the math could be really interesting too is, if everybody picked an instructor's desk, did everybody pick it last? Did they pick it first? Or second? Do they shove it up in a corner somewhere and then it got moved around over and over again?

Mark shows interest here in showing readers that their arrangement of and relationship with classroom furniture is mediated by convention and habit. By visually juxtaposing readers'

classroom preferences against other readers' preferences, he seeks to render potentially unconscious assumptions and typification of the social space of the classroom available for inspection, thereby emphasizing the mediated nature of our experiences with classroom space. He sees this potential compositional choice as one way to make the classroom space "strange" and provoke a moment of critical reflection. Ultimately, he seeks to provoke reflection on the routinized in order to make formerly "unavailable" designs available and possible (Wysocki, 2005).

For example, in one of the classroom layouts I generated in interacting with the mockup interactive classroom software Mark provided (see Figure 3.3),³² my bias toward small-group collaboration and active learning activities comes through in the small student pods I created. My assumptions and experiences with decentering the classroom show up as well, with the mobile tablet arm chair I provided for the instructor in place of a fixed instructor's lectern. The process of designing the classroom space and being forced to make choices about the number of students the room would accommodate and in what type and configuration of desks, as well as the instructor's spatial relationship to students and the classroom space forced me to consider my assumptions and how many of them were based

³² My interaction with the software also illustrates a point made by Christine Hine (2015) in her work on connective ethnography that autoethnographic practices become "central to ethnography for the Internet, allowing us to interrogate the experience of navigating mediated social territories, exposing the practices and skills of making sense and forging connections as they become available to us, and allowing us to produce rich descriptions of the emergent social territories that surround and suffuse the Internet" (p. 183). Observing my participants interacting with the software would not have sufficed for developing ethnographic understanding. I needed to interact with it myself, but this also meant experiencing a view of it that perhaps no one else had or would experience. This is where reflexive practices associated with autoethnography become helpful for digital research, since it encourages us to develop thick descriptions of personal experiences navigating digital spaces, while coupling these with reflective writing about the personal dimension of that experience.

on habit versus pedagogical theory. Presumably, seeing my design juxtaposed against those of other users/readers would deepen that critical reflection.

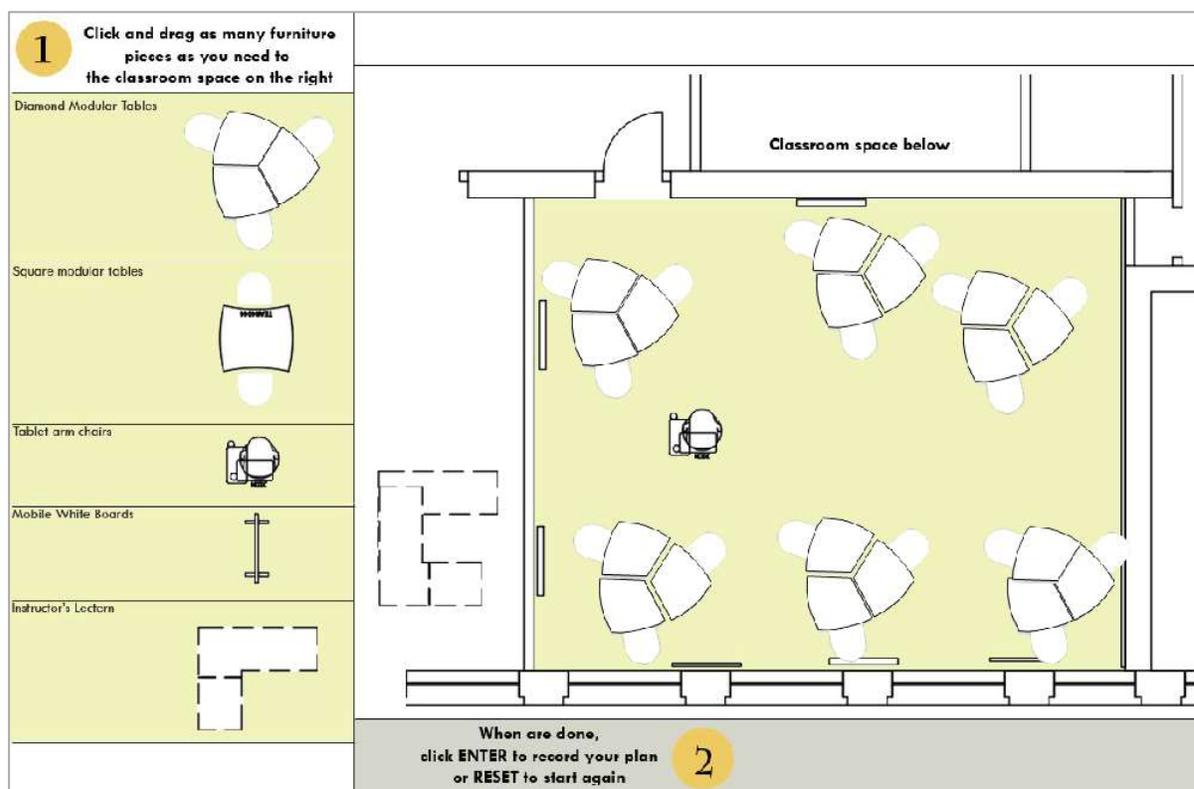


Figure 3.3. Screenshot of one of my layouts with the mockup interactive classroom software.

In terms of multimodal meaning-making, then, Mark’s work here employs a combination of the linguistic, visual, and spatial. The interactive nature of this portion of the webtext—the fact that the user must select furniture, then place it, with the possibility of moving it around the room and rotating pieces—adds movement and perhaps even time to the modes used to make meaning. Certainly, if the group chose to take up Mark’s idea of having subsequent readers be able to “watch the entire process, and maybe even overlay other processes” from other readers’ designs, time would become a significant part of the

meaning made in the webtext, much as with video. For example, as Mark points out, readers could see whether other readers chose an instructor's lecture first, second, or last, or "Do they shove it up in a corner somewhere and then it got moved around over and over again?"

Mark's use of modes is distinctive from the meaning compression and meaning expansion seen in the two empirical traditions represented in his coauthors' work, with his multimodal choices organized instead by the disciplinary goal of *drawing attention to* meaning making as such. The reflexivity Mark seeks to facilitate for his audience—the consciousness about the meaning they routinely make and how that is colored by convention, habit, ideology, etc.—drives his use of modes and its attention to meaning, or what I'm calling "*meaning attention*." Together, Tara and Mark illustrate how multimodal composition is driven by larger disciplinary goals and values, such as giving voice to participants' lifeworlds or drawing attention to the conventional aspects of meaning making and the role technologies play in this. They also seem to call into question the disciplinarity of "rhetoric and composition," itself a longstanding question, though the pluralistic nature of the discipline is well established and what we may be seeing in these distinctive multimodal practices is simply the force of the long histories of semiosis and use behind methodologies like ethnography and hermeneutics, methodologies arising in distinct but present disciplines like anthropology and literature. As Paul Prior (1998) has pointed out in his study of writing and disciplinarity, "every moment [of disciplinary writing] implicates multiple activities, weaves together multiple histories" (p. 277), including those of individuals, methodologies, and disciplines themselves.

Before concluding my analysis of Mark's multimodal composing practices, I must reflect on the difficulty of analyzing the multimodal composing practices of someone within my own discipline, an endeavor that cannot but engage with disciplinary questions of mutual salience and potential disagreement. In this case, while Mark graciously allowed me to study his process and apply my research question on multimodality to his case, he professed to not finding social semiotics particularly productive, largely because his work seeks to draw attention toward the post-representational aspects of composition, rhetoric, and reality. Regularly drawing on theorists such as Gilles Deleuze and Félix Guattari, Mark is most concerned by the hybrid reality and the changing "relationship between self and object or self and world" that physical computing enables. So while Mark focuses on "post-alphabetic" composition and rhetoric, a focus in common with theories of multimodality, he does so with the goal of moving attention *away* from the representational space of the screen and toward the hybridity created by increasingly embedded technologies and media (e.g. wearable technologies). One interest, for example, is in the movement away from graphical user interfaces and toward natural user interfaces that include gesture. While seeking to honor Mark's perspective and voice, I still found multimodality to be a useful lens for understanding how he composed using multiple resources like space, image, numbers, and text. I would also venture to say that modes like gesture and space are still being used to make meaning and that they still "re-present" prior meaning making in those modes (gesture has a sociocultural history of meaning making too). We cannot step outside the "ceaseless chain of semiosis," instead constantly responding to, remaking, and transforming prior meaning making (Kress, 2010, p. 53).

Medium: Disciplinary Remediation

I turn now to my second compositional lens—medium—and specifically to a focus on the centerpiece of the team’s digital composing, their remediation of the original “interactive classroom” (the blank sheet of paper for hand-drawn conceptual maps) to the digital interactive classroom (Mark’s software). A term coined by Jay Bolter and Richard Grusin (1999), remediation³³ describes “the representation of one medium in another,” a phenomenon that they argue “is a defining characteristic of the new digital media” (p. 45). They in fact point out that, at this historical moment, “all mediation is remediation” (p. 55), a quite ordinary and routine aspect of human meaning making, which is additive and transformative. New media, they explain, present “themselves as refashioned and improved versions of other media,” with no medium able “to do its cultural work in isolation from other media, any more than it works in isolation from other social and economic forces” (p. 15). Media’s meaning and rhetorical work, then, stem in large part from their relationships with other media, with each new medium “refashion[ing] its predecessors and other contemporary media” (p. 19). There is nothing particularly stable about media ecologies, a fact that also calls into question the assumptions about replacement that underlie the common narrative of progress we tell about media and communication technologies. Bolter and Grusin explain that the change and absorption described by remediation is propelled by a “double logic” in which Western culture seeks to both “multiply its media and to erase all

³³ While transduction denotes the remaking of meaning from one mode to another, remediation denotes one medium’s representation in another.

traces of mediation: ideally, it wants to erase its media in the very act of multiplying them” (p. 5). They label these twin desires hypermediacy and immediacy, with hypermediacy rendering mediation opaque and visible and immediacy rendering it transparent and invisible (p. 19). This double logic propels media change and development, because

Although each medium promises to reform its predecessors by offering a more immediate or authentic experience, the promise of reform inevitably leads us to become aware of the new medium as a medium. Thus, immediacy leads to hypermediacy. (p. 19)

Examining remediation, then, whether at a cultural level or at the level of an individual rhetor, offers insight into the state of these twin cultural desires and their roles in particular social contexts and moments, including disciplinary ones. Disciplines, as emergent, stabilized-for-now cultural categories that are constantly (re)produced in situated acts, interactions, and compositions, can become visible through, among other things, analysis of remediation, an action imbued with both the long history of the discipline’s mediational practices and the transformation of those practices into the next iteration of the discipline. How individual rhetors negotiate the choices related to remediation can tell us a lot about disciplinarity and where that disciplinarity is going.

In the case of the Webtext authors, the main remediation they engaged in was the simple movement of the original “interactive classroom”—that blank sheet of paper for hand-drawn conceptual maps—to the digital interactive classroom—Mark’s software. While seemingly a simple shift that would afford faster, better, more efficient data collection, the shift involved complex compositional choices with disciplinary implications. Remediating

Tara and Joy's conceptual mapping protocol, in fact, involved two acts of remediation: (1) remediating the hand-drawn conceptual mapping protocol in combination with (2) remediating the AutoCad diagram developed by the flexible classroom design team (Figure 3.4).

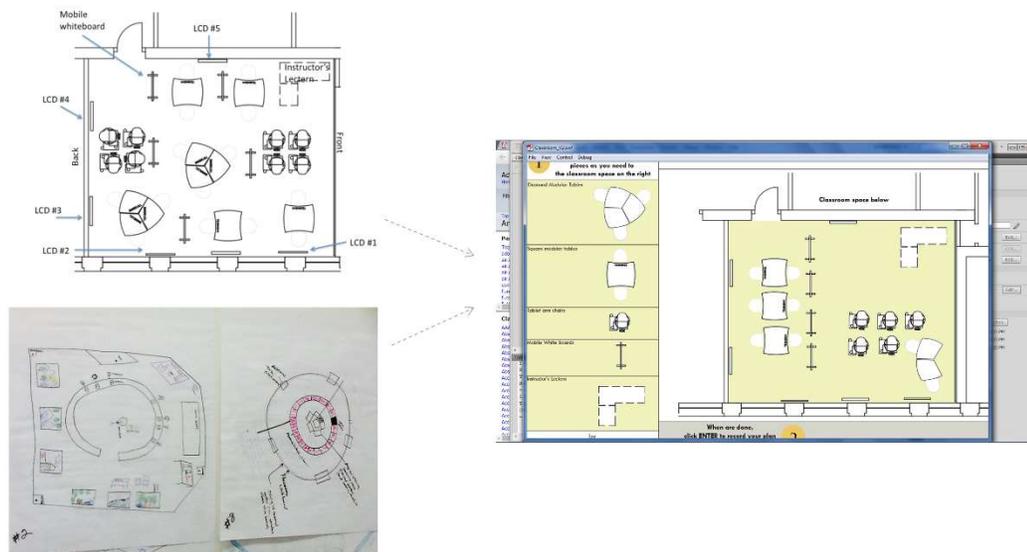


Figure 3.4. Remediating the hand-drawn conceptual mapping protocol and AutoCad flexible classroom diagram.

Each of these has its own long history of use, histories that involve other disciplines and have only recently become part of rhetoric and composition's history. The classroom diagram, for example, a diagram developed with AutoCad, a computer-assisted design software that has been used by designers for a little over thirty years now, is itself a remediation of hand-drawn drafting, a techne developed over thousands of years and that includes the use of specialized tools like drafting tables, T-squares, triangles, compasses,

French curves, and a whole host of drawing implements. Remediating paper-based drafting to design software not only resulted in a set of technological “gains and losses” (Kress, 2005) and a changed set of affordances to be enlisted (Prior, 2005), but also changed the relationships and social uses of these related media, with traditional drafting on paper still used for specific purposes, but now with newly acquired meaning. The immediacy created by AutoCad, which allows designers to create, manipulate, and revise designs with relative rapidity and ease once the program has been learned, also created hypermediacy for traditional drafting by emphasizing the mediation at work in the medium. Similarly, the hand-drawn conceptual maps Tara and Joy used had long histories of use that included the history of drafting, of drawing more broadly, of disciplines like library science that have employed it as a research method, and recently of rhetoric and composition through Nedra Reynold’s work on space (Reynolds, 2004). The Webtext Project team’s decision to remediate these two mediated forms, then, participated in, added to, and was colored by these long historical chains of mediation. So while it is important to consider the role of affordances and the gains and losses involved in the movement of Tara and Joy’s conceptual mapping method from paper and marker to its digital form, it’s important to realize that the meaning and rhetoricity of this movement were mediated by the histories of the media involved and of their changing positions in evolving media ecologies.

As scholars who either define themselves primarily as “rhet/comp” scholars (Joy, Tara, and Mark) or who at least participate in its scholarship regularly (Christopher), the members of the Webtext Project team were highly reflective about the affordances and implications of remediating their classroom map. In moving from the freehand conceptual

mapping exercise conducted with instructors to a more constrained version of that that involved taping down paper cutouts of furniture, Joy and Tara had already exchanged some freedom for participants (freehand drawing) for some constraints (predetermined furniture), an exchange they were willing to make for its analytical affordances—they could more easily compare student maps that had some degree of uniformity. Their approach, however, involved only limited statistical analysis. In fact, in her initial interview with me in 2014, Joy described their analytical approach as primarily rhetorical:

Tara and I were doing such a ... our approach was very much just kind of a visual rhetoric approach to doing an analysis of those visual texts. We weren't thinking about it mathematically or computationally.

Their collaboration with Mark provided an exigence for thinking through the affordances remediating the activity from paper to digital would entail. Some of those affordances were related to empirical data collection, but the possibilities for making use of them were not fully fleshed out until Christopher noted them and approached Joy after her presentation of preliminary findings at a conference:

So when I presented it there and I was talking through the data that Tara and I are working with and the heuristic questions that I had at the end [of the presentation] were things like, "If we're going to put this into a digital format what kinds of things would be interesting to you? What can you imagine?" And after that presentation, Christopher came up to me and said, "Okay, I have an idea about what we could do statistically to report some of the results of what you have here and to maybe

analyze—if you're bringing all that data in, there are some really cool things we could do with it mathematically *as* it's coming in too.”

When they began collaborating with Christopher to perform more sophisticated statistical analysis of their initial (paper-based) student data set and work through how to use data from the digital classroom, one of the constraints of the paper-based blueprint protocol became apparent to them, something Joy described:

So in the very first stage of this study, Tara and I had collected a lot of these conceptual maps on paper. And what I didn't realize was by doing that then, when Christopher wanted to go through and statistically analyze some of the aspects of these maps, he actually had to hand code it and enter it in.

While Tara and Joy had paid attention to some basic frequencies as part of their analysis, the labor-intensive nature of their approach became apparent as more data points became available and as the possible sample sizes expanded as a result of the digital classroom's *networked* affordances. Here, Joy explains their original approach to numerical analysis, which involved manually dividing participants' blueprints into quadrants:

In the variety of ways that Tara and I were analyzing things, one of the things we looked at is which quadrants in the room had the most seats and where they were placing things.

Christopher, however, was most drawn to the larger scale that a digitally-remediated version of their protocol would afford, something he articulated in his initial 2014 interview with me:

I definitely see this as a very dynamic project that poses questions that can only be answered by this large-scale collaboration that the digital format will facilitate.

As analysis of the team's use of modes revealed and as analysis of their consideration of media reinforces, the primary affordances and "gains" that Joy, Tara, and Christopher focused on related to the empirical nature of their work and specifically to data collection. Once the full team had been assembled, Joy described the digital interactive classroom precisely in those terms, as "an application that would help us to collect the data digitally" and that would allow Christopher to

just pull the coordinates of where people are placing things on the map and very easily plug it into his statistical analysis program without having to go through and measure things and hand code where things are appearing. It basically creates the coordinates that are already in there.

In empirical terms, the main gain of remediating the paper-based blueprint protocol was, according to Joy, to allow them to "collect a pretty large corpus of data to understand, across a broad spectrum, what people's preferences are in writing classrooms."

For Mark, however, whose epistemological approach to rhetoric, composition, media, and technology centered on a humanistic project of making those things "strange" and thereby visible for critical inspection and reflection, the empirical affordances of the digitally remediated classroom were exciting, but secondary in importance to the project of making the writing classroom, as a construct, strange. When asked whether the early prototype of the interactive classroom already fulfilled his goal to allegorize, or create a larger metaphorical meaning out of readers' individual interactions with it, Mark replied, "Not much, no," but that his compositional focus would be to realize this potential in the project, particularly through the medium's affordance for interactivity:

I think what becomes interesting is when people interact with the piece and their interactivity becomes an object of discussion or it becomes something that you can actually think about. I think most people would just kind of put pieces on the screen. They might think a little about like, oh, why did I pick that piece? But they wouldn't actually notice the actual gesture that they use or how much time they spend with their mouse over one thing, maybe squiggling, because that's what they do when they're just thinking or nervous or whatever it is. Like, to be able to give all of that kind of microgestural data, and related to that, the time that, you know, it's connected to—I think that lets people, it objectifies [the experience and classroom] in a way that really lets people think about it.

Mark's compositional work, then, would focus on amplifying and accentuating those microgestures to make what is typically invisible visible. Mark's reflection on how the final interactive classroom will allegorize hinges simultaneously on the affordances for interactivity of the digital medium used to compose it, but also on its ability to record and replay that interaction. These are, in fact, the same affordances his coauthors focused on in their inventional work, but that invention was colored by differing epistemological goals and traditions, a fact that reinforces the need to consider sociocultural context and histories of use in considering the affordances of media, modes, and technologies. For Mark, the digital medium as it is being used in this composition affords an extension and inspection of internal deliberation and embodied movement:

You know, there is that kind of statement about how technology extends certain things that you're already capable of. So, McLuhan or anyone else will say like, you

know, different technologies, they just extend one of the senses or they extend certain kind of capacities that you have. And, you know, I think, in its own little way, that's what you're basically doing with something like this. You're extending some of the otherwise internalized process of deliberation, you know, that is inextricably linked to embodied movement, you know, movement stuff. So, yeah, I hope I'm explaining the allegorical dimension, but I think what makes this I think an interesting piece, a conversation piece, when it's all said and done and it's got to get further developed to get there, is to help researchers [as both readers and authors] see all of those micro-movements and pauses and things.

In order for fellow writing and classroom researchers to *see* these micro-movements, pauses, deliberations, conventions, however, the media involved in the composition must become accentuated and palpable—the experience must be marked by hypermediacy rather than immediacy. As Bolter and Grusin describe it, “hypermediacy multiplies the signs of mediation” and “makes us aware of the medium or media” (p. 34), a process that, rather than favoring transparency through familiarity and habit, favors unfamiliarity, strangeness, and, in Mark's words, allegory. So while both Mark and his more empirically-minded coauthors focus on the same digital affordances—interactivity, recording, replaying—the compositional possibilities those affordances suggest for them differ in perceptible ways, with the need to use those to create hypermediacy for readers playing a large role in Mark's inventional work and largely absent for his coauthors, whose work relies on immediacy to see through (as opposed to with) media to the empirical meaning they've developed.

Genre: Composing a Hybrid Disciplinary Text

My third compositional lens—genre—puts the Webtext Project team’s formal choices related to mode and medium in relation with their social context, the recurrent actions the comprise disciplinarity. In the two years I followed the Webtext Project, the team did not make enough progress to submit to *Kairos*, though they continued to express interest in the project and an intention to do so, occasionally emailing each other to continue parts of the process or set up meetings. Studies of academic writers have shown how *laminated* an activity writing is, a term taken from sociologist Erving Goffman’s work to describe “the dispersed and fluid chains of places, times, people, and artifacts that come to be tied together in trajectories of literate action, the ways multiple activity footings are simultaneously held and managed” (Prior & Shipka, 2003, p. 181). As the metaphor of lamination evokes, the activity of composing is always overlaid with layers of other activity, events, and preoccupations, many of which come to play a role in that composing. Certainly, this was the case for the Webtext Project coauthors and contributed to the slow tempo of their work together. During those two years, the coauthors collectively experienced two job searches and job changes, a major illness, a cross-country move, a research sabbatical, new or changed administrative roles (all four held administrative positions of some sort), planning for two national conferences, work on several monographs and textbooks, a wedding, and much more. When asked about the role these were playing in their tempo, the coauthors recognized them as contributing factors, but not necessarily among the most major reasons for the project’s slow progress. Joy, who changed jobs and institutions, though retaining a WPA role in her new institution, did explain how in her previous institution, the project served multiple

purposes and was a “manifestation of how I tried to bring a lot of those things together. I guess my secret recipe for getting lots of things done.” In her new institution, the project, while “still very interesting to me,” became “just a research project that I’m working on. It’s not bringing a lot of other things together.”

While some accounts of born-digital composing include themes related to inequities in technology-related literacies or access to technologies, those were also not so much the case for these coauthors, who as (mostly) senior scholars were well connected to computing resources and who had diverse technological expertise represented on the team, including qualitative data analysis and survey softwares (Joy and Tara), mathematical computation and statistical softwares (Christopher), and various coding languages (Mark). Mark did note that he might need to hire a graduate student to help with moving the project from its Flash-with-ActionScript prototype to a version created with Java, CSS, and HTML5, which points to the changing proficiencies required by new technological standards, but also speaks to the fact that Mark had access to the resources necessary to address any gaps in his technological expertise. The project’s technological challenges included those related not only to its design as a text, but also to data transmission and storage that would satisfy IRB-sanctioned levels of security and privacy. That said, Mark, in fact, did not feel technological or design challenges played much of a role in the project’s slow tempo, instead pointing to the project’s relatively low priority for members of the team. In particular, since the original work on flexible classrooms came from them, Mark saw Joy and Tara as the project leaders and felt it had taken a lower priority for them relative to their other responsibilities and projects.

Because all faculty members juggle a potentially unachievable number of tasks, the key to understanding what gets done, in Mark's estimation, is actually the priority level of a project:

This project is slow because it was not a priority for at least a couple of the people who are kind of defining a direction, you know. So I think, like, you know Joy and me, we have a hundred projects going on. ... But if it were a book with a deadline, you know—I've seen Joy get together with her partner in crime, *bustin.*' They just make it happen when they have to.

Joy's change of positions and institutions, then, and the fact that the project no longer helped her create synergy between administrative and research exigences helps explain some of this lowering of priorities. It is also important to note the role of Tara's labor conditions, however, as she was both one of the leaders for the project and the only member of the team to be off the tenure track. Having struggled for several years since completing her doctorate to find a well-matched position for herself, Tara accepted a non-tenure-track Teaching Assistant Professor position at the institution where she had conducted her flexible classroom dissertation research, a move that was extremely positive for her and met several personal and professional needs. That said, the position allotted 50% of her time to teaching, 30% to administration, and 20% to scholarship, a ratio that included space for research, but in a fairly limited way that necessarily put the Webtext Project at a lower priority for her while she was completing several other publications further along in their process. The lack of resources or know-how, however, does not seem to account for the project's slow pace.

Another possibility raised by my interviews and my observations of the coauthors' work and communication is that their collaboration dynamics contributed to the project's

inertia. Rebecca Burnett's (1993) study of conflict in collaborative writing, for example, suggests that substantive conflict plays an important and productive role in collaborative writing, with groups who produced low-quality documents in her study "consider[ing] few or no alternatives and voic[ing] little or no explicit disagreements" (p. 154). While not all forms of disagreement are productive, positive forms play a role in collaboration and can be indicative of coauthors' levels of investment, engagement, and trust. The Webtext coauthors certainly expressed few substantive disagreements, though they did explore alternatives together. It is also possible that they interpreted their relative coauthorship roles differently, with Joy and Tara potentially seeing Mark's role as more of a leadership role than he himself interpreted it. Early on, for example, Joy described herself as the "data collection person" and the "resource collector" rather than as a project leader. Tara, who described herself early on as a "methods junkie" but also the person for whom the research area contributed to by the project was "absolutely seated in my wheelhouse," saw herself as taking a leadership role in the research design and ultimately in the webtext's rhetorical direction. In her usual collaborative process with Joy, Tara typically wrote the methods section alone "because I'm very detail-oriented, so I always am thinking about those who might want to try it out, who might want to follow those steps," and then they would "do a lot of the analysis and discussion together." For the Webtext Project, however, Tara explained how "this is a little bit different" and that she and Joy "envision[ed] us being a lot more involved in the design process, but again, with much guidance" from Mark, as the writer with the most expertise in developing scholarly webtexts and publishing at *Kairos*. Christopher, as the "quantitative person" was understood to be part of the data collection design process and then later

analysis, but less so the rhetorical and design planning process. Interestingly, Mark himself pointed to Joy and Tara as the project's leaders, hesitating to even put his name on the prototype he created for it: "I even felt a little bit uncomfortable putting my name in with 'software written by,'" though he recognized that "my name will show up eventually." He attributed this mostly to "a personality thing" and a fear of inserting himself too strongly rather than a belief that design work was arhetorical. It is also possible that his general self-effacing tendency was accentuated by the gender makeup of the team and a desire not to assume his female coauthors were necessarily desiring him to take a leadership role.

However, while various external forces, collaboration dynamics, and even gender may have played some role in the project's slow tempo, the most explanatory factor at play seems to be related to genre. In his analysis of the scientific experimental report, Charles Bazerman (1988) framed genre as a recurrent "linguistic/symbolic solution to a problem in social interaction" (p. 62). As a powerful form of cultural knowledge about how to communicate in recurrent rhetorical situations, genre knowledge means "the individual writer and reader no longer need make so many fundamental choices and perform virtuosities of communication" (p. 23). For scientists specifically, this means that,

If each individual writer does not think originally and creatively about how to master recalcitrant language in order to create such powerful stories [as experimental reports], it is only because the genre already embodies the linguistic achievement of the three hundred years since the invention of the scientific journal necessitated the invention of the scientific article. (p. 59)

The scholarly webtext as practiced at *Kairos*, however, seems precisely to ask its writers to “perform virtuosities of communication,” something that necessarily slows down their work. Writing activities and rhetorical choices that in some genres are a given and can be deployed without extensive reflection and deliberation, a fact that can facilitate collaboration and juggling multiple projects and activities, in this case must be questioned, invented, deliberated upon. This is not to say that the scholarly webtext works outside of genre—as Derrida (1980) observes in this chapter’s epigraph, “a text cannot belong to no genre, it cannot be without or less a genre” (p. 65)—but rather that its recurrent rhetorical situation precisely asks writers to reopen seemingly closed questions related to style (form) and substance (Campbell & Jamieson, 1978, p. 18), both for themselves and for their readers. Each webtext responds to and (re)produces an exigence to open and reflect on conventions related to form and substance (including medium and mode), to make those conventions visible in such a way that they can be reflected on.

As described in my section on the history of the scholarly webtext, its defining feature according to both rhetorical analyses of the genre and genre-talk by editors and other experienced producers of the genre is the relationship between form and content that its exemplars perform (Ball, 2014, 2016; Kuhn & Vitanza, 2008; J. Purdy & Walker, 2012; Warner, 2007b). Specifically, *Kairos* editor Cheryl Ball (2016) describes how “The design of the webtext must convey the author’s scholarly argument and not be gratuitous,” a feature around which several of the other criteria she lists revolve around (p. 55). In other places, Ball and other editors and writers use the word *enactment* to convey this, describing the work *Kairos* publishes as “work that enacts its scholarly argument through rhetorical and

innovative uses of new media”(Eyman & Ball, 2015, p. 66). What bears noting, however, is that *all* texts enact arguments through their formal features, through style. Eyman and Ball (2015) recognize this, citing Bradley Dilger’s observation that, “style is never optional, as the common sense opposition of style to substance wrongly indicates” (as cited in Eyman & Ball, 2015, p. 68). Considering how to enact a scholarly argument using new media, then, is a matter of degree rather than kind, and, more to the point, a rhetorical operation that requires a higher degree of *reflexivity* about the relationship between style and substance than is typical of most genres. The scholarly webtext as a genre, then, is characterized not just by performativity, but by reflexive performativity. And a large part of how it achieves this reflexivity is through its generic invitation to explode convention, to deliberately transgress.

Transgression and reflexivity, however, take time and can feel uncomfortable as these consist of a generically required questioning of most every rhetorical choice, of “perform[ing] virtuosity of communication” (Bazerman, 1988, p. 23), and presuppose a different exigence than that of empirical genres. In her initial interview with me, for example, Joy explained how she was most comfortable with empirical research and with writing empirical research reports:

I feel really comfortable doing fairly empirically-based research, because I understand how it works. I like that there are certain expectations that I know that I can depend upon. Things that I know an audience would expect to see, even though there are a lot of things within that that are contentious, in terms of how you report data or how you determine validity and reliability for things that you do. But, still, it follows a particular pattern that feels very comfortable to me.

In contrast, she expressed much less comfort with theoretical genres not directly grounded in empirical data or in analysis of concrete artifacts like texts:

I feel very uncomfortable writing things that are just theoretical. ... It's just not what I do. I don't do that. But I find it interesting, just in a self-reflexive sense, to think about why that is. I think I like working with other data or other texts, even if it's historical work that I'm doing, working with archival data. It makes sense to me. So, if I'm doing something that's more a grounded theory approach, but working with empirical data, that I feel comfortable with.

In working out what rhetorical moves the Webtext Project would need to make and how those would relate in a highly interactive, dynamic text, Joy drew on her genre knowledge of empirical research reports and their typical IMRAD format³⁴ to identify the elements that would be required, though how those elements would be arranged (and especially the results) was an open question for her:

The data that Tara and I collected, it was a pretty straightforward—what I would kind of put into a category of a social science empirical study. So there are some elements of that that will still need to appear. We're going to need to report on where the research questions came from, what prior research we're drawing on. I think there are interesting ways we can make those moves in a web-based environment, but still the moves are still pretty much—we're still doing the same thing. We'll need to describe the methodology. But then, when we get to the point of talking about results and

³⁴ Introduction, Methods, Results, and Discussion.

presenting results, I think that's where possibly some other possibilities are opened up for us.

Tara's inventional process for generating the rhetorical moves or "chunks" that would be necessary to include followed the same path and drew on the same genre knowledge. In her first interview with me, Tara drew on her experience with another digital project, a digital book chapter also based on empirical data, in order to explain her thought process and the concerns she was weighing in determining what rhetorical possibilities and constraints they faced with the Webtext Project:

One of the suggestions from the reviewers was, "Why don't you just take out this results heading?" I thought, wow, that kind of gets rid of my whole IMRAD format and that's a genre thing! I think people going into that webtext want to know what to expect and want to be able to go to those sections quickly. I think that's particularly important for a digital text. So I had a discussion with the digital designer and the rhet/comp editor about that and he's, like, "Oh, we didn't quite think about that. Let me have a discussion with the rest of the editorial team to think through that."

Because I didn't want that to go away, because I felt that was an important part of a traditional genre. But how do we make that fit into a digital genre?

Working with an experienced webtext designer with coding abilities and with a mathematician, however, provided an exigence for reconsidering the digital affordances at their disposal, pushing both Tara and Joy to move beyond new ways of *displaying* the elements of a traditional empirical research report to considering new *relationships* with their

readers. Joy, for example, considered the affordances of the webtext for repositioning readers as research participants, creating a dynamic data set that would also require a dynamic text:

But one of the reasons I liked the design that Christopher and Mark and Tara and I have been talking about, with having people actually manipulating something while they're reading, or as part of the reading experience, is that we can collect a pretty large corpus of data to understand across a broad spectrum what people's preferences are in writing classrooms.

Here, we see the digital affordances of the webtext prompting rhetorical innovation, but drawing on existing genre knowledge of empirical genres. The repositioning of reader roles as research participants, however, potentially created a cascade of repositionings in the network of genres supporting empirical research reports, thereby also creating some sizeable writing problems. For example, turning readers into research participants had implications for IRB-related genres like the informed consent form, posing writerly problems about where and when to inform readers and gain their consent. The dynamic nature of the data also created problems related to the webtext and how to create a dynamic text. Would the coauthors need to iteratively write the verbal portions of the text post-publication, returning to revise the results periodically? How would this impact the rhetorical moves made in other sections like the discussion? Presumably, new data could change the results in significant ways, requiring substantive changes throughout the text. Traditionally, however, publication signified a bracketing of analysis and writing, with new findings requiring a new publication, not revision of an existing, stable, published text. The opportunities the team perceived, then, were prompted by existing genre knowledge, but the deviation from the conventional writer-

reader and textual relationships in an empirical research report created some seemingly insoluble writing problems.

Reconsidering relationships with readers of an interactive webtext, however, also prompted the team to reach outside empirical genre knowledge, which includes social roles as genre serves as an index of rhetorical situation. Tara, for example, also expressed hope that manipulating the elements of the interactive classroom would yield particular rhetorical effects for readers, namely reflection about personal schemas for learning and classroom spaces as well as reflection on students' experiences of learning:

We're trying to create some type of interface so that the user can somehow use this map and map out their own in a digital way. So it not only becomes a one-way transmission of information to them, but an interactive experience that they could potentially take and apply in some other way. Learn something more about themselves or their students.

This repositioning of writers, text, and readers, oriented toward a goal of self-awareness and reflection, deviates from the typified roles in empirical genres, which tend to position readers as fellow researchers focused on the activity of constructing new knowledge and who will use the report to further that activity. Here, the reader is positioned as a stakeholder in writing instruction, likely a teacher, interested not solely in new empirical findings, but also in greater pedagogical reflexivity. The rhetorical operation at work is for the intended rhetorical effect to stem in large part through interaction with the webtext, something more akin to procedural rhetoric of games than the rhetoric of empirical research reports (Bogost, 2007). Tara expresses a goal that taps into an existing value both for qualitative researchers and

teachers—reflexivity—but that is tied to teachers through its centering in the pedagogical space of the classroom and readers’ presumed relationship with students. Moving away from the research report genre here opens up possibilities for the webtext and reduces some compositional problems, but the team’s interest in the *data* generated by readers’ interactions consistently cued them to return to their genre knowledge about empirical research reports, a fact reinforced by their decision to apply for IRB approval to collect data from students’ interactions with the digital classroom software before continuing to compose the webtext for submission to *Kairos*.

Tara’s expressed goal here, to foster reflexivity in readers, actually comes closest to Mark’s goal with most, if not all, of his webtexts and digital projects: to provoke critical interrogation. As the most experienced webtext composer and one who has been recognized nationally for his work, Mark provides the best insight into the webtext as a genre—as “typified rhetorical actions based in recurrent situations” (Miller, 1984, p. 159). This definition of genre emphasizes genre as an index of culturally meaningful rhetorical situations—situations that *recur*—and therefore repeated exigences that prompt communication take on special importance for understanding genres. Miller (1984) in fact elaborates on the special importance of exigence, characterizing it as a “social motive” (p. 158) or purpose: “motive becomes a conventionalized social purpose, or exigence, within the recurrent situation” (p. 162). Mark’s repeated motive and method of achieving it through his webtexts, then, is particularly important for understanding the webtext as a recognizable genre for the rhetoric and composition disciplinary community. As highlighted in discussions of multimodality and digital media, Mark’s goal is to enable critical reflection or

interrogation by “mak[ing] some aspect of a conventional experience show up objectively in a way that’s going to be strange, because it’s out of context.” The recurring exigence Mark responds to in his work is conventionalized experience that is left implicit and unavailable for critical reflection. The term Mark repeatedly returns to in describing his purpose is *allegory*, viewing digital media as a “powerful opportunity ... to allegorize some aspect of behavior or experience or attitude.” Webtexts and digital projects (“critical making” also recurred as a meaningful term) were then seen as an opportunity to make conventional experiences of digital texts and technologies “show up” for readers or users in order to prompt and facilitate critical reflection. While *enacting* arguments digitally was central to *Kairos* editors’ definitions of the genre, Mark goes a step further in his purpose, requiring that his webtexts prompt critical reflexivity—for Mark, enacting is insufficient as a purpose if readers are not critically *aware* of the enactment. This additional consideration supports the proposition I made earlier that the scholarly webtext is best characterized by reflexive performativity. Mark’s orientation toward the critical and interpretive, an orientation that seems to characterize his disciplinary participation, leads me to add that the scholarly webtext is characterized by reflexive performativity *in the service of a hermeneutic hypermediacy*, and that, as discussed earlier, this hypermediacy is aimed at drawing attention to conventional experiences of mediation, modality, genre, and composition.

In the case of the Webtext Project, Mark understands his goal in the project (which is in part the goal of helping the team’s work be understood by the editors of *Kairos* as a high-quality example of the webtext genre) as helping allegorize readers’ conventional experiences of classroom space and pedagogy, experiences that are mediated by conventional

schemas of teacher-student relationships, teacher-student-space relationships, teaching and learning, writing instruction, etc.:

So, [in] this kind of project, I think I'm enabling—I'm using the digital medium to *allegorize* the process that people go through when they're putting together this kind of spatial arrangement of the classroom. And I think I do that over and over again. I just find a novel use for a technology, one that's kind of unconventional, and the feedback that one gets from the object or the environment becomes a basis for allegorizing something that they're doing or feeling implicitly. And then that becomes a kind of critical interrogation on a scholarly level of culture and society and whatnot. In this case pedagogy.

While Mark is excited about providing a “novel” method of data collection, his work on the project constantly enlists genre knowledge about this larger socially-shared motive for webtexts, a motive exemplified by award-winning webtexts such as his own. Tara’s hope that the webtext will help readers “learn something more about themselves or their students” articulates well with Mark’s goal of promoting critical reflexivity, but her disciplinary genre knowledge centers on empirical genres. Mark, as the more experienced webtext composer is better able to express this desired rhetorical action and how it is achieved. The contrast between Mark and his coauthors highlights the heterogeneity of participation in the rhetoric and composition disciplinary universe, but the coauthors’ work suggests that *reflexivity* is a value in common that helps hold this pluralism together beyond the shared interest in rhetoric and composing.

Mark's explanations also help clarify how a category of text with so little formal typification can be understood as a genre. Rhetorical genre theory helps move understandings of genre away from purely form-based models to the rhetorical actions genres perform in particular social contexts and recurring rhetorical situations. While it is tempting to continue to place emphasis on formal elements when defining and describing genres, the scholarly webtext in this particular disciplinary (social) context seems better understood by the typical relationship between formal elements and substantive and situational elements than between formal elements alone. This is not to say that scholarly webtexts do not make recognizable rhetorical moves that can be seen formally. Allison Warner (2007b), for example, finds in her analysis of "*Kairos* Best Webtext Award" winners that these generally include a set of recognizable formal conventions derived from print-based genres, as well as what she sees as newer, web-based conventions such as form/content relationship, navigational design, link strategy, node strategy, and multimedia incorporation. Purdy and Walker's (2012) more recent analysis of *Kairos* Best Webtext Award winners (along with other types and sites of digital scholarship) also finds evidence of five categories of rhetorical operations characteristic of digital scholarship in English studies: explicit argumentation, speculation, implicit association, dialogic exchange, and formal enactment. Based on these findings, Purdy and Walker argue that "scholarly activity happens in new ways in these digital spaces" and that,

Digital forms not only allow for some of the same moves that define the scholarly productions long valued in English studies, they allow for extending our definitions

of the “scholarly” and provide new outlets for productive knowledge-building work.

(sec. /conclusion.htm)

What analysis of the Webtext Project’s composing adds to these analyses, however, is the plurality that exists in a disciplinary area like English studies, or, more narrowly, rhetoric and composition, and how that plays out at the level of genre and text, which, particularly in scholarly contexts, are largely the engines of disciplinary (re)production. The features and moves identified by Warner (2007a; 2007b) and Purdy and Walker (2012) elide this plurality and the need for it to be negotiated every time a disciplinary text is produced. The fact that these moves most closely resemble humanistic genres, which overtly “argue” rather than “test” or “report,” also supports the idea that the scholarly webtext’s generic antecedents lie in humanistic traditions like literature and rhetorical criticism, more than in some of the empirical traditions that also play a significant role in rhetoric and composition.

Rhetoric and composition, in fact, has long been known for its epistemological pluralism, a dynamic Janice Lauer (1984), for example, attributed to its members’ embrace of “what a number of disciplines are just starting to admit—that many of their most important problems can be properly investigated only with multiple research methods” (p. 26). According to Lauer, scholars in composition early on “saw the value of building on relevant work in other fields and of using methods of investigation refined elsewhere” (p. 26). Louise Wetherbee Phelps (1986) similarly argued for a pluralistic understanding of the discipline, noting the “marginal fluidity” of its boundaries and advocating for “‘syntopical research,’ which synthesizes and applies the work of other fields according to its own pragmatic principle” (p. 191). Analyzing at the level of genre, Carol Berkenkotter and Thomas Huckin

(1995b) found based on their analysis of four years of abstracts of the Conference on College Composition and Communication (the main conference for rhetoric and composition) that accepted abstracts represented both the empirical tradition, with those abstracts primarily invoking an “extension of knowledge” topos, and the humanistic, hermeneutic tradition, with those abstracts primarily invoking a “complexity” topos (p. 112). In this analysis, Berkenkotter and Huckin also found, however, a set of abstracts that noticeably blended the empirical and hermeneutic, primarily with empirical case studies using hermeneutic approaches to interpret and problematize empirical findings (much as I have done here). This finding led them to hypothesize that this blended, hybrid mode might become the discipline’s “exemplar” or prototype research approach (p. 114). Anne Beaufort’s (2007) much-cited study of an undergraduate writer a decade later, for example, seems to offer a case in point as she describes herself as writing in “a blended genre of both ethnography and argument” (p. 6).

Setting the Webtext Project’s composing against Berkenkotter and Huckin’s findings from twenty years earlier suggests that the Webtext Project team’s composing continues in rhetoric and composition’s current digital genres a tradition of hybridity originally begun in its print-based genres. The fact that *Kairos*’s award winners’ rhetorical moves most resemble those of humanistic genres, “arguing” rather than “reporting,” also suggests that the “scholarly webtext” as a disciplinary genre has from early on drawn on rhetoric and composition’s humanistic, hermeneutic tradition more than its empirical tradition. This is not to say that empirical webtexts do not exist—both Joy and Tara have published digital chapters of empirical research that they consider webtexts. But empirical webtexts do not

appear to be the prototypes for the genre, something supported both by analyses of award winning webtexts and by the team's "genre talk." This is not to say, however, that the scholarly webtext genre will not evolve in an empirical direction as it moves to other forums, but that it is likely to maintain traces of its hermeneutic origins.

If the scholarly webtext is a hermeneutic genre characterized by reflexive performativity and hypermediacy, then the team's efforts to develop a webtext that will fit closely with exemplars of the webtext genre *and* with the empirical research article genre are best understood as an attempt to compose a *hybrid text* participating in at least two genres. This hybridity explains the challenges the team faced in trying to find a path forward for their webtext, something the coauthors understood as built into the experience of composing a scholarly webtext because the webtext genre is deliberately experimental and transgressive in achieving reflexivity. But this challenge is only compounded by also trying to honor the logics and epistemological values built into empirical genres. It seems that many of the Webtext Project team's struggles in composing a digital hybrid text may stem from not having typified "blended" models of the scholarly webtext genre similar to the "blended" (print-based) genre Berkenkotter and Huckin hypothesized would become the prototype for rhetoric and composition. It also suggests that generically hybrid texts are important sites for understanding the negotiations and conflicts at the core of disciplinary constitution and evolution. In contexts like disciplines where written communication plays such a significant role in constituting the rhetorical community, each act of disciplinary composing becomes a site of negotiation of how that rhetorical community will be defined. In genres that are more regularized and stable (recognizing that all genres are only ever, as Catherine Schryer (1993)

put it, “stabilized-for-now”), that negotiation is effaced as a fairly stable set of goals, values, and relationships are reproduced. In hybrid texts like the Webtext Project, however, that negotiation becomes more explicitly central to composing, calling into question which goals, values, and relationships will or should be reproduced. This sort of conflict both highlights tensions already existing in the discipline and holds potential for influencing the discipline’s development if the authors’ solutions are deemed acceptable by gatekeepers like editors and are then reproduced through others’ disciplinary texts. Hybrid texts, then, are productive sites for understanding disciplinary development. For rhetoric and composition, the Webtext Project suggests that while the scholarly webtext as defined by the journal *Kairos* has served a recurrent disciplinary function for those engaged in humanistic digital scholarship related to rhetoric and composition, it has not served a recurrent function for those engaged in empirical research. For those engaged in the humanistic hermeneutic tradition, scholarly webtexts offer a recurrent exigence for exercising the rhetorical imagination in exploring the possibilities digital media and communication technologies hold for composing and rhetoric. This imagination has not been exercised as often for exploring the possibilities for empirical research that digital media and communication technologies hold for rhetoric and composition as a discipline. Yet the Webtext Project underscores that those possibilities exist and have the potential to be productively tied to the discipline’s digital hermeneutic tradition, particularly through shared values such as reflexivity.

Recapitulation

To summarize, this chapter examined the case of the Webtext Project, a team of faculty in rhetoric and composition collaborating to create a scholarly webtext for the digital journal *Kairos*. Specifically, this case focused on the team's inventional process in order to shed light on how disciplinarity shaped and was shaped by digital and multimodal composing. Over the two years I followed the Webtext Project, composing the webtext presented the coauthors with a number of challenges. Working out the roles and relationships between formal elements of the webtext and between those formal elements and the substantive and situational, for example, proved challenging for the group, despite the senior status of its members and Mark's extensive experience producing scholarly webtexts. For example, how would the interactive classroom, with its dynamic data, relate to the verbal text in the webtext? How could a dynamic stream of data from readers of the published webtext be marshalled into some sort of findings without constantly destabilizing the webtext and requiring ongoing revision of the analysis, an unsustainable option. And how would gathering data from readers change the relationships between authors, text, and readers? Equally challenging was the scholarly webtext's invitation (or demand) to let go of previous genre expectations, which for Tara and Joy in particular meant letting go of the traditional IMRAD structure of an empirical research article, something they were willing to try, but found difficult.

Analysis of the team's composing through my first compositional lens—mode—revealed several important operations at work, including multimodal meaning making that was distinctly tied to disciplinarity. Tara's empirical research on learning spaces, for

example, some of which was completed in collaboration with Joy and which formed the basis for the Webtext Project, revealed the role of *traversal* to forge empirical connections across time, space, interactions, texts, and artifacts through purposeful use of multiple modes, such as the spatial, visual, linguistic, and gestural. These traversals were achieved in part through what Kress (2010) calls *transduction*, remaking meaning from one semiotic mode to another (such as between research participants' conceptual maps and numbers through coding), in order to forge empirical connections and facilitate analysis and communication of her research data. While some of this transduction led to greater abstraction and *meaning compression* (Baldry & Thibault, 2010), Tara's ethnographic sensibilities led to multimodal practices that were better described as *meaning expansion*, seeking to expand understandings of a social world through multimodal thick description. Tara's multimodal practices gave insight into the qualitative and empirical research traditions in rhetoric and composition, while Mark represented a very different thread in that discipline—the humanistic, hermeneutic tradition. Mark's use of modes, in fact, was distinguishable from both meaning compression and meaning expansion and was better described as *meaning attention*, drawing attention to meaning making as such and promoting critical reflexivity in readers. Together, Tara and Mark illustrate that multimodal composing practices, like more traditionally linguistically-based composing practices, are driven not simply by the affordances presented by semiotic modes, but also by disciplinary goals, values, histories, and conventions.

Analyzing the team's media-related practices through my second compositional lens—medium—revealed *remediation* as a central operation for the project, with, for example, the team remediating both a mapping protocol and an AutoCAD classroom diagram

to create the webtext's interactive classroom. This remediation produced an interactive classroom with new affordances that were seen as offering rich possibilities by the coauthors, but that were perceived differently according to their epistemological orientations. So while both Mark and his more empirically-minded coauthors focused on the same digital affordances—interactivity, recording, replaying—the compositional possibilities those affordances suggested for them differed in perceptible ways, with the need to use those to create *hypermediacy* for readers playing a large role in Mark's inventional work and largely absent for his coauthors. For Joy, Tara, and Christopher, these affordances instead cued data-related research designs and possibilities over those tied to creating critical reflexivity in readers.

While the team communicated regularly and produced work related to the project over the two years that I followed them, the tempo of their work was admittedly slow. Although collaborative dynamics, various external forces, and even gender may have played some role in this slow tempo, the most explanatory factor seemed to be related to my third compositional lens: genre. Remediating the classroom to a digital, interactive form provoked reconsideration of relationships between formal elements of the webtext as well as between authors, text, and readers. Because the webtext was designed to collect data from readers, this cued the empirical research article genre for Joy, Tara, and Christopher, along with its network of genres (like IRB applications, informed consent forms, etc.). The scholarly webtext in rhetoric and composition, however, is less related to empirical research genres than to hermeneutic genres like literary criticism, with editors and analysts of the genre identifying rhetorical enactment or *performativity* as its defining feature. For Mark, however,

the most experienced webtext composer, this performativity was seen as insufficient if readers are not *aware* of it and able to reflect on it, and therefore his rhetorical goals and those of the scholarly webtext genre more broadly were better described as *reflexive performativity in service of hermeneutic hypermediacy*. Much of the reflexivity in the genre is achieved through the generic invitation to explode convention and to deliberately transgress, something that greatly adds to the rhetorical labor involved in composing a scholarly webtext. Scholarly webtexts offer a recurring exigence to reconsider formal relationships and conventions and therefore are best understood through the typified relationship between form and situation, with situation understood through the shared disciplinary motive of understanding digital rhetoric and composing. The fact that the team made an effort to honor both the logics and epistemological values of empirical genres and the humanistic, hermeneutic scholarly webtext genre made their composing best understood as composing in a *generically hybrid text*. The Webtext Project team's struggles in composing a digital hybrid text raises the possibility that the epistemological and generic "blending" Berkenkotter and Huckin (1995) hypothesized would become the research prototype for rhetoric and composition is a less traveled compositional path in its digital genres.

The Webtext Project case highlights the continuing epistemological pluralism that defines rhetoric and composition and how that pluralism plays out in this distinctive digital genre. For those engaged in the humanistic hermeneutic tradition, scholarly webtexts offer a recurrent exigence for exercising the rhetorical imagination in exploring the possibilities digital media and communication technologies hold for composing and rhetoric. The team's

struggles, however, suggest that this imagination may not have been exercised as often for blending those possibilities with the empirical possibilities digital media and communication technologies hold for rhetoric and composition as a discipline. Yet the Webtext Project underscores that those possibilities exist and have the potential to be productively tied to the discipline's digital hermeneutic tradition through the shared value of reflexivity. These results highlight both the generative potential of rhetoric and composition's pluralistic traditions for digital practices and scholarship, and the immense difficulty of forming productive collaborations between members of the discipline who participate in its different epistemological traditions. For rhetoric and composition, mode and media are both subject of inquiry and tool for inquiry and the interplay between the two can lead to unpredictable outcomes that are disciplinarily distinctive.

Chapter 4

Rhetorical Practices of the Biological Imagination: Reimagining Evolution, Public Science, Genre Networks, Scientific Semiotics

Scientists are tellers of tales, creative writers who make meaning and who choose the ways they go about doing so.

—Jone Rymer, 1988, p. 244

I've often referred to science and art having the same creative wellspring, which I believe can be expressed aphoristically: the ideal scientist thinks like a poet and works like a bookkeeper.

—E.O. Wilson, 2014, p. 80

A new generation of artists, writing genomes as fluently as Blake and Byron wrote verses, might create an abundance of new flowers and fruit and trees and birds to enrich the ecology of our planet. Most of these artists would be amateurs, but they would be in close touch with science, like the poets of the earlier Age of Wonder. The new Age of Wonder might bring together wealthy entrepreneurs [with] academic professionals ... and a

worldwide community of gardeners and farmers and breeders, working together to make the planet beautiful as well as fertile, hospitable to hummingbirds as well as to humans.

—Freeman Dyson, 2015, p. 141

In his book, *Dreams of Earth and Sky*, physicist Freeman Dyson (2015) speculates that science may be entering a new “Age of Wonder.” He borrows this term from Richard Holmes’s book by that name, which examines the Romantic period’s rich intermingling of poetry and science. Holmes describes the heady creativity of scientific inquiry in the brief post-Enlightenment period between 1770 and 1830, a period he dates the close of with the first meeting of the British Association for the Advancement of Science (BAAS) in 1831 (Dyson, 2015, p. 136). The BAAS marked a turn for British science toward a more professionalized scientific community, with more connections to industry and fewer to amateurs and poets. Dyson, lauding citizens’ increasing access to scientific knowledge like human genomic data, contemplates the possibility of a new opening of science, with new collaborations between amateurs, artists, entrepreneurs, and scientists, though this time with biology, computer science, and graphic art dominating over chemistry and poetry. Dyson admits his proposal is speculation, but that “it is not too soon to begin examining the evidence,” with the evidence he would find persuasive including “a shift backward in the culture of science, from organizations to individuals, from professionals to amateurs, from programs of research to works of art” (p. 137).

The research story this chapter tells intersects in some important ways with Dyson’s vision for science’s new Age of Wonder. The scientists it features are part of a biology

research lab that has increasingly focused on developing citizen science projects, which, by creating a mechanism for ordinary citizens to contribute to science, also create a relationship between professional scientists and amateurs. In many ways, the lab's efforts have been to embrace participatory culture and experiment with ways to extend it to scientific work. In addition to these citizen science projects and extensive public science writing, the lab's principal investigator, whom I'm calling Soren Thomas, has also experimented with forming direct relationships with artists by inviting artists-in-residence to work in his lab alongside scientists, not simply to represent their science, but for the mutual exchange of ideas that can benefit and change both science and art.³⁵ For the scientists in this lab, the present moment is kairotic for science, presenting important possibilities to reimagine what "doing science" looks like and who is invited at the table.

Much of this kairotic moment can be traced to the possibilities presented by digital media, though it's also important to remember that digital media and the Internet are not new to scientific researchers, a fact that complicates how we view the present kairotic moment. Indeed, Brian Trench (2008) reminds us that the Internet, from the moment four decades ago when "two university computers were first linked to each other over the prototype Internet," was developed in context of scientific research and "has scientific communication indelibly inscribed into its fabric" just as "Internet communication is thoroughly integrated into the practices of science" (p. 185). That said, in the last two decades, digital media and the

³⁵ This lab is not alone in exploring the possibilities of partnerships between science and art, a partnership that often falls under the moniker of SciArt (search Twitter for #sciart for a sampling of projects and initiatives). This same logic has led to arguments for educational approaches that stress STEAM (science, technology, engineering, art, and mathematics) over STEM. It can also be seen in biomimicry design projects that partner scientists with designers.

Internet have become central to public communication too, with widespread access for many social groups, particularly in developed countries. Much as Carolyn Marvin (1988) found for new communication technologies like telephones and telegraphs in the late nineteenth century, which offered “sudden and largely unanticipated possibility of mixing heterogeneous social worlds,” widespread access to networked digital media through the World Wide Web has offered similar possibilities, including the possibility of changing communication patterns between scientists and the public. Trench, in fact, goes on to address this phenomenon, arguing that networked digital media have effectively turned science communication “inside-out,” exposing the back-stage of science to nonexperts and offering scientists and their institutions opportunities for “disintermediation,” or direct communication with the public as opposed to mediation through science journalists (p. 185; p. 191).

Set against these accumulated changes to patterns of social use and to sociotechnical relationships, Soren Thomas’s understanding of the present moment as kairotic for science and for scientist-citizen relationships makes sense. As the Webtext Project illustrates, kairotic moments require individuals to define and respond to them and Soren Thomas stands out as a visionary and innovator in this respect, both perceiving a rich moment for innovation and being willing to push against convention to define and respond to it, embracing public participation in science in ways other scientists might still be skeptical of. Marvin’s study of nineteenth century communication technologies also emphasizes that how these communication technologies end up stabilizing into recognizable patterns of use can involve a period of conflict over that use and simultaneously opposing uses and goals. The role of

conflict in the communicative innovation associated with technological change seems salient here, because part of the present kairotic moment Soren Thomas and his lab have responded to also includes responding to conflict, specifically, the sense that science is under attack and has become contentious. While some may double down on practices that keep the back-stage of science inaccessible to the public and attempt to protect traditional notions of scientific credibility in digital contexts, Soren Thomas and his lab have operated with the sense that the innovations made possible by networked digital media might positively intervene in this perceived attack.

The case reported on in this chapter focuses on what I'm calling the Heartbeats Project, one of many ongoing projects in Soren Thomas's lab. After several "scene casing" interactions (Lindlof & Taylor, 2011, pp. 87–93) with Soren and other members of the lab in fall 2014 during which they came to understand my interest in scientific digital composing, I was matched with the Heartbeats Project as one that would be fruitful for me to follow through its development. During an early scene-casing visit to one of their lab meetings, members of the lab had discussed aspects of their digital composing ranging from enhanced articles and PDFs to interactive maps and data visualizations, as well as open access journals and open peer review. Because the Heartbeats Project was still at early stage of development and they anticipated that manuscripts coming out of the project would engage with these aspects of digital scientific composing, I was matched with this project and with Clay, the postdoc leading the project and the composition of the first manuscript coming out of it.

The Heartbeats Project was conceived as a response to the limited data behind the well-known "rule" that on average mammals' hearts beat one billion times per lifetime.

Using data collected through a combination of citizen science data submissions and lab member contributions, the Project sought to test whether the original rule holds, as well as to extend the analysis to other biological classes, like birds and amphibians. To participate, citizen scientists submitted species heartrate data found in the scientific literature, which was then vetted by members of the Project team before inclusion in the data set. While some of the lab's citizen science projects have garnered participation by thousands of citizen scientists, the Heartbeats Project participants only number in the hundreds, perhaps because of the barriers presented by the inaccessibility of the scientific literature (both at the level of technical infrastructure and genre). The contributions, however, were sufficient to help address the limited data of the original research in this area and to develop a manuscript on the mammals data (my focus here), with plans for a second manuscript on reptiles and amphibians.

During my twenty-four months of ethnographic engagement with the Project, it became apparent that while the team's digital composing included consideration of born-digital elements such as videos, graphical abstracts, data visualizations, etc. for scientific communication, their use of digital media for interaction with citizen scientists played a significant role in their composing. Analysis of these interactions in context of the team's composition of the Project's first scientific manuscript, in fact reveals that these served an *inventional* role for them, productively influencing their analysis and the composition of their manuscript. The affordances of networked digital media interacted with the team's disciplinary goals and exigences, including the pressures faced by their discipline as a social entity, to create an opportunity for changing *who* would be included in "doing science" and

how that empirical activity would be structured. Changing the participants and activity involved in the Heartbeats Project, a change which included extensive additional communication, did not leave their scientific composing process untouched, instead becoming part of that composing and therefore part of my analysis in this chapter. As with the Webtext Project, this chapter begins with a narrative description of the project over the twenty-four months I studied it and then proceeds to three analytical sections reporting on the project through my three compositional lenses, but this time beginning with medium before moving to mode and genre.

My first compositional lens—medium—reveals a similarity with the Webtext Project's digital composing: namely that, the Heartbeats Project coauthors, like the empirical members of the Webtext team—Tara, Joy, and Christopher—focused a great deal on the affordances of digital media for data collection, analysis, and presentation. Both teams, in fact, used networked digital media for dynamic data submissions from participants. The participants from the two projects, however, were positioned differently and the relationship of their data submissions to the disciplinary text differed substantially as well (i.e. Heartbeats citizen scientists were not positioned as readers of a disciplinary text in the way Webtext Project participants were). In contrast with the Webtext Project, the Heartbeats Project did not enlist performative reflexivity and hypermediacy in their use of digital media, instead enlisting *immediacy*, to use Bolter and Grusin's (1999) term, to make use of digital media for disciplinary goals, while letting the media and mediation at work recede transparently into the background for composers, citizen scientists, and eventual disciplinary readers. In this disciplinary context, which has been developing ways of sharing data and the results of

empirical inquiry through the Internet for some time (forming, in fact, part of the exigence for the development of the Internet), what is more innovative and urgent—the kairotic moment—is developing scientifically productive ways of extending that beyond specialists and internal scientific communication to the public and what has been traditionally understood as external science communication. And so the Heartbeats Project’s empirical uses of networked digital media for citizen science can be seen as the intersection of exigences that scientific disciplines have faced (and that have increased in urgency with current proposals for defunding government sponsors of scientific research like the Environmental Protection Agency and National Institutes of Health; Reardon, Tollefson, Witze, & Ross, 2017), with a broader cultural movement towards a more participatory culture (Jenkins, Purushotma, Clinton, Weigel, & Robison, 2005). In a scientific disciplinary context like biology, however, which has over its history developed highly regularized and regulated tools and conventions for the construction of scientific knowledge, the potential and limits of participatory culture are still being worked out, with the Heartbeats Project an attempt at embracing it while maintaining disciplinary conventions for knowledge construction through scientist leadership. As with the Webtext Project, the Heartbeats Project’s composing reinforces that the affordances digital media offer for scholarly composers are perceived and taken up in relation to disciplinary goals, practices, and systems that influence how those affordances are taken up. What the Heartbeats Project adds, however, is that in some disciplinary contexts, public audiences and institutions are seen as strongly related to these disciplinary goals, practices, and systems and can also influence how digital media are taken up for disciplinary purposes and what communication practices and

forms stick. In this case, public audiences were seen as so relevant to disciplinary purposes that the team engaged in “composition for recomposition” (Ridolfo & DeVoss, 2009), composing elements of their scientific manuscripts with the express view that those elements would be taken up and repurposed in public-facing texts.

Looking at the Heartbeats Project through my second compositional lens—mode—suggests some reasons why certain publisher experiments with multimodal “digital enrichments” have been successful with scientists and others less so. The team’s work exemplifies what Jay Lemke (1998) has termed the “semiotic hybrid” that is scientific knowledge construction, which includes practices that use, move across, and combine multiple semiotic modes simultaneously and that have a multiplicative effect for scientific meaning making (p. 93). As discussed in context of the empirical members of the Webtext Project team, scientific knowledge construction is also characterized and enabled by meaning compression and the “greater abstraction in representation” that multimodal partnerships and linguistic practices like nominalization allow (Baldry & Thibault, 2010, p. 60). This is visible in the Heartbeats Project’s manuscript drafts as well as the graphs the team produced to communicate with citizen scientists, which by definition abstract physical data collected from animals’ bodies to numbers that can be used for statistical operations and transformed into meaningful statistical relationships. Members of the lab were less impressed, however, with digital enrichments like videos and graphical abstracts, perhaps because they deviated from the logic of meaning compression into the logics of both meaning expansion and meaning attention, and because they did not fit with scientific reading and research practices. The lab’s communication with citizen scientists adds complexity to our understanding of

scientific multimodal practices, however, in that some of their public science communication used meaning expansion strategies that resembled Tara's ethnographic multimodal practices—for example, bringing individual animals' bodies back into their meaning making through photographic representation. Ethnographic engagement with the lab's larger citizen science work in fact revealed that projects generally included instructions that allowed citizen scientists to produce acceptable data through an embodied, multimodal scientific meaning making experience. While those instructions necessarily compressed meaning using a small number of modes (e.g. linguistic and visual), they allowed citizen scientists to expand their scientific meaning making back out to a more complex, multimodal experience of “doing science” that included modes like touch, smell, spatiality, temporality, temperature, etc. Much like Tara's multimodal thick description that sought to “thicken” her audience's understanding of her embodied ethnographic experiences, the lab's citizen science instructions allowed citizen scientists an expanded, embodied scientific meaning making experience more closely resembling the multidimensionality of scientific semiosis. Rhetorically, citizen science instructions amounted to a form of *procedural rhetoric* in scientific meaning making. In context of the Heartbeats Project in particular, this insight suggests another reason for low citizen science participation in the project: namely, that the project offered a bibliographic scientific experience that did not fit citizen scientists' conceptualizations of scientific work as an embodied, multimodal meaning making activity (rather than an exclusively literate one). It may also help explain why the team was less interested in some of the digital enhancements like videos offered by scientific journals, as these did not contribute to the disciplinarily useful multimodal practice of meaning

compression, instead operating with a logic of meaning expansion more suitable for other goals.

Finally, I close this chapter with my final compositional lens—genre, an analysis that includes attention to *uptake* (Austin, 1962) between genres in the team’s composing and to the team’s *recontextualization* (Linell, 1998) of information across texts and genres. Using rhetorical genre theory to examine these two types of intertextuality provides a rhetorical basis for understanding the team’s composing and the relationships between the texts they composed for the Heartbeats Project. Specifically, the genre chains revealed by this analysis demonstrate how the change in *sequence* for internal and external scientific communication that citizen science introduces can also influence the rhetorical actions of the genres involved. Compositionally, the team’s recontextualization of citizen science communication for their research article manuscript suggests that citizen science can also serve an inventional role for scientists and that therefore scientists can benefit from citizen science in less tangible ways than the collection of data. Soren’s commentary on these practices, however, revealed purposeful genre innovation, particularly in forging new genre chains that reached across discursive fields and back again—genre innovation aimed at a much larger discursive change, changing science itself.

Narratio

“There you are!” My contact, Sara, navigated a large stroller into the spacious atrium I was waiting in. Her petite frame was dwarfed by the equipment she was transporting—stroller, backpack, camera bag, lunch bag—but her infectious smile shone

through unobstructed. Her baby, however, did not reciprocate my smile, instead choosing to observe me cautiously.

Sara used her keycard to let us into the small elevator, which took us to the Soren Thomas Lab on the second floor of the building. Upstairs, she led me down a warmly-lit, tiled hall to a lounge furnished with a long, upholstered booth-like bench and several small round tables. A couple of young women were already chatting in a corner and greeted us as we came in. Sara introduced us—they were both lab postdocs—and then left me with baby Mia for a moment to warm up Mia's lunch.

Mia's chin quivered fleetingly, but stabilized as the two young women came over to coo at her. She clearly knew them. More people casually trickled in, mostly young women in their twenties and thirties. A young man came in and leaned against a window observing the scene.

Sara returned and started feeding Mia, continuing to introduce me to people as they came in. Based on the emails I'd exchanged with Sara and Georgia, the lab project manager who had given me permission to attend, this was the lab's weekly meeting. I came prepared to observe, not wanting to disrupt their meeting, and so took out my notebook to take notes.

The meeting, however, didn't seem to be crystallizing into a formal meeting—instead, it felt more like a social hour. Someone brought in brownies and almost everyone got up to partake. Slowly, they all found seats again, some sitting on tables and window ledges. The room got suddenly quiet as the stranger Sara had brought became the focus of attention.

“So what do you study?”

The questions came quickly. They were clearly intrigued by having a representative from the other side of campus in their midst and wanted to know all about my world and research.

Once they knew I was interested in their writing, however, they soon transitioned to telling me all about the issues they were confronting. The young man leaning against the window had a lot to say—open access journals, open data, open peer review, data visualization, impact factors, media impact, technical competence, greedy journal publishers. These were all things he was thinking about on a daily basis as he went about his work.

One woman complained about having to pay \$3,000 to make an article open-access. And how challenging it was to gain the technical competence to create all the interactive maps and graphs they wanted to be able to create and publish.

This issue of technical expertise was clearly something I'd heard among those in the humanities, but I expressed surprise that this would be challenging to scientists too.

Another woman chimed in an explanation, "Anyone who can do that could go find a 6-figure job with Google!"

This scene describes my first scene-casing visit and first moment observing the Soren Thomas Lab, an evolutionary biology lab at a land-grant public university that exudes vitality and creative thinking, both in the physical space of the lab and in the online network of sites they have created to conduct and publicize their work. This meeting-that-was-not-a-meeting puzzled me at first, but I soon learned that the majority of their work was physically and temporally distributed, conducted in a variety of spaces including labs, lab offices, forests

(“the field”), urban natural spaces (more of “the field”), coffee shops, museums, classrooms, and homes. They, of course, constantly interacted via email and other channels, but the weekly meeting was a rare opportunity to rub elbows with members of the lab in a physical space. The “lab” was a distributed social entity more than a co-located physical one. Eventually, Georgia, the lab project manager, joined the meeting and made a few updates about remaining grant funds and about submitting travel receipts, but this was done over the din of packing up and was not the focal point of the meeting. The focal point, in fact, had been me.

Going in to observe, I did not expect or want to be the focal point, instead preferring to observe the lab culture in action with as little influence from me as possible. Communication and writing, however, seemed to be a major preoccupation in the lab and central to what it meant to them to “do science,” as they put it. As soon as they heard about my interests in writing and digital media, all the communication-related issues they were confronting on a daily basis poured out. It probably helped that I fit the age and gender profile of those working in the lab, and that I came in as a friend of Sara’s, whose official title was “Curator of Digital Media.” My identity as a fellow member of the campus community and as a doctoral student conducting qualitative research also meant they had multiple ways of identifying with me—they could assume I’d understand some of their experiences as researchers or as students. Yet as someone from outside their field, I could also take on a learner role and let them teach me about their discipline and the things they’d learned about operating in it.

The warmth and light of the bookstore contrasted sharply with the cold, dark February night outside. The shop, which was something of a Raleigh institution, was crowded for a Tuesday night and I had to skirt several groups of shoppers as I made my way to the event space in the middle of the open floorplan store.

Spotting Sara among the youthful crowd of lab of attendees to the left of the lectern, I made my way to an empty seat nearby. While the left side was filled with lab and family, those sitting in the space in front of the lectern were clearly older—jacketed university colleagues and retirees come to hear Soren Thomas read from his latest popular science book, which had just come out that day. I'd heard him interviewed about the book on NPR a few days before and had gathered he would be an engaging speaker.

Scanning the crowd, I spotted him seated next to two children, who appeared to be elementary or middle-school aged and seemed remarkably well behaved. After a few opening remarks from the bookstore owner, he left his family and took to the stage.

He was indeed an engaging speaker, and what I quickly discovered was that this stemmed in part from the unassuming ethos he projected. Beginning with the family story that provoked the inquiry that became the book, he proceeded to weave together the history of medicine, science, and the arts with current medical, biological, and evolutionary questions into a compelling and oddly personal story. The curiosity that drove everyone from Galen to da Vinci and to modern scientists came alive through his stories and the full-screen art, medical illustrations, documents, and photographs he projected on the screen behind him. Taking on highly specialized inquiry and theories, he put them in context of the people who asked and sought to answer and made the endeavor seem present and accessible.

After the talk and a lively Q&A that confirmed for me that the audience in the center included quite a few scientific colleagues, the lab crowd converged on Soren congratulating him and congratulating Summer, a research technician in the lab, for her work on a graph she had created and published on the citizen science webpage related to the book—just in time for the book’s launch and tonight’s talk.

A few weeks after this talk, I officially began studying the Heartbeats Project, getting matched to the project through a series of conversations and emails with, among others, Sara, Soren, and Georgia. I met with Summer about her experience developing her graph, which was initially designed to be interactive and then revised to be static. She also explained the Heartbeats Project’s genesis in Soren Thomas’s popular book and the fact that this was not unusual for their lab. Soren apparently wrote quickly, following ideas with intensity, often emailing members of the lab to locate literature relevant to what he was writing. If they couldn’t find it, sometimes that gap would become their next project, regardless of whether the gap had been identified while writing for the public or for scientists.

Once matched with the Heartbeats Project, I discovered that the young man leaning against the window at my first visit to the lab was Clay, the postdoc leading the Heartbeats Project citizen science project and the lead author on the first related manuscript. Clay invited me to observe his weekly meetings with Jada, the undergraduate researcher assigned to the project who was helping vet and collect data, and who would be given the opportunity to be lead author on a second manuscript related to the project. At our first meeting, in March

2015, I learned more about the Heartbeats Project as a citizen science project and the status of its mammals manuscript.

While writing about the “billion beats rule,” the general rule that mammals average a billion heartbeats per lifetime, Soren and his team had traced the rule to a short review article in the *Journal of the American College of Cardiology* that based its analysis on only sixteen species (Levine, 1997). The species, in fact, weren’t always stated, with one point on the graph for “elephant” (see Figure 4.1), which turned out to be the heart rate for a circus elephant whose species was not documented (*Lexodonta Africana? Elephas maximus?*). On top of this, one of the two “whale” data points turned out to be a beached whale, and some of the data came from an entry in the 1971 *Encyclopedia Britannica*. All of this added up to the need to test the rule using a larger data set and more stringent criteria for data inclusion. The idea was to start with mammals, as Levine had, but also expand out to other classes, like reptiles.

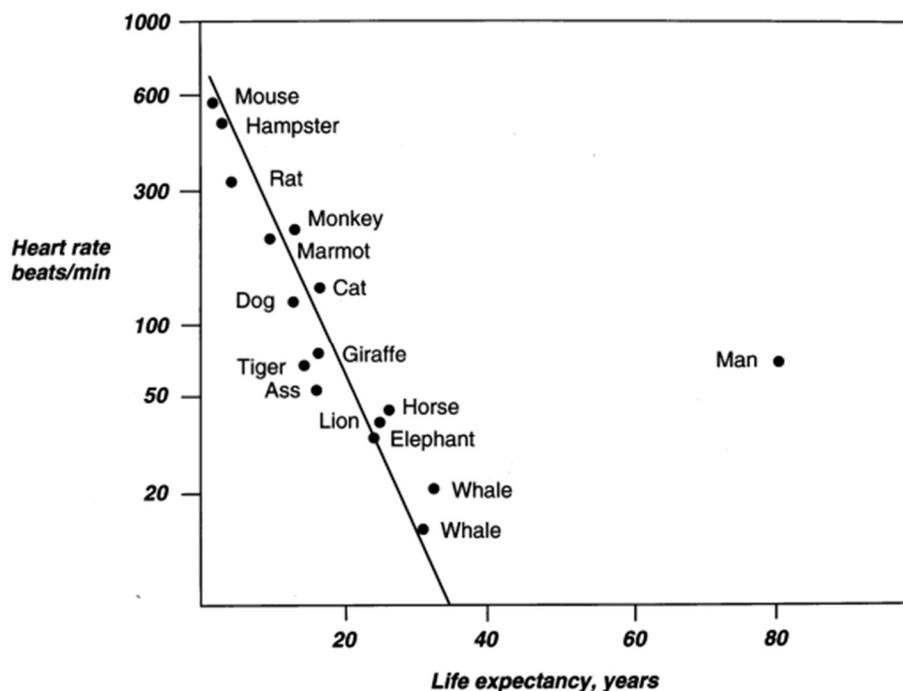


Figure 4.1. Figure from Herbert Levine's (1997) "Rest Heart Rate and Life Expectancy"

The lab team had seeded the project by locating a few species' heartrate data in the scientific literature, but now the project was open to citizen science contributions through the lab's website. The website included instructions for citizen scientists to search databases like Web of Science and Google Scholar to locate scientific articles that included species heartrate data as part of their studies. Jada had been part of the team contributing data from the literature and now her job was to check citizen scientists' contributions to make sure they met the criteria. At this meeting, Clay was checking on the data Jada was managing. As Clay looked over some spreadsheets and PDFs of scientific articles that had been contributed, Jada told me about her excitement that morning at receiving multiple notifications of citizen science submission on her smartphone:

It was crazy! Like, at eight-something this morning, I'm getting dressed, getting ready for class, and I just, like, my phone it just starts buzzing. And it's not a text message, because that's two buzzes. It's, like, buzz, pause, buzz...buzz, and I'm just like, what is going on? So I check it and it's just submission after submission and I'm just, like, what in the world?

Much of the session consisted of Clay teaching Jada the features of the spreadsheet software she could use to check and manipulate her data and start asking questions of it. For example, she did not know how to sort the data (she was afraid it would only sort a single column, mixing up the data in the rest of the spreadsheet). Once he showed her how to sort, he showed her how to select the rows and numbers she needed to communicate to the lab's webmaster in order to update the information on the citizen science webpage. Finally, because they were starting to reach some target points in their data, he showed her how to use the tables to do some quick analyses to evaluate the direction the data was taking.

At one point, he asked, "Are you familiar with regression? You know what that means?"

To which she replied, "The line?"

"Yeah, just a linear regression, right."

By this point, he had created one from the data they had already collected and showed it to her, happy to see this pattern already emerging.

This simple exchange highlights how integrated the experiences and activities of asking questions, collecting data, analyzing data, and communicating were for the team—while continually collecting data, they were already asking questions of it and considering

what provisional findings to communicate. The interaction also demonstrates how multifarious the project was, serving the purpose of mentoring an undergraduate while engaging the public with science, answering disciplinarily useful questions for science, and helping a postdoc develop and professionalize. For Jada, learning to be a scientist meant learning these goals and strategies in an integrated way. As her experience with receiving data notifications while getting dressed illustrates, it also meant learning them in way that was integrated with her personal life.

This moment, in fact, illustrated for me why an ethnographic approach to studying composing was so useful. Constraining my attention to the moment when words and numbers were typed would have missed this integration and interconnection of activities across sites, moments, and spaces. Even as Clay was conducting a rough linear regression on this preliminary data, he was testing an already-written hypothesis and mentally composing a research article. Would the relationship they observed with mammals and birds—with endotherms—also hold for amphibians, reptiles, and fish—for ectotherms? If the answer was yes, he'd be able to create one sort of exigence for one of their reports. If the answer was, no, he would craft another sort of exigence and aim lower or higher in the hierarchy of scientific journals and claims (Myers, 1985a).

Clay leans back in his chair, considering my question. A large poster of an umbrella inspired by the anatomy of bat wings hangs on the wall behind his computer. His elbow grazes the wooden case of butterflies on the counter behind his chair. It's a small office. He straightens up and swivels toward me.

We're discussing the first draft of a paper reporting on mammal heart rate data and lifespan. Clay is listed as first author, with the lab's head scientist listed last. This is still an early draft and I'm feeling my way around the project, trying to understand its scope and how they're conceptualizing it. I've just asked Clay about where they intend to submit it.

*"Yeah, I mean, right now, we're aiming, for the first one, maybe someplace short and sweet—like *Biology Letters*," he explains. "Everybody starts out, oh, this paper, we're gonna send it to *Nature and Science*," he continues, "And, you kind of manage expectations as you go."*

He works through some of their considerations as they work through how to frame their findings and choose a target publication. "There's gonna be some tricky things," he continues, "We're looking at heart rate, but there's the body size component, there's metabolic rate—why is heart rate different than all these other things? How are we controlling for those things?"

I scan the draft again. I didn't recall a discussion of body size or metabolic rate. Ah, there was a reference to metabolism in the opening sentence. The rest of the draft focused exclusively on heart rates.

"You know, I think our initial goal in the first paper might be to just say," he goes on, "We don't care—this is it, the heart rate relationship. That hasn't even been established."

He leans over to look at the draft of the introduction again. "I think one of the major novel things that is coming out of the paper is," he straightens up, "comparing this relationship through using it as a common metric to compare species. So, do they fall above

this line? Do they fall below? What are the traits of species that fall above? What are the traits of species that fall below?”

I consider what he’s saying—he’s considering a lot of factors to answer what I thought was a fairly straightforward question and clearly thinking through the job of this first paper in a larger series of scientific claims and how his readers will read it.

Clay continues, “You could do this with metabolic rate. We did it with heart rate. But the approach is gonna be the thing that pushes it to a higher impact thing—rather than just, oh, gee, we drew a line through a bunch of graphs.”

After Jada had left to go to class, Clay and I looked at the first draft of the mammal manuscript together, a short 1500-word affair that had been put together in a Google Doc. Clay described how Soren had quickly written the general gist of the paper, with other team members including himself contributing elements like tables, numbers, methods, and references. The manuscript included material in all four IMRAD sections, with the discussion the most skeletal. It also included a number of bracketed “notes to self” and notes to collaborators (e.g. “[one more sentence here...]” and “[write down the methods Summer]”), including more humor and literary allusion than I anticipated. The title, for example, included a reference to Edgar Allan Poe’s “Tell-Tale Heart” (“The Telltale Pump”) and one of their institutional affiliations was listed as the “Department of Modest Panic.” The manuscript gave the impression of a discovery draft, an analytical and rhetorical rehearsal of sorts, which Clay confirmed during our interview. The draft was,

Just Soren wanting to look at the data before we got it all and doing some rough analyses that weren't designed to be really that rigorous, but just really quickly showed something that was interesting.

While the manuscript included statistical analysis in two tables and a graph, these were preliminary analyses that would need to be repeated once they had their complete data set and the data had been rigorously vetted. At this point, however, it was enough to confirm the direction of the analysis and start rehearsing how to frame it in the manuscript.

If measured by words-on-a-page, the next several months after that March 2015 meeting didn't include much composing activity. However, the team continued work on the project in intermittent spurts and continued adding data to it as citizen scientists contributed it, though participation slowed and never reached the numbers seen in some of the other lab's projects, a subject Clay and I discussed on several occasions. As part of her undergraduate research program, a program funded by the National Institutes of Health and designed to promote diversity in research, Jada participated in two research poster presentations related to the Heartbeats Project, an undergraduate research symposium at their institution and a national conference on the West coast. Clay mentored her for both, in addition helping her write a blog post on the project for the lab website to encourage more citizen science participation.

Later in 2015, Clay also gave his own talk on the project at a science café event at a nearby university. Talking through his planning ahead of the talk, he explained how public speaking "helps me organize my thought about where to start, how to provide the context" and even "what you can get away with ... like what things sound stupid when you say it in

front of a group of people versus when you write it.” These writing and speaking opportunities, including the ones he coached Jada on, prompted him to rework parts of the analysis and, most of all, rework how it would be framed and discussed. Communicating with a live audience also helped him assess the larger claims he was making. In December 2015, however, Jada resigned from their biology lab to join a psychology lab, which she had discovered fit her professional goals more closely. Perhaps because the project no longer served the purpose of undergraduate mentoring, and the routine check-ins that came with that mentoring, the activity related to it dropped substantially in 2016. That said, I discovered how much more extended a social group the lab was through this, because Jada continued to be considered a member of the lab, remaining on their internal listserv, and continued to be considered a potential coauthor on the subsequent reptiles and amphibians paper.

In addition to this change in roles, Clay was working on a number of other manuscripts and projects at varying levels of completion, with most of those at a higher priority than the Heartbeats Project. He explained how “Soren is very pushy on new things ... but is less pushy at the end of things,” which contributed to the trailing activity on the project. Another factor was Clay’s job search. As the term of his postdoc was coming to an end, Clay had made a first foray onto the academic job market in 2015 and was redoubling his efforts in the 2016-2017 academic year, an activity that was extremely time consuming. The job market, however, had exerted some influence before this as Clay, an ant scientist, had initially joked how this and other projects he had worked on in the lab had kind of “messed up my CV,” changing the narrative it told about him as a researcher. Soren, however, felt the paper and others like it would actually enhance Clay’s profile, since they

were of interest to the public and would appeal to search committees and job talk audiences *as people*, demonstrating an ability to work with broad, varied audiences (like the public and undergraduates). By the end of 2016, Clay was indeed changing his mind, noting that “the best [scientific] papers are the ones that you can read starting from the beginning and not have background in the field and be interested in and understand” and that because he was “an insect scientist writing a paper” on mammals, it made it “a little bit easier for me on this one to think that way.”

While Clay was apologetic about not making progress more quickly, he actually made significant progress on the mammals manuscript in 2016, making the decision to cap his data collection on mammals at 160 species (already a 10-fold increase over Levine’s data set) and embarking on the painstaking task of rechecking each data point in the set, a process that required him to access 160 scientific articles and evaluate whether their methods led to heartrate data that met the project’s criteria. Animals, for example, must have had their heartrate documented while conscious but inactive to work for their purposes—no stressed or sedated animals. Clay also used the AnAge Database, an open access database on animal ageing and longevity to collect lifespan data on each of the species. Based on his interaction with an audience member at his December 2015 science café talk—a “cranky” retired scientist who had stayed after the talk to ask Clay questions—Clay had decided they must look at body size data too, since reviewers would likely have the same questions about their analysis. The scientist had argued that what Clay had presented was “not a heartrate relationship, [but] a body size relationship.” At an interview in February 2016, Clay reflected on this:

The other factor, which I was hoping to avoid, but because it was brought up at my public talk, is the body size component. And so, in 1997 [when Levine published his article], you could get away with not looking at anything besides heart rate and lifespan. But it's been about twenty years or so. And so now it, depending on where you want to publish, like if we want to aim higher, we might have to add body size and control for that and see if there's still a relationship or what it looks like.

To complicate matters further, Clay explained that heartrate and metabolic rate are correlated, though not perfectly linearly: “One of the reasons why they measure heartrates in most of the studies we look at, is because they want to use it as an estimate of metabolism,” since “it’s just easier to hook up a heart rate monitor [to an animal] than it is to measure oxygen consumption or CO² output.” Because the relationship was not fully understood and was not a perfect correlation, their analysis would need to address this as well and add metabolic data to their data set as well. Acting on this realization, he made the decision to extend the analysis in this direction and by April 2016, he and Summer had “finally got all of the body size and metabolic rates pulled together” and “sent out to Rachel.”

Clay described Rachel, an alumna of the lab who was now a faculty member at another university, as a “a statistical whiz” whom he preferred to defer to on these sorts of analyses. She had performed the preliminary analysis that had allowed them to draft their 2015 discovery draft—the Edgar Allan Poe draft—and they would need her to do something similar with the added variables of body size and metabolic rate. In addition, she was a good

resource for controlling for phylogenetic signal,³⁶ a “modern technique that’s expected [by journals] in the last five years” and that “control[s] for branch length and relatedness between different groups [of species]” to see “if the pattern still holds up when you control for phylogeny, which it does.” Because the technique was so recent, “the Levine paper didn’t do [it],” which meant they were not solely replicating and confirming his findings. As Clay put it, “we aren’t just confirming, we’re adding this evolutionary perspective to it. And I think that’s the real story.”

By the end of 2016, Clay had used Rachel’s analysis and was ready to start on a new draft of the manuscript, this time minus the humor and literary allusions. He had, in fact, over the course of the last two years been toying with how to revise the paper’s claim to potentially make it “higher impact” and aim for a journal higher in the hierarchy of scientific journals. Early on, Clay had aimed for *Biology Letters*, which published short articles, then *Science Advances*, which published short, digital articles but was associated with the prestigious *Science*, and now was aiming for *Current Biology*, again publishing short articles but published by Cell Press. The decision-making here seemed to include matching the level of claim with the journal’s impact factor and prestige (aiming as high as possible for the claim), as well as assessing the depth of the paper’s analysis, and finally considering a mix of personal factors such as relationships with editors and the mix of journals already present on CVs. In a study of scientists’ composing and revision during the peer review process, Greg

³⁶ Jason Kamilar and Natalie Cooper (2013) define phylogenetic signal “as the tendency for related species to resemble each other, more than they resemble species drawn at random from a phylogenetic tree” (p.2). It is “the pattern we observe when close [evolutionary] relatives are more similar than distant relatives” (p. 2).

Myers (1985a) found that author-reviewer negotiations over article revisions during peer review are also negotiations over the status of the article's claim in a hierarchy of possible claims (p. 596). At the beginning, authors tend to "start by making high-level claims for the importance of their findings, while the reviewers demand that they stick to the low-level claims that take their findings as part of the existing structure of knowledge" (p. 596). Clay's decision-making prior to journal submission or peer review is consistent with Myers's findings.

Over the course of the two years, Clay had broadened the implications he saw for the manuscript and had started feeling that the claim they could make was higher than he had initially thought. The manuscript, in his mind, could go beyond looking at factors like heartrate and body size as simply indicators of metabolism, to making a claim about evolutionary changes in the heart itself that might account for longer or shorter lives in certain groups of species, a claim that could have much higher impact. It was less interesting to him to be able to say, "Okay, we can measure all these things that are related to metabolism and draw a line through them." It was more interesting to ask "What is the real factor that is contributing to this?" Based on the data he was seeing, which supported the position of humans as outliers and added primates as outliers as a group, Clay felt it might be justified to make a claim about natural selection:

I think part of it is probably correlation and probably *is* metabolism—like all this oxidative stress, and that's reduced if you have a lower metabolism—but that doesn't preclude that there's also active selection on the *mechanics* of the heart ... it makes sense that if you live a long time, your heart works more and that there's potential

adaptations in the heart itself ... it suggests that, like, looking at primate hearts versus other hearts in mammals might also give some explanations for what's happened in the evolution of the heart [to make them outliers in terms of lifespan and heartbeats per life].

This sort of claim could have some important implications, for example, potentially avoiding medical research that might not be useful:

If you start looking at humans in the context of other species, you can make smarter decisions and you can stave off medical research that might not make that much sense. If you look at humans, it makes a ton of sense. But if you look at five other species on earth *and* humans, then you realize, “Oh, okay, there's really nothing going on there, maybe we should focus on other questions.”

Developing a new draft of the manuscript in December 2016, then, meant developing its research story and deciding whether this claim would be part of it. By that time, Rachel had developed another preliminary analysis using the additional data Clay and Summer had collected, but it wasn't the final analysis yet and Clay explained how recursive the data analysis and writing became at the stage. Rachel was extremely busy in her new role as faculty member, and so Clay wanted to be very efficient and targeted in what he asked of her:

What I want to do is to sort of plan out the paper and start thinking about what I really want the statistical backing for and I think that can help at this point. Rachel did analysis first that helped drive the questions we asked along the process. And at this point I wanted to do some of the writing and think about exactly what analysis we want to support the statements that we want to make . . . And so, I feel like if I can get

the story clean so she can really quickly understand what I'm looking for and what this is about, then she can efficiently get back with the data for the data analysis.

To draft this new draft, which was now targeting *Current Biology*, a general interest biology journal, Clay gathered material from the citizen science website, the old manuscript, and the abstracts he had helped Jada write and “just copy and pasted that all into this main document” to get started. Reflecting on his process, he explained that his draft was “definitely a mix between [Jada's work] and a little bit of our public engagement site, which I think is probably fairly unique.” The fact that the manuscript was aimed for a journal that sought explicitly to publish “important findings of general interest” may help account for why this process worked well in this case (“Information for authors: *Current Biology*,” 2017). One of the challenges Clay was encountering for the manuscript was the extremely streamlined nature of the reports published in *Current Biology*, which were limited to 2,500 words of main text and no more than four figures and which combined the abstract and introduction into a single 250-word section called “summary.” The journal submission guidelines asked authors to note that “all essential background information should be included in the summary, and the Results (or Results and Discussion) section should begin immediately with a presentation of the new findings” (“Information for authors: *Current Biology*,” 2017). This required Clay to hone the manuscript's research story to its very essence.

The two working titles Clay had drafted illustrated the important choices he was making, with one describing the manuscript's findings in a sentence-style title that included the evolutionary contribution they were making and the other including an evocative

metaphor (but no Edgar Allan Poe) before a colon and then simply stating the relationship the manuscript examined. For Clay, the choice would affect how they would be cited and the contribution the manuscript would be known for, and so could not be taken lightly: “it’s going to affect how you are cited later, because most people, like 90%, are going to read your title and maybe, like, your abstract.” He saw the first title option as “basically telling people what they should cite [the manuscript] for” with the second “a flashier, more broadly interesting title.” The first title, then, would firmly situate them in a well-defined scientific conversation, while the second would facilitate extension beyond specialties and perhaps beyond science to the public.

Medium: Reimagining Public Science

I end my narrative of the Heartbeats Project’s composing with their second draft because that is the stage they were at as I closed my own data collection for this dissertation. While the team had yet to achieve a draft they could submit to a journal, the two years of work I followed provided me with enough to gain some insight into my original questions. Looking first at the Heartbeats Project’s disciplinary composing through the compositional lens of *medium* reinforces the fact that “at this historical moment, nearly all composition is digital composition” (Eyman & Ball, 2014, p. 114). Nearly every aspect of their composing was mediated by digital media in some way, with oral communication the most striking exception (see Table 1). The team collected data, for example, using a range of digital databases, including specialized biological databases of species-related data on longevity, body size, etc. and article databases like Google Scholar and Web of Science. The data points

contributed by citizen scientists were submitted through an online form tool called WuFoo that also sent notifications to members of the team on their smartphones (e.g. Jada's excitement over these notifications). Because the data on heart rates that they needed was often found in scientific articles' graphs, they also used the evocatively named data extraction tool, Data Thief. The data itself was stored and shared in spreadsheets on Dropbox, or sometimes in comma-separated tables in CSV files or even simple text files. Clay performed preliminary analyses using Graphpad Prism, while Rachel conducted the more robust, final analyses using the statistical analysis software, R.

The line between the team's data-related technologies and their composing/communication technologies was somewhat fuzzy, as some tools were used for both or interacted with tools in the other category. The project's webpage, for example, was developed using WordPress and mainly used for external communication with citizen scientists; however, it was also used to collect data submissions from those citizen scientists and was linked to WuFoo for that purpose.

Table 4.1. Digital tools used to develop and communicate the Heartbeats Project.

Data Analysis	Composition & Communication
Data Thief (data extraction)	Google Docs (drafting)
WuFoo (online forms)	MS Word (drafting)
PanTHERIA (database)	Adobe Illustrator (figures)
AnAge (database)	Keynote (Clay's presentations)
Google Scholar (database)	MS PowerPoint (Jada's presentations/posters)
Web of Science (database)	Email (internal)
PubMed (database)	Gmail Chat (internal)
Interlibrary loan portal (article access)	Skype (internal)
Library websites (present & former institutions)	Google Hangouts (internal)
Wikipedia (for scientific names)	Lab listserv (internal)
Dropbox (data storage)	WordPress (external)
MS Excel (data storage & manipulation)	SciStarter (citizen science database)
Notepad & CSV (data storage & manipulation)	Lab and project websites (external)
Graphpad Prism (preliminary analyses)	Twitter (external)
R & RStudio (statistical analysis)	Facebook (external)
D3.js (interactive data visualization)	Google+ (external)

That said, the list of composing and communication technologies that I observed, as listed in Table 4.1, illustrates how important networked digital media were to those processes. The first draft of the mammals manuscript (the Edgar Allan Poe version) was drafted in Google Docs, which mediated a highly collaborative process with geographically distributed members of the lab. The subsequent draft of the manuscript (for *Current Biology*) was drafted in a more solitary manner by Clay, using materials gathered from multiple texts and platforms (Google Docs, the citizen science webpage, abstracts in other Word files, etc.) into a single Word file. Developing these drafts involved communication among coauthors, which took place using digitally-mediated platforms like email as often as embodied conversations in the same space. At the same time that these compositional events took place, members of the lab used the project website, Facebook, Twitter, and SciStarter to reach out to citizen scientists, engaging them with updates and the opportunity to submit heartrate data.

While the Heartbeats Project team's composing was best characterized as digitally mediated, the team did not pay the same sort of explicit attention to the digital medium as the Webtext Project team, which was highly reflexive about their digital composing. The Heartbeats Project team had most in common with the empirical members of the Webtext Project team—Tara, Joy, and Christopher—in that, like them, they focused on the affordances networked digital media presented for data collection, analysis, and presentation. The genres they composed in, however, did not encourage or provoke reflexivity about media. Because the lab (particularly its extended form that included alumni) was so highly distributed, the team also made significant use of the affordances of networked digital media for collaboration and communication. That said, their use of media for scientific work and communication was not characterized by the hypermediacy at work in *Kairos*'s scholarly webtext genre. Instead, medium was often transparent to them and kept transparent for citizen scientists and other readers, and therefore better characterized by Bolter and Grusin's (1999) concept of *immediacy*. Considering this in context of disciplinarity, digital media were found useful for doing the work of the discipline—for answering disciplinarily useful questions—but were not themselves the subject of that work. Digital media were used to accomplish disciplinary goals, but were not themselves part of those goals.

The notable exception I observed was Soren's interest in exploring the relationship between art and science, which he encouraged in many ways including an artist residency in his lab. At a lab meeting in 2016, for example, Soren and several members of the lab discussed Laura Snyder's (2016) book, *Eye of the Beholder*, which juxtaposes 17th century Dutch artist Vermeer with his scientist contemporary van Leeuwenhoek to consider the role

of changed practices of seeing for art and science in that moment and context. Soren was interested in how artists and scientists were “both trying to see new things.” He noted that science was currently playing an inventional role for many artists and asked members of the lab to explore how art might play a similar role in scientific invention as well. To illustrate, he brought up the case of British artist Anna Dumitriu and her Communicating Bacteria Project dress, an Edwardian whitework dress imbued with a purple pattern created by the rare-but-dangerous bacteria *Chromobacterium violaceum* and designed to engage the public with the field of bacterial communication and related issues like superbugs and infection control. Her Tumblr blog explains the process of creating the dress:

The dress was laid out on a one metre square agar plate (a makeshift Petri dish bought by the artist from a DIY centre and normally used for mixing concrete and sterilised with ethanol) and inoculated by Dumitriu with CV026, which was left to be absorbed into the fibres and travel along the fine stitches. The white CV026 was exposed to the purple *Chromobacterium violaceum* and the communication signal travelled across the fabric as the white bacteria turned purple. (Dumitriu, 2015)

For Soren and other members of the lab, the reflexivity about media inherent in this type of art, and particularly art that engages directly with science, was provocative and seemed to offer imaginative possibilities for science as well. Turning nature and science into artistic media rendered them visible and strange in a way similar to Mark’s goals with digital media and physical computing and seemed to offer possibilities for the biological imagination as well.

The Heartbeats Project specifically, however, did not overtly engage with this sort of purposeful reflexivity about media, though its coauthors reflected on their choices for me and were quite thoughtful about whether and why they found certain digital innovations to scientific communication compelling. My first scene-casing visit, in fact, had demonstrated this much for me, with lab members eager to discuss the digital experimentation going on in scientific publishing (e.g. open access journals, open data, open peer review, data visualizations, etc.). As my work with them had progressed, we had many opportunities to discuss the sorts of “digital enrichments” publishers were developing, such as those that were part of Elsevier’s Article of the Future project, an initiative the journal publisher had launched in order to develop and test born-digital features they could integrate into their journal articles (Elsevier, 2011). Carmen Pérez-Llantada (2013) describes the prototype interface they developed, which was launched in *Cell* in 2009. The prototype was built around three vertical panels:

The central pane presents a bulleted list of research highlights followed by the abstract and the main text. Some prototypes incorporate graphical abstracts containing interactive figures/tables with the key findings of the article, and embedded videos in which the authors contextualise their study. Inviting interactivity, the prototypes incorporate two navigation sidebars with detailed additional information. The left sidebar displays the RA [research article] outline, hyperlinks to the different IMRD sections, tables, interactive figures, graphs and embedded videos. The right sidebar provides authors’ institutional information and links to related

articles, supplementary material (appendixes and datasets) and citation records. (p. 222)

These sorts of “digital enrichments” (itself a telling term) were by now common across many scientific journals and Clay had on numerous occasions been required or encouraged to submit videos, graphical abstracts, and other enrichments with his journal submissions. What I found, however, was that Clay was not particularly impressed with most of these and, after spending substantial time and resources developing some of these, had even developed a certain distaste for them, hesitating to submit to journals that required videos, for example:

After publishing three or four papers with videos that never got any kind of response back and that didn't seem to be really major components of the process to me, I was just like, there's no value in it. And why am I going to invest time into making a video that no one's going to watch? And then there's weird rights issues if I want to re-use the video? And if people download the PDF, which is what most people do, and then look at them later, if it's not embedded in the PDF, then how much does it really matter?

Part of what Clay reacted to was the mismatch between supplemental or author videos and scientific reading practices. Scientists, in his experience, read rhetorically, reading in a targeted manner for a specific purpose, and often saving PDFs for later reference. They did not spend time immersing themselves in authors' stories or arguments in the way scholars in some humanities disciplines might and which requires linear reading and encourages deep exploration of materials. Sources tended to be cited for a single finding and readers typically read titles and abstracts, and then jumped to the figures (Berkenkotter & Huckin, 1995a; Paul

& Charney, 1995). The Heartbeats Project illustrated this reading practice well, in fact, with Clay and Jada reading titles and abstracts first, then typically finding heartrate data in figures before moving back to methods sections to determine whether the heartrate data was usable. They also stored PDFs of these articles in their shared project Dropbox folder to consult again at a later date if necessary. Many of the enrichments journals were experimenting with, then, did not fit with the activities of scientific inquiry, particularly if, as Clay pointed out, they weren't embedded in PDFs, but instead treated as supplemental material and displayed in a sidebar, or worse, a separate supplemental section.

The videos Clay had previously submitted were related to animal behavior, but Clay had also run across author videos, which he felt were problematic to the point of being uncomfortable to watch. In his words, "They're the worst things that I've ever had to sit through." He recounted a visit by a scientist who was "sort of a big shot" and discovering that she had made a few author videos and so deciding to watch them. The disappointment at what he found was palpable:

It's like watching someone . . . It's like . . . Basically people design theirs mostly like a PowerPoint presentation. There's a couple slides, there's, like, a disembodied voice speaking. People with no video skills make them. Because, of course, they don't. They're already published in, like, the biggest journal in their field and they're, like, doing *real* research, and they don't have time to do a video without those resources being given to them.

Once more, Clay felt these enrichments did not contribute to the scientific work of the journal articles and even conflicted with scientists' activities and expertise. Returning to the

concept of meaning compression raised in the Webtext Project and the central role visuals play in achieving this for scientists (Baldry & Thibault, 2010, p. 60), both the animal behavior videos and the author videos served to *expand* meaning rather than compress it, and so did not fit their typified logic and its role in scientific work. Rather than serving abstraction and economy and facilitating complex statistical operations or efficient conceptual representations, these made individuals concrete, whether the individual subjects of a study or the individual authors who had completed them. As Soren put it, the reason these often don't work scientifically is that these "become about the scientist and the work." This violates another logic embedded in scientific genres—the almost exclusive focus on the scientific study and de-emphasis of scientists as human beings (e.g. the persistence of passive voice among many scientists and journals).

Clay felt similarly about graphical abstracts, which he did not feel fit with scientific reading practices and served no scientific purpose. While these seemed to fit the logic of meaning compression behind scientific figures, Clay still felt they conflicted with other parts of research articles that were already typified and that fit with scientific activities. His experience creating one, in fact, suggests that their lack of typified role made the process of creating one extremely difficult and seemingly without reward, enough so that Clay felt journals should not require them:

I had to do for a paper a graphical abstract and . . . this journal, the *Journal of Experimental Biology*, sent, like, a survey to their authors about different things they wanted, and they asked "What do you think about graphical abstracts? Is this something we should add?" And after having done them, *zero!* Absolutely *do not*. I

mean, if someone wants to make one, let 'em do it. Maybe even have a box that encourages them to do it. But to me, personally, it was a time sink. Nobody, I mean, if anybody wants to read the paper who's a scientist, they're just gonna read the actual abstract and look at the figures. There was no . . . For me it was a lot more work to make a graphical abstract and put it out there and then to realize that no one has ever looked at it. I think I put some of it in the paper as a conceptual figure.

Notably, although Clay found a way to repurpose some of this work later on in his paper as part of a figure, the graphical abstract did not seem to fit a scientific communicative purpose for him. It is also possible that the visual, while adhering to the logic of meaning compression, could not function the way scientific visuals do outside its parallel placement with contextualizing verbal resources (i.e. in the results section). Taken out of context, the visual could not function as part of the “semiotic hybrid” Lemke (1998) has noted.

Taken together, Clay’s experiences with digital enrichments suggest an environment in which digital media have prompted scientific journals to experiment, but in which scientists are more reluctant partners. This would not be fully accurate, however, as a number of data-related innovations to scientific publishing were seen as useful. While the team raised some problems related to the increasingly common journal requirement to include open access to data with articles in either a data supplement or data repository (e.g. privacy for sensitive or geolocated data), on the whole they found this development scientifically useful. The Heartbeats Project, in fact, as a meta-analysis of published data benefited directly from this sort of access. Indeed, considering that the scientific “information explosion” (Berkenkotter & Huckin, 1995b) has only gained momentum in the last few decades, meta-

analyses like the Heartbeats Project have become a critical way to navigate the extensive scientific literature that exists and networked digital media have facilitated these. Reading older articles that did not include access to data sets for the Heartbeats Project (some were published in the 1950s and 1960s) reinforced for Clay how valuable it was to publish accessible data with articles and to be specific about species names, something these articles did not always include:

This meta-analysis thing is now . . . So this isn't, this would have been much more difficult to do before the onset of the Internet. Now we can, like, the way we do this is we go to Google Scholar and we type in the keyword "heart rate" and different species and, still even there it's not always clear, but I mean, like, imagine trying to do that same thing [before widespread access to the Internet]. I mean, I guess there's a lot less literature to deal with back then, but, um . . . I think in some cases it's easier for us to do these types of studies and so people are more conscious that, like, oh the kinds of stuff you do might, you know, pop up in later studies. But, yeah, I don't know. It just seems in some ways more rigorous to—there's just maybe a culture of being more rigorous about defining really clearly the species you use.

Bearing this in mind, Clay now wrote articles with the anticipation that future scientists would come along and use his data for meta-analyses: "Now people write in a way that people might come around and do meta-analyses, so they put the information there. I just had to submit all my raw data to a website, so people could go and find it." Because older articles were still used, however, as were recent articles without open access to data sets, scientists had developed digital tools for extracting usable data from graphs:

But for these [articles], a lot of times, the raw data set—we pull it up in graphs normally—is rarely mentioned in the text. So we pull their graphs out in this little program we use we call Data Thief and we kind of hover over a data point and figure out what the heart rate is from that.

While many publisher experiments with digital enrichments, then, were not seen as useful, those related to data sharing were, as were a number of digital tools that had been developed to extract, analyze, and visualize that data.

For the Heartbeats manuscript itself, Clay was most excited about the possibility of an interactive digital interface for its figure. Part of the research story the manuscript would tell would be about the heartrate-lifespan relationships among different phylogenetic groups. This was a story he had told in his 2015 science café talk and again for an invited talk in 2016, and he was eager to find a way to tell the story in a similar way within the scientific paper. When we sat down to discuss the second draft of the manuscript in December 2016, he described his typical strategy and how that might translate to this paper:

This is really a one-figure paper in some ways. It's the heartrate-lifespan relationship with the trend line. But the really interesting thing is breaking it down and showing the phylogenetic signal in that. And the way I like to do it in talks is, I like to break it down one by one and show, like, here's what primates and humans look like in relation to everything else. And then the next [slide] might show marsupials in relation to everything else. And I kind of, am leaning towards *trying* to do that in the paper.

Publishing a digital article might allow him to build an interactive figure that would allow readers to explore phylogenetic groups on their own, according to their interests:

We know what the basic figure is going to be, which is all of the points. This is actually the case where I think it will be great to have a digital interface for the figure, because it's one thing. It would be nice for you to have the whole thing you read and turn on and off those things [phylogenetic groups.] And apply that and look through it and do things like hover over the points. Because there's 160 points on the graph, and each of them is a species.

That said, Clay wasn't sure editors and reviewers would respond well to his approach or that it would fit with scientific reading practices. In his words, "paper is still on paper," meaning that scientific papers, even if digitally remediated to PDF formats, are still strongly tied to paper as a medium (hence the persistence of the term "paper" to refer to articles). Like their own team, most readers would want to download and store a PDF for later reference and many would even print those PDFs to examine away from their computers. Designing for a PDF format as the main version of the article, with enhanced PDFs and enriched digital versions as secondary variations on that central theme, preserved an important level of interoperability between technical systems and between digital and paper media.

For the Heartbeats Project team, the more pressing and exciting opportunities for innovation came from the opportunities networked digital media presented for interacting with the public in scientifically productive ways. Soren and members of the lab viewed currently available digital interactive platforms and technologies coupled with widespread public access to the Internet and—just as important—the development of participatory

cultures and practices *using* those technologies as converging into a kairotic moment for science and society. This kairotic moment was fertile ground for the biological imagination, prompting them to imagine ways these could be used that would benefit both science and society, primarily through their citizen science and public science work. What I came to understand, however, is that the positive dimensions of this kairotic moment were also layered with negative dimensions of the current moment, dimensions seen as threatening to the discipline and to science more generally. While, as Clay explained it, providing citizens with opportunities for “actually helping discover new things” and contributing data was part of their motivation, they also hoped to boost scientific literacy more broadly and change citizens’ relationships with nature and science. For example, Clay described how the data was helpful but not necessarily the largest driver of these projects, something he instead described as getting “people to realize how little of the world we actually know,” essentially, eliciting wonder for science and the natural world, a goal reminiscent of the “rhetoric of wonder” Jeanne Fahnestock (1986) found in public science writing. This motivation for eliciting wonder and engagement with biology was nested in a larger educational motive tied to immediate disciplinary reproduction (targeting kids and “get[ing] them to think, ‘Oh, I can do science—even as a kid there’s some useful things I can do, so maybe when I grow up’”) and to forces relevant to disciplinary reproduction like funding and public policy. While Clay didn’t feel citizen science alone would be enough to influence public policy, he did see it as part of a general effort to make regulatory and funding conditions more favorable for science. As he put it,

What scientists can do more to influence the end game is what I've been trying to do personally. And what I think our lab in general has been trying to do. And so I think citizen science is one of those ways that it happens.

Taken together, the multiple motivations behind their citizen science projects suggest citizen science can be understood as a digitally-mediated rhetorical and scientific solution to a range of problems facing science. And so while it may be tempting to separate the team's citizen science communication from its scientific communication as separate matters, working with the Heartbeats Project team demonstrated to me that the public was understood as disciplinarily salient and important to both the reproduction of the discipline and the preservation of the natural world the discipline studied.

In context of their digital composing, this translated to efforts at engaging the public directly using a range of media (e.g. videos, blog posts, etc.), and at *composing for recomposition*. Jim Ridolfo and Dànielle Nicole DeVoss (2009) use the term “recomposition” and later on “rhetorical velocity” to describe “situations where composers anticipate and strategize future third-party remixing of their compositions as part of a larger and complex rhetorical strategy that plays out across physical and digital spaces” (intro.html). Using the example of the press release, Ridolfo and DeVoss argue that “composing in the digital age is different than traditional practices of composing” and that anticipating how other composers might remix and appropriate your work has become an important characteristic of digital composing and participatory culture (remix.html). With the public and citizen scientists playing such a large role for the lab, various writing teams in the lab have experimented with just that, focusing on the affordances for sharing and

recomposition that well-designed scientific figures present. Anticipating that the publication of the scientific article would lead to a press release that would ideally be taken up by the popular press, members of the lab were experimenting with designing figures for their scientific articles that could be included in their press releases and become part of popular science articles or shared on social media. Clay explained this to me at an observation in September 2015:

It's this idea of, why make crappy figures, if you know it's gonna be something you'll use in presentations? And people are going to be talking about the data and popular publications? Why not have something that's already amenable to those formats? In some ways, it gets people [in the popular press] to show the data, which they wouldn't normally. They might just, like, write about the paper and draw a picture of a heart, right? But if you can get someone to write about the paper and then show a picture of the actual data that makes sense to people . . . So, it's kind of like building the outreach figures ahead of time and just putting them into paper.

Soren explained this similarly, pointing to this as the most distinctively digital aspect of their writing. Pulling up on his computer a figure from a recent article on ants published by the lab, he explained:

So, that's a simple figure. It's nothing like you would say "that's new technology" about it. But it incorporates a ton of design ideas to make it really, easily compelling. And so the thing that *does* happen, I think, is that a figure like this gets set up to be part of new media. And so, the way this is built—more conscious of this as, like, a discussion—it's not an accident. If you want to write a story about this, this is a

really easy element to share in the story. If one wants to write about it when this comes out, it's a figure like this that facilitates other people talking about it. And so, in a way, I would say what the new media has done, and we have experimented with lots of things, but I think the most conspicuous one on the lab is that it's changed how important we think a figure like this is. And so, I'm actually willing to spend a fair amount of money making a figure like this really work, because it changes the extent to which people can interpret the results, engage with the results, tell the story of the results.

Here Soren explained how even in developing their scientific articles, the team is anticipating how elements of those articles—specifically visual elements—will get repurposed and become part of other texts and other conversations. As he put it, with the right sort of thinking and composing, a scientific figure “gets set up to be part of new media,” to be shared, talked about, engaged with.

An important feature of this rhetorical strategy is the attempt to structure the subsequent recomposition, to influence the stories that are told and the discussions that develop about their science. Ridolfo and DeVoss, in fact, outline this as a key feature of composing for rhetorical velocity, writing that “rhetoricians may balance the future possibilities in terms of possible positive, negative, and neutral outcomes for recomposing, remixing, and appropriation” ([velocity.html](#)). Composing as a scientist, Soren's foremost concern is ensuring that the science is understood and not mischaracterized in subsequent writing and discussion:

So this [figure] structures the narrative really strongly. And that's almost the whole narrative of the paper. And so, I think that [this practice]—it's a response to the way that people are now writing about stories, which is under very quick timelines. It's often driven by an image that's getting shared, and it's often very below scientific background. And so, *how do we make the study unbreakable through the figure?*

And so, while this sort of digital composing embraces participatory culture and the fact that remix and recomposition will happen, it also seeks to control this to avoid the negative outcome of misinterpreted science. As Soren asks, “how do we make the study unbreakable through the figure?” How can the visual representation of the study's findings help ensure that those findings are understood correctly—along with their limitations and implications—as it is shared and repurposed across contexts, including nonspecialist contexts? Both citizen science and composing for recomposition can be seen as digital composing strategies that embrace participatory culture, acknowledging the public's salience to biology as a discipline and collaboration and remix as values in harmony with science. The history, conventions, tools, and values of biology as a discipline, however, exert force over these strategies, encouraging scientific leadership even in these participatory public-science partnerships.

Mode: Reimagining Scientific Semiotics

Turning now to looking at the Heartbeats Project through my second compositional lens—modes—confirms once more the “semiotic hybrid” that Jay Lemke (1998) argues characterizes scientific knowledge construction (p. 98). My observation of Clay and Jada's meetings, for example, revealed ongoing meaning making on the fly, moving across multiple

modes at once and using a variety of senses. One of these sessions illustrates this particularly well. Clay and Jada were going over the most recent citizen science data submissions and assessing how these would affect their analysis. Jada had been sitting with her laptop at a second desk in Clay's office in order to consult spreadsheets stored on Dropbox as they talked. She moved progressively closer to Clay's desk as he pulled up one of the spreadsheets and imported it into Graphpad Prism to do some preliminary analyses, until their attention was jointly focused on his screen.

Clicking on "analyze" and making a selection in a dialog box, Clay explained, "Yeah, we'll use linear regression."

Jada replied, "A quadratic . . ."

Thinking better of what he had done, Clay changed some options. "And so, what we'll do—technically, actually what's better to do for this is we'll do a heart rate . . . we'll transform it."

Trying to anticipate his reasoning, Jada offered, "Oh, yeah. I remember you mentioning that a while back. So, then, it'll be a, it'll look nicer? The graph itself, or something like that?"

"Yeah, it'll—it's a more accurate way to, like, get the relationship. So, if you take this, it's probably gonna improve the . . ." Clay trailed off as he examined the resulting graph. "So, right now the significance is .03, so barely significant, but it's there. And r-squared is a measure of how well it fits the data."

"So you want it to be as close to 1 as possible?" Jada asked.

Clay continued clicking and scrolling to explore the graph. “So our r-squared is .14. Yeah, and this is really low, so it's not a very great r-squared. But, um, but then what we can do is—let’s get this right. I'll just leave this.” Clay returned to the spreadsheet view of the data and began sorting and then deleting a group of rows.

“Why are you getting rid of some of them?”

Returning to a view of the graph, “So this is the log and so. Oh, just cause those we didn't have lifespan data for. So now, it's like .0032. It’s very significant and the r-square went up to .26, which is actually a respectable r-squared for a data set like this.

“Okay.”

Clay returned to a dialog box with options for his analysis and made some changes. The new graph this generated formed a clear line.

“That’s interesting.”

“That's a line!” Clay exclaimed. General laughter, including from me over his excitement.

This session reinforces how deeply multimodal scientific meaning making is. In context of ongoing data collection, Clay and Jada made provisional meaning from their data that would guide future collection, analysis, and communication. The moment of this provisional meaning making, however, highlights the number of modes at work in constructing scientific meaning. In this brief session, Clay and Jada combined numbers, mathematics, text, and visuals with spoken word, intonation, and gesture to make sense of the data that had been contributed. Interestingly, while this was *quantitative* analysis, they found the visual representation of that analysis to be more meaningful than the numbers alone

(“That’s a line!”). Earlier in the session, in fact, Clay had asked Jada, “Are you familiar with regression?” To which she had replied, “Uh, the line?” For Jada, an entire statistical operation was best remembered by its visual representation—a line. This geometric shape was actually part of the operation’s name, as Clay replied, “Yeah, just a linear regression, right.” In the session recounted above, the numbers (significance, r-square) acquired meaning in relation to the *visualization* of the statistical operation on their data set. Making meaning with numbers alone would have been much more difficult, if not impossible, without their combination with visual representations of those numbers, more specifically geometric shapes. Indeed, a little later on in the session, the importance of visual representation to their meaning making was reinforced again when Clay visually spotted an error in their data set by looking at its visual representation in a graph. The first data set had been for fish heartrate and lifespan data and Clay had cloned his graph and replaced the data set with their mammals heartrate and lifespan data.

Clay pointed to a clear outlier in the graph, “And this is humans and so it's . . .” They both laughed, looking at a point farther away from the trend line than human beings. “So what is *that*? That's not accurate. Something is on here that shouldn't be. What's 2,000? Oh, yeah, ‘cause I guess we have close to 1,000. Shouldn't have 2,000 though. I don't know. I don't . . . this one's weird. So, this should be lifespan and this should be heart rate.”

“Is it saying 2,000 years?”

“Yeah. Let's see if we can find where that one is.”

“Maybe we can CTRL-F 2,000.”

“Yeah. Nah. It's somewhat near there. Some of it's really high. Oh, it's this. The day count in there, yeah. Now, let's see this.”

“Oh, it's a much better graph.”

Clay pushed back from the screen to survey the graph, “So, in mammals it's pretty clear.”

Jada gestured at the point for human beings, “Is it saying we're 125 years?”

“Uh-huh. 125 years is the oldest recorded human lifespan. That's us right there.” Clay explained what seemed like a high lifespan for human beings, “You know, it's a French woman, I think that's who it was. But, um, yeah, that's us.”

Once more, the visual representation of their numeric data was critical to their meaning making, and, in fact, how closely the resulting representation resembled the ideal form of the geometric shape (the line) helped Clay interpret the results and locate anomalies in the data that merited closer inspection. This did not substitute for the laborious process of checking the data, but helped them notice egregious errors quickly and make provisional meaning of their ongoing data collection that could then guide future study decisions, such as when to stop collecting data for a certain class of animals.

The role of the visual in making meaning of data, and particularly large data sets (e.g. “big data”), was further reinforced by a 2016 lab listserv exchange exploring how Phinch, a new open-source data visualization framework for biological data, might be used in some of the lab's initiatives. The framework, available to other scientists through GitHub (Bik, Bu, & Grubbs, 2014), offered biologists an interactive visualization tool that would allow them “to

explore and manipulate large biological datasets” (see Figure 4.2) (“Phinch: A framework for visualizing bio data,” 2014).

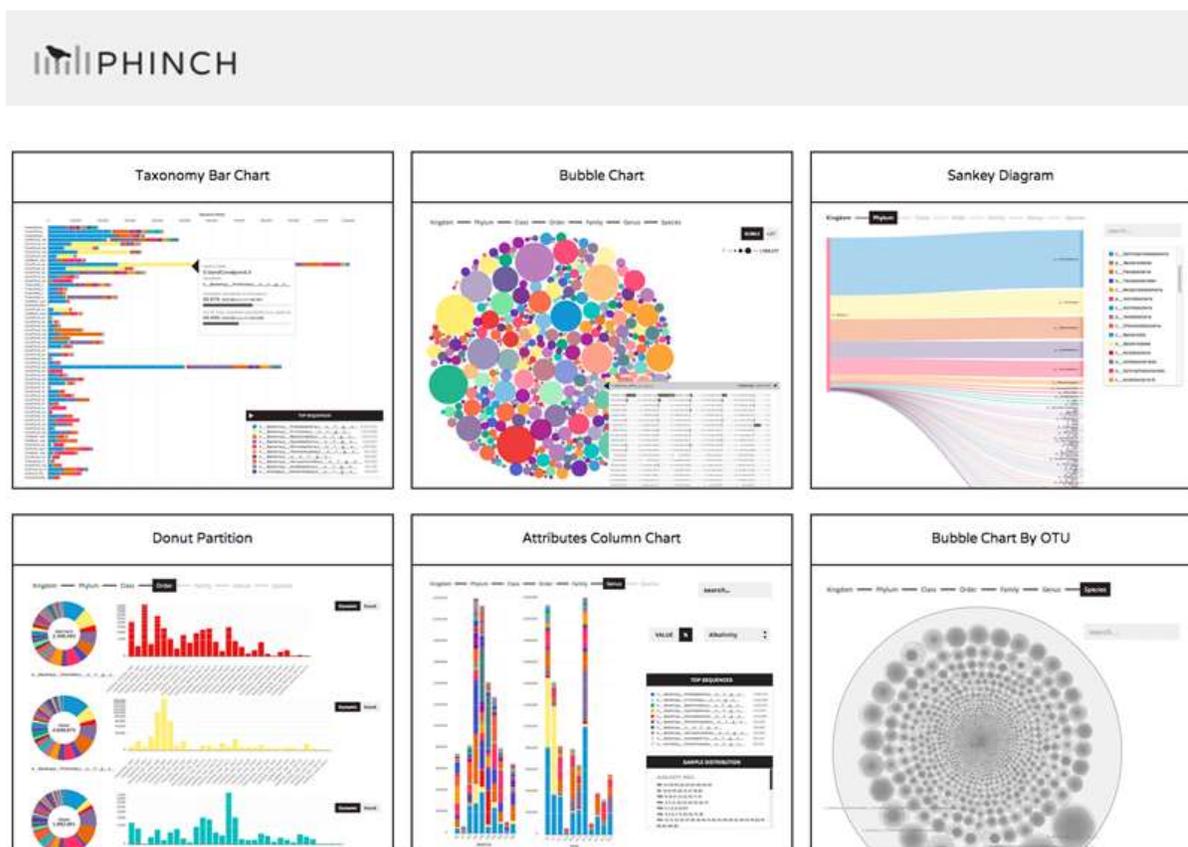


Figure 4.2. Sample data visualizations enabled by the open-source biological tool, Phinch (Bik et al., 2014).

The project’s website described Phinch (evoking nature through a pun on the bird, finch) and the scientific problem it sought to address as an analytical one that could only be solved visually, and, interestingly, by the human eye:

Computer algorithms face significant difficulty in identifying simple data patterns; writing algorithms to tease out complex, subtle relationships (the type that exist in biological systems) is almost impossible. However, the human eye is adept at spotting

visual patterns, able to quickly notice trends and outliers. It is this philosophy especially when presented with intuitive, well-designed software tools and user interfaces [sic]. The sheer volume of data produced from high-throughput sequencing technologies will require fundamentally different approaches and new paradigms for effective data analysis. Scientific visualization represents an innovative method towards tackling the current bottleneck in bioinformatics; in addition to giving researchers a unique approach for exploring large datasets, it stands to empower biologists with the ability to conduct powerful analyses without requiring a deep level of computational knowledge. (“Phinch: A framework for visualizing bio data,” 2014)

In context of the biology lab’s efforts with citizen science, a framework that could enable “powerful analyses without requiring a deep level of computational knowledge” and that valued the human eye as most “adept at spotting visual patterns,” held a great deal of promise for offering citizens a way into “doing science,” particularly since Phinch is web-based.³⁷ In context of scientific multimodality, however, Phinch reinforces how visual the activity of doing science is and how it routinely harnesses multiple semiotic modes at once (e.g. visuals, numbers, text) to construct scientific knowledge.

The Heartbeats Project team and the lab’s work more generally also reinforced that this multimodality and visuality were most often in service of meaning compression.

Individual animals, in all their multidimensional, idiosyncratic furry, feathery, scaly or

³⁷ Much as the citizen science project Fold It makes use of human pattern recognition to solve scientific problems related to protein structure and folding: “Foldit attempts to predict the structure of a protein by taking advantage of humans’ puzzle-solving intuitions and having people play competitively to fold the best proteins” (“The science behind Foldit,” n.d.).

naked glory, were reduced to a number representative of one small dimension of their lives: their heartrate at a given moment in time, ideally not a stressed or sleeping moment, though Clay pointed out the gray complexity of even this moment when he laughingly explained how “Sleep's not even well defined for a lot of organisms, for that matter.” The distinctive individuality of that animal and moment were then abstracted and compressed by placing the animal in the larger category of its species (it is no longer “Spot,” but rather *Canis lupus familiaris*) and the momentary rhythm and pace of a beating heart inside a spreadsheet of numbers. Those numbers, together, were manipulated and made sense of, using a variety of modes, coming to represent an abstract, visual pattern of heartbeats and lifespans for an even larger, more abstract group—a class of animals, like mammals. All the while, the meaning made about individual animals in individual moments receded, blackboxed and compressed by the layers of abstraction afforded by scientific practices around categories, numbers, language, and visual practices. The statement that humans and primates as a group are outliers among mammals’ heartrate-lifespan relationships could not be made without compressing scientific meaning through many layers and steps, using a variety of modes to enable this. Meaning compression enables scientific knowledge construction.

Although the Heartbeats Project team made most extensive use of the modes most often associated with science—numbers, mathematics, visuals, and written and oral language, they also experimented with other modes and other ways of using modes. Clay, for example, recounted an experimental collaboration with musicians to set DNA to music, something also discussed in a lab meeting I attended. Music, as a modal language highly centered on *pattern* (e.g. rhythm, form, interval, etc.), seemed to afford another way to

perceive patterns in genetic data and therefore make scientific meaning from them. Unlike the image, however, music has a temporality that makes it more ephemeral and harder to grasp as a whole, though the patterns in music make it easier to grasp and remember than unpatterned sound. Gunther Kress (2005), in comparing the affordances of the image to written language and oral language, describes the logic of the image as “spatial and simultaneous”—viewers are able to view the image in its entirety simultaneously and choose their own path to view “spatially expressed” relationships among visual elements (p. 14). Speech, on the other hand, is “temporal and sequential,” while written language expresses temporality and sequence through linearity (p. 14). The transduction of alphanumerically represented genomic data to musical sound would maintain sequentiality and afford another way to perceive pattern, but would render it ephemeral and more difficult to grasp wholly and simultaneously than images. Images, it seems, are particularly useful for compressing meaning, particularly when coupled with numbers and mathematics. Clay, in fact, was not convinced that this use of music would be scientifically productive, though he thought it could be “interesting to make music [from scientific data] for special events.”

Considering, during one of our discourse-based interviews, whether sound could be used productively for the Heartbeats Project, Clay reflected on an NPR Radio Lab episode that used the sound of footsteps to share a study’s findings that “the walking pace of people in cities . . . correlates with how big the city is and how many people live in the city.” He felt “the heart rate thing would be [similarly] interesting,” but that it would be more suitable to radio for public audiences than to scientific communication (i.e. the digital version of their manuscript). The scientific meaning from the study was predicated on meaning compression,

with nothing gained scientifically by inclusion of sound data of individual species' heartrates. This would amount to using multimodality in service of meaning *expansion* and could be counterproductive for communicating the meaning the manuscript was constructing to scientific audiences.

While the temporality of music or sound did not seem scientifically productive to Clay, temporality did figure in his scientific composing. Kress (2005), in fact, argues that spoken and written language are particularly suited to narrative because of their sequential logics:

The temporal and sequential logic of speech, and, leaning on speech, of writing, lends itself to the representation of actions and events in time; hence, the ubiquity of forms of narrative in human cultures; hence also the ubiquity of the event and action oriented uses of speech and writing. (p. 14)

For Kress, the question asked and answered by spoken and written language is, “What were the salient events and in what (temporal) order did they occur” (p. 14)? The fact that both Clay and Soren used the word “story” to talk about their scientific manuscript underscores the temporal logic behind the IMRAD structure, which tells the narrative of the study, complete with a problem or conflict—the poorly understood phenomenon—and a (re)solution—the study’s contribution to understanding it and how the scientists went about developing this contribution. In discussing his second draft, for example, Clay spoke of needing to “get the story clean so [Rachel] can really quickly understand what I’m looking for” in the data analysis. While the narrative logic embedded in the structure and language of the research article has been well established (Bazerman, 1988; Berkenkotter & Huckin,

1995b; Gross, 1985; Rymer, 1988), Clay had also attempted to use images to convey temporality and motion. Kress (2005) does not see images as particularly suited to narrative because their logic of display privileges spatial rather than temporal relations, though this can include an element of sequentiality (p. 14). For him, the question asked and answered by display is, “What were the salient entities in the visually encountered and recollected world, and in what order are they related” (p. 14)? Clay, perhaps because in addition to his biology background also had a design background, sought to use image to convey motion and story, not just to convey spatial relationships, citing comics as a resource to draw on. For the Heartbeats Project manuscript, he felt the way he would “show motion is gonna be a four panel figure,” with one panel “with every point plotted on it,” and then a second panel with “humans pointed out as a big exception,” and then another panel pointing out another group of mammals to tell another part of the research story, and so on. In Clay’s option, this, in fact, was a preferable way to show movement and temporality than video for scientific communication. He cited one scientific journal article he had seen this done in that he admired, a paper about some ancient bear bones that had been found in a Chinese cave. The authors had used panels to tell how they thought the bear had come to be there:

They had a reconstruction of what they think happened—like, how he fell, and how the bones were scattered, and how they think he would have died. It was like this really sad six-panel thing with this bear walking around and it was funny. And so we know from comics and stuff like that, you *can* communicate stories in a sequence. And I think that's something else that makes a lot of sense. Maybe that's a different mode than a static graph that you would look through.

Clay, however, had yet to successfully accomplish this in a scientific paper and feared that editors and reviewers would push back against his attempts with the Heartbeats Project manuscript. He had previously attempted this with another manuscript and been asked to remove it because it was perceived as redundant. He described how he had placed “the same two figures at the top” and then “broke[n] them down below it in a panel.” One of the reviewers, however, had pushed back against this choice, stating “It shows the same information. Why didn’t you just show it all in one?” For Clay, the reasoning was obvious: “If you’re the reviewer of the paper and you studied it, of course at that point you can [see what we want you to notice], but I want people to be able to just *look at it* and understand that it’s walking you through the figure.” While the reviewer experienced the manuscript in its entirety, likely moving back and forth between written text and image to interpret it, Clay was interested in readers who would enter the published research article primarily through its figures and not experience the figures and written text together. Clay explained that he “like[d] to feel that I could just pull the figures up and understand this is going to tell a story.” The fact that he and other members of the team were actively composing scientific visuals for recomposition in other contexts also likely played a role in Clay’s perspective. The reviewers, however, seemed to react against Clay’s attempt at creating “figures [that] could tell a story” because the redundancy violated the principle of meaning compression and the economy and efficiency this supports.

While the principle of semiotic meaning compression explains why the use of modes for meaning expansion might not work in scientific composing (e.g. comic strip figures, audio of heartbeats, videos, etc.), Soren provided additional insight on why some multimodal

practices might or might not be readily adopted in many scientific disciplines. At a lab meeting in 2016, for example, he hypothesized that scientific cultures had their own aesthetics—what they considered beautiful—and that this influenced their use of modes, particularly the visual. Figures that fit that aesthetic and the vision the discipline had of itself would be more likely to be accepted and deemed effective. Another factor, however, was the role of the human in constructing scientific knowledge. Soren and other members of the lab were quite reflective on science as a human activity and scientific audiences as human, with human interests. Discussing this dimension of Clay’s job search, Soren pointed out that “departments are filled with people,” and so would find the questions Clay was working on—questions designed to reside at the intersection of public and scientific interest—inherently interesting. That said, scientific genres are built around a positivist epistemological logic that emphasizes the phenomenon under study and deemphasizes the people studying it. Because, the logic says, natural facts exist on their own and are simply being discovered, the people doing the discovering are irrelevant and beside the point in any account of this discovery. They may be deemed counterproductive, even, to that account, as drawing attention to them calls the objectivity of the enterprise into question (e.g. Gross, 1985; Hyland, 2001; Miller, 1979). Even though, in Soren’s words, “approaches to science are now pretty relativistic,” the logics governing scientific communication are not. Considering digital enrichments with innovative multimodal elements, like videos, Soren felt that these often broke that logic:

What the video does is, the human part comes in. And the journals, for the most part have not responded to that. Which is interesting, because historically they did it a

little bit more . . . You know, when relativism hit anthropology, there were all those journals that had this great part at the end where you had the story of the person and why that bears on what has been discovered? . . . It should be here too. But we won't do that. Maybe ecology will do it, but you won't get any further in.

Here Soren referred to ethnographic positionality statements, reflexive statements meant to acknowledge and analyze the ethnographer's role in the research. In context of the natural sciences, this sort of attention to the researcher would violate the epistemological worldview underpinning its research genres. In Soren's estimation, many experimental multimodal elements transgressed a logic that scientific disciplines found vital to maintain. In his words, a supplemental video, often "becomes about the scientist and the work" and is "not giving you that many" scientific benefits. He could think of very few instances when an element like a video would fit the logic of the scientific report: "If you're studying waves or something, and there's this obvious temporal visual thing, great." But most of the time, attention was drawn to the wrong aspects of the research. The problems Soren raised, then, suggest that neither multimodal practices in service of meaning expansion nor those in service of meaning attention would be readily adopted in biology, and that, in fact, this might be an explanation for why many of those publishing experiments failed.

The lab's communication with citizen scientists, however, adds some complexity to our understanding of the team's multimodal practices. Specifically, the lab's citizen science communication included the meaning expansion and meaning attention practices that were seen as less fitting for their scientific communication. In my connective ethnography, which included participating in several of the lab's citizen science projects, I found that the lab

communicated digitally with citizen scientists using project webpages, blog posts, Youtube videos, Facebook posts, tweets, and a Flickr photo gallery. These worked primarily by adding multidimensionality to citizen scientists' understandings of and connections to both the object of study and the project itself. Here, beautiful, extreme close-ups of, for example, an insect were coupled with group shots of scientists, teachers, and students collaborating, and videos explaining the phenomena in question. These videos ranged from high-production-value videos on the project or phenomenon to amateur one-shot videos of a scientist giving a talk to a live audience. Because these worked together to "thicken" citizen scientists' experience of the project and of "doing science," most of these could be characterized as working within the logic of meaning expansion. A number of these, however, also humanized the scientists behind the projects and the process of doing science, conveying their excitement and wonder—the "delight" Richard Harris (2017) has recently argued is so critical to good science. By drawing attention to the process of scientific meaning making, these could be said to work within the logic of meaning attention. That said, in contrast with the Webtext Project, the *subject* of attention was not on the meaning made through mode, medium, or genre, but rather on meaning made through scientific inquiry (or "doing science," as the team called it).

A large portion of their projects also included a readymade lesson plan for teachers interested in incorporating the project into their science curriculum. Ultimately, whether in the form of a lesson plan or a simple project webpage, the central point of contact and participation for citizen scientists was a set of instructions. This genre allowed citizen scientists to harmonize their scientific activity with the scientists and with each other in order

to produce reliable data (Galloway, Tudor, Haegen, & West, 2006; Ratnieks et al., 2016). In addition to generally being multimodal themselves (e.g. text, photographs, numbers), the instructions also organized citizen scientists' scientific meaning making. What the team framed as engaging citizens with "doing science" was a semiotic experience that expanded citizen's meaning making from the scientific findings they might encounter in news media to include some semblance of the "semiotic hybrid" of scientific inquiry. Through the project instructions, citizen scientists expanded their experience of science to a multimodal and multisensorial experience involving modes not available in digital form, like touch, temperature, and even smell. Clay recounted, for example, a museum-based project that "had participants *smell* ants and like tell us what they smelled like." Many projects were based outdoors and so also mediated rich multimodal meaning making with the natural world in a way that is semiotically distinct from other outdoors activities.

What I came to realize was that citizen science instructions amounted to *procedural rhetoric*³⁸ for scientific meaning making. By participating in the process of scientific meaning making, citizen scientists would hopefully come away with greater appreciation for science as a process predicated on both wonder (Fahnestock, 1986) and systematic inquiry. By having participated in scientific meaning making, they might change their relationships with the scientific findings they would doubtless encounter outside scientific communication,

³⁸ Here, I use "procedural rhetoric" in the more general sense of procedure than the algorithmic and computational sense of procedure in Ian Bogost's (2007) use of the phrase. His concept is tied to what he sees as the defining feature of digital artifacts: their execution of a series of rules through code. These rules become a way to form an argument and becomes rhetorical in users' interaction with that coded argument. My use of the phrase here is a more general way of describing the rhetorical dimension of following instructions or rules, which could also be applied to procedural documents such as the U.S. Constitution, Robert's Rules of Order, or a parenting manual.

focusing more on the process of meaning making than the end result, a result most scientists read as provisional anyway. In Clay's words,

This is, kind of, a different way to get people involved and maybe break the cycle of, "Oh, here's a cool discovery," and people see it, and then kind of move on. Versus, like, "Here's an interesting *idea*," which is really what scientists are interested in. It's more the idea phase than the, sort of, finished product.

Participating in the process, which could take longer and be more difficult than anticipated, might also communicate to the public how challenging science can be, and how much is still left to know, a message Clay saw as positive and hopeful. Clay hoped participants would come away realizing,

"Oh, god, it's harder to find! This is hard to find. This is surprising. Like, we don't *know* things like that." And I think that has a positive spin, because it's like, things you think are really basic, aren't known. And if you do get into science, even some of the biggest questions have barely been investigated.

The procedural rhetoric the team composed through their citizen science, however, was predicated on an audience actively searching for such opportunities—an audience with an existing positive conceptualization of science and motivated to participate in scientific meaning making.

The fact that citizen scientists were generally searching for specific types of projects suggests a reason beyond the issues of access or accessibility for the low citizen science participation in the Heartbeats Project. The Heartbeats Project, as a meta-analysis, was built around semiosis with the existing scientific literature: scientific remix. Scientific articles that

entexted empirical sensory meaning making with the natural world were themselves serving as the basis of new scientific meaning making without returning to the natural world. While this variety of literate meaning making is both scientific and multimodal—this too is “doing science”—it is possible that it did not fit citizen scientists’ conceptualizations of scientific work as an embodied, multimodal, multisensorial meaning making activity. For many citizen scientists, searching databases and reading scientific articles may not fit their existing idea of doing science, or at least is not the part they are motivated to engage in. They come to citizen science instructions with the aim to produce a full, multidimensional scientific meaning making experience for themselves, which for many means working with objects, tools, and nature, not reading and writing at a screen.

Genre: Reimagining Scientific Genre Networks

I turn now to my third compositional lens—genre. While studies of individual genres have yielded important insights into a range of rhetorical communities and events, a number of genre theorists have found it productive to expand their focus to groups of genres, such as genre sets, systems, and networks, for a fuller account of the processes at work in the production of events, texts, and communities (Bazerman, 1994; Berkenkotter, 2001; Devitt, 1991; Swales, 2004). In this same vein, the concept of “intertextual chains” has been of use (Fairclough, 1992; Linell, 1998), though once routinized into fairly predictable, recurrent patterns of relationships between genres, these might best be thought of as “genre chains” (Swales, 2004). Because the Heartbeats Project team’s scientific composing took place in context of so many other texts, including their composing for citizen scientists, I found this

view of genre and intertextuality most useful for developing an understanding of the team's rhetorical actions situated among other typified and emergent science-related rhetorical actions.

My analysis, therefore, draws on both, with intertextuality affording a view of the relationships between individual texts, and genre chains affording a view of recurrent patterns of communication. These relationships, however, can vary in nature, with some texts directly prompting or forming the exigence for another (the second explicitly responds to the first) and others bearing more implicit traces of each other in what Mikhail Bakhtin (1986) has called the “dialogic overtones” of all language—the “echoes and reverberations of other utterances” that fill our own utterances (p. 91). For the first, more directly linked relationships, I have drawn on John Austin's (1962) concept of uptake, particularly as it has been put into conversation with genre theory by Anne Freedman (2002), who theorizes that “a text is contrived to secure a certain class of uptakes,” and that “the uptake text confirms [the first text's] generic status by conforming itself to this contrivance” and responding in the expected way (p. 40). While warning against the impulse to systematize these utterance-uptake relationships into rigid sets of rules, Freedman offers a rationale for looking at pairs of texts (and ultimately genre chains) as a productive way to understand both the relationships between genres in a given context and, through this, the social actions of individual genres. For the second, more implicit intertextual relationship, I have drawn on the notion of recontextualization, defined roughly as “the extrication of some part or aspect from a text or discourse, or from a genre of texts or discourses, and fitting of this part or aspect into another context” (Linell, 1998, p. 145). This can involve direct quoting or reworking of material for

another context, as well as “vague influences” between texts (p. 148). While these are different types of relationships between texts, both can become routinized and typified into recurrent relational patterns that can be usefully mapped into genre chains. For my purposes, they have provided useful analytical tools for concretely mapping some of the paths professional scientists, like the Heartbeats Project team, and citizen scientists travel in interacting with each other, and therefore some concrete mechanisms for how scientific discourse and public discourse about science influence each other. Theoretically, I see these chains as part of larger genre networks that constitute permeable discursive fields, a term John Swales (2004) argues better represents the mutability of these fields than a term like genre system, which “suggests that we have a greater understanding of how everything fits together in a ‘system’ than is likely the case” (p 23).

Overlapping Models of Communication

Before looking at where the patterns between genres and texts deviated from the typical for the Heartbeats Project team (or at least what is generally conceptualized as typical), it is important to note that the team does enlist this typical pattern and that it is an important schema for them regarding how communication between scientists and between scientists and the public works. By “typical,” I am here referring to the canonical model of scientific communication, which shows scientific discourse as a distinct sphere and theorizes the movement of scientific information as unidirectional, moving from science to the public through the mass media, generally losing precision along the way (Bucchi, 1998, p. 5; Hilgartner, 1990, p. 519). Alongside their citizen science communication, for example, the

team wrote research articles that were then popularized for the public along traditional genre chains like press releases and science news articles. Because the team saw the public as disciplinarily relevant, finding ways to engage the public, including through traditional channels like the news media, formed an important part of the lab's rhetorical work. The dominant model of scientific communication between experts and the public, therefore, was strongly present in the lab's work, both as a resource to be enlisted and a standard to be pushed against. This traditional model, for example, manifested in the genre knowledge Clay shared with me about the typical order of genres in their genre networks and the typical connections between genres in their scientific genre network and public genre networks about science. For Clay, this traditional genre chain and the desired uptake between genres amounted to important procedural knowledge for acting effectively as a scientist. Figure 4.3 shows the genre chain represented in Clay's discussion.



Figure 4.3. Traditional chain of genres communicating science to the public

In describing this genre chain, Clay explained that the way to set the chain in motion in his institutional context was to contact the university public information officer assigned to them, Brendan Cross, as soon as a research article was accepted. The desired uptake from the

press release Brendan produced was widespread coverage of their work through both traditional news media and through social media, though such uptake was by no means guaranteed. Having a press release ready to send out while the research article was still under embargo or on the day the article was published was one way to increase the chances of success, since, as Brendan explained to me, “depending on the discipline, [the research article’s] shelf life can be as short as days.” Yet while the genre chain to the news media and to social media was a fairly concrete path that participants could readily outline for me, the desired uptake by the public itself was more nebulous. This uptake was often represented by quantified “views” and “shares” and by references to “impact.” That numeric representation, however, seemed to stand for a host of desired outcomes not easily reduced to the number of a times a given article was viewed, such as educating the public about science or engaging them with science. The team was also sensitive to the injustice of having publicly-funded research rendered inaccessible to the public by journal and database paywalls. Regardless of the ambiguity of the end of the genre chain, this well-traveled path underscores how the canonical model Massimiano Bucchi (1996) and others have described serves as a blueprint for scientists in their work, something Clay confirmed for me. When presented with a visual of the model (Bucchi, 1996, p.377), Clay admitted how the directionality of the model is “one every scientist acts under” (see Figure 4.4).

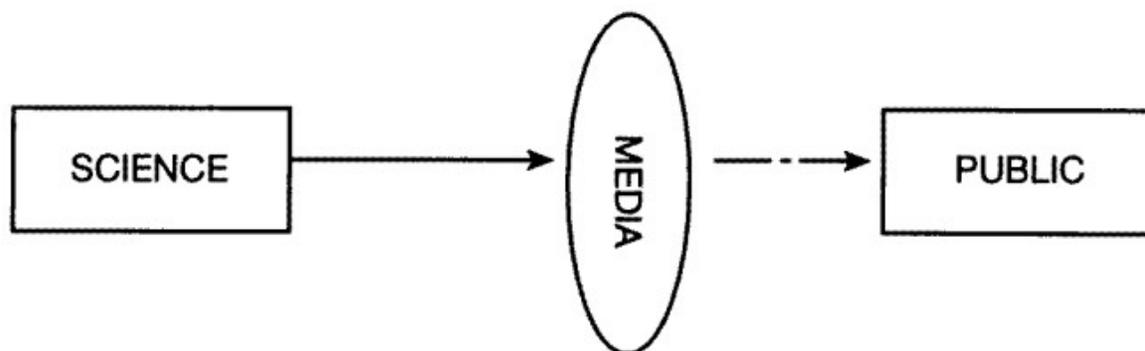


Figure 4.4. The canonical model of public communication of science (Bucchi, 1996)

What was interesting, however, was that while the team enlisted this traditional model (even mentally, as a schema for a typical genre chain), they simultaneously resisted it, through both their citizen science practices and other communication practices. Clay, for example, routinely circumvented the traditional mediators of science-related communication by posting videos “on my own website” or “on a Vimeo account” where they were more likely to be found, viewed, and shared. The team’s strategies for communication, in fact, suggest that multiple models of communication overlap and coexist for them, with the traditional genre chain outlined in Figure 4.3 coexisting alongside the team’s direct communication with the public through websites, blogs, etc. This traditional chain of genres reflects what Bucchi (2013) has more recently termed Science Communication 1.0, a model that includes mediators like the press release and news genres in a sequential pattern of communication (p. 906). At the same time that the Heartbeats Project team has made use of this traditional sequence of genres, however, it also made use of resources presented by what Bucchi (2013) calls Science Communication 2.0, in which scientists communicate directly with the public in a horizontal, simultaneous relationship (p. 906), or what Trench refers to as

“disintermediation,” direct communication with the public as opposed to communication mediated by science journalists (p. 185; p. 191).

While the Heartbeats Project team’s regular use of blogs, Facebook, Twitter, and public events are evidence of a direct and simultaneous approach to communication overlapping with a traditional sequential approach, these coexisting communication models also presented some challenges to the genres they were enlisting. Clay, for example, recounted a conflict created by enlisting the traditional genre chain (via the press release), while also enlisting direct genres like the project website. Wanting to gain some publicity for the project through the news media, Clay described an attempt by Brendan, the University public information officer, to have some news outlets write about the study before they had published a research article on their findings:

Brendan is . . . an amazing press guy, but he pitched it to a writer recently just to try to get them to write a longform piece about it. But [the] science writers [said], “It’s not news, What’s new? I can’t write this as news.” . . . So he pitched this to somebody [else], but the guy doesn’t know—he was like, “Well, I’ll think about this for a while, but, you know, what’s the new piece here?”

These science journalists’ responses to Brendan’s query suggest that part of the recurrent exigence for much science writing (the “news”) is understood to be the publication of a scientific journal article. Without that exigence, these writers had trouble conceiving of how to write an article about the project. Contacting them without that exigence violated the typical genre chain and broke the rules for the science news articles Clay and Brendan hoped they would write.

The team's overlapping communication model also created stress in the other direction, with their scientific writing. As my opening narrative with Summer illustrates, publishing data ahead of journal publication—even a preliminary analysis on a citizen science project webpage—could jeopardize their ability to publish in a high impact scientific journal. This influenced the team's decision to forego publishing an interactive graph with all their data on the project's webpage, instead opting for a static graph of a partial data set. As Clay explained it, major, high impact journals like *Nature* held on to that status in part by restricting authors' abilities to publicize their work ahead of publication. Even presenting a preliminary analysis at a conference or writing about results on a blog could be a problem, because it was seen as endangering the “big splash” and “big impact” they wanted articles to garner when first published. Simultaneously enlisting both the traditional genre chain and a “disintermediated,” “direct” genre chain for their citizen science projects created both opportunity for the team and stress on the genres themselves.

Recontextualizing Science for Science

While the traditional chain of genres used to communicate with the public after a research article's publication could be traced through explicit evidence of uptake (i.e. through direct references to the research article), those involved in the Heartbeats Project's citizen science before its publication were better traced through through evidence of recontextualization. In concrete terms, the press release in the genre chain outlined in Figure 4.3 directly “takes up” and responds to the exigence presented by the publication of a research article, and, ideally, a news articles will take up the invitation offered by the press

release (though the science news article's exigence is clearly more complex or every published scientific article would result in a corresponding news article). Each of these explicitly signals the text it is taking up through textual features such as evidentials (e.g. According to X). The research article, however, does not have an overt utterance-uptake relationship with any publicly-oriented genre—this relationship, when it exists, is occluded. While press releases and news articles are meant to call attention to the publication of a research article as their nominal exigence,³⁹ the research article genre has sedimented in it the logic that the exigence for scientific work lies in the scientific literature, not in publicly-oriented genres or even in the lab (Berkenkotter & Huckin, 1995). Observing the relationships between texts and genres related to the Heartbeats team's citizen science and its scientific writing, then, required looking at slightly different traces than for those participating in the traditional science-to-public genre chain, specifically recontextualization rather than direct uptake.

Examining the Heartbeats Project's writing for recontextualized material revealed a striking aspect of this type of citizen science project, namely that, in direct contrast with the conventional wisdom about how scientific ideas are recontextualized from scientific conversations for public fora (e.g. Luzón, 2013), citizen science *recontextualizes science for science*. By this, I mean that citizen science practices encourage the recontextualization of scientific activity and science-related communication occurring in public contexts (citizen science) for scientific discourse (the research article). In the case of the Heartbeats Project,

³⁹ I say the exigence is "nominal" because this is often the explicitly named exigence in the text of a science news article, but there are clearly interacting forces at work in what a science journalist sees as an exigence for a science news article or thousands of these would be published every day.

the project's origin story begins with publicly-oriented writing in the form of a popular science book Soren had been working on. This required recontextualizing scientific findings on the billion beats rule for a public audience (the conventional order of things), but then prompted the inception of the Heartbeats Project when the scientific literature was found lacking (a departure from the conventional). From that point forward in the team's composing, their citizen science activity and writing developed in tandem with their scientific writing, with recontextualization often occurring from the publicly-oriented texts to the scientifically-oriented texts. For example, as the team compiled and analyzed data in part originating from citizen scientists, they first communicated those to citizen scientists and the broader public using the project website and the lab blog. This material then provided a starting point for working on research articles related to the project.

The project website from February 2015 and an early manuscript of their research article from this same time period provide a useful example of this recontextualization (Table 4.2), with material originally developed for a public audience making its way into writing intended for an expert audience. For instance, the examples developed for citizen scientists of species with extremely fast and extremely slow heartrates—the shrew and the grey whale (sentence 2)—show up in the manuscript draft (sentences 5), as do the explanations of the billion beats rule (sentences 1 and 3, respectively). Interestingly, both documents also begin by gesturing at the scientific literature.

Table 4.2. Sentence-level moves in two introductions to the Heartbeats Project, public and scientific

Heartbeats Project Website, 2015	Draft Article, 2015
1. “Studies have concluded” – the rule	1. “A large literature considers” – the variables
2. Shrew and grey whale examples	2. Generally understood relationship between variables
3. Exceptions to the rule	3. Relationship, continued – the rule
4. Outliers with more than 1 billion beats	4. Empirical support for the rule
5. Outliers must be explained by biology	5. Shrew and grey whale examples
6. Potential implications for human longevity	6. Limited evidence
7. Call to contribute data	7. Most comprehensive study based on limited data
	8. Potential for more complex relationships than [2]
Word count: 132	Word count: 186

But while the two texts show a clear relationship, they also depart from each other in important ways. The manuscript makes extensive use of hedges, like the verbs “consider” and “suggest,” while the website conveys greater certainty with verbs like “conclude” and “are.” The website allots substantial space to considering outliers and research implications, both pointing toward the possibility of supporting greater longevity in humans. These lead up to a call for more data—a clear call to action for citizen scientists to participate. This early draft of the manuscript, on the other hand, situates its exigence in the literature, following John Swales’s (1990) Moves 1 and 2 in his “Create a Research Space” (CARS) model of scholarly introductions: “Establishing a Territory” and “Establishing a Niche.” Using the literature to establish the “territory” of the relationship between heart rate and longevity, the manuscript then establishes a “niche” by pointing out a gap in this literature—the scant data the understood relationship is based on. It doubly secures this niche by suggesting that the understood relationship may in fact be found to be more complex once additional data are examined. Notably, the manuscript’s explicitly stated exigence rests squarely in the scientific literature, with the text’s relationship with citizen science and other publicly-oriented

communication occluded. The scientific story and relationships sedimented in the research article genre are not, at this point, challenged by these overt written choices. The activity related to citizen science, however, including its communication, does leave substantive and rhetorical traces on the manuscript.

Discussing the traces of recontextualization I found with Clay revealed that the rhetorical work required to communicate with citizen scientists served as something of a rehearsal for his scientific communication. Later in 2015, for example, Clay gave a publicly-oriented talk about the project, including solicitation for more citizen science participation, at a science café, a genre he explained he found useful for helping him “organize my thoughts about where to start, how to provide context” in the manuscript, including which ideas sound “ridiculous” and which work. Discussing a “cranky” audience member who stayed after the talk to take issue with some elements of his talk, Clay confessed that this exchange gave him useful feedback on a variable they would need to address more robustly in their research article. His experiences giving these sorts of talks and the inventional role they ended up playing for him in his scientific writing led him to express a preference for “giv[ing] a presentation or two on a project before I even start to write the paper,” particularly “the introduction and the discussion.” Increasingly, during our check-in interviews, Clay expressed an appreciation for how communicating with citizen scientists invited him to consider the “broader implications” of his work, implications that showed up in the introduction and discussion sections of research article manuscripts and that allowed him to target the higher tier journals (“high impact journals”) that stress such broad implications.

The recontextualization of material from citizen science communication to the team's scientific writing extended to other areas as well, including the visuals developed for research article manuscripts. At the same time that the team was composing scientific figures for recomposition—anticipating that published scientific figures would be taken up in public-oriented genres—the team was also recontextualizing the images they created for citizen science communication for their scientific manuscripts. The Heartbeats Project website, for example, featured a cleanly-designed scatter plot chart that Clay recontextualized in his science café talk, and that then became a starting point for manuscript figures. As this communicative rhythm and movement recurred across multiple citizen science projects and research articles, the lab as a whole, in fact, routinely created figures for research articles that recontextualized material developed for citizen scientists and that would then be accessible to public audiences later, potentially being published in press releases and news articles, and shared on social media platforms. In Clay's words, why not “show a picture of the actual data that makes sense to people?” Why not “[build] the outreach figures ahead of time” and “[put] them into the paper?”

Figure 4.5 maps the relationships between genres used to communicate with citizen scientists in the Heartbeats Project and demonstrates how this communication served an inventional purpose for the team. Routinely participating in this network of genres gave the team a recurring reason to continue producing new material—new figures and analyses based on the data submitted—and a communicative reason to think more deeply at the level of implications (like human longevity) and values (like wonder). This activity was then recontextualized for scientific discourse, a movement that reverses the canonical model of

public communication about science and bookends the research article, the dominant genre of professional science, with publicly-oriented genres.

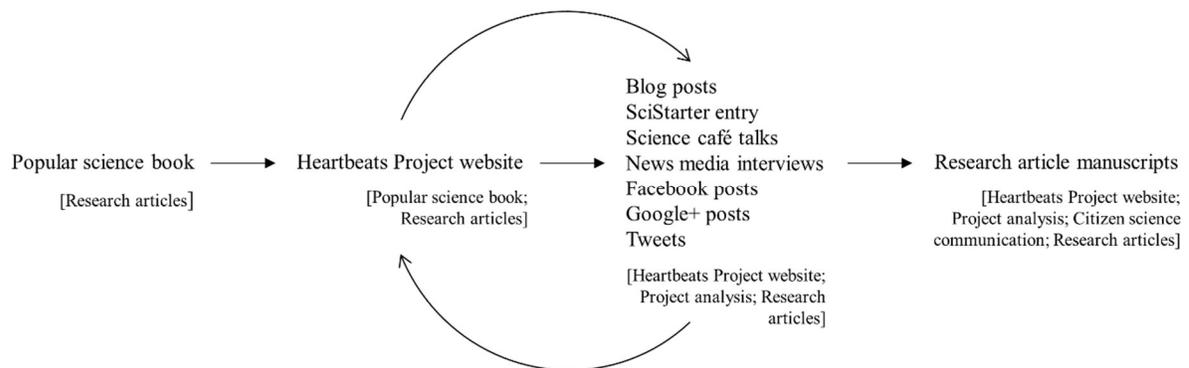


Figure 4.5. Citizen science communication as scientific invention. Arrows indicate the sequence of texts, with recontextualized material in those texts indicated in brackets. Circular arrows indicate the recursive interaction between the Heartbeats Project website and public communication, which together served as invention for the scientific manuscript.

In addition to influencing data collection or question asking, the Heartbeats Project demonstrates another way citizen science can influence professional science: through the *scientific invention afforded by their communication with citizen scientists*, invention that can influence the shape of the final research and the arguments made to situate it.

Shifting Networks, Genres, Roles

The genres enlisted for the Heartbeats Project illustrate the shifted networks of genres that citizen science can prompt for scientists who choose to lead or engage with these projects (Figure 4.5). These are not the genres generally associated with scientific communication (e.g. research articles, literature reviews, research proposals, posters,

abstracts, conference papers, grant proposals) or even with the occluded genres of scientific work (e.g. lab notebooks, emails, article reviews) (Hurd, 1996, 2000; Hyland, 2000; Swales, 2004). Instead, these more closely resemble the genres enlisted to communicate with the public about published research articles (i.e. the traditional chain of genres in Figure 4.3 that amounted to important procedural knowledge for Clay). The sequence and timing of these genres, however, is changed and requires more direct communication between scientists and the public, a fact that may be both attractive and uncomfortable for some scientists. For many, however, the challenges of citizen science will outweigh those misgivings as it presents itself as a fitting response to a commonly understood rhetorical situation, a situation that includes an exigence to share scientific research with the public and technological resources to do so widely and meaningfully. Clay, for example, noted the “huge disconnect” of having “the public pay for [science] through tax dollars” but having the final products in a form “the public can’t read or have access to.” This disconnect, in fact, is one that funding agencies like the National Science Foundation (NSF) have attempted to address by attaching requirements for public outreach in their grants and through the initiatives like the NSF’s Public Access Repository (NSF, n.d.). It is also part of the motivation behind the Open Science movement, whose proponents see openness and collaboration as values key both to cultivating relevant, rigorous science and to ensuring that this science is available to inform public decision-making. This latter concern encompasses perceived public hostility toward science and scientific findings and a general low level of scientific literacy (issues like vaccine safety and climate change are often cited). This complex of exigences (taxpayer hostility, funding, collaboration, life-threatening issues, literacy) has propelled a great deal of

experimentation with both scientific genres and genre networks, including experiments with open access publishing, open data, open peer review and new genre elements like lay summaries, supplements, primers, and videos (Costello, 2016). Situated in this context, citizen science can be seen as a response to many of the pressures for change in scientific genre networks, holding potential for fostering public trust and literacy and, in Clay's words, affecting the "end game."

The Heartbeats Project, however, underscores how citizen science also contributes to the forces for change in scientific genres and genre networks. It is important to note that the larger scientific network of genres is generally more structured and regulated than other networks of genres, with multiple institutionalized forces acting conservatively to maintain stability—forces like university tenure and promotion practices, blind peer review, professional associations, funding and regulatory agencies, etc. (Kelly & Maddalena, 2015, pp. 8–9). Interviews with members of the Heartbeats Project team, in fact, highlight the power of these forces and the limited value some scientists see in many of the genre innovations occurring at scientific journals (e.g. Clay's assessment of video supplements). Yet analysis of the Heartbeats Project's communication suggests that routinely engaging with citizen scientists can influence scientists' inventional work, contributing incrementally to a movement toward access, accessibility, and open science. Communicating with citizen scientists, for example, influenced the team's visual choices in a way that contributes to the accessibility of their research article manuscript. Shifting the network of scientific genres to include citizen science, then, can promote a degree of scientific genre change toward accessibility and toward addressing the "big picture" implications of scientific research.

The shifted timing and nature of public communication introduced by citizen science, however, contributes to the pressure for genre change in another important way, namely by altering the roles indexed in scientific genres. Genres provide a set of social rules, constraints, and resources for particular situations, including “reproducible speaker and addressee roles, social typifications of recurrent social needs or exigences, topical structures (or ‘moves’ and ‘steps’), and ways of indexing an event to material conditions” (Miller, 1994, p. 71). Research articles do not have typified roles for the general public, instead traditionally relying on other genres to “accommodate” scientific findings for nonspecialists (e.g. Fahnestock, 1986). The fact that a research article manuscript like the Heartbeats Project manuscript includes the public in its making introduces a new set of relationships that have some similar precedents to guide them (e.g. extended scientific collaborative teams), but that introduce many new and distinctive dynamics as well. These dynamics raise rhetorical problems not fully addressed by research article conventions. For example, at what point are citizen scientists coauthors and at what point is an acknowledgement sufficient? Are data citations sufficient and what is the most accurate and effective way to cite these (Hunter & Hsu, 2015)? At what point are citizen scientists human subjects? Can they play multiple roles? What ethical obligation do professional scientist authors have to make research articles based on citizen science projects available to citizen scientists? Is a press release or news article sufficient? Or do citizen scientists have a right to published journal articles and to lay summaries tailored for them? Will the research article genre allow for a research exigence situated in citizen science (i.e. discovered by a citizen scientist or through

citizen science activity)⁴⁰ or must the scientific story told in research articles continue to focus exclusively on the exigences presented by gaps in the scientific literature?

These are not simple questions to answer and they have not been answered often enough yet for the research article genre to have typified answers typified for them. In the case of the Heartbeats Project, manuscript drafts do not list citizen scientists as coauthors, something Clay attributes to their fairly minor level of participation. The reciprocity and obligations elicited by the Heartbeats Project is rather low. The set of factors that must be considered in order to answer questions related to roles and attribution, however, draws attention to the fact that citizen science is not a single monolithic practice, but rather a set of practices with variations. The typified answers that will evolve in response to this rhetorical problem will need to account for the various manifestations citizen science can take, something addressed by several typologies of citizen science practices (Bonney et al., 2009; Cooper, Dickinson, Phillips, & Bonney, 2007; Haklay, 2013; Wiggins & Crowston, 2011; Wilderman, 2007). Haklay's (2011) four-level typology of citizen science based on level of participation, for example, helps explain the Heartbeats Project team's decision not to include citizen scientists as coauthors: (1) "Crowdsourcing" with "citizens as sensors"; (2) "Distributed Intelligence" with "citizens as basic interpreters"; (3) "Participatory Science"

⁴⁰ I see a parallel here to the "phony story" biologist June Davis felt reviewers asked her to construct in her research article manuscript (Berkenkotter & Huckin, 1995b, p. 54ff.). The genre did not allow for her to situate her exigence in "the story of her work in the lab," which felt like the more authentic exigence, but rather required her to construct an exigence situated in the "much larger narrative" of "the ongoing narrative of Tumor Necrosis Factor," or, in other words, the scientific literature (p. 59). Some citizen science projects originate with citizens' problems and questions and "citizens partner with experts to do the science that's useful to them and their community, not just someone else" (Maynard, 2016, n.p.). The question is whether the research article genre will require that publications based on these inquiries also construct a "phony story" and occlude exigences outside the scientific literature or find a routinized way to include these as well.

with citizens participating in “problem definition and data collection”; and (4) “Extreme” with citizens collaborating on “problem definition, data collection and analysis” (p. 116). In this typology, the Heartbeats Project fits at the level of “distributed intelligence,” since participants must make several interpretive decisions about their data collection, including whether the heartrate data in a research article are valid (drugged animals, for example, should be excluded). While a step above the citizen scientist as “sensor,” this level and type of participation raises only minimal questions about attribution and ethics. In contrast, projects like the Flint Water Study, a community-led citizen science project partnering with researchers at Virginia Tech University to investigate the contamination of the water supply in Flint, Michigan (Maynard, 2016), raise more extensive rhetorical and ethical questions about the relationship between scientists and citizen scientists and the obligations this relationship raises. The obligation to communicate findings to citizen scientists and stakeholders in an accessible, actionable form, for example, is much greater and draws attention to how citizen science can encourage change at the level of genre and genre networks.

Changing Science

My interaction with the Heartbeats Project raised another notable dynamic, namely that the generic experimentation the lab engaged in was designed not just to change the relationship between science and the public, but also to change science itself. In his effort to complicate how we understand the relationship between science and the public, Bucchi has proposed several conceptual models, most recently theorizing the relationship as a double

helix, a metaphor he finds useful for modeling how scientific and public discourses develop in parallel, mutually acting on one another at “certain junctions,” with influence moving both ways (Bucchi, 2004, p. 279). Earlier, however, Bucchi (1998) presented what he called the “continuity model” of scientific communication, an alternative that, instead of theorizing science and the public as discrete spheres, theorizes a continuous and reciprocal movement of scientific information through four stages: the intraspecialistic, interspecialistic, pedagogical, and popular stages (p. 13). In this model, scientific ideas lose nuance and gain unqualified certainty as they move further away from specialized scientific discourse and toward popular discourse (Fahnestock, 1986). While Bucchi has expressed dissatisfaction with this model in that it maintains some elements of the transfer model of communication that he finds problematic, the stages Bucchi identifies are useful for understanding an important goal behind the lab’s (and specifically Soren’s) citizen science endeavors and communicative innovation. Specifically, many of the texts and practices seemingly targeting the “popular” stage (the public, citizens) are also simultaneously meant to engage the “interspecialistic” stage.

In my opening narrative, Summer speculated that today’s scientists need to be “digital da Vincis,” with expertise ranging from science to the arts to public writing and digital composing. When asked whether he agreed with Summer’s speculation, Soren contextualized his answer by pointing to the “atomization” of science—its increasing specialization, a phenomenon linked to the professionalization of science since the first meeting of the British Association for the Advancement of Science (BAAS) in 1831 (Dyson, 2015, p. 136), which has gained momentum in recent years. Soren explained that “the ways of being a scientist

have atomized,” with many scientists not even noticing the phenomenon because “when they’re being trained,” they “see this one domain and the adjacent domains,” but no further. This atomized specialization is sustained by a variety of professional structures and incentives, something that Soren stated could be “productive,” but was not necessarily satisfying or conducive to some important types of scientific thinking and abilities:

One push in all the fields is to get people to publish faster, get more grants faster, and go down the straight line as fast as possible. The incentives are lined up there. And I think that that very often leads to very unsatisfying careers for people.

While these incentives line up to cultivate specialization and a certain type of productivity, they do not necessarily foster the ability to communicate across specialties or to discuss matters of scientific and societal importance with diverse audiences. Using the classroom as a proxy for this ability (the “pedagogical” stage), Soren described how challenging it was to hire good candidates for faculty positions, because the expertise and achievements incentivized for a highly productive researcher were often at odds with those who could communicate with students:

When we look at candidates for jobs, somebody who’s on that road [toward high productivity]—in a great big department where they want National Academy [of Sciences recognition]—will always get put in the pool. But they are hard to hire. And they are hard to hire, because you really want somebody that, kind of, gets your students to be a member of the department—to be able to engage in discussions.

Soren’s digital composing strategies, including his citizen science strategies, were meant to intervene in this environment. Rather than the requirement Summer speculated about, Soren

saw the idea of the “digital da Vinci” he clearly embodied for members of the lab as a “hopeful” move:

I think more about the digital da Vinci thing as something that lends itself to new ways of being part of a broader community in a moment in which science has become, maybe not *as* specialized as we think it is, but pretty specialized. And so, I see it as more hopeful, than necessary.

For the postdocs and other young scientists he mentored, Soren’s hope was that by creating opportunities for them to communicate about science with diverse audiences—audiences that often included scientists of other specialties like the “cranky” retired scientist Clay interacted with—they would see that “Oh, we can still bridge these things, but to do it, we’re going to use different kinds of tools.” Citizen science and the changes to the genres and genre chains he and his lab enlisted were part of a larger, purposeful strategy for resisting scientific compartmentalization:

What I would hope is that . . . if people are starting to engage the public, they become—I’ll hypothesize—become more aware of the different languages necessary to communicate. And more aware of where they sit relative to a broader group of people. More aware that that’s not the one right place, and also more aware of other kinds of discussion or conversation.

The mentorship Soren provided in this way of “doing science” was multilayered and multidimensional, including the undergraduates, graduate students, research assistants, and postdocs in his lab, as well as the teachers, students, and citizens he mentored through citizen science. It included his leadership on campus and across campuses and institutions (e.g.

museums). And, I realized, it included other scientists when he reached them through the ostensibly “popular” (public) stage of citizen science that he so clearly also saw as “interspecialistic.”

The team’s genre innovation, and particularly its innovation in forging new chains of genres that reached across discursive fields and back again, could be seen not only as an attempt at enacting scientific genre change (e.g. the changes they attempted through their composition for recomposition), but as enacting a much larger discursive change—at changing science itself. In my epigraph, Freeman Dyson (2015) hypothesized that science might be entering a new “Age of Wonder,” with increasing collaboration between scientists and amateurs, and that together these would work “to make the planet beautiful as well as fertile, hospitable to hummingbirds as well as to humans” (p. 141). Soren and the Heartbeats Project suggest that this collaboration, at least for this team, seeks to create an environment more hospitable for scientists and science too.

Recapitulatio

I began this chapter with the idea that Soren Thomas understood the present moment as kairotic for science. Soren and his lab stand out as visionary and innovative in their digital composing practices, seizing a complex of sociotechnical and scientific dynamics to push against convention and embrace public participation in science in ways other scientists have yet to. As the Heartbeats Project illustrates, the present moment and the innovative relationships it has allowed have provided fertile ground for their biological imaginations. The composing that has been part of this innovation has been deeply digital—digital media

have formed a critical part of the opportune moment for the lab. Yet digitality has not been obvious, often receding transparently into the background. In fact, the team's innovation could just as easily be summed up by Clay's observation that "scientists are all just people." Much of the team's efforts has consisted of humanizing science for the public and appealing to scientists as humans. The questions they have tackled have often been designed to reside at the intersection of public and scientific interest, and their composing practices have banked on science as an exciting, wondrous, *human* activity.

My first compositional lens—medium—revealed that while the team actively grappled with the digital enrichments available to them in today's publishing environment, adopting some and rejecting others according to their fittingness for scientific work, the more distinctive aspect of their digital composing was their *composition for recomposition*. For the Heartbeats Project team, who viewed the public as disciplinarily relevant, the most compelling affordances of digital media were those that connected heterogeneous groups, for example, connecting scientists with members of the public. The team embraced and anticipated participatory culture, composing elements of their scientific manuscripts with the express view that those elements would be taken up and repurposed by journalists and the public.

My second compositional lens—modes—added more nuance to why certain publisher experiments with multimodal digital enrichments have been successful with scientists and others less so. Specifically, the Heartbeats Project team tended to reject digital enrichments, like videos, that deviated from the logic of meaning compression into the logics of meaning expansion or meaning attention. Author videos that brought attention to scientific

meaning making, for example, were seen as at odds with the positivist epistemology underpinning the scientific research article genre. That said, the lab's communication with citizen scientists added complexity to the picture of their multimodal composing practices, which included meaning expansion and meaning attention practices to enrich citizen scientists' experiences of scientific meaning making. My ethnographic engagement with the lab's citizen science projects also revealed that project instructions functioned as a form of *procedural rhetoric* in scientific meaning making that organized the experience and enabled citizen scientists to experience some semblance of the rich, multimodal, multisensorial "semiotic hybrid" of scientific inquiry. This lens afforded a view of scientific composing that suggests that some ways of being an effective scientist today include flexible abilities in a variety of types of multimodal composing.

Finally, I closed this chapter with my third compositional lens—genre, an analysis that included attention to two types of relationships between genres in the team's genre networks: (1) utterance-uptake relationships in genre chains; and (2) intertextual relationships through recontextualization of ideas and elements across texts and genres. The first afforded a view of the relationships between genres in one direction—from the team toward the public—and the second afforded a view of relationships in the other direction—from public-facing texts and genres to scientific genres. This analysis revealed that the team strategically enlisted two models of science communication at once, the canonical, mediated model and a direct model, which sometimes created conflicts for both their public-facing composing and scientific composing. This analysis also revealed that the team's citizen science composing influenced their scientific text by *recontextualizing science for science*—the team

recontextualized public-facing science activity and communication for the scientific context, reversing the commonly understood relationship between science and the public. The team's citizen science communication, then, functioned as a form of *scientific invention*. I hypothesized that this shift in how and when scientists and the public relate might become a force for genre change as it also committed scientists to new ethical and reciprocal responsibilities. Soren's commentary on these practices, however, revealed purposeful genre innovation, particularly in forging new genre chains that reached across discursive fields and back again—genre innovation aimed at a much larger discursive change, changing science itself.

Digital composing in this disciplinary context, then, included attention to digital meaning making itself, using digital media as a tool for promoting disciplinary change. The affordances of digital media the team found most compelling, that provoked their biological imaginations the most, were those that facilitated reaching across discursive spheres, for networking seemingly heterogenous groups together. For Soren, the most hopeful, generative aspect of composing with networked digital media was that they prompted, and provided a tool for, learning to speak other people's languages:

The thing that's key is that there's a real value then in [the current] context in *figuring out ways to talk to other people in their own languages*. And that that, maybe more than the tools themselves, becomes . . . the tools become a *way* to do it, but what you're trying to achieve again and again is, "How do I talk to this community in their language?" And because people are trained in these clumps, I think that then becomes a really hopeful thing.

For Soren, digital composing is interdiscursive composing—composing across discursive fields to promote imaginative, flexible science, blending and blurring commonly understood scientific and natural compartments to produce a less disciplined science and more scientized public. Soren may not think it necessary that all scientists be “digital da Vincis,” but he performs the hopeful move of demonstrating that they can be.

Chapter 5

Twin Tales of Disciplinary Digital Composing

A Word on Disciplinarity

The question I have sought to address in this dissertation is how disciplinarity might shape and be shaped by scholarly digital and multimodal composing. Coming at this question informed by genre theory, I have seen composing *as* disciplinary work. Not only that, but I have seen my participants' rhetorical work as an act of composing the discipline, just as the discipline composes them as disciplinary subjects through this work (Goggin, 1997, p. 323). The question this raises, however, is, which discipline?

Each of these two projects poses considerable challenges when it comes to classifying them according to discipline, something necessary in order to form any conclusions about the discipline each case helps us understand. In the Heartbeats Project case, for example, Clay identified himself as an “ant scientist” by training and initially joked about how working in Soren’s lab had “messed up my CV,” changing the narrative it told about him as a researcher. Soren often either identified himself broadly as a biologist or more specifically as an ecologist and evolutionary biologist. The lab itself, in fact, was first classified as an entomology lab, but transitioned to a microbiology lab at the end of my study period. The Heartbeats Project contributed to neither of those and ultimately targeted *Current Biology*, a

generalist biology journal, with findings of interest to both general biology and evolutionary biology.

The Webtext Project case participants also demonstrated remarkable disciplinary diversity. While Joy, Mark, and Tara identified themselves as “rhet/comp,” they each had other fields of expertise they regularly contributed to and readily mentioned. In Mark’s words, “rhet/comp is my home.” Tara, as a recent graduate of an interdisciplinary doctoral program, less readily identified herself in this way, quickly pointing out her work in learning spaces research as well, a field that cuts across multiple disciplines. That said, she used pronouns in such a way that demonstrated her identification with rhetoric and composition. On the subject of pedagogy, for example, Tara spoke about how “folks in rhet/comp, *we* have a real dedication in *our* discipline” to the scholarship of teaching and learning (emphasis added). When participant checking this analysis, she confirmed rhet/comp and learning spaces research as her research homes, only adding “writing teacher” to how I described her. Christopher was quite hesitant to “pigeon-hole myself, having a foot in two very distinct ponds.” While his training and institutional home was in mathematics, with “25 peer-reviewed articles in mathematics research journals” to his name, in the past several years his “focus [had] shift[ed] almost exclusively to rhetoric and composition, and, more specifically, writing in the disciplines.” His identity and writing had shifted so much that writing for a project in mathematics felt “odd.” On several occasions, he qualified mathematics as “my so-called home discipline.” The Webtext Project, while targeted for *Kairos*, a rhetoric and composition journal, was intended to reach beyond that audience to learning spaces researchers, college educators, and administrators making classroom spaces decisions.

Neither of these teams or projects, then, could be said to be disciplinarily homogeneous. Placing either of them *in* a discipline is not a simple matter. Some might say this makes the cases too atypical to be productively considered for a study of disciplinary writing. The cases might better be defined as examples of interdisciplinary writing. I suspect, however, that this sort of disciplinary ambiguity is much more typical of scholarly experience than often assumed. The centrally-located disciplinary scholar—the prototype of the discipline—may actually be the outlier in terms of the lived experiences of disciplinarity, with disciplinary identity and participation much more fluid than we generally expect. These cases, in fact, and their participants' disciplinarily heterogeneous stories, support the idea that disciplines are neither stable nor fixed and bounded. Likewise, they support the notion that scholarly *identities* are neither stable nor fixed and bounded, and that scholars participate in constituting disciplines, but are not themselves, in any essentialist sense, “in” a discipline. Our expectations of disciplines as clearly demarcated spaces or territories may in fact be more related to our cognitive schemas for categorization than to disciplines themselves, an argument I have made elsewhere with Carolyn Miller (Reid & Miller, 2018).

In this work, we drew on category theory to complicate how we think about disciplines, contrasting the common “closed” or “container” approach to categorization derived from Plato with the “open” or “family resemblance” approach derived from Ludwig Wittgenstein. The closed approach has been culturally quite persistent. In this model, categories are discrete with clear boundaries between them and with specific criteria items must meet to fit inside a category. The category is a unified space with all items related to each other in the same way. It's also very common to see these categories as somehow

“natural” and objectively true—they are “out there” to be discovered and tell us some underlying truth about how the world works and fits together into patterns. George Lakoff (1987), in fact, in his book on human categorization, *Women, Fire, and Dangerous Things*, notes that “the idea that there is a single right taxonomy of natural things is remarkably persistent” (p. 119). This closed model often leads to hierarchical classification systems as we try to fit items into mutually exclusive categories and sort out how they fit together. In terms of disciplinarity, this schema seems to lie behind questions about disciplinary hierarchy (e.g. disputes about whether an area is a subfield of another) and behind questions about what criteria to use to determine who is “in” a discipline. It is likely also responsible for confusion about what to do with work or scholars who don’t seem to neatly fit a discipline.

In this piece, the approach we offered as preferable for thinking about disciplinarity, is the open or “family resemblance” approach. Wittgenstein (1953) chose the metaphor “family” to describe this approach because we intuitively understand that family members are not identical and may not all be related to the category of family in the same way (i.e. by marriage, blood, adoption, affection, etc.). Members don’t fit a checklist of criteria and there may not even be a feature shared by all members (e.g. the same nose). We also generally belong to more than one family. Yet we understand the category as a meaningful one. We chose the term “open” because there are numerous approaches related to “family resemblance,” but the thing that these approaches have in common is that they lead to open categories. We argued that “a category, then, is a loose cluster with open boundaries, perhaps questionable instances on the margins, and some instances that seem fairly ‘central’ or most representative of the concept”—the prototype (n.p.). Drawing on research by cognitive

psychologists like Eleanor Rosch, we noted that categories, including those like disciplines related to understanding our world, are not natural, but rather social:

Just as biologists have surrendered the concept of “species” as an unchanging essence to the continual flux posited by evolution, cognitive psychologists have demonstrated that our everyday categories are similarly difficult to square with a criterial, or logical, approach. Like species, our categories do not have clear boundaries; they change over time and across locations and groups; and they do not produce logical taxonomies based on consistent criteria (Lakoff 1987, 187ff.): in other words, our categories are always social and not “natural.” (n.p.)

An example Wittgenstein gave to illustrate his thinking about categorization is the challenge of finding a single shared feature across the category of games. Instead of a set of criteria, he concluded that, “we see a complicated network of similarities overlapping and criss-crossing: sometimes overall similarities, sometimes similarities of detail” (sec. 66). This image of the network is, in fact, the metaphor we offered as preferable for thinking about disciplinarity. In place of metaphors like containers, boxes, or even spatial metaphors like territory or turf, metaphors that come culturally-loaded with concepts like boundaries, ownership, and policing, networks help us conceptualize how diverse, but connected, people, artifacts, practices, concepts, etc., might form a category that is open, permeable, sometimes ambiguous, but still a meaningful, distinguishable unit. This metaphor also casts doubts on the common criticism of disciplines as “hegemonic, modernist structures of power” bordering on the unethical, instead revealing that this criticism may have “less to do with disciplinarity as such and more to do with the schema for classification through which we

understand disciplines” (Reid & Miller, 2018). For genre theory, the open schema for categorization has led to a more dynamic understanding of these cultural categories (Bazerman & Prior, 2005; Miller, 2015), leading to insights such as Schryer’s (1993) that genres are only ever “stabilized-enough” and “stabilized-for-now” (p. 204). For the concept of discipline, understanding it as an “open, evolving, networked category” (Reid & Miller, forthcoming, n.p.), allows us to see it as a less unified and stable concept—one that is constantly being constituted by diverse forms of participation. Disciplines, like genres, are always on their way somewhere. This emergent quality, in fact, is part of what led Berkenkotter & Huckin (1995b) to observe that “asserting a relationship between the concept of genre and that of ‘discourse community,’” their frame for discipline, “is a slippery proposition because neither concept refers to a static entity” (p. 21).

This open, emergent approach to disciplinarity fits with that of many other scholars who have sought to complicate the common view of disciplines as discrete, stable, and “natural.” In a work on literacy education, for example, Charles Bazerman and Paul Prior (2005) invoked Wittgenstein’s “family resemblance” and Latour’s notion of “heterogeneous networks,” arguing that we need to “move from a . . . notion of disciplines as unified social and/or cognitive spaces to a notion of disciplinarity as the ongoing, mediated constitution of a kind of social network” (pp. 152-153). This notion of ongoing constitution as more explanatory of the dynamics of knowledge construction than essential criteria or static boundaries also led them to argue for “disciplinarity” as the preferable term over “discipline” as it highlights participation and action. Prior (1998), in fact, made much the same point in his earlier study of graduate student disciplinary acculturation where he offered

“disciplinarity” as way to emphasize disciplinary “doing” over the more abstract concept of “discipline,” which appears to exist independently of people’s continual constitution of it (p. 26). Drawing on their scholarship on disciplinary communication, Bazerman and Prior point out that the “interdiscursive blendings and blurrings” that are often termed interdisciplinarity are much more “mundane” and routine than generally assumed and that, rather than the exception, hybridity and interdisciplinarity may be the norm in scholarly work (p. 154). One of the dangers of a closed schema for disciplinary categorization is that people will discipline themselves (or others) to fit their notion of a unified, bounded discipline. An open schema is one conducive to living with intellectual diversity and difference. Beyond the oppressive dynamics they create, closed approaches to disciplinarity also contribute to patterns of hyperspecialization and our “narrowing the acceptable data, method, or theory” for disciplinary inquiry to the point of putting us “in danger of misunderstanding or even distorting the processes, practices, and products” of our objects of study (Bazerman, 2011, p. 8). The metaphor of the network adds the notion that nodes, such as people, methods, concepts, tools, and publications, can help constitute more than one disciplinary network through its “edges.” As graphs of our own social networks (i.e. on social media) illustrate, a single person can help constitute, through her connections, more than one distinguishable network, helping give these their discernable shapes all while their borders visibly bleed into one another. The ability to participate in multiple disciplinary networks simultaneously, without contradiction or threat to a person’s identity, is one of the chief advantages of this metaphor, freeing the concept of discipline from some of its more damaging, oppressive

associations, while keeping it a distinguishable, meaningful concept for understanding collective knowledge constructing work over time.

To return to the Webtext Project and Heartbeats Project, neither of these cases is disciplinarily homogeneous or straightforward. Classifying their authors “in” a discipline is not a simple matter, as their very scholarly identities seem best described as only “stabilized-for now.” Theorizing disciplines as heterogeneous networks with open, ambiguous borders, networks that are continually constituted through disciplinary action, however, goes a long way toward solving this quandary as it places attention on that action rather than any stable identity. Action has movement and temporality built into it. And so, rather than taking my participants’ training or institutional roles or even their expressed identities as the definitive answer to which discipline each case helps us understand, I have classified each project according to the primary discipline it seeks to help constitute: rhetoric and composition, in the case of the Webtext Project; and biology, more generally, in the case of the Heartbeats Project. The coauthors’ scholarly identities and patterns of disciplinary participation become part of understanding each project, but do not wholly define the project. It seems reasonable to say that each of these is not centrally located in its disciplinary network—these are not prototypes of disciplinary participation by any means—but that they are clearly meant to address the “explanatory ambitions” animating those networks, to use Stephen Toulmin’s (1972) phrase (p. 151).

It is possible that the disciplinary pluralism and multivocality embedded in each text’s story, with each team drawing on work and training and ideas from many disciplinary networks, may in fact be more common than often assumed (e.g. Bazerman & Prior, 2005).

Perhaps many published texts that appear unproblematically unified and stable have these sorts of stories behind them. This complex view of the origin of a text and its complicated relationship with disciplinarity is one advantage of studying the “not-said” and “discoursal silences” in this way (Swales, 2004, p. 86). It seems likely that the disciplinary remixing visible in these stories of composing is one way disciplines change and evolve, though the force of prior texts, of prior disciplinary actions, has a reciprocal conservative effect on this creative repurposing, bringing it more in line with what has been done before and what is considered the prototypical disciplinary action now. As Bakhtin argued, every utterance is imbued with both responsivity and addressivity (Bakhtin, 1986, p. 94f.) and is at the intersection of centripetal and centrifugal forces (Bakhtin, 1981, p. 272)—between stability and change.

Comparing the Webtext & Heartbeats Projects

The view of disciplinarity as open, emergent, and networked complicates any conclusions about disciplinary composing we might draw, lending greater provisionality and contextuality to them than we might already have couched them in. That said, the Webtext Project and Heartbeats Project do shed insight on the question of how the activities and operations of disciplinary shape and are shaped by digital and multimodal composing. For one, these twin stories of disciplinary collaboration reinforce that the way scholarly composers perceive and take up the affordances presented by digital media and multimodality is influenced by disciplinary goals, practices, and systems, including those related to genre as typified and recurrent disciplinary action (Miller, 1984). The composers in

these two cases saw and used modes and media in distinct ways best explained by their epistemological traditions and explanatory ambitions. These cases also suggest that the rhetorical possibilities presented by digital media, when taken up by scholars, amount to changed ways of participating in disciplines, and therefore can affect the constitution of those disciplines. Remediating a genre, for example, does not leave that genre unchanged—it is not epistemologically, semiotically, or rhetorically agnostic. This remediation therefore has the potential to change the stabilized-for-now discipline over time if taken up and reproduced by others.

To begin with multimodality, the way each team composed with modes was best explained by their epistemological orientations and how they understood the disciplines their work was intended for. The Webtext Project, for instance, was intended for an online journal in rhetoric and composition, a pluralistic discipline with strong empirical and hermeneutic traditions. With coauthors representing both of those traditions, it became apparent that the team's multimodal composing employed three distinct strategies with distinct logics: *meaning compression*, generally seen in the sciences (Baldry & Thibault, 2010); *meaning expansion*, which seemed tied to the ethnographic tradition of multimodal thick description; and *meaning attention*, which drew attention to meaning making as such in a common humanistic move. Tara, for example, used the combination of numbers, visuals, and text in tables to compress meaning made across multiples times, spaces, and modes to a more economical, efficient form. At the same time, she employed strategies of meaning expansion to expand her audience's understandings of the social world she was studying and communicate the multidimensionality of participants' lived experiences. Mark, on the other

hand, sought to draw attention to meaning making to provoke critical reflection. These multimodal strategies amounted to different ways of making meaning and accomplishing rhetorical goals and, together, reflected a discipline with a historically pluralistic approach to addressing its “explanatory ambitions” (Toulmin, 1972). Janice Lauer (1984), for example, famously called composition studies a “dappled discipline” because it had, from the beginning, seen “the value of building on relevant work in other fields and of using methods of investigation refined elsewhere” (p. 26). As the Webtext Project’s varied multimodal strategies illustrate, this epistemological and methodological remixing, an important part of rhetoric and composition’s history of disciplinary formation, is still present, as is the spirit of creative repurposing behind it.

The Heartbeats Project offered a very different story of multimodal composing, with the team primarily following meaning compression as its guiding strategy for its formal multimodal composing, and rejecting journal publisher innovations like author videos that were better described as following either the logic of meaning expansion or meaning attention. That said, the team embraced all three strategies in its composing for the public and in its inventional work, experimenting with modes and media that deviated from those typified for scientific communication in order to draw attention to their own meaning making and provoke ideas. The Heartbeats Project case supported the theory of scientific work as a “semiotic hybrid” (Lemke, 1998, p. 93) and suggested that, for some scientists, being an effective scientist today requires flexible abilities in a variety of types of multimodal composing. My ethnographic engagement with the lab’s citizen science projects, of which the Heartbeats Project was one, also suggested that citizen science project instructions

functioned as a form of procedural rhetoric in scientific meaning making that organized the experience for citizen scientists and enabled them to experience some semblance of the rich, multimodal, multisensorial hybrid of scientific inquiry.

Together, the two cases suggest that distinct multimodal strategies exist and that disciplines may develop and draw on them in disciplinarily distinct ways, which are likely informed by a combination of tradition, explanatory goals, epistemology, methodology, etc. Epistemological values and assumptions, in particular, seemed to play a large role in these multimodal strategies. Ethnographers, for example, generally assume that data are produced through interaction with people in a given context and that the human is the most sensitive instrument for perceiving and understanding complex human systems. All the senses are understood to be relevant to this process and ethnographers tend to be quite aware of the reduction that occurs in any account of human experience, including that of ethnographic interaction. “Thick description” (Geertz, 1973) has developed as a way to compensate for this unavoidable reduction and so it makes sense that someone who constructs knowledge in this tradition would use a strategy like meaning expansion as a form of multimodal thick description. Because both of my cases included evidence of all three of these strategies (one could not be said to “belong” exclusively on a discipline), it seems likely that a complex of factors influence disciplinary multimodal composing strategies and that disciplinary composers repurpose creatively, using strategies developed in one context in another according to explanatory goals and the perceived fittingness of the strategy for a disciplinary action (much as disciplines borrow methods from each other).

Turning now to digital media, an interrelated but distinguishable facet of communication, my two cases exhibited interesting similarities considering the gap in their disciplinary goals, objects of study, epistemologies, etc. Both teams, for example, used digital media extensively for collaboration, analysis, and composing, with some divergence in tools by discipline. Both also saw the affordances of digital media for data collection as particularly compelling, using networked digital media for dynamic data submissions from participants. The participants submitting data to the two projects, however, were positioned differently and the relationship of their data submissions to the disciplinary text differed substantially. The Heartbeats Project solicited data submissions from a citizen science project webpage separate from their disciplinary text and did not position citizen scientists as readers of that disciplinary text. The Webtext Project, on the other hand, sought to collect readers' contributions dynamically through their disciplinary text, with readers positioned as disciplinary readers. The textual and methodological difficulties of this type of dynamic collection, however, also led them to explore separate data collection using their interactive classroom software, with those participants (students) not positioned as disciplinary readers. The Webtext Project team's disciplinary sensibilities seemed behind this textual experimentation, since understanding texts and composing are part of rhetoric and composition's explanatory goals and destabilizing texts and composing can further that end by making visible otherwise tacit expectations. Mark, the member of the Webtext Project team most aligned with the humanistic tradition in rhetoric and composition, provided a revelatory contrast with the empirical members of his team in use of digital media. As the team member coding the webtext and its software component, Mark was, similarly to his

coauthors, interested in digital affordances like interactivity, recording, and replaying, but specifically for the purposes of creating *hypermediacy* for readers, making the digital mediation strange and visible to them and provoking critical reflection.

Mark's interests contrasted directly with the empirical uses of digital media both by his team members and the members of the Heartbeats Project team, who relied instead on *immediacy*, with mediation receding transparently into the background for composers and audiences. For the Heartbeat Project, media and modes were *tools* of inquiry, while for the Webtext Project, they functioned both as tools of inquiry and as *subjects* of inquiry. The Heartbeats Project team used digital media for a large range of scientific purposes—the networked digital media were deeply and routinely embedded in “doing science.” That said, they were not themselves the subject of that work and so were often transparent for members of the team. The team did, however, experiment with the affordances presented by digital media in their communication. For the Heartbeats Project, the opportunities presented by digital media interacted with a complex of other exigences facing biology and science more generally to prompt communicative experimentation, but *across discursive fields*.

Specifically, the team's creative attention was largely focused on developing scientifically productive ways of reaching beyond specialists and internal scientific communication to public contexts, using means such as citizen science. Through a confluence of structures and factors, public audiences and institutions were seen as strongly related to disciplinary goals, prompting the team to experiment with “*composing for recomposition*” (Ridolfo & DeVoss, 2009), composing elements of their scientific manuscripts with the express view that those elements would be taken up and repurposed in public-facing texts.

Comparing these cases at the level of genre, which connects substance and form—including medium and mode—to rhetorical situation, reveals that digital media presented both teams with material and an exigence for innovation. While the Webtext Project drew on genre knowledge to innovate primarily at the level of text and discipline, the Heartbeats Project innovated across genres with the goal of reaching across discursive fields. Many of the challenges the Webtext Project team experienced seemed connected with conflicting genre knowledge and the attempt to reconcile it in a generically hybrid text. While collecting data dynamically through their webtext cued empirical genres and the IMRAD structure for Tara, Joy, and Patrick, it became apparent through Mark's participation that the scholarly webtext as practiced at *Kairos* is more closely related to hermeneutic genres like literary criticism, with rhetorical enactment or performativity a defining feature. Mark, as the most experienced webtext composer, saw this performativity as important but insufficient if readers are not aware of it and able to reflect on it. His goal, and that of the scholarly webtext genre more broadly, was better described as *reflexive performativity in service of hermeneutic hypermediacy*. The team's attempt to blend the empirical with the hermeneutic in a generically hybrid text highlighted the epistemological plurality of this disciplinary context and both the challenges and generative potential of collaboration across epistemological traditions. While one hybrid text does not make a genre, were the team to be successful in publishing this digital text it could have the potential to be taken up by others and offer the discipline new ways of blending its epistemological traditions in digital fora.

The Heartbeats Project, on the other hand, innovated at the level of text, composing textual elements for anticipated recomposition, but with the express purpose of creating

intergeneric and interdiscursive change. The team's citizen science, for example, changed the typical timing and sequence of professional scientific genres with public science communication, in part with the intent of changing public attitudes toward and understandings of science. In the context of the Heartbeats Project scientific manuscript, this earlier communication with the public about in-progress work ended up functioning as part of their scientific invention, generating ideas for their composing. However, interaction with Soren, the team's principal investigator, raised another notable dynamic, namely that the lab's generic experimentation was designed not just to change the relationship between science and the public, but also to change science itself. For Soren, citizen science and the changes to the genres and genre chains he and his lab enlisted were part of a larger, purposeful strategy for resisting scientific "atomization" and hyperspecialization that prevented making important connections across disciplines. While, to use Bucchi's (1998) terminology, citizen science is ostensibly communication at the "popular" stage (communication about science with the public), for the Heartbeats Project team, it was also an opportunity for communication at the "interspecialistic" stage (communication about science with researchers in other scientific disciplines). Cultivating citizen science meant, in part, cultivating a recurrent rhetorical situation that networked seemingly heterogeneous discursive groups together and compelled scientists to learn to speak other people's languages. If this network of citizen science genres were to recur and typify, these genres might have the potential to create disciplinary change. The affordances of digital media the team found most compelling, then, and that provoked their biological imaginations the most, were those that facilitated reaching across genres and discursive spheres to create scientific

change. Unlike the Webtext Project, however, digital media were *tools* for rhetorical action and change, not the subject of disciplinary rhetorical action, and so did not provoke or require the same level of reflexivity and hypermediacy.

Together, these two cases of disciplinary digital composing suggest that disciplinarity—as a complex of explanatory goals, subjects of inquiry, epistemologies, methodologies, genres, etc., that is continually (re)constituted through people’s actions—colors how the affordances of media and modes are seen and taken up. The social dimension of this taking up is, in fact, built into psychologist James Gibson’s (1977) original coinage of the term “affordance” as an “action possibility” that an environment or object presents to an organism for either “good or ill” (p. 68). This possibility for action relies on *perceiving* that possibility, something that will always be shaped by culture, including disciplinary culture. In the case of media and modes, these offer possibilities for rhetorical action that are colored by the weight of prior rhetorical action (genre) and by existing exigences and networks of meaning, knowing, and doing. This means that in one disciplinary context, affordances like interactivity may be perceived as offering possibilities related to data collection and in others as offering possibilities related to critical reflection about communication. In one context, affordances like hyperlinking may be perceived as offering possibilities related to data and literature references and in others as offering possibilities related to destabilizing author-reader roles and the unity of texts. In one disciplinary context, digital experimentation may be most obvious *within* texts and genres and in other in the relationships *between* texts and genres. None of these is more or less digital. Each is native to a communication environment where the Internet and digital media are embedded and routine. Each loses dimensions

critical to its rhetorical action when moved out of digital environments. Each is thoroughly digital.

Research Limitations & Suggestions

While the two ethnographic case studies I have presented in this dissertation reveal the complex experience of disciplinarity that shapes and is shaped by composing in digital environments, they are not without their limitations. The advantage of ethnographic work is that it can yield richly detailed, contextualized, and nuanced views of social phenomena, but this also points to its disadvantage: it is time and labor intensive, limiting the number of cases a given researcher can undertake. Because the academic world is so large and varied, two cases is low in proportion to the number of existing disciplines (which are themselves diverse). These two case studies of disciplinary digital composing would benefit from comparison with additional case studies in disciplines with contrasting epistemological traditions. Michael Carter (2007) identifies four “metadisciplines” that contrast significantly in their disciplinary “ways of doing”: empirical problem solving, empirical inquiry, research from sources, and performance (p. 394). These could serve as a starting point for ensuring disciplinary diversity in further studies of this kind. My one reservation with this taxonomy is that by eliding departments and disciplines, Carter has also elided some of the heterogeneity within disciplines, including that related to epistemology and methodology. Ethnographers and chemists, for example, both presumably engage in empirical inquiry and yet their epistemologies, methodologies, and genres contrast markedly. This taxonomy, however,

could provide a rough guide to those seeking to add disciplinary diversity to this picture of digital disciplinary composing.

While these case studies provide a good vantage point on the rhetorical landscape these writers faced during invention and early in composing, I had to conclude my inquiry into them before either team was ready to submit their work to journal editors. This means that the cases give us access to generally occluded aspects of composing such as motive and how the authors understood their rhetorical possibilities and constraints, including the affordances of modes and media, but do not give us access to how those goals and choices might be revised through interaction with important disciplinary gatekeepers such as editors and reviewers. That is not to say that editors and reviewers were completely absent from my analysis, since the authors made choices partly in function of anticipated editor and reviewer responses, but these anticipations are just that—anticipations based on prior experiences that do not necessarily reflect how editors would actually respond to these texts. Prior studies of the influence of editors and reviewers on academic writing have shown what an important part they play in the final outcome of disciplinary composing (e.g. Berkenkotter & Huckin, 1995b; Myers, 1985a), and so future studies would do well to include these interactions in their analyses.

Another limitation of this study is that it focuses exclusively on the *production* of digital disciplinary texts. This complements existing work that examines published examples of genres or that surveys members of a discipline about a genre (e.g. Pérez-Llantada, 2013), but genres are constituted by and can be examined from a variety of disciplinary institutions, practices, and artifacts. In order to avoid making genre claims that are not meaningful to a

community (i.e. since we can take any two texts and find commonality, making a genre claim), Tzvetan Todorov (1976) recommends examining “those classes of texts that have been perceived as such in the course of history” as “indicated by the [existence of] the discourse on genres” (p. 162), something Miller (in press) frames as following the “genre talk.” This is something I have attempted to do in this study, an approach complemented by Hine’s (2015) connective ethnography, but that suggests other avenues to explore for analyses of disciplinary genres. Jason Mittell (2001), approaching the issue from the perspective of television studies, recommends that we “look at all discourse constituting and defining the genre, not just examples of the genre or even production of the genre” (p. 19), suggesting that we “gather as many diverse enunciations of the genre from the widest possible range of sources” (p. 9). His sensitivity to medium as someone who studies television is one that we can learn from as we continue to cultivate our own. Television, for example, is constituted by multiple practices, requiring that “an analysis of the television industry’s generic practices must look beyond production to how exhibition, advertising, and textual framing all work to constitute television genres” (p. 13). Genre-based analyses of television, for example, could include:

corporate documents, press reviews and commentaries, trade journal accounts, parodies, regulatory policies, audience practices, production manuals, other media representations, advertisements, and the texts themselves. Linking together these numerous discourses will begin to suggest more large-scale patterns of generic definitions, meanings, and hierarchies. (p. 9)

These may include statements of definition, interpretation, and evaluation, which “may seem to reflect on an already established genre, but they are themselves constitutive of that genre” (p. 8). In the context of disciplinary composing, this suggests that in addition to studying the texts, artifacts, and practices related to production or to studying corpora of texts, we should also include attention to relevant criticism, audience practices, textbooks and manuals, institutional documents, journal documents, regulatory documents, parodies, and even enunciations in other discursive spheres and institutions academic texts are imbricated in that we do not normally see as directly relevant (e.g. grant-making agencies, government, professional/trade contexts, etc.). As Cheryl Ball (2015b) has pointed out based on her experiences as editor of an online journal, sustainable digital publishing requires attention to accessibility, archivability, and usability, suggesting additional foci for genre-related research such as accessibility-related discourse and technologies, libraries and information technologies, and usability studies and reader-related technologies.

Finally, my findings on the teams’ three distinguishable strategies (meaning compression, expansion, and attention) would also benefit from additional research on multimodality in disciplinary genres, potentially through analysis of published/presented texts and through discourse-based interviews of multiple disciplinary writers (Odell, Goswami, & Herrington, 1983). This latter method presents alternatives to a rhetorical choice in a composer’s own text in order to elicit tacit knowledge about the genre and its social context, including disciplines and their goals, epistemologies, methodologies, etc. Presenting composers with multimodal elements that employed strategies conflicting with the strategies

seen in their text could be a productive way to learn about the implicit genre knowledge disciplinary composers are bringing to bear on their multimodal composing choices.

Implications for Publishing & Pedagogy

Publishing

I began this dissertation by painting a picture of the multiple interrelated exigences for work on disciplinary digital composing, including the renewed efforts to create platforms to enable digital journals to publish more easily and sustainably, such as Vega, which seeks to make the editing and publishing processes developed over the twenty years *Kairos* has been publishing available to other editors of online journals through its editorial interface (“Vega Academic Publishing System,” 2017). This project takes seriously Christine Borgman’s (2007) argument that, as opposed to the technologies in their most discrete sense, “the underlying social and policy changes” that accompany digital scholarly publishing “will have the most lasting effects on the future scholarly environment” (p. xvii), putting emphasis on making the otherwise tacit social processes and knowledge developed at *Kairos* available to other digital editors. Vega also brings much-needed disciplinary diversity to the range of existing publishing initiatives, many of which have emphasized scientific disciplines.

Accounts of the design process for developing Elsevier’s Article of the Future, for example, explain that the project was launched “as an initiative of the life sciences journals of Cell Press, an Elsevier imprint” and then expanded to other disciplines: “parasitology and tropical diseases, electrochemistry, materials science, psychology and cognitive science,

mathematics and theoretical computer science, paleontology, and business management” (Zudilova-Seinstra et al., 2014, p. 358). While the disciplines included in the project’s second round of design and research are diverse, they do not represent as large an epistemological range as they might, with the humanities completely unrepresented, despite Elsevier owning humanities journals like *Russian Literature* and *Computers and Composition* (“Computers and Composition,” 2017, “Russian Literature,” 2017). That said, the project took a promising discipline-specific design approach, including “one-to-one interviews, group discussion sessions, observations, usability tests and on-site visits” as part of that discipline-sensitive design approach (p. 358).

My dissertation findings reinforce the need to account for disciplinarity when building new scholarly digital publishing platforms and to conceive of these broadly as comprised of heterogeneous networks of explanatory goals, foci, epistemologies, methodologies, people, genres, tools, etc. Disciplines are more than their traditional subject matters, and these other aspects of disciplinarity need to be accounted for in designing digital platforms for their formal communication, since those may influence how digital media are used. The Webtext Project case reinforces, for example, that in some disciplines digital media can be both a *tool* for communication and a *subject* of inquiry, which can lead to distinctive genres with more reflexivity and hypermediacy, such as the scholarly webtext as published at *Kairos*.^c As Jeanne Fahnestock and Marie Secor (1991) found in their corpus of literary criticism, in some critical traditions part of the generic argument is made performatively through the virtuosity of the critic with her subject matter (p. 91f.). When that subject matter includes media, genres like the scholarly webtext may develop that require the

author's control over the form and disposition of those media. In those cases "ease," a common usability concern, may be beside the point, potentially limiting the scholarly inquiry that can take place. A platform that limits authors' abilities to design may even prevent participation in a disciplinary genre.

As these publishing platforms are designed, it may help to conceive of them as meta-genres and to consider how to build them flexibly enough not to become overly prescriptive, limiting possible disciplinary actions and evolution. Janet Giltrow (2002) define meta-genres as meta-discourse about genre that prescribes and regulates the genre (p. 190). Meta-genres are traditionally a form of genre-talk, but hold privileged positions in their generic universes, regulating other genres. The IRS Tax Codes and Regulations, for example, function as meta-genre for the tax returns and correspondence produced by tax accountants (Devitt, 1991). The contemporary media context, however, has complicated this picture somewhat with the development of digital platforms that can function as meta-genres, with their genre-talk occluded behind the design process. Amy Devitt (2009), for example, has suggested that blogging software may function as a meta-genre in that it "delimits another genre" (p. 45).

Though delimiting may be inevitable, in order to avoid prematurely making design decisions that will delimit scholarly genres in ways that conceive of disciplinarity in overly univocal, stable terms, designers and publishers embarking on developing digital scholarly publishing platforms might consider design practices that include collaboration between researchers, designers, and disciplinary members over the entire design process (rather than making major decisions ahead of usability testing). Design-based research (DBR), a design-research tradition that has gained traction in education because it is contextually sensitive,

may be promising for academic publishing as well, as it simultaneously develops a technology and theory about its context (e.g. a discipline), something that may encourage scholars to invest the time necessary to develop a nuanced, polyvocal understanding of a discipline. Wang and Hannafin (2005) define design-based research as

a systematic but flexible methodology aimed to improve educational practices through iterative analysis, design, development, and implementation, based on collaboration among researchers and practitioners in real-world settings, and leading to contextually-sensitive design principles and theories. (pp. 6-7)

Theory and design are developed iteratively and in context, with the alternatives explored through those iterations uncovering meaningful research insight into the context. Barab and Squire (2004) explain that in this research paradigm, researchers “systemically adjust various aspects of the designed context [or technology] so that each adjustment served as a type of experimentation that allowed the researchers to test and generate theory in naturalistic contexts” (p. 3). With diverse disciplinary genre users as partners, these sorts of iterative cycles have the potential to elicit otherwise tacit knowledge about both genres and disciplines that could help develop platforms more likely to be meaningful to the externally and internally diverse world of a discipline. That the Heartbeats Project team composes their scientific articles with an eye toward anticipated recomposition, for example, is a finding with design implications that could be also be elicited and theorized through this sort of iterative, collaborative design process.

Pedagogy

I turn now to another set of exigences that drove this work: pedagogy. How do we best cultivate students' rhetorical development with the knowledge that effective participation in many disciplines and professions will (or already) require(s) people to be “digital da Vincis” of the sort Summer described? First of all, these two case studies suggest that there is an exigence for paying attention to multimodality and digital literacies in the context of academic communication instruction, written and otherwise. While Lemke (1998) has specifically described science as a “semiotic hybrid” (p. 93), this term describes meaning making in both of these cases equally well. Writing was often completed in context with other semiotic modes and these were together animated by a cohesive strategy for furthering both epistemological and rhetorical goals (e.g. compressing meaning, expanding meaning, drawing attention to meaning making). Attending to modes separately would miss these larger rhetorical strategies and dilute what students understood about each mode, including written language. In addition, both teams' research and composing processes were equally and thoroughly digital, though they differed in their relationships to digital media (tool vs. subject) and in the digital tools and platforms that they used. Both teams also spent considerable time assessing the affordances of digital media for their work, situating these against a complex of disciplinarily-specific rhetorical and epistemological factors. These cases also suggest that attention to digital literacies—beyond those related to library database research—has a place in academic communication pedagogy as much as in civically-oriented curricula. Together, these cases provide evidence against any inclination toward a decontextualized “best practices” approach to multimodal and digital composing, instead pointing toward the need for pedagogies that sensitize students to the numerous rhetorical

possibilities that modes and media offer academic communicators and how those choices are made in the context of prior discourse (genres) and disciplinarity (explanatory goals, epistemologies, cultures, etc.). While the concept of affordance is a useful concept, and perhaps even a threshold concept, for thinking about modes and media, these must also be put in context of situation and culture.

In essence, these two cases point to the need to do for multimodality and digital media what many in rhetoric and composition and in WAC/WID have done for academic alphabetic writing: put them in context with situation and community, and specifically in context with rhetorical communities organized around epistemological goals. As many WID-based pedagogies have done for writing, this means putting multimodal composition and digital literacies in context with inquiry—how these are used to further inquiry. What genre and disciplinarity add to the concept of inquiry, however, is that distinct traditions and conventions? have developed (and are continuing to evolve) to conduct that inquiry. Genre and disciplinarity add social and rhetorical aspects to inquiry and communication that can otherwise be obscured.

An important dynamic that must be accounted for, however, is the immense amount of “creative repurposing” authors in both cases engaged in (Prior & Shipka, 2003; Roozen, 2010; Wardle, 2012). Authors in both cases drew from other genres and discourses, from other uses of modes and media, at will, a repurposing that put possibilities in the context of what had come before and that was guided by disciplinary goals. This repurposing was important to their disciplinary contributions, helping them develop new ideas and intervene in the discipline. Summer’s linking of the lab’s digital practices with Leonardo da Vinci,

was, in fact, her way of drawing attention to the important role of creative repurposing in those practices. Da Vinci, as the archetypal renaissance man and polymath, represents wide-ranging knowledge, curiosity, and virtuosity, with the ability to bring disparate bodies of knowledge together creatively to develop ideas and address problems. He represents an ability and disposition for productive interdiscursivity and repurposing. Just as the heterogeneity and pluralism in both cases support a loose rather than organized conceptualization of disciplinarity, their routine repurposing and interdiscursivity support a pedagogy aimed at cultivating rhetorical flexibility.

Elizabeth Wardle (2012), pointing out that what we call transfer is repurposing, has argued that we should “design our programs to teach for repurposing” (n.p.), a concept echoed in Yancey, Robertson & Taczak’s (2014) Teaching for Transfer (TFT) curriculum, which emphasizes developing students’ capacities for productively selecting, adapting, and repurposing prior knowledge to new contexts and purposes. Teaching to support such productive repurposing requires introducing students to key concepts and helping them make meaning of them and develop generalizations to draw on later through reflection and theorizing. Meta-awareness is key, with the goal for students to develop personal theories of writing they can use as “a framework of writing knowledge and practice they’ll take with them when the course is over” (pp. 57-58).

These insights suggest that rather than focusing on the achievement of particular technical or discursive skills related to multimodal and digital composing, we should cultivate meta-awareness about key concepts related to modes, media, genres, and disciplinarity that will facilitate future repurposing and promote rhetorical flexibility. In this

model, prior self-sponsored multimodal and digital composing become resources for promoting metacognition and abstraction as do creative experiments and failures in repurposing, such as those that ask students to transduct ideas across modes or remediate texts across media. Assignments such as Reiff and Bawarshi's (2011) that "invite students to use a wider range of their discursive resources—assignments, for example, that invite students to mix genres and modalities from different domains and then to reflect afterward on the experience of crossing between genres and domains" (p. 332), can play a role in developing students' meta-awareness of mode, medium, genre, and discipline. Mark's strategy of making convention "strange" in order to provoke critical reflection may in fact play a role here as well. It seems to me, however, that in contrast to other pedagogies of multimodal and digital composing, one informed by disciplinarity foregrounds the epistemic aspect of this composing—that choices of modes and media shape and are shaped by knowledge construction—and therefore may require students to develop, not just personal theories of writing, but personal theories of knowledge. Just as personal theories of writing support students' "development as reflective writing practitioners who are able to abstract their theories and employ them in new contexts" (K. Yancey et al., 2014, p. 58), personal theories of knowledge, and particularly the iterative process of developing them, could be a productive way to sensitize students to the many types of knowledge human beings construct, to the varying methods, assumptions and social processes at work in constructing knowledge, and to the relationship of communication to knowledge construction. Attending to how disciplinary communities use complexes of modes, the materiality of media, and

constellations of genres to construct knowledge is a reminder that these are not only always social and rhetorical, but also always epistemic and creative.

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Appendices

Appendix A: Initial “Grand Tour” Interviews (Coauthors)

This appendix contains the protocol for my initial, semi-structured “grand tour” interviews with coauthors. These were conducted individually in order to get a sense of each coauthor as an individual writer and to get their perspective on the collaborative project. These were semi-structured in that I had planned a set of structuring topics and questions for our interview, but, in keeping with a grounded theory approach, these questions were primarily open-ended and I followed up on themes as they emerged in the shared conversation.

You, as an Academic Writer

1. What kinds of academic texts would you say you have the most experience with writing?
 - a. Which of these would you say you prefer or are most comfortable with writing? Why?
2. Have those been typically written alone or collaboratively?
3. Tell me about your experiences (if any) with developing academic work meant solely for a digital format. (If has prior experiences, follow up with sub-questions as needed.)
 - a. How would you describe their format?
 - b. How would you describe their audience?
 - c. How would you describe their purpose?
 - d. What genre would you classify these as?
 - e. Were these developed alone or collaboratively?
 - f. What role have these played for you professionally? (e.g. conversations entered, doors opened, review feedback, time, etc.)
4. (If no experience) What would you say has prevented you from writing for a digital-only academic context before now?

The Digital Project You’re Developing

5. What would you call the text you’re working on? What genre would you classify it as?
6. How would you describe the text’s primary intended audience? Who are you writing to?
 - a. Is this a different audience than the audience you typically write academically for?
 - b. What secondary audiences do you see it as relevant to?
7. What do you see the project as saying? What would you say is its main point or contribution?
8. What do you see the project as doing? What do you see as its purpose or potential impact?
9. Why did you and your coauthors choose to develop this project into this digital format? What went into your decision-making for choosing the format and digital elements you are working with here?
10. What moves or parts does this project make/include that you see as similar to other academic genres you’ve written in before?

11. What moves or parts does this project make/include that you see as most different from other academic genres you've written in before? What are you doing or considering that you don't usually consider in other academic genres?
12. What texts and models have you found yourself referring to as you develop this project? Influences?
13. What would you say is the overriding principle or concern you're keeping in mind as you make composing choices for this project?
14. Tell me about your writing process for this project so far.
 - a. What role have you played so far?
 - b. What kinds of composing strategies have you found yourself using?
 - c. What kinds of tools have you found yourself using?
 - d. What aspects of the process have you been most happy with?
 - e. What aspects are you finding challenging?
 - f. What role do you see collaboration as playing in the process?
15. What advantages do you see with the digital-only format?
16. What drawbacks or limitations do you see with the digital-only format?
17. What role do you see the project playing for you professionally? For example, where will it go on your CV? How do you hope a review committee will see it? Colleagues? Is there some other professional benefit I'm not thinking of?

Appendix B: Check-In Interviews

This appendix contains a sample protocol for semi-structured “check-in” interviews with coauthors that I would periodically schedule to get their individual perspectives on the project. The following are sample questions, since as semi-structured interviews these had the flexibility to explore themes as they emerged in the shared conversation. In keeping with my constant comparison approach, these interviews allowed me to follow up on analytical insights as they developed and to participant check interpretations as I refined them (e.g. Questions 6 and 7).

1. Tell me about where you are in the process and how you feel it is going right now?
2. What are you most happy with at this point?
3. What challenges are you experiencing at this point?
4. Do you feel the project is changing from how you initially conceived it? If so, how and why?
5. I've noticed that you and your coauthors have been considering/grappling with [X]. Can you tell me about that? What role is it playing in your writing?
6. As I've observed you and your coauthors doing [X], I've started understanding it as [Y]. What are your thoughts on this? Does that ring true? Am I missing something?
7. Are you still happy with your decision to choose this digital format and venue for this project?
8. What are your hopes for the next stage of writing? Concerns?

Appendix C: Discourse-Based Interviews

This appendix contains a sample protocol for discourse-based interviews with coauthors, which occurred in context of a draft or prototype. Ahead of these interviews, I analyzed their draft and developed alternatives for some of their choices in order to probe their tacit knowledge (e.g. Question 1). I also took the opportunity of these interviews to ask more general questions about the draft or prototype and check on where they were in the process. Once more, these general questions were semi-structured and so responsive to the shared conversation and the specifics of the project.

1. Can you tell me about why you would or wouldn't choose [X option] as an alternative to the choice you've made here? What considerations would go into the decision?
2. Tell me about your choices for [e.g. the introduction]. What do you see it doing? Why did you choose to do that? Is anything missing or not working in your mind?
3. What kinds of things were you thinking about and considering as you decided to do [X].
4. Can you point out and tell me about the choices you are most happy with? Why did you choose those? What about them is working?
5. Can you point out some of the choices that were most challenging to you or that you're less happy with? Why did you choose those? What about them is not working?
6. How different do you feel the project is at this point from how you originally conceived it?
7. How well do you feel the manuscript makes your intended point or contribution at this point?
8. How do you feel the digital features of the text help or limit you in making that point?
9. Are you still happy with your decision to choose this digital format and venue for this project? Benefits? Limitations?
10. Did anything about writing this for this digital format surprise you?
11. Did you find yourself thinking about considerations you don't usually think about in your other scholarly writing?
12. As you get closer to making this work public, what hopes or fears do you have for the work as it goes out into the world?
13. What kind of impact do you think it will have (in your discipline, beyond, for you)?
14. Would you write a text like this again? Recommend the format to other scholars in your field?

Appendix D: Consultants Interview

This appendix contains my protocol for semi-structured interviews with consultants, experts teams tapped to help them with their projects. These allowed me to look at relevant activity surrounding the teams' composing. These are sample questions that were tailored to the specific project.

1. Can you tell me about why you think [the authors] felt the need to consult you? What exigency do you think was behind it?
2. Tell me about what you contributed to [the authors'] project. What did they ask you for help with?
3. Can you talk me through what you did for the project?
4. Is this similar to how you typically approach projects like this? Did anything stand out here as atypical?
 - a. [If necessary] Can you describe what was similar about this project with other projects you've completed or been part of?
 - b. [If necessary] Can you describe what was different about this project from other projects you've completed or been part of?
5. In your communication with [authors], you mentioned [X] as being a concern. Can you explain to me what is important about [X]?
6. How does your contribution to this project fit with your own work and expertise? What would you say is your area of expertise and how does this project connect with that?
7. Will this project [or type of project] complicate or inform anything that you do?
8. How do you feel about how the project has turned out? [or is turning out so far]
9. Anything I didn't ask about that you'd like to share?

Appendix E: Community Informants Interviews

This appendix contains the protocol for semi-structured interview with community informants, people not directly connected with the project but who could shed light on an issue related to it. As part of semi-structured interviews, these are sample questions that were tailored to the specific project.

1. Can you tell me about how common digital scholarship is in your field right now? By this, I mean scholarly work that exists solely in digital form (not a PDF of a print journal article, though an enhanced PDF would qualify)—work that is “born-digital.”
2. What are some of the forces that you think are drawing members of your field toward digital scholarship? What do you think your field finds attractive or useful about publishing in born-digital forms?
 - a. [If necessary] What about this do you or don’t you think is unique to your field? Why?
3. On the flipside, what are some of the forces that you think are discouraging members of your field from digital scholarship? Why might members of your field stay away from born-digital academic work? What are its challenges or drawbacks?
 - a. [If necessary] What about this do you or don’t you think is unique to your field? Why?
4. Could you tell me about your personal experiences with digital scholarship? Do you read it? Produce it? Review or edit it?
 - a. Are these experiences primarily in your field? If not, why do you think that is?
 - b. What have you appreciated or benefitted from in those experiences?
 - c. What challenges, if any, have you had with them?
5. The authors I’ve been working with have expressed a challenge with [X]. In your experience, is that a common challenge? Do you see this as connected with your field?
6. I’ve also noticed that the authors have paid a great deal of attention to [Y]. Getting [Y] right has been very important for them. How might this be connected with your field?
7. What have been the most significant changes in writing/publishing in your field in the last five years? Why are these so significant?
8. Where do you think writing/publishing in your field may be heading next?
9. Is there anything I didn’t ask about that you’d like to share?

Appendix F: Coding Scheme

This appendix contains my final coding scheme, a product of several cycles of coding conducted simultaneously and recursively with data collection following the constant comparison method.

Webtext Project

- **Compositional Lens: Mode**
 - Making empirical traversals
 - Compressing meaning
 - Expanding meaning
 - Drawing attention to meaning
- **Compositional Lens: Medium**
 - Remediating disciplinary texts and artifacts
- **Compositional Lens: Genre**
 - Composing a generically and epistemologically hybrid text

Heartbeats Project

- **Compositional Lens: Mode**
 - Making scientific meaning through modes and senses
 - Compressing meaning for science
 - Expanding and drawing attention to meaning for the public
 - Engaging the public through procedural rhetoric
- **Compositional Lens: Medium**
 - Doing science with transparent digital media
 - Doing science with the public
 - Composing for recomposition
- **Compositional Lens: Genre**
 - Enlisting and resisting traditional genre sequences
 - Recontextualizing science for science
 - Communicating as scientific invention
 - Changing science through interdiscursive composing