

Creating Spaces for Interdisciplinary Research across Literature, Neuroscience, and DH: A Case Study of The Digital Humanities and Literary Cognition Lab (DHLC)

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Abstract

The Digital Humanities and Literary Cognition (DHLC) lab at Michigan State University was founded in 2012 with the mission of bringing together scholars from disciplines including literature, neuroscience, education, computer science, and digital humanities to investigate the cognitive processes involved in reading texts of all kinds. The real story is much more complicated: emerging through a combination of institutional risk-taking and serendipitous accident, the lab was — and remains — an example of how conventional definitions of a “laboratory,” and particularly the rather fraught label of “humanities lab,” often come short of capturing the true cross-disciplinary nature of this type of work. More than any academic or methodological template, the DHLC lab emerged through the curiosity and enthusiasm of the students who inhabit it. For that reason, this case study — a brief history of the DHLC’s development, cultural practices, and ongoing work — has been written collaboratively with multiple voices, including the lab director (Natalie Phillips) and the student researchers. Together, we describe the challenges and opportunities created by embarking on a radically interdisciplinary research effort. We report the elements that enabled the DHLC lab to find success through a willingness to abandon expectations and adapt to rapidly evolving research practices, while maintaining our core focus on the humanities. We hope this case study proves useful for those who, like us, seek to explore the vast potential of interdisciplinary lab space for DH practice, the pedagogical benefits of collaborative research, and how to prioritize humanities in a STEM-focused world.

Prologue

The Digital Humanities and Literary Cognition (DHLC) lab at Michigan State University (MSU) emerged not through top-down strategic planning, but through a combination of university proactivity and serendipitous accident, with an emphasis on the latter.^[1] It emerged organically from interactions between me and excited students, newly interested MSU colleagues, collaborators from Duke and Stanford... and at times, people who just happened to be walking by and came in. This odd beginning is precisely what makes our lab such an interesting case study, similar to the development of other humanities labs [Breithaupt 2017]. One common way to approach building such a lab — a trend you might say — is by creating a digital scholarship or digital humanities center, a space devoted to supporting as many different fields, departments, and faculty as possible: building websites, “provid[ing] a support mechanism for the growing areas of e-research and digital scholarship,” and facilitating the use of big, expensive pieces of technology (or even better, the analysis of “big data”) [Lippincott 2014]. We have a version of this at MSU, the Digital Scholarship Lab, and it’s amazing. That’s not quite what we do. I can run an MRI and conduct advanced brain imaging, but I can’t build a website to save my life, so I’m glad that others aren’t relying on me or the lab to do this type of DH. Instead, the DHLC began with a specific research question about close reading and literary neuroscience. Now, we design and run a variety of new

experiments, opening up the space for ever-growing grassroots engagement with others across campus and with our community.

In 2012, the lab wasn't what most would call a "lab." One day, I was working with three students — one from English, one from education, one from neuroscience — at a table we'd dragged from a supply closet. Clustered over our laptops, we were so focused we scarcely looked up as a team of technicians walked in and began installing computers around us. For a DH lab, the moment when the technology appears is normally a glorious occasion; looking back, I can see why the arrival of these computers wasn't treated with the usual tech-centric revelry. The actual lab was already there — in full swing, fueled by the energy being brought by everyone around the table. The lab was the students, the people. And with them, we got momentum, a combination of student energy and brilliance that would propel us for the next seven years.

It's the energy of the people in the lab that sustains me as I navigate the balance of my own work and these new fields we're engaging. I'm an eighteenth centuryist who gets excited about Margaret Cavendish's seventeenth-century jokes about the brain, and I also put (willing!) students in brain scanners to see if we can learn more about the cognitive intricacy and uniqueness of reading literature. Fortunately, I work alongside equally interdisciplinary folks. The computer scientist who helped us code our sonnet study at MSU loves poetry so much he actually memorizes it, down to the punctuation (you should hear him recite Whitman or Keats). My co-lead on our music study was a major in violin before he switched to computer science; only later did he jump to cognitive science, focusing on rhythm and music. This sort of interdisciplinary work is not without its limits. As Urszula Pawlicka points out with Bruno Latour, just the name "humanities lab" risks assuming an ideologically dangerous "scientification of the humanities." If the laboratory is "a place that has been socially constructed so as to project the mythos of science onto the world outside its walls," she writes, "then humanities laboratories may begin by borrowing the foreign glamour of science and end by reproducing its ideological parochialisms" [Pawlicka 2017, 527]. Rather than remaining naïve to such challenges, our lab — with over thirty students from across disciplines — tackles them head-on in an ongoing, energetic attempt to demonstrate that one can do work that cuts across both humanities and sciences without caving to reductionism and instead centering our humanist commitments. We have not given in to an "interdisciplinary delusion" but seek to model the pluralism of true cross-disciplinary work, with all the multiplicity it entails [Kramnick 2018]. This is why we are writing this case study — and why we have chosen to tell it collectively. The only way to tell this story is to have students write as well, as equal collaborators and researchers who have made the lab what it is today.

Introduction

The sounds of the lab on any given day include the clack of typing, the light squeak of pen against dry-erase board, and music — live streaming everything from classical to indie-rock (one undergrad lab lead's favorite band is Rainbow Kitten Surprise). Academic conversations about our latest lab project on music and narrative intermix with light cursing over how to change font size in E-Prime (the requisite software for taking our poetry study to fMRI). It's a space for kvetching about grad school applications. Most importantly, it's a space for laughter, be it a fierce debate on whether the lab's next event will be an escape room or laser tag, or an equally fierce argument over whose favorite candy is actually disgusting. Entering the lab means joining a warm, rich, chaotic space full of work, odd debates, and enjoyment. The collegial and even goofy atmosphere of the lab is not a weakness — if anything, it energizes our work and makes it more generative. This is our kind of interdisciplinarity.

One of the real strengths of an interdisciplinary and comparatively young field like digital humanities is the sheer amount of experimentation and invention that digital humanists engage in on a daily basis. We have to, because the work we do is often the first of its kind. We can't help but be cutting-edge, unique, and integrative, because we have limited models to draw from in terms of literary neuroscience. Even as digital humanities labs at prestigious universities such as Stanford, MIT, and CUNY have become well established, there remain many interdisciplinary areas (i.e. literary cognition) that are only just starting to be explored. As the field continues to grow and mature, however, we have the opportunity to build on one another's wisdom, to create new models and best practices for present and future digital humanities scholars to follow. That is part of what this article seeks to do, inviting readers to learn from the story of our challenges as well as our successes.

We cannot, however, give you a template. We do not have a model you can simply copy. There is no formula for how to create your own cutting-edge humanities lab — such a thing does not exist, because the most effective labs and programs build on the specific strengths of a given community. Instead, the following case study is an exploration of one lab, our Digital Humanities and Literary Cognition (DHLC) lab, with a discussion of some of the approaches and strategies we used to create it. In our current moment when the question is shifting from whether or not to have humanities labs to how those labs should operate in more inclusive, equitable, and sustainable ways, our experiences in the DHLC offer some practices for those working in labs old, new, and yet to be. As you read the specifics of how the DHLC works and why we set it up that way, we invite you to imagine yourself and your own situation — to dream of what your own lab could be.

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The Digital Humanities and Literary Cognition (DHLC) lab was founded in 2012. Its first seven years provide a powerful and unique case study that reveals what interdisciplinary work in DH can be, including points of promise and innovation, points of disciplinary tension and translation, and most importantly, lessons that point to the power of actively involving students in a humanities lab. At its core, the DHLC's mission is to understand how humans think in and through genres of literary art. In other words, we want to understand the intertwined cognitive, neurological, emotional, and cultural processes by which we engage with art, relate to it, and use it to make sense of ourselves. We call our research in cognitive and digital humanities "literary neuroscience," a phrase that captures how such work could never be just one or the other, just humanities or just science.

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In 1959, C.P. Snow famously described the humanities and sciences as "two cultures" separated by a "gap" of "mutual incomprehension." It seemed the two were unable to communicate, and the increasingly siloed nature of disciplinary knowledge throughout the twentieth century did little to help. The present situation is a paradox. As many institutions call for interdisciplinary scholarship and teaching, arts and humanities programs continue to be defunded [Wythoff 2018]. In this cultural moment, interdisciplinary labs like the DHLC have a vital role to play by communicating across the humanities and sciences, translating the value of the humanities, and in particular, championing the critical perspective that the humanities *brings* to interdisciplinary research.

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The DHLC works hard to be a truly interdisciplinary space — we actively integrate methodologies, approaches, and scholars from different disciplines on equal footing. As one example, we always insist on capturing both qualitative and quantitative data whenever we design experiments, and we further ensure that our qualitative data includes space for narrative. The stories and reflections of our study participants are as important as the numbers on an aesthetic pleasure scale, and our student researchers specializing in both humanistic and scientific methods work directly with each other in small groups to analyze the data in tandem. In this way we bring together the strengths of both sciences and humanities, which gives us a richer set of data that enables us to talk to people in different fields in their own languages and concepts.

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In pursuing such a significant cultural and academic goal, it can be easy to get lost in the sauce, so we try to keep our day-to-day research practices in perspective. Walking into the DHLC means walking into a space enclosed by the usual four walls, one of which is a window that stretches from floor to ceiling, offering a gorgeous view of trees and the occasional sunset. Double layered, bright green blinds — technologically advanced to move with the changing daylight, yet broken beyond comprehension — seem to have a mind of their own and close and open over the window randomly, making temperature regulation uniquely difficult. To counteract this, we have an ancient box fan, named "Fanny" after the protagonist of *Mansfield Park*. Eight state-of-the-art computers for processing MRI data, DH visualizations, and project results line two walls, and tables are littered with brightly colored sticky notes that range from complex mathematical equations to single words like "gender?!?" There are four different styles of chairs, ranging from the foldable to the "spinny" chairs that allow for a dramatic turn to listen to someone talking. A portrait of Jane Austen looks over the lab, observing the years of inside jokes written around the room. Most importantly, this physical room we call our lab — the DHLC — not only brings together students from English, Psychology, Neuroscience, Computer Science, Rhetoric, Business, and Art; it creates unique points of contact between them. Neuroscience students read poetry, debate Austen's irony, and listen to excerpts of orchestral music. Scholars of literature and psychology work together on interdisciplinary fMRI experiment design while artists join computer scientists to develop new digital tools for making art accessible across museum spaces, digital platforms, and coffee shops. There are not many places where a freshman

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undergrad in political science can talk literary cognition theory with a 5th year English PhD, or where you find professors taking careful notes about sophomores and seniors' latest project insights. But this is what it means to be at the DHLCL.

Our lab has never adhered to traditional hierarchies, and we actively cultivate a lab culture that resists the neoliberal, top-down power structures of the contemporary university [Lothian 2013] [Mann 2019]. We have a PI and lab leads, but these roles are more administrative than anything else. Questions, ideas, answers, and new directions can, should, and do come from everyone (including new researchers bringing fresh perspective to our projects), such that it can be easy to forget who is an undergraduate student, who is a graduate student, and who is a faculty member. Our PI specifically goes by "Natalie" in the lab as one way to emphasize our non-hierarchical structure. No one asks your rank when you walk into a lab meeting, nor offers their own; instead, anyone might suggest where you can jump in on the latest spreadsheet or data sorting. Our interdisciplinarity supports this setup, because we recognize that each of our members brings a different set of skills and experiences to the lab. Strict hierarchies simply do not make sense when a third-year student might be the expert on a piece of software, a first-year student might be trained in fMRI, a graduate student might have a music theory background, a faculty member might have several successful grants under her belt, and a fourth-year student might have actually run participants in a particular study. We help each other communicate across these many fields and experiences by holding workshops during our regular meetings where researchers will introduce each other to particular concepts, theories, methods, or software and discuss how to best incorporate that knowledge in our studies. In essence, we all do the work, we all have different roles to play, and we could not possibly do all that the lab does if we assumed that any of those roles is more prestigious or more important.

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Bringing together science and humanities in the study of cognition and literary art is certainly a tall order. We "manage" it in the lab — day by day and project by project — by relying on an open system and a question-led approach, rather than an institutionally-designed order. This model brings with it particular affordances and limitations. It requires maintaining an open lab space in collaboration with student researchers and project leads while also ensuring secure storage for study participants' data. It relies heavily on the energy and guidance of both the PI and the lab leads. It invites students from all kinds of disciplines who never dreamed of being part of a lab to join in the work of creating knowledge. It means that projects are abandoned partway through, or unnecessarily redone, or go in three directions at once; it also leads to astonishing breakthroughs. It loses some portion of institutional knowledge with every student researcher's graduation. It can also feel overwhelming especially for new lab members, so we introduce new researchers to the lab's projects one at a time in order to help them learn about the projects, navigate the IRB process, and let them choose where and how they want to participate according to their interests and availability. It means keeping in regular contact with weekly meetings for the different projects, with constant reminders to take breaks and step back from the work in order to take care of ourselves and each other. And, crucially, it must ensure that all researchers (especially students!) are compensated and credited for their work in the forms of hourly pay, presentations at conferences, and authorship on lab publications. All of this continues to successfully sustain the lab after eight years with minimal advertising (mostly by word of mouth in classes) because it draws people in and gives them the space to explore their own research practices.

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At the beginning of each semester, lab leads for each of the three major research projects present broad semester goals. At the same time, if any group members come up with a hypothesis, they are given a semester or two to play around with the new approach. If the research idea seems sustainable, it becomes a long-term project and is incorporated into a future beginning-of-semester goal presentation. If not, we store detailed notes on the process in a "research questions" document for future reference. For example, one of the undergraduate researchers got so excited about metaphors that he spent a full semester mapping how often participants highlighted metaphors and how tangible, familiar, or cliché the metaphors were. Although this got stored away for a year, it turns out that it will be absolutely pivotal as we start writing a new article (TBA) for a special issue of *Narrative* in 2023 titled "When Do We Love Literature?: The Pleasures of Poetry Reading and the Power of Story."

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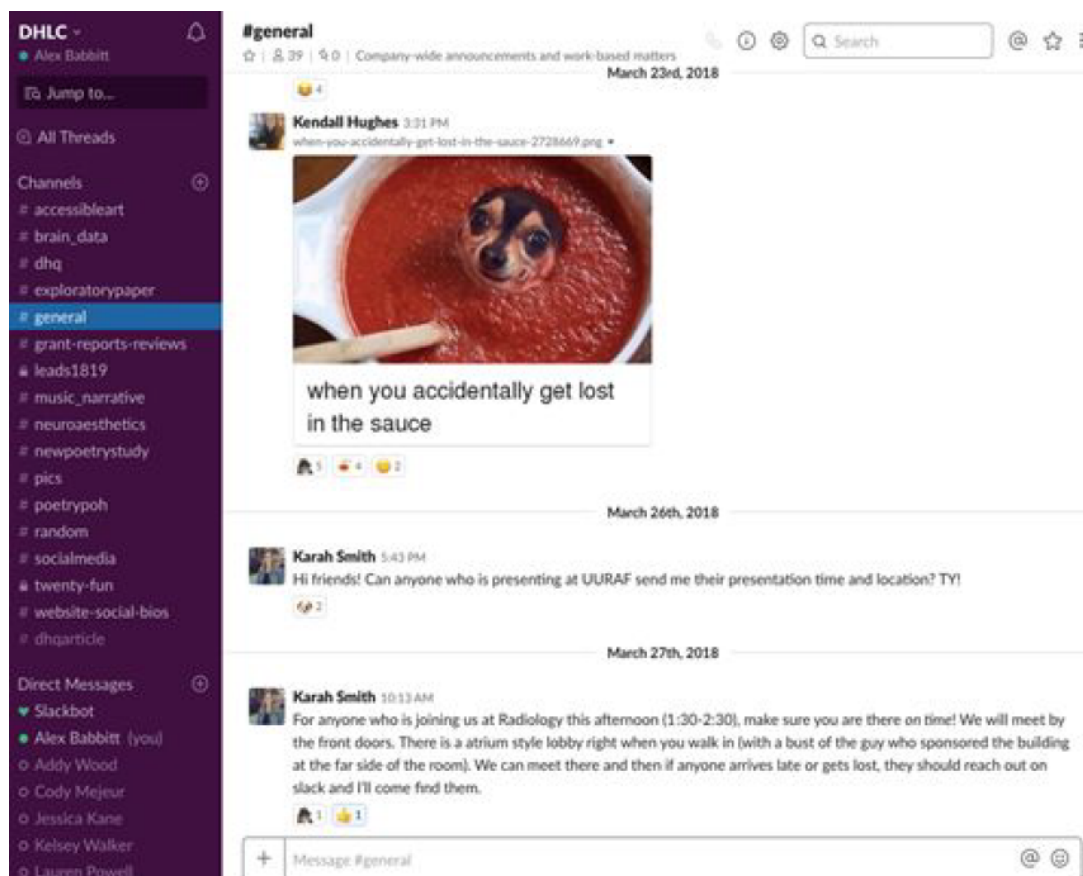


Figure 1. Lab Slack conversation. Image and names shared with permission. Source: DHLC Lab

Our projects range from fMRI studies of novel reading, to experiments on poetry and pleasure, to cultural explorations of the stories we hear in music. Outside the world of interdisciplinary experiments, the DHLC also organizes exhibitions that blend art, medical humanities, and disability studies to create accessible art installations in museums where everyone — including those along the visual disability spectrum — can *touch* the art. This means we have used DH tools that range from computational software for analyzing brain data and patterns in neural activation (FSL), text analysis tools such as Voyant and sentiment analysis, and Guide by Cell, the latest web-based link that we use to provide audio descriptions for Accessible Art visitors with visual disabilities (much better than QR codes). The fact that we use DH tools so much in order to *do* our research makes the lab an equally fascinating case study in how digital tools blend the virtual and physical. Depending on the day and number of computers, we use Skype, Zoom, or Google Hangouts, we write and edit on Google Drive, and we communicate in almost twenty Slack channels for different projects, though most researchers are active primarily in the few related to their chosen projects. In the image above, a lost-in-sauce meme motivated students to focus in the last frantic hours of poster writing before our yearly undergraduate conference (see Figure 1). We use many of these same channels to talk with collaborators around the world: Stanford University, New York University, The University of Arkansas, Princeton University, and the University of Hong Kong. In these ways, our lab is quite expansive, both physically and virtually [Perkel 2016].

This highly collaborative nature of our digital humanities research makes our lab a “hybrid space,” something Steve Harrison and Paul Dourish define as a space that “comprises both physical and virtual” [Harrison 1996, 72]. We experience this physical–digital interplay in the lab daily, in embodied interactions that are “framed simultaneously by the physical space, the virtual space and the relationship between the two” [Harrison 1996, 72]. Interdisciplinary work in the lab involves bridging not only disciplines but also places and practices, and how we conduct research is in many ways defined and delimited by both physical and virtual spaces (see Figure 2). For instance, our lab is located at Michigan State University (MSU). Most of our lab members and participants therefore reflect typical university demographics and range in ages from seventeen to thirty-five. Thus, we constantly remind ourselves when analyzing data that we have a particular group of college students who like coffee and poetry, are interested in \$5 Starbucks gift

cards to participate in our latest study, and have many other time commitments in their studies, work, and social lives. The lab's physical space comfortably fits only approximately ten of our thirty lab members at a time. Accessibility measures are also ironically difficult in a lab that intentionally organizes accessible art events — Natalie uses a rolling walker when needed but can't fit it inside our small space.



Figure 2. Members working in the lab. Source: DHLC Lab

The role space plays in defining research becomes even more apparent when that research involves placing people in circular magnetic tubes. As Joshua Mann notes of digital technologies used to represent the past, nothing about this present technology is “hermeneutically neutral” [Mann 2018]. The MRI scanner presents a panoply of physical limitations on research almost too numerous to describe. Students cannot bring a paperback inside a scanner, so they read a digital rendition of a “page” (or sonnet) at the back of the scanner through a mirror above their eyes, pushing a button or scrolling with a mouse to move through the lines and pages.

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Head movement in an MRI machine means the scan will pick up on the wrong brain regions, so we make a participant as comfortable as possible, providing ear-plugs to drown out the noise of pulse sequences, as well as foam pillows under their knees, for their elbows, and alongside their head for comfort. In this case, we accept the unique constraints on physical space inside an MRI scanner (we can't change Radiology...yet), but we use our humanist background to push to the very edges of what's traditionally allowed to be seen inside a scanner. In a radical humanist departure from MRI tradition, our participants read long sections of novels and poetry *at their own pace*, rather than being presented with single sentences or phrases flashing rhythmically on the screen. Yes, the physical constraints determine the research that can be done. Yet DH can open new opportunities, as the DHLC's first project demonstrates.

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The lab's first project, “Jane Austen and the Neuroscience of Reading and Attention,” was an fMRI study of the different levels of attention we can bring to a novel and specifically the differences between close and pleasure reading [Phillips 2010]. Eighteen Ph.D. students in English (picked for their literary training) were asked to read the first chapters of Jane Austen's *Mansfield Park* inside an MRI, switching between close reading and pleasure reading at defined sections. Afterward, outside the scanner, they wrote informal literary essays on the sections they'd close read. To our

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astonishment, they ended up quoting the text extensively from memory [Phillips 2015] [Phillips 2018]. Sponsored by an ACLS Digital Innovations grant, we also began to map the unique patterns of quoting from *Mansfield Park*, revealing an attraction to tangible and material words in the text and how these mnemonic anchors grounded sophisticated analysis of class dynamics, stylistics, gender roles, and Austen's irony. Analysis is still ongoing, but this first experiment exemplifies the spontaneity and delightful accident that marks all our projects. In seeking to study the different levels of attention we bring to books, we ended up being the first study of natural reading. Based on an article gone viral, the study also ended up being an unexpected showcase for the value of literary study, revealing the widespread brain regions activated by close reading, a core skill in the liberal arts [Goldman 2012] [Thompson 2012].

Ultimately, this study and the other DHLC projects we describe in the coming pages reveal how digital humanities labs can take an active role in championing the humanities in our communities. We believe that the interdisciplinary, non-hierarchical structure of our lab is valuable philosophically, politically, and practically. We see the different fields represented in the lab as equally important partners in our work, rather than science chasing humanities or humanities chasing science. In the same vein, the members of our lab are equally important partners in our work, regardless of university rank. Together, these approaches shake up the relationships between fields and between people, giving everyone ownership in what the lab does and reminding us that everyone can and should be part of the process of expanding human knowledge.

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The Pleasures of Poetry Reading

We could say that the international recognition our first study of Austen received naturally led to a second project, "Neuroaesthetics: Poetry and Aesthetic Pleasure." We moved from novels to poetry, conducting an experiment that emerged organically from a research group centered at NYU on the neural and cognitive dimensions of aesthetic experience. In reality, I was grading papers for a course on the eighteenth-century novel with a friend when an unexpected email arrived from a Dean at NYU declaring she and her colleagues had been following my research and inviting me to join a global collaboration on neuroscience and art. I knew if I wanted to take this on — that is, involve the lab in designing three new experiments on literature, music, and art — I would need to bring the lab with me. I said yes, and boarded a plane to New York... with three students in tow.

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What I didn't expect was that it was absolutely necessary that the students be there. Sitting at the table in a group of neuroscientific leaders, I watched in awe as they offered insights (and even experimental critiques) again and again, gaining the respect of famous scholars in the neuroscience of music, vision, and art. Yet, as we all know, most of the work — and many of the decisions — happens, not in the conference room, but over dinner. During the wining and dining, the students mixed and mingled with enviable ease, picking up comments that would prove invaluable. Had they been virtually present over Skype, all that would have been lost. On our final night, free from the formality of fine dining, we ordered to-go Indian food and clustered over our laptops in my hotel room. As we pieced together our notes from the weekend, and laughed over the comic tidbits we'd overheard, we dropped all previous expectations and began to design a totally new experiment on poetry — one that would advance Neuroaesthetics and further define the DHLC. As we worked and laughed, I realized the lab had been moved, so to speak, to a small hotel room in New York, with plastic knives and chana masala in styrofoam cups.

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Forging ahead with the energy from that first trip to NYU, and in ongoing collaboration with G. Gabrielle Starr, we designed a study looking at real-time responses to poetry [Starr 2007] [Starr 2010] [Belfi 2018]. We wanted to capture readers' aesthetic reactions to poems as well as how their pleasure shifted as they read; thus, we asked participants to highlight moments they found aesthetically pleasing and displeasing while reading sonnets. First with pencil and paper, later with red and green highlights on a computer screen, fifty MSU students registered their aesthetic responses when reading a set of sonnets drawn from the early modern period to now. After reading and highlighting, participants were asked to use a provided numerical scale to rate the vividness of imagery, the poem's positive or negative overall theme, and the intensity of their own emotional response. What we found fascinating is that, while individual tastes clearly differ, there are stunning similarities in moments people collectively find moving. For example, reading "Dawn in New York," a sonnet by key Harlem Renaissance writer Claude McKay, 60% of participants single out the description of women and men wandering the streets of Manhattan with "wine-weakened" eyes as particularly aesthetically pleasing [McKay

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2019]. At this point pleasure aligned across readers, revealing an unexpected moment of cognitive and emotional unity.

The data for each sonnet was so rich, with so many things to explore, that students involved in the poetry study decided to pursue two distinct research questions. One group (nicknamed “LIT”) is exploring the question of why so many people “like” (or positively highlighted) obviously negative words and phrases.^[2] They observed, with a wry joy, that participants hadn’t only positively highlighted moments of aesthetic pleasure associated with positive themes (i.e. love, sunrises, hope) but also took pleasure in negative themes (i.e. war and sadness). For instance, participants found poetic beauty in McKay’s “cheerless domes;” similarly, in Michael Ferris’ “The Catskill Eagle,” numerous participants loved the moment where the sonnet describes “rage and wonder battle cruel, and strange” [Ferris 2011]. The other group became fascinated with the question of the potential differences between how English majors and non-English majors read and enjoy poetry, with a zeal that earned them the group name “Oxford Comma.” Curious about the influence of a literary education on aesthetic pleasure, they decided to design and run another set of experiments. Fueled by coffee and candy from our famously always-full candy pitcher and recently-donated Keurig machine, they ran another approximately thirty psychology majors as participants (see Figure 3).

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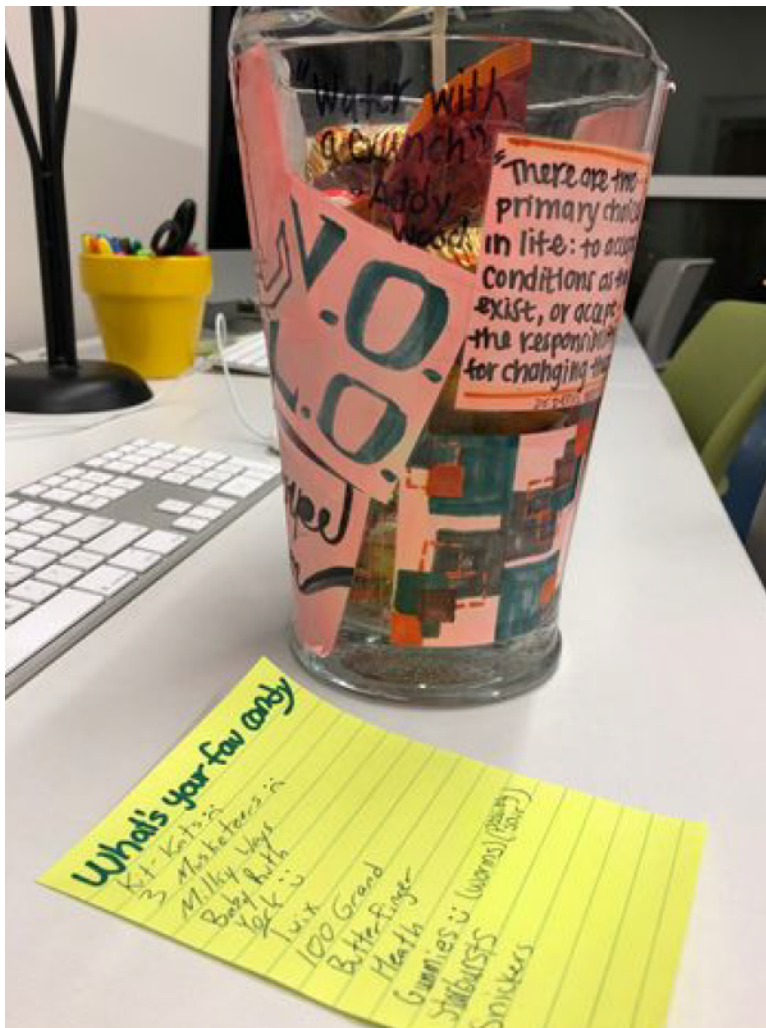


Figure 3. Candy Jar. Source: DHLCLab

In the new experiments, Psychology majors highlighted what they loved (and didn’t) about poetry, providing key data to match up with the previous data from English majors. Immediately, we noticed radical differences in aesthetic pleasure, with Psychology students generally loving Henry Wadsworth Longfellow and English students delighting instead in the far lesser known poem, Catherine Chandler’s “Henslow’s Sparrow.” Though Chandler’s poem opens with extensive descriptions of the elusive bird, it turns, mid-poem, to admit the poet has never heard or seen one:

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Or so they say; for I have yet to spy
the shy, elusive bird, or hear its song,
except in Audubon recordings. I
admit to shaky faith, but play along; and though my yard's a skirl of jays and crows,
someday it might show up. One never knows.
[Chandler 2019]

The part English majors love best is the final cryptic phase: "One never knows." In a world where students notoriously complain that they don't like poetry because they don't know what it means, the English majors are *drawn* to the uncertain ending that one can "never know [sic]."

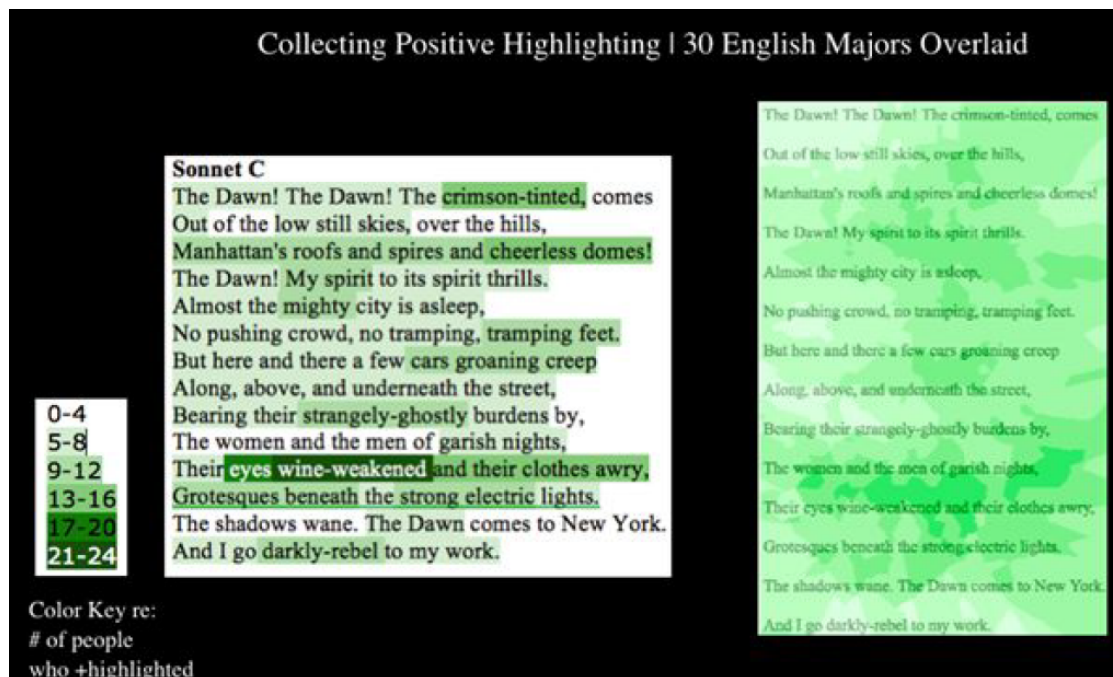


Figure 4. Compiled highlighting for all participants. The highlighting on the left was our first attempt that highlights specific words, the image on the right is the heatmap method created with ArcGIS. Source: DHLCLab

What students highlighted as particularly pleasing (or not) grew more and more riveting to us as we gathered more responses. Some phrases in poems stood out to a majority of readers, either positively or negatively. But before we could answer that, we had to be able to see it. We tried bolding words that participants had repeatedly highlighted, but this method couldn't represent the magnitude of students who loved or hated a phrase. Based on the number of likes we tried changing the font size by statistical increments but the rest of the poem was too small to be read. The best answer we could find was to create a statistical highlighting system where words and phrases got darker and darker, in green for pleasure and red for displeasure, which worked well enough until we reached a point where so many people liked or disliked a word that you could no longer see it. Our lab solution was to just turn that word white (see Figure 4). Fortunately, MSU is invested in DH beyond the lab, and had just created a Digital Scholarship Lab in the library. We reached out with a rough idea in mind to solve the visualization problem and they quickly set us up with someone who knew a technology for heat mapping. Together, their GIS specialist and an English undergrad from the lab solved the problem that we had been staring at for a year using ArcGIS, a geographical mapping software. The result was a heatmap that showed where participants collectively found the most pleasure and displeasure in the sonnets they read. Amusingly, we later returned to the Digital Scholarship Lab as invited presenters, with our co-created poetry heat map on display. The presentation received many excited questions for our innovative use of ArcGIS — a testament to how interdisciplinary scholarship can generate new, often unexpected engagements with digital tools that push our questions and how we answer them further.

The poetry study epitomizes the crucial role physical place and in-person interactions play in advancing the work that goes on in and beyond the lab. Being in the same physical space allows us to rapidly iterate on experiment design, data analysis, and digital tool development in our studies, responding to theoretical concerns and practical considerations as they emerge. However the poetry study also demonstrates how the physical, the virtual, and the digital are increasingly blurred in an interdisciplinary lab. As our most recent study on music and narrative cognition reveals, online collaboration and digital tools for both communication and community research are just as essential for understanding how we encounter literary art in the twenty-first century.

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Narrative Perceptions of Music

Some studies come from concerted effort and invited collaboration, as at NYU. Others emerge by serendipitous accident. This was certainly the case for our study on the stories we hear in music. I had gone to Nashville with my fiancé for one of his (many) music cognition conferences. I'd skipped out of most of the talks and spent much of my time exploring the streets of Nashville, with its eccentric restaurants, huge musical billboards, and fabulous collection of old bookstores. But one poster session caught my eye, so I made my way back to the conference, keeping my badge face-down to stay blissfully incognito. As I read over a poster on "close listening" to music, I marveled at the structural similarity to our Austen study's exploration of close and pleasure reading. All of a sudden, the presenter appeared and said: "Oh my goodness, it's you!" I swiftly learned she had designed her study at Stanford intentionally building off our previous work. She had tons of questions and I was happy to help, delving into a conversation that lasted far beyond the poster session and carried us down the stairs toward lunch. I saw my fiancé deeply engaged in a conversation about budget practicalities with the new treasurer for the society, and told her we'd need to meet up later, exchanging cards. When she turned to me on the last step and said, "I can't believe we met. The Brain on Jane!" the acoustics of the space magnified her voice so that (it seemed) the whole room heard. Certainly, my fiancé's conversation about treasury suddenly ended; his companion, Lisa, evidently familiar with our study, promptly turned to me and said, "You're a cognitive narratologist? There's something I need you to see."

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Lisa Margulis, it turns out, is an interdisciplinary scholar who runs the Music Cognition Lab in the Music department at U. Arkansas (soon to be moving to Princeton). She ran a study where she had participants listen to music without words and asked them to describe any story they heard; a surprising number of people did indeed hear a story [Margulis 2017]. She sat Natalie down and had her read some of the narratives they wrote, many of which were incredibly similar, often sharing the same topics, themes, even specific words. The images she showed Natalie — expanded and extended to represent the full experiment — were to become for us the crucial narrative data to explore convergences (and divergences) in the stories people hear in music. When Natalie got back she called the lab leads together at the DHLC and asked the unaskable question: "I know we have a lot going on at the lab — too much already. I'm tired, you're tired... still, is it interesting enough for us to run with it anyway?" Everyone was fascinated. And, despite the amount of work we had, it was too interesting to *not* work with.

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Supported by a number of fellowships (written together over Skype), an ever-accumulating number of collaborators, and a National Science Foundation (NSF) grant, we began to explore whether — particularly how and when — we use narratives to understand music. In other words, when trying to make sense of a new piece of music, do we begin to "hear" stories — or, certain types of stories? How much do the tendencies to construct narratives when listening to music, and to have those narratives align, depend on cultural background? The study itself is deceptively simple: participants listen to a piece of orchestral music and are asked if they imagined a story or elements of a story while listening. If they say yes, they are asked to describe the imagined story in as much detail as possible. The similarities in participant answers were often startling. For example, almost 74% of participants listening to an excerpt of Liszt's music at U. Arkansas described a "cat-and-mouse story" (see Figure 5).

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Sample Participant Descriptions from Liszt's "Faust's Symphony"

1	The music made me think of a classic cat mouse situation. The lighter music represented the cat scurrying and running from one hiding spot to the next, while the heavier sounds represented the cat getting close to catching the mouse, but never coming quite close enough...
2	It felt to me as if a game of cat and mouse was being played. The mouse would be getting away but the cat would slowly catch up and try to make an attack but the mouse would escape again.
3	I imagined a Tom and Jerry story outline.
4	Mostly scurrying feet. I couldn't really hear the pursuer, but it felt like little mice scurrying around and sometimes something bigger.
5	I imagined a chase scene. My first thought was cat and mouse. It became a ballet. The cat and mouse were represented by humans.

Figure 5. Sample participant descriptions for two pieces of music. Source: DHLC Lab

For the excerpt from Telemann's "Suite in E Major, II," a completely different narrative emerged for listeners: 88% of these subjects imagined wealthy — even royal — characters dancing in a fancy ballroom. Unlike the cat-and-mouse stories, participants listening to Telemann were highly focused on setting. According to their descriptions, any narrative activities — dancing, feasting, socializing, etc. — took place, not consecutively (i.e. cat chases mouse, mouse runs, cat chases again, etc...), but recursively, choreographed in social tandem.

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In order to assess how much cultural context affects these narratives, we are partnering with researchers at the U. of Hong Kong to compare results of our narrative listening studies at U. Arkansas and Michigan State with participants from rural China. In this new cross-cultural version of the study, participants from U. Arkansas, MSU, *and* regions of rural China listen to both Chinese and Western music, allowing us to explore if cultural familiarity with a certain musical style affects the likelihood of imagining stories, or the similarity of the stories they tell. Through five iterations of this study, from the original at U. Arkansas to the ongoing research in China, we have data from a total of 1202 participants. After Natalie's in-person meeting with Lisa, the rest of the NSF *Narrative Perceptions of Music* study unfolded in virtual space. The musical selections are stored online and played for participants on a computer, with participants' responses stored carefully in coded Excel files. Since our collaboration spans the globe as well as the country, most of our conversations happen online, fitting the trend of increasingly digital scholarly communication [Lopez 2015]. Messages and results wing back and forth between MSU, U. Arkansas, and the U. of Hong Kong. Most often, we use Zoom, Google Hangouts or Skype to create a collaborative, interdisciplinary, and cross-institutional space to allow ethnomusicologists, computational sound-technicians, cognitive musicologists and narrative theorists to connect. Bringing a variety of DH and humanistic tools to the analysis of these narratives, we are beginning to explore how much these music-inspired storylines converge or diverge for each piece — with the goal of testing this across cultures. This means that at any given time, walking into the lab, you might find people dispersed, each working on a different computer and using a different DH tool to explore similarities and points of uniqueness in our now ~1,500 musical stories. At one computer, we have a student (relatively new to the lab) using Voyant to offer a first-round exploration of common themes in the seventy-nine stories from the students at U. Arkansas listening to musical excerpt WA15. With appropriate stop words, we can begin to see what stands out as a through-line for the stories linked to this particular piece. Do people tend to invoke pirates? Dancing squirrels? Star Wars and/or lightsabers? Out of the word-cloud, we can then return relatively quickly to the specific stories and check their context for more nuance and richness, always keeping a humanities eye out for themes that might go unnoticed by sheer word count. Comments jotted down on a sticky note pose questions: 1) Do these commonly-used words actually point us to themes? 2) Does sheer frequency of a phrase reveal focus? 3) How about what's implied or left unsaid here...which often seems to carry as much meaning as the explicit and stated?!?

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If you look next to her, on the same side of the lab is an English major, who jumped into our poetry study so early and deeply that he taught himself E-Prime, the standard tool for creating computerized experimental design and data collection. Now, having finished designing macros for our lab computers to make certain common lab tasks easier, and having finished developing an algorithm to map word count for our ever-increasing data-set of stories that people heard

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in music, we find him deep in network analysis, looking to see how often key terms and phrases from the music-inspired storylines intersected for different pieces of music. He's never lost his English side — you should hear him go on about metaphor theory some day.

Across the lab, with headphones in and deeply focused, is a tech-savvy grad student in English and DH developing a tool in R to improve sentiment analysis for our narratives, seeking to assess subtle similarities and differences in the *mood* or *tone* of the stories that might otherwise go unnoticed. In a previous effort to do this for ~500 stories with sentiment analysis tools from IBM Watson and Stanford NLP, two dogged undergrads ran into problems so obvious we couldn't continue without digging into the algorithm. Our funniest example was about ducks. As it turned out both IBM Watson and Stanford NLP rated a student-imagined story about a bunch of ducks swimming in a pond gathering food as "strongly negative." Other less comic cases of this abounded, and, knowing that we must be thinking critically about these tools, we decided, "why not just create our own." Thus, our brilliant grad student developing a tool in R to better analyze the sentiment of our narratives and capture moods that will always slip by word count.

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At the end of the day, no matter how many different tools we're working with (or how many people are at the lab), someone usually jokingly admits that candy isn't cutting it. "I'm going to need a drink after this... does anyone want to join?" and off we go to a local bar or restaurant. We stay away from work as much as we can at the bar but conversation often includes laughing over the inside jokes and funniest stories we've seen. Some of our favorites examples include: "I imagined a fight between two squirrels," "This music sounded like a mixture of Michael Myers and clowns," and "plz stp playing songs that stress me out." While all of these last examples happened *in* (or near) the lab, *Narrative Perceptions of Music* is one of the best studies for talking about how extensive a role virtual tools play in DHLC life, especially considering the national and international collaborations. At one point we met with Lisa virtually on Google Hangouts to discuss challenges with the system we were developing for categorizing the narratives. With the help of our new technological tool, OWL, we could have 360 degree video conference camera scope that allowed access to the whole room while automatically shifting focus to different people as they spoke. Still better, everyone in the room could hear (and be heard) while simultaneously being seen no matter where they were. This technology helped the conversation stay vibrant and productive, bringing people together over great distance [Bly 1993]. Modeling the spirit of the lab, Lisa and Devin (two full professors) listened intently as students offered critical feedback on how literary scholars would approach narrative categorization. For instance, when they offered the example "I imagined animated shadows creeping over the walls" as an abstract narrative without characters or agents, students were able to offer feedback as equals. When our undergraduate lab lead pointed out that shadows (as well as colors, objects, animals, etc.) could be considered agents (i.e. characters), traditional professorial power dynamics went out the window. Lisa simply said "I trust your intuition as a literary scholar."

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It is this same spirit of equality and open-access that motivates our development of Adagia, an online app that collects and maps the narratives of users who listen to a short musical excerpt and share any story they heard (see Figure 6). Their response is immediately visible to them (and others) on a GPS-based map, allowing us to explore how local and cultural influences shape the stories. Our long-term goal for Adagia is to allow users to enrich and reshape the project (adding new music samples online, suggesting new questions, or proposing an easier coding platform). Crowdsourcing traditional scientific research, rendering it online, and making it humanities-friendly, this digital work will also yield an ever-expanding set of stories ripe for DH text analytics. We view Adagia as filling a similar role to Amazon's Mechanical Turk, an online platform often used to scale up psychology research, but without the corporate overlords or problematic labor practices [Burhmester 2011] [Bohannon 2016]. The virtual and digital elements of our work allow us to reimagine our situated research practices and bring our work beyond the DHLC, MSU, and China.

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Figure 6. Adagia screenshot. Source: DHLC Lab

Neurodiversity, Medical Humanities, and Accessible Art

In Lab Girl, Hope Jahren has a beautiful and moving description of her lab space:

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My laboratory is a place where the lights are always on. My laboratory has no windows, but it needs none. It is self-contained. It is its own world. My lab is both private and familiar, populated by a small number of people who know one another well. My lab is the place where I put my brain out on my fingers and I do things....In my lab, whatever I need is greatly outbalanced by what I have. The drawers are packed full with items that might come in handy. Every object in my lab — no matter how small or misshapen — exists for a reason, even if its purpose has not yet been found....The door is locked and I know everyone who has a key. Because the outside world cannot come into the lab, the lab has become the place where I can be the real me. (18-19)

I find this gorgeous because it captures such a strong part of how I feel about the DHLC. Yet there's a part of the lab that's different; something central to its beauty. Yes, the lab is its own world and a sanctuary to me. Yes, it's stocked with objects whose purpose may not have been found (yet). But every time I go into the lab, I see both people who I know well and people I've never met before. And it's just as often the people I've never seen before who have suddenly (I learn) solved an experimental problem — or a problem with complex software and coding — I didn't even know existed. This shows what it means to be an "open" humanities lab. We have IRB to protect the confidentiality of brain data, but since the IRB training is essential and free, the lab is radically and powerfully open. This means that problems are solved from the ground up, not top-down. And that the students come up with new questions to ask about each and every project we do, with an energy that carries it far beyond the original idea.

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The ultimate proof of this came when I had to go down briefly for medical leave. I'll admit, egocentrically, I worried that the lab would come to a complete and grinding halt without me. Instead, it flourished as much it always has, possibly even more, since the students knew, deeply now, that what I'd been telling them — that they had the leadership, they had to trust their own instincts, and they could take it forward — was true. They'd been trained for it. This is the ultimate proof that the lab is not vertically driven, nor hierarchical by nature; it continued and prospered while the director was down. Two English majors from a class I taught who joined the lab while I was away ended up, in their first semester,

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designing and running an entire new branch of the poetry study, getting scientists to highlight the aspects of the poems they found most powerful (or not). Another group went out into the dormitories and hallways and gathered everyday students' definitions of aesthetic pleasure. Perhaps most impressively, an Accessible Art event that I'd been working on, pulled out of my hands by necessity, expanded based on student innovation to include not just students — as had been my original model — but local community artists and a week-long public exhibition. While away, I found myself missing the lab more than I can say; going in to the DHLC had always meant going into a space where things were happening...where students always had new projects and ideas (not that three experiments and an accessible art project weren't enough to keep us on our toes). Not that I'm back, I realize what I missed most; the vibrance in the atmosphere — and the sanctuary it provided, always showing, rather than telling that humanists and scientists could do things together...at times, brilliantly...and in ways that expand beyond experiments into the community.

One of the most powerful ways the DHLC breaks the mold of what labs usually do (obscure experiments behind closed doors) is through a series of multisensory and inclusive art exhibits that have come to be known as Accessible Art. In 2015 the student editor of *Exceptions*, a journal housed within the DHLC that publishes work by and for people with visual disabilities, approached an English professor and an art professor with the idea for a touchable art exhibit. English students would select or create a sensory-rich passage of text, which students in the art class would use as inspiration for a multisensory piece of art. The Accessible Art exhibit was born with the motto “Touch the Art!” After that first year, *Exceptions* editors continued to plan different accessible artistic events, including a second Accessible Art exhibit in 2017. In honor of Veteran's day this exhibit focused on depictions of war, and drew over 200 visitors. One wrote, “This changed the paradigm of art for me, before this event I only thought of art as visual and did not consider the fact that art can and should engage all senses and be accessible for all people.” Another put it this way: “it was actually accessible to everyone. QR codes were available to have the literary aspects of the art read aloud and then of course we were encouraged to touch the art, which is something unheard of in a museum.” Our events were never only about opening museum spaces to visitors with visual disabilities, important as such work is. Instead, we sought to encourage every visitor to think about engaging with art in a different way. The enjoyment that comes from the multi-sensory indulgence of touching the untouchable opens people's minds to consider what a more inclusive and accessible world might look like (see Figure 7).

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Figure 7. Children at Accessible Art exhibit touching artwork. Source: DHLC Lab

It was precisely this call for art to engage all senses and all people that guided our vision for the 2019 exhibit. Natalie was on medical leave, but it didn't occur to us to question whether a group of students could pull off the project

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beginning of where our lab has been, and where it is going. It certainly hasn't always been easy to organize and run an interdisciplinary DH lab, but thankfully I've had the support of many fantastic colleagues — including my students — in doing so. In so many ways, the DHLC is driven by student innovation and research, including students creating their own studies using the skills and tools they learned in the lab. For example, graduate students Cody Mejeur, Soohyun Cho, and Jes Lopez have designed experiments that identify the neural networks involved in narrative comprehension in video games, investigate the cognitive and cultural effects of Kindle Popular Highlights, and analyze the representations of autistic characters in literature and film through embedded sentiment, respectively.

If I could sum up the most important lessons I've learned along the way for those interested in building and running similar labs, these would be my main points:

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1. **Involve students as equals.** Not just as students but as lively, active, curious people. Let them explore and grow. Even better, treat them with the respect you give your colleagues and global collaborators. You'll be astonished.
2. **Accept that serendipitous accidents will grow into new things:** a lab, an fMRI, a poetry study, or a series of accessible art exhibits. Embrace it, and embrace the fact that each new project will make you want a new tool.
3. **Things expand: be ready** (it's going to be okay). The lab can't hold it all, so reserve extra rooms.
4. **Think of interdisciplinary as pluralism.** It's not DH vs traditional methods, but rather a both/and situation that involves a lot of translation work, over and over again.
5. **Allow yourself the joy of working with students.** Running a lab is a lot of work, I won't lie. But you'll experience moments of personal fulfillment and pride in a group that are absolutely unrivaled.

In the *Chronicle of Higher Education*, Jonathan Kramnick claims we are living in an academic moment governed by "The Interdisciplinary Delusion" [Kramnick 2018]. And there are days when it does feel like a delusion, but not the one that Kramnick cites. It feels like a delusion when on the morning of a university-wide research competition, I stop by the lab to see students in English, Biology, and Education still adding new data to their posters, and then, hours later, watch them accept the top prize. When I return from medical leave to discover that students have run two new studies despite joining the lab just a month earlier. When I step into the Broad Art Museum for the lab's Accessible Art exhibition and get to touch my first work of student art and feel how they captured an element of the poetry. It's the brilliance and energy of the students that are drawn to this work, not the facade of interdisciplinary novelty, that so astonishes and inspires me.

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Interdisciplinary work is a shift of view, not a truth claim. No one in the lab and none of my colleagues feel that we will somehow find the absolute truth about poetry and pleasure. Far from it. Instead we are simply using a different set of tools to get a glimpse into what 30 students love, or hate, about sixteen sonnets. Our music and narrative study may extend to China, but it has the same limits. The excitement isn't all "an interdisciplinary fantasy of the moment." It comes from real students, professors, and colleagues around the world who have their own deep disciplinary training and are contributing it to illuminate a new facet that otherwise would never have been seen about how we engage with literature, music, and art.

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The common fear of digital humanities and other interdisciplinary fields like literary neuroscience is that we are attempting to scientize the humanities, making them more quantifiable, measurable, and profitable [Pask 2018]. Without wading too deeply into a longstanding debate about the validity of these fields, we want to acknowledge that there are reasons to be cautious about a type of interdisciplinary research that just seeks to import scientific knowledge to the humanities in order to attract more institutional support and grant dollars [Allington 2016] [Kirschenbaum 2016] [Singh 2016]. In the DHLC, we make it a primary goal to challenge this trend. We believe that truly interdisciplinary work isn't a one-way street, as though the sciences have the authority on truth and reality and the humanities are here merely to dress it up. Rather, we are proud of having a lab space that humanizes the sciences, seeing young neuroscientists regularly reading literature and poetry, and introducing scholars in English, Education, Rhetoric, and other areas to neuroscience and digital tools for analyzing artistic media. Interdisciplinary digital humanities labs are uniquely positioned to make these points of contact happen, and to do the critical work of championing the humanities and

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resisting the institutional privileging of the sciences.

In an age where human life is increasingly shaped by digital media — indeed, where we seem to be evolving alongside our technology, as N. Katherine Hayles argues — brain imaging technology can give us new insight on how human meaning-making is embodied, and how it operates in different digital contexts [Hayles 2012]. At the same time, our ability to critique the forms, power, and ideologies that shape the sciences we use helps us to encounter the limits of neuroscience — all the many places where existing studies fail to account for the rich diversity of human experience [Kim 2018]. The implications of such understandings are potentially far-reaching. For example, knowing how we close read and pleasure read differently can change how we teach and approach texts, or learning how we perceive music as narrative can affect how we compose and use everything from advertising jingles to symphonies.

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Our work in the digital humanities and literary cognition is just one of many possible sites for interdisciplinary collaboration and research. Imagine, for example, what humanities-based ecocriticism labs might look like, or consider what the humanities could bring to the critical coding and computing centers and networks that have sprung up in recent years [Ruiz 2017].^[3] In many ways we have only begun to see the potential combinations and new perspectives that such lab work can generate. And even on the level of individual labs, as the DHLC demonstrates, work is expanding beyond the walls of any one institution into many physical and virtual spaces across the globe [Klein 2016]. Approaches from the DHLC have inspired the structure and process of other digital humanities labs, like Dr. Stephen Grandchamp's Digital Humanities Lab at the University of Maine at Farmington, which utilizes the student-led model of the DHLC by having undergraduates work with faculty to integrate DH into curricula and to provide one-on-one instruction for students. Grandchamp also adjusted and adapted this model in ways that are different from how the DHLC run: all his student assistants have been hired as freshmen with the goal of working four complete years in the lab. This creative reconfiguration has led to brilliant work for DH outreach in Maine — the student assistants are taking the lead on a digital archival project by scanning the historical catalogs (including creative writing and visual art) of a local seed cooperative with the goal of creating a fully-searchable online archive.

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Of course there are good reasons to be suspicious of these trends, and thankfully the humanities draw our attention to questions of access, privilege, and power in pursuing them [Lothian 2013] [Risam 2015]. Still, if there is anything we have learned that can help others in running, starting, or just considering a lab, it is that embracing a “try everything” ethos can lead to unexpected and generative opportunities for changing how we think, especially when trying everything is inclusive of different peoples and supportive of their skills, knowledges, and goals. Our research practices are always situated within various types of institutions, traditions, and systems of power, but they also always hold out the possibility for new and revolutionary insights to spontaneously emerge. To be more specific to the digital humanities, if we are to critically engage with digital technologies, then we have to be willing to let those engagements evolve and emerge to address the critical question or situation at hand. We also have to be open to taking risks, and even to failing. After all, we can learn just as much (and sometimes more!) from the experiments that fail as the ones that produce promising results. The great benefit of prioritizing the humanities in this trial and error is that they can guide the process, minimizing the harm and emphasizing the importance of considering the meanings and ethics behind research projects. This interdisciplinary work is not the delusion of one moment in higher education, it is an ongoing project that contributes to answering some of the most pernicious problems of the twenty-first century.

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Notes

[1] We use italics here and throughout to represent the voice of Professor Natalie Phillips, Director of the Digital Humanities and Literary Cognition lab. When we switch into non-italic font, this indicates the collective voice of the article's six authors.

[2] A nickname that is simultaneously a combination of team members' initials, a shortening of the word “literature,” a reference to the colloquial phrase “lit,” meaning something fresh and on fire [Jolly 2017].

[3] See FemTechNet, Fembot Collective, Software Studies Initiative, to name only a few.

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