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Teaching and Learning with Situated Data: Socio-Technical Pedagogy and Reform at the Community Data Clinic and Biological Computer Lab

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Abstract

This paper reviews how situated data methods were used to critically engage students in sociotechnical case studies drawn from campus history and archives in courses developed under the Community Data Clinic and the Biological Computer Lab at the University of Illinois at Urbana-Champaign. In contrast to conventional data practices—that have long been critiqued by feminist, critical race and decolonial STS scholars for conditioning researchers to adopt a disembodied, de-gendered, -raced and -classed "God's eye view from nowhere" (Haraway 1988) in order to project claims to objectivity and universality, situated data practices underscore the need for acknowledging the kinds of epistemic violence that a reproduction of "seeing from nowhere" expands, including through accelerating trends in datafication on and off university campuses. Pedagogy around situated data cultivates instead more accountable research practices through acknowledging the specificity of data that researchers collect and the necessary partiality of any researcher's ability to see and know. As I review here, too, situated data methods offer valuable lessons for teachers and scholars in critical data and STS fields working to preserve pluralist, human-centered approaches to data in the face of accelerating campus investments in industry-centered data science programs. Indeed, at a time when STS and critical data scholars are witnessing the rapid growth of data science programs on campuses that train students to uncritically meet the profit-driven demands of datafication driven largely by Big Tech companies, the adoption of situated data methods to revisit sociotechnical practice and STS' own overlooked histories of innovation in intersection with counter-cultural politics in the US uncovers the richness of alternative resources. Such histories can highlight how sociotechnical change and infrastructural transformation are more than just the domain of industry sectors or elite knowledge institutions, especially when they involve justice-based reforms.

Keywords

big data; biological computer lab; community archives; community data; community Data clinic; data science; situated data; STS pedagogy; University of Illinois

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Introduction

1968—we remind undergraduates in our Community Innovation course—was a turbulent year, not only for civil rights, counter-cultural, and student movements in the US, but for higher education and institutions of science, technology and knowledge production more broadly. In April of that year, the US civil rights leader and labor organizer Martin Luther King had been assassinated. Only months later, Robert F. Kennedy, then a leading candidate for the Democratic presidential nomination who had energized students and campus communities, had been shot and killed while campaigning. And later that summer, as the US escalated war in Vietnam and the Democratic National Convention (DNC) opened in Chicago, US publics would gather around televisions to see images broadcast of young demonstrators—thousands of whom had gathered peacefully in Chicago for the DNC—being violently assaulted by police and state military in what reports later confirmed as a "police riot." All this happened while protestors' chants that "the whole world is watching" was broadcast across the airwaves.

STS historians remind us that if the decades immediately following the end of WW2 had been marked by a "near-utopian belief in technology's beneficence" in the US (Wisnioski 2012, 3), by the mid-1960s—as the nation became a technological society characterized by nuclear weapons, military computers, and chemical pollutants—technology would elicit too much deeper public ambivalences, especially among student populations (Kline 2015; Moore 2008; Wisnioski 2012). US university campuses would become active spaces where such concerns—and US students' explicit critiques of dominant technological practices and their influence over university funding, operations, and students training—would be loudly channeled and mediated.

By the mid-'60s, growing critical orientations around science and technology would seed the first curricular infrastructures for STS in the US—with Harvard University's Program on technology and society and Cornell University's science, technology and society program emerging in 1964 and '69 respectively (Cutcliffe 1987, 1990). Within just a few years, the National Science Foundation (NSF) would document how escalating interests around sociotechnical themes would lead institutions to offer some 2,300 courses in over 130 formal programs related to STS (Heitowit, Epstein, and Steinberg 1976). As historian Stephen Cutcliffe writes, such rapid growth in STS pedagogy emerged "at least in part as a response to campus unrest and the need to develop interdisciplinary courses at the undergraduate level on topics relevant to the world's problems" (1990, 360) that were increasingly recognized as defined by science and technology. At the University of Illinois at Urbana-Champaign (UIUC), where I've worked and taught as a feminist and decolonial STS scholar for over a decade, counter-cultural critiques and calls for more socially-responsive science and technology practices would manifest across broad sectors of the campus, in STEM and non-STEM fields alike, and even in engineering labs like cybernetics' famed Biological Computer Lab (BCL 1958–75).

While such histories of university infrastructure and transformation have been largely forgotten and might not be conventional material to teach in technology studies courses today, such overlooked resources provide fruitful ground for developing what I argue for here as pedagogy in situated data methods and practice. This paper reviews how situated data methods were used to critically engage students in sociotechnical case studies drawn from our campus' history and local archives in courses developed under

the Community Data Clinic that I direct at UIUC's School of Information Sciences. In contrast to conventional data practices—that have long been critiqued by feminist, critical race and decolonial STS scholars for conditioning researchers to adopt a disembodied (i.e. de-gendered, -raced and -classed) to paraphrase— a *God's eye view from nowhere* and pretense of *infinite vision* (Haraway 1988) to project claims to objectivity and universality, situated data practices underscore the need for acknowledging the kinds of epistemic violence that a reproduction of "seeing from nowhere" and the pursuit of "infinite vision" have expanded, including under contemporary conditions of accelerating datafication on and off university campuses. Pedagogy around situated data thus aims to cultivate more accountable research practices through acknowledging the specificity of data that researchers collect and the necessary partiality of any researcher's ability to see and know. Situated data pedagogy, moreover, underscores that awareness of such partiality is less a liability to "hard" knowledge claims than an opportunity for researchers to forge more accountable research relationships through their data practices that intentionally draw in other intersectional perspectives, particularly from historically under-represented and marginalized actors.

As I review here too, situated data methods approaches offer valuable lessons for not merely student learners, but for teachers and scholars in critical data and STS fields working to preserve and fortify pluralist, human-centered approaches to data practice in the face of accelerating campus investments in industry-centered data science programs. Indeed, at a time when STS and critical data scholars are witnessing the rapid growth of data science programs on campuses that train students to uncritically meet the profit-driven demands of datafication driven largely by big tech companies, the adoption of situated data methods to revisit STS's own overlooked histories of growth and intersection with counter-cultural politics—uncovers the richness of alternative resources. Such histories can highlight how sociotechnical change and infrastructural transformation are more than just the domain of industry sectors or elite knowledge institutions, especially when they involve justice-based reforms. To take seriously the lessons of past local transformations at campuses like UIUC's is to recognize the vital work of vulnerable communities—on and off campus—as empowered stakeholders, and ones, moreover, who worked to not only document and give voice to past harms, but who articulated an alternative vision for what "campus research" and "community data practice" might be.

Indeed, as STS historians underscore, the fact that by the '60s, technology had taken center stage "as a principal fault line in the nation's culture wars, channeling cold war anxieties about status and identity into an existential conflict over the meaning of progress . . . and the limits of technical solutions" (Wisnioski 2012, 33) created new possibilities for interdisciplinary and intersectoral allyship. Archival engagements and situated data methods allow us to see anew how national conditions were shaped by the critical voices and organized networks surrounding specific campuses. Such active elements undoubtably played key roles in varied campus reforms in the '60s and '70s, including the hundreds of campuses that came to seed the first STS programs in the nation.

In the sections that follow, this article expands on situated data methods as explicitly site-specific, data-centered engagements that offer students and teachers alike critical resource that highlight the diversity of innovation actors, and that offers critical alternatives to data science's expansive claims over data futures. The first section brings focus to one particular historical case study—that of cybernetics' Biological Computer Lab (BCL) at UIUC—whose archives we introduced students to in class, and that framed

its work as fostering modes of inquiry "in the absence of effective algorithms," (von Foerster and Brün 1970, 7) where "algorithms" referred to set rules or procedures followed to solve a given problem. The second section explores the means by which local campus archives became a central site of situated pedagogy in the course I co-developed with a computer scientist and historian at UIUC under the Community Data Clinic (CDC). Designed to expand undergraduate students' interdisciplinary data skills, the archival exercises we designed for the CDC's community innovation class allowed students to engage situated data methods to unsettle the givenness of the campus and their roles in it, and to explore their agency as situated campus researchers engaged in mixed methods' data practice.

Across such sections, I argue archival encounters open channels for engaging the complexity of knowledge production in the very institutions we too often take for granted as familiar and fixed, and can destabilize—as postcolonial and feminist scholars have reminded us—the givenness of what we normally take for granted as the "past" and "present" (Trouillot 1995). In such modest acts, we open new possibilities for recognizing the multiplicity of knowledge futures that were always imagined and spoken for across such sites—and may continue to be, even against the loud proclamations of an industry-centered data science's claims over data futures.

Histories of Situated Learning: BCL Pedagogy and Counter-Cultural Innovation "In the Absence of Effective Algorithms"

By the time the first experimental heuristics classes of the Biological Computer Lab (BCL) were launched at UIUC in the beginning of the fall of 1968, university campuses all across the US were being redefined by demands for a radically different kind of knowledge practice. Sustained from '58 to '75, the BCL cultivated a lab-based community of students, researchers, teachers and faculty—diversely organized around cybernetics—for counter-cultural exploration and innovation decentered from conventional hierarchies around faculty and student roles. Together, they channeled a broader counter-cultural spirit already sweeping across the campus (Kennedy 1991; Simon 1968). Earlier that year, UIUC students had launched a new "anti-war, anti-establishment" publication entitled *The Walrus*, that framed the university as motivating much of the current dissent. The editors wrote—

> [for] channel[ing] young people into institutions and jobs which, instead of correcting the glaring social ills of America, simply perpetuate the unjust system . . . The university is not simply complicit in the war and discrimination. It is in fact an integral part of the machinery and structure which prosecutes the war and continues racial and political discrimination (Metz 2019, 139).

Only a month later, some 200 students had come together to form a new ad-hoc Educational Reform Committee (ERC) that further indicted the university and its power structures as "an anachronism" (Simon 1968, 1) that was out of touch with "the needs of today's students" (ibid.), and a society under rapid transformation.(Educational Reform Committee 1968).

The 11-page manifesto penned by the students of the ERC, in fact, offered a critical snapshot of what higher education had become for UIUC students by the late '60s. Articulating a socio-technical critique of the pedagogical and cultural norms channeled through classroom and campus infrastructures, the ERC delineated the largely invisible, and routinized operations that reproduced what the student authors

characterized as "authoritarian relationships" between administrators, faculty and students that prevented students "from taking any effective role" in educational policy or content. Pressing for a radical departure from the system's "instrumental" information practices that widely operated on the assumption that the "capacity of an individual can be fully determined by objective testing," and that "one need only manipulate information to achieve [individual] ends," they called for an end to conventional discipline-centered models that failed to prepare students for the reality of their day and robbed students of individual humanity. Further describing the university as a machine operating algorithmically and processing students into predictable, predetermined social roles, the ERC advocated for a radically "dialogical approach" to education that would enable "the equality of all the participants" in curricular designs. Framing such reforms as driven by a spirit of "innovation and experimentation," they asserted a vision for knowledge institutions grounded in "the struggle for freedom" and responsible for "the humanization of the structures of society" in an age of growing complexity and technification. As they wrote:

> We insist that the university assume responsibility for the humanization of the structures of society: it must become the prophet of the new age, the leader and innovator of the struggle for freedom. (ibid.).

The interdisciplinary class series that was offered by the BCL (starting in the fall of '68 under the title "heuristics") was an immediate response to such students calls for an end to traditional, top-down models of instruction anchored around the faculty instructor, and demand for student-driven courses that would decentralize authority and directly address "the realities of the twentieth century—war, racism, illiteracy, nuclear power, and population growth." While the heuristics course was launched under the college of engineering—the home college of the Biological Computer Lab (BCL) and its director, Heinz von Foerster—it was far from the most obvious host for the kinds of reforms students demanded. Only the year before, engineering firms like Dow Chemical, a manufacturer of napalm and Agent Orange, had drawn widespread campus attention after an anti-war sit-in opposing on-campus recruitment by the company resulted in seven expulsions and 47 students disciplined. (Metz 2019; Prutzer 2017) Furthermore, despite the BCL's cultivation of a community of uncommonly interdisciplinary luminaries in cybernetics—that included music professor Herbert Brün, psychiatrist Ross Ashby, psychologist Gordon Pask, and biologist Humberto Maturana—course developments had never been part of the primary outputs of the BCL (Scott 2011). By the end of year, however, the experiment in developing the heuristics course would grow student demands for follow-up courses to such an extent that it would create a new infrastructure for interdisciplinary instruction at the BCL that remained a routine feature on campus until von Foerster's retirement in '75. Beyond campus, the BCL's curricular experiments further pushed new developments for a "cybernetics of art, design, learning and conversation," and would turn such subjects into socio-technical models from which the principles of feedback, change and regulation could be drawn (Anderson 2016; Clarke 2012; Scott 2011). With the classes that emerged from the BCL, new attention was drawn to the classroom and class instruction itself as the living system and socially embedded mechanism from which insight on cybernetic feedback, self-regulation, and systems change could be drawn. John White, then a PhD student in math and member of the teaching team for the first class in heuristics commented 'matter of factly' on BCL developments and the influence of the counter-culture's external agitations following '67:

> Whatever we did in BCL was often guided by the social structure of what was happening (interview, April 23, 2018).

Team-taught by interdisciplinary faculty and graduate students, and drawing a first class of 50 students from colleges all across the campus, the '68 heuristics class provided a platform for students of the time to define problems of the larger system, and explore dissent as a central part of university life. Each class culminated in a publication that showcased student work and allowed varied arguments for infrastructural transformations to be formalized. Based on the counter-cultural Whole Earth Catalog publication (whose decentralized form of content creation was once compared by Apple® founder Steve Jobs as the "internet search" of his generation), the "Whole University Catalog" that resulted from the '68 version of the class featured student essays—on topics ranging from "Dissent as an Extension of the University," to "Education as Access to Tools," "The Invisible College," "Changing the Grading System," and "Drugs and the University." Such content eventually led von Foerster to be called before the Illinois legislature's Horsley Committee (Clardy 2002; Scott 2011)—or what was also known as the Joint House and Senate Committee on Campus Unrest, to explain what they insisted was a "seditious manual" (Prutzer 2017). But as John White recalled:

> *Our focus in the BCL was to give students a voice. Not to "emancipate" them. That word was around, but I don't know that we knew what it meant . . . [We felt] we had to somehow to give a pathway to that side of the opinion, [to] people who aren't being listened to.* (Interview, April 23, 2018).

This was neither the first time—nor the last—that UIUC students would organize to press for a fundamental transformation of the everyday campus infrastructures among other sociotechnical issues governing student life—and would call for new, community-accountable infrastructures in their place. Several decades earlier, students with disabilities (many of whom were young veterans of WW2) had joined a cluster of campus staff to pressure the administration—via wheelchair protests and demonstrations on campus and in the state capital—to redesign campus facilities into accessible infrastructures for all students. Such efforts, beginning in the late '40s, eventually pressed the campus to redesign classroom buildings, sports team and athletic facilities, residence halls and bus systems, establish the nation's first Disabilities Resources and Education Services (DRES) office for students, and convert UIUC into the nation's first accessible campus. (Brown 2008; Reagan 2017) By late '68, as well, the work of African American student leaders and members of UIUC's Black Students Association would succeed in holding campus leadership accountable to promises to build new infrastructures—including one of higher education's first equal opportunity programs, the Special Educational Opportunities Program (SEOP)—that tripled UIUC's African-American student population, installed new equity-based reforms, and established policies to extend comprehensive support for historically under-represented students (Williamson-Lott 2013, 2018).

But the various student actions that had led to the ERC manifesto, and that would culminate in other infrastructure transformations by the end of '68, uniquely influenced the content of not merely the heuristics class, but the work and vision of interdisciplinary scholars working with socio-technically-oriented labs from the late '60s onward. When it was first founded in '58 in UIUC's Department of Electrical Engineering, the BCL was one of only two major cybernetics labs funded by the US government. MIT's

Research Laboratory of Electronics was the other, which established cybernetics research groups in communications (supporting the work of Norbert Wiener), biophysics (headed by Walter Rosenblith), and neurophysiology (headed by Warren McCulloch). Led by Heinz von Foerster, one of the members of the Macy conferences and an editor (with Margaret Mead and Hans-Lukas Teuber) of its proceedings, the BCL came to be remembered for work on artificial neural nets to advance the development of bio-inspired computing. (Müller, A., and K. Müller 2007) As historian Ron Kline noted about the role of MIT's and UIUC's cybernetics sites: "[T]he scientific fate of cybernetics was largely in the hands of these laboratories and some social scientists in the tumultuous 1960s and 1970s" (Kline 2015, 101).

While both labs initially explored the mathematical foundation upon which self-regulating machines and systems could be constructed, it was the BCL alone that, after more than a decade of successes in building various material prototypes of such systems (Asaro 2007; Müller, A., and K. Müller 2007; Scott 2011), would starkly pivot in the late '60s towards a radically new experimental, student-centered lab practice. In doing so, the BCL advanced new arguments for a "cybernetics of cybernetics" that shifted focus away from cybernetic mechanisms towards an explicitly self-reflexive and dialogic sociotechnical practice in research and education. As anthropologist Margaret Mead described the turn in her '67 keynote address before the American Society of Cybernetics, the shift would assert cybernetics as a form of cross-disciplinary thought which made it possible for members of many disciplines to communicate with each other in an accessible "language which all could understand" (Mead 1968; von Foerster 1991). Importantly, the shift argued for the need for a critical ethics of technical and knowledge practice that recognized the social embeddedness of research practice and its technical systems, and urged practitioners to be accountable for their effects. Such a framing required "using cybernetics as a form of communication in a world of increasing specialization" (1968, 4–5) and urged fellow cyberneticians to develop new techniques for "handling the complexities that cybernetically designed systems are introducing in society" (Krippendorff 2008, 181) by addressing both specialist and non-specialist audiences.

Von Foerster would later recall that the proposal by students from diverse departments—across humanities, arts, sciences and engineering alike—for the BCL's course "was taken as a welcome opportunity to carry the activities and results of the research laboratory into the classroom" (von Foerster and Brün 1970). When the first BCL experiments in course development began in the fall of '68, the core principles of the new second-order cybernetics that Mead stressed—self-reflexivity and cross-disciplinary dialogue—were already evident. From the start of the new heuristics class, its intentional socio-technical vision was evident in the BCL's assurance that it would be open not just to engineering undergraduates, but to students from other colleges, including graduate students. The course drew students from a wide range of disciplines—chemistry, economics, music, Spanish, psychology, English, philosophy, political science, history, industrial design, mechanical engineering, and electrical engineering. Notably, other interdisciplinary classes had existed on the campus at the time, including courses that centered on topics parallel to cybernetics. As John White recalled,

> *It was obvious then that computers were going to be transformative . . . and there were also some other budding [interdisciplinary] classes like computers and society in Engineering and LAS [the College of Liberal Arts and Sciences].* (Interview, April 23, 2018).

But the heuristics courses uniquely succeeded in growing student demand. Even in its first semester offering, a new location had to be found for the class to accommodate its growing enrollment. By its second and third semester, the class grew to 70 and more than 150 participants, respectively.

BCL class enrollments continued to grow, despite being offered in a context where engineering education was predominantly projected as an expedient to a new, utopic information age. The BCL's classes explicitly refused such a turn, and worked to invite the messiness of the era's social realities beyond the classroom, directly into its center. As John White described it:

> *If we looked at the problems that we saw then, it was clear that these problems were endemic, they were societal and political, you couldn't solve them with engineering . . . [and] it was clear that separate disciplines were not going to solve complex social political issues [either]. It was going to have to be interdisciplinary. . . . Our whole thinking [after 1967] was how to create an underswell and attitude to this kind of problem solving. And we were trying to apply that thinking to the university.* (Interview, April 23, 2018).

The explicit departure from the positivist framing of engineering and knowledge work more generally became a thread throughout the series of the BCL courses, which underscored ecological frameworks and the social implications of new technologies. Publications like the Whole University Catalog and the Ecological Sourcebook that followed it as the next collective student publication, were filled with essays and articles that expressed concern and critiques, often from the explicit viewpoint of an engineering student, of the impact of modern systems and technologies. Moreover, von Foerster's own early lectures for the class would elaborate on heuristics as a "methodology of search procedures in the absence of effective algorithms." (von Foerster and Brün 1970). In the preface for the Whole University Catalog, he would later elaborate it as "the study of the as yet unknown processes by which knowledge is acquired."

An embrace of uncertainty and awareness of the liabilities and limitations of prediction were explicit and consistent themes emphasized by the BCL instructors. With course content expressive of "an intersection of cybernetics, politics, experimental pedagogy, and composition" (Scott 2011), weekly sessions were organized with texts selected by the instructors and "copious input from the students who were to organize discussions, groups, and documented responses." Students were "continuously kept aware of the fact that they had initiated and asked for the course," generated content "in cooperation with the instructors" (ibid.), and discussed questions—as von Foerster specified in this 1970 report on the course, such as: "Who are the Students? Who are the instructors? What is a problem? *Who* is a problem?" As John White explained the experimental approach:

> *We were just exploring. I think the experiment was how do you bring these things together? How do you get people who have never talked to each other before [who] are in isolated disciplinary streams to cross over and discuss things. . . . We didn't know what we were doing or what the end looked like.* (Interview, April 23, 2018).

Arguably, such approaches weren't just a departure from the procedure and mechanics-based focus of first order cybernetics specifically, it was a turn away from conventional positivist approaches to teaching in science and engineering disciplines more generally—and was an explicit turn towards the development of another form of interdisciplinary information-centered education and training that emphasized the productive value of designing against (rather than for) predictability. As John White recalled, one of the

guiding principles of the instructors was the question of how to "take away predictability" as a means of "enabling people" to adopt a process of discovery—and how to destabilize contexts where "everyone knows what the outcome is going to be, and [where] the only solutions to apply are preordained." Indeed, such principles had already been articulated by the UIUC students who had penned the Education Reform Manifesto the semester prior to the teaching of the first heuristics seminar, who had called for an end to an education system that assumed knowledge was "value-free or objective," and lambasted campus administrations who assumed:

> . . . it is possible to predict accurately the activities in which an individual will be engaged during life. . . . [and that] the university need only teach the student those facts [needed] in order to work effectively in the predicted areas of activity. [For the university] to become a true community of students and teachers [they argued,] students must be given a real voice in governance . . . with greatly increased student representation in all matters which concern them -including curricula, admission policies, teacher hiring, and the election of administrators. (Educational Reform Committee 1968).

Such a spirit, and such direct calls from students themselves, echo throughout the BCL's course series over the following half decade. The varied publications of the BCL—from the Whole University Catalog to the Ecological Sourcebook, Metagames, and the Cybernetics of Cybernetics, each filled their pages with the observations of hundreds of student authors who testified to the range and depth of their concerns. They arguably serve as reminders too, that if there was an "unfinished revolution" (Müller, A., and K. Müller 2007)—as cybernetics historians had dubbed second order cybernetics' legacy—perhaps it was that of student organizers and participants of such alternative communities as those cultivated by the students of the BCL and ERC. Remarkably, even years before the notions of information society or socio-technical politics had become part of the mainstream language (Kline 2015), they argued boldly for the need for community infrastructures—as alternative ways of relating *through* and *around* information—and as transformational to modern knowledge institutions alike.

Situated Data Pedagogy: Seeing Community Infrastructures

While the first section of the essay explored a specific case study covered in the Community Data Clinic's (CDC's) approach to teaching students situated data methods—that of cybernetics' BCL at UIUC that was influenced by the student-driven moments and politics of the US counter-culture—the second part of this essay explores pedagogical approaches developed under the CDC that brought big data's harmful impacts on vulnerable populations into stark contrast with the long record of marginalized communities' work to develop their own alternative infrastructures around research and data practices that better met their needs. Thus, to emphasize situated data methods in teaching, day one of class with the CDC begins with underscoring that, above all else, data is a relationship, and not primarily a discrete "product," form of property, or worse, disembodied monetizable "thing." The responsibility to extend a legibility of data as relational to students—and to decenter the instrumentalist perspectives around dominant industry framings of data promoted under "big data" frameworks (Benjamin 2019; boyd and Crawford 2012; Gitelman 2013; O'Neil 2016; Vaidhyanathan 2011, 2018; Zuboff 2019) was one of the primary motivators that brought our interdisciplinary cluster of UIUC faculty together under the CDC three years ago. Likewise

motivated by models of unteaching racism (Mercer and Moses 2019; Noble 2014) as a form of domination that can be reinforced through education (Freire 1970) and datafication systems, we aimed to explicitly de-program a dominant framing of data that big tech companies have reified that projects data as a capturable resource, necessary to uncritically amass at scale for profit and research ends, and to maximize the future-readiness of user populations. Well before our students reach our classrooms, most of them have been regularly exposed to the commercial logics of big tech, and seen the many messages targeted to their demographic about the rapid growth of data science programs developed to respond to big tech companies' heightened demand for new skills in—as one university program website specifies—managing "massive amounts of data" across the "data science life cycle's" stages of capturing, maintaining, processing, analyzing, and communicating data and its findings.

These outsized reifications of technology and data as principally defined by their utility for profit generation has made the relational emphasis, we stress in our alternative approach to data increasingly critical to communicate. In the last decade, it's been the hyper-promoted 4Vs of "big data"—volume, velocity, veracity, and variety—that have objectified data as value-laden commodities and exploitable resources whose fullest potentials for monetization (even if unrealized today) are surely yet to come. Computer scientist Karrie Karahalios, historian Karen Rodriguez'G and I thus came together under the CDC to push back on the reduction of data to such narrowly instrumental ends, and to speak instead for the long record of community-centered methods for knowing through data that speak for other data pasts and futures. (Chan forthcoming; Chan and Garcia forthcoming) In developing the situated approaches in our framing of data as grounded in relationships, we drew from STS traditions that have long attended to the complex social dynamics embedded within and around data, technology and their related infrastructures. (Bowker and Star 2000; Star 1999) We similarly drew from more recent critical frameworks—including feminist data lenses that "begin by examining how power operates in the world" (D'Ignazio and Klein 2020, 19) and that interrogate the extractive logics of data-driven systems that should be "critically refused" (Cifor, Garcia, Cowan, Rault et. al. 2019). We drew too from scholarship and practice around decolonial archives (Anderson and Christen 2019; Christen 2018) and abolitionist technologies that center "solidarity among oppressed peoples" as a means of transforming dominant practices and the master narrative around technology (Benjamin 2019, 183). Such approaches as alternatives to dominant modes of data science have become all the more critical in the wake of growing public scandals involving big tech and popular data-driven platforms, and evidence of the disproportionate harms they have had on marginalized populations. From the Cambridge Analytica data breach to the amplification of disinformation campaigns and hate speech online, social media's galvanization of far right, white supremacist and extremist networks all across the globe, the tech industry's tolerance of a culture of sexual harassment and racial discrimination in its own workforce, the automation of surveillance of Amazon® warehouse workers, and the use of union-busting tactics in the face of growing concerns over worker safety—the cases have amassed, even as vocal calls from vulnerable communities have underscored the varied forms of violence extending from data-driven platforms.

Many faculty and educators have thus been prompted to examine what role our own institutions had in fomenting the current state of affairs, where extractivist conventions, surveillance practices, and a seemingly pervasive lack of accountability in data companies were being powered by newly graduated data

scientists. How had it come to be that an erosion of basic research ethics and democratic norms was so readily accepted and amplified by so many "reasonable" professionals in the IT sector? What did the explicit lack of gender, race, class diversity, and lack of familiarity with feminist, critical race, and decolonial traditions among the IT sector's "knowledge professionals" have to do with such outcomes? Could pedagogy under the growing number of data science programs promise students something beyond skills in "computational and inferential reasoning" and "practical use of mathematical and scientific thinking" (as one top data science program effuses) as the basic competencies for responsible and accountable institutional practice? And what could a history of other community-driven educational reforms—on our own campuses and beyond—offer as means to newly center questions of equity and justice into data pedagogy and research infrastructures today?

More than ever, we felt, another form of data pedagogy and practice was needed that would build upon the legacy of other civic, public-interest and justice-based approaches to data practice. And more than ever, we imagined an approach that could orient students instead around the relational and situated nature of data and technology via local infrastructures that demonstrate the possibility of grounding data practice around the concerns and priorities of vulnerable actors and populations and recover their own history of research and data practice. Intentional about creating a "data" course that would draw diverse students whether they saw themselves as specialists in technical practice or not, we identified a sociotechnical object of focus for the class could be anticipated as a broadly "shared" object of concern and exploration for students across disciplines—the campus itself. We thus set ourselves to the work of composing a Syllabus that could allow students to explore the history and archives of the campus, and the development of varied infrastructures within it that emerged after critical advocates—including interdisciplinary students themselves and off-campus communities—pressed for key reforms. Such an approach aimed to cultivate alternative sensibilities around data and research practice via situated engagements with local infrastructures and archives that students were already loosely connected to, but rarely have a chance to explore and develop independent inquiries around.

Over the semester, students engage with readings, films, and archival resources from campus that critically explore the history of UIUC through various socio-technological case studies that allow students to activate situated data methods. While almost all our students begin the course confident in their sense of "knowing" UIUC's campus, almost all come to find that the cases covered are unfamiliar to them. This enabled a sense of critical discovery around a space they already have an invested relationship to. Starting with materials that cover the origins of the US "land grant movement" (Geiger 2015) that in the mid-nineteenth century, reimagined higher education so that public universities like UIUC would become free and open to the working classes of the time, students go on in the course to explore infrastructural innovations that emerged through the development of such UIUC resources as the Disabilities Resources and Educational Services (DRES) Office, the first campus disability services office in the US in '47 (Brown 2008; Hartin, Southworth, and Wood 2016; Reagan 2017), and the development of UIUC's Special Educational Opportunities Program (SEOP) that was spurred by the assassination of the Rev. Martin Luther King Jr. in '68 and that, with the urging of students and community residents, pressed the campus to actively reform discriminatory infrastructures that had, until then, kept African American students at no more than a mere one per cent the total student population. (Williamson-Lott 2013, 2018). Alongside material on the history

of UIUC's BCL as a leading cybernetics lab in the US post-WWII era (Asaro 2007; Clarke 2012; Müller, A., and K. Müller 2007; Prutzer 2017; Hutchinson 2008), the case studies reveal to current UIUC students how the sustained advocacy (and sometimes outright protest) of earlier generations of students, staff and off-campus families and community members, and the spirit of past countercultural movements, were responsible for campus innovations that created new infrastructures students still actively use and recognize.

Through engaging situated data methods, students were able to not only newly explore their relationship to and identity within UIUC's campus, but could also decenter the "fixation on the future" and presumption that knowledge now depended only on simply acquiring data at scale, as emphasized by dominant data science frameworks. The practice allowed students to explore the archives and its contents, and design final projects that allowed them to connect campus histories to their current interests or frustrations around the campus. This includes final projects that connected a history of DRES's struggle for disability justice and design to the campus' still unresolved underinvestment in DRES sports and athletic infrastructures, others that connect histories of counter-cultural computing and student-driven game design to current developments (and student involvement) in game studies, and to histories of student movements to demand inclusive housing infrastructures to student work to support "sanctuary spaces" on campus following the 2016 US presidential election. Situated data methods thus enabled students of diverse backgrounds and disciplines (who in our classes, were undergrads in computer and information sciences, media studies, and other arts and humanities fields, alike) to see how archives function as vital spaces that can connect them to past and present voices of marginalized communities, and the diverse forms of overlooked work that communities on and off campus have often undertaken to develop actively-used campus resources. Via such connective work to recover overlooked voices, new perspectives on the "key" actors and voices that shaped the campus' present and future could be brought to light, and underscored new potentialities for recognizing the diverse interdependencies of knowledge work on campuses, and seeing shared allyship in struggles for justice-based change across diverse projects.

Throughout the course, students were able to focus on the research and data work undertaken by diverse, marginalized actors—and not just faculty researchers and technicians—in order to press for reforms and innovate new campus policies and resources that ultimately helped to redefine higher education on campus and beyond. The course's design thus aimed to avoid an all-too-common exclusionary frame in data science that reifies data work as exclusively the domain of technology and research professionals, and that defines data practice as either a form of technological benevolence (Benjamin 2019) or salvation (Noble 2018) bestowed from the technological/data rich upon the technological/data poor. Such a universalist frame around digital technologies (Chan 2014) likewise presumed that the future designs of data scientists' making would save us from crises of the present, whatever their context. Pedagogy around situated data methods instead reminds students how data practice was never the exclusive domain of elite and dominant actors, alone, and has long been cultivated too from the interests and concerns of vulnerable populations. And it reminds learners how vulnerable populations today—much as in generations before—have undertaken their own research practices, and acknowledges the often-overlooked histories of such capacities in data work. (Christen 2018; Williamson-Lott 2013, 2018) Rather than encouraging students to see themselves as specialized knowledge classes separate from other populations and entitled—as young researchers—to an

asymmetric access to user data, situated data methods allowed them to see data sources as something other than abstract, depersonalized and exploitable resources. Data sources—whether resources from campus archives or interviews with campus actors and alumni—instead were engaged with as situated resources which were embedded in relationships to they were directly accountable.

Pedagogy around situated data methods further prompted new ways of thinking among the teaching team, allowing us to recognize learning and data-centered engagements in the classroom and campus, more broadly, as reliant on collaborative infrastructure in a variety of ways. Firstly, it acknowledged how much one's experience and success within the classroom—and within university learning environments more broadly—rely upon more than just a showcasing of individual skills and competencies around curricular content (or assessment of personal performance within the free competition of a course-structured environment), and are instead always dependent upon engagements with others that are imbricated within ecologies that often extend beyond formal academic work. Such an ecology involves a collective of peers and fellow learners in a course structure, and often involves extracurricular activities as well as instructors and other department-level actors who directly and indirectly impact the capacity for responsive and responsible pedagogy. Secondly, it examines the instantiation of collaborative infrastructures in the classroom—as spaces where bonds of affinity and mutual support across a range of experiences and shared objects—including data resources and archives—can extend. And thirdly, it acknowledges the work of vulnerable communities (both on and off campus) as vital agents in pressing for transformations to existing infrastructures—and for the expanded accessibility and support for historically marginalized populations.

We'd come to find that the community infrastructures we explored with our students would also open a range of lessons for us as faculty instructors and sociotechnical scholars—lessons about the legacy of interdisciplinary commitments in pedagogy on our own campus—and the different futures around information and society that had been imagined, long before debates around data science had begun to unfold. Engaging with the students and case studies, we'd learn to see anew how many of the concerns around education in technology and data practice, and the arguments we made around community data, had been voiced too by generations much earlier. Indeed, then as now, we'd see that the most salient and powerful arguments for infrastructural reforms were asserted by populations other than campus researchers or IT professionals working alone, but were made alongside the voices of marginalized actors and communities pressing for new innovations and reforms in an inclusive, safe and accessible future of higher education.

Conclusion: Seeing Interdependence Across Socio-Technical Pedagogy

By engaging archives as spaces that connect interdisciplinary researchers and students to a multiplicity of voices behind the development of architectures of the present, situated data methods bring to light the overlooked work of marginalized actors in arguing for distinct knowledge futures. They underscore too the central role marginalized accounts—those records likely to be missed or marginalized by official history and dominant narratives—in opening lenses that destabilize the givenness of the past and present alike. It's via such connective work, that campus archives as situated data resources can open new potentialities for

recognizing interdependencies and shared allyship in interdisciplinary knowledge work and the long trajectory of struggles for change.

Today, contemporary framings around the age of big data mark big tech companies' collection and processing of massive scales of information as operations that will not only magically lay to rest uncertainties of the past, but unleash vast new forms of predictive power over the future. As feminist and critical race media studies scholar Wendy Chun has observed about the epoch-defining presumptions around the "big data revolution," such framings claim that big data's expanded scales of data analysis and collection have unlocked nothing less than a new paradigm for knowledge production where knowledge work—once burdened by yet unanswered questions related to "understanding the past"—can at last be freed, and newly directed towards the singular aim of "grasping the future" (Chun 2021, 50). This paper argues for the need to robustly counter and unsettle the amplifications of big data as "finally settling" the past, and supposedly ending the need for history, historical analysis and pedagogy. Such calls have been disturbing—not only for reanimating colonial imaginaries (Couldry and Mejias 2019) that position big data and its applications through AI systems as the pinnacle of an evolutionary arc towards an inevitable future of progress and enlightenment, and away from a "primitive past," but for positioning for profit big tech firms as best able to speak for a singular data-driven future. They've thus rationalized (and often celebrated) a disinvestment in other forms of knowledge practice that can supposedly now be relegated as obsolete, outevolved and centered on data and methods too small or slow. Or as Wired Magazine's Chris Anderson ruthlessly projected in praising what he termed "The Petabyte Age," in:

> . . . a world where massive amounts of data and applied mathematics replace every other tool that might be brought to bear, [we can f]orget taxonomy, ontology, and psychology. . . [and] every theory of human behavior, from linguistics to sociology. . . . Who knows why people do what they do? The point is they do it, and we can track and measure it with unprecedented fidelity. With enough data, the numbers speak for themselves. (Anderson 2008)

Situating myself as a feminist and decolonial STS scholar working within the US academy—where recent investments have rapidly grown data science programs across diverse campuses nationwide—I've underscored the need for not only situated data methods, but the possibility for another kind of data science oriented inclusively around disciplines, and where human-centered methods might also ground research practice around more than numbers and scale alone. In doing so, I echo the calls of other feminist and critical race data scholars (Chun 2021; D'Ignazio and Klein 2020; Noble 2018) who have highlighted the narrow means by which "relevant skills" are defined under dominant data science pedagogy models, and who have argued forcefully for how such narrow models and a marginalization of feminist and critical race methods has led to an amplification of algorithmic bias and discrimination under big tech firms' growing data science applications. In the wake of big data's rush to "grasp the future" through scale and numbers, and urge to occupy the "conquering gaze from nowhere" (Haraway 1988, 581), I argued here for the value of historical analysis and the possibility of archives as situated data resources that—like others oriented around "small data" (from ethnographic to interpretive encounters)—are more than ever needed as means to recenter the complexity of the human and demonstrate the multiplicity of imagined futures for data practitioners.

Archival reencounters may be engaged, in other words, in relation to what feminist science studies scholar Donna Haraway argued for as situated knowledge practices that recognize the need for partial and embodied modes of seeing and engagement in order to counter "unlocatable" and "irresponsible" modes of knowledge practice, and so too, in order to offer a "better account of the world, in order to live in it well and in critical, reflexive relation to our own as well as others' practices of domination" (ibid., 583). Following such critical voices, the situated data pedagogy and methods I posited here, importantly, are not ones whose undertaking promises to "settle" once and for all, questions around the past for those living in the present. They instead open encounters that I argue should be valued for re-engaging challenging questions from the past, including ones that demonstrate the multiplicity of unequal interests and potentialities—always only partially captured—that surround any single "event" (Trouillot 1995), and whose revisiting bear valuable lessons in imagining new futures for higher education and pluralist data practice alike.

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Data Availability

Data published in this article can be accessed in STS Infrastructures at: https://n2t.net/ark:/81416/p4g880.

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