Trans*formative TechnoCraft

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1 Critical AI & creative–critical coding need each other

> "I'm stuck here inputting and outputting the data of a story I can't change."

> –Italo Calvino "The Burning of the Abominable House"
> (**calvinoNumbersDarkOther1976?**)

❤️ ⬚ *Trans*formative TechnoCraft* argues for the essential entanglement of critical AI approaches and creative-critical coding communities, showing how each is predicated on the other. No intervention in disproportionately harmful algorithmic systems is possible without critically aware approaches to technologies from deeply plural perspectives. No such proliferation of perspectives is possible without inviting spaces to understand, interrogate, and reimagine the infrastructures that support those systems. Many other works have confirmed that [critical AI interventions (or creative coding) are necessary]. This work shows what entanglements of intersectional, interdisciplinary, creative–critical approaches to the urgent problems of [emergent technologies] can look like. Its collection of texts apply these approaches as in-practice experiments — in different contexts, for different audiences, for different aspects of the issues, which must be addressed [through multimodal and polyvocal means].

The stakes are high: technologies like machine learning urgently require transformative interventions that recalibrate their values and [stakeholders]. The communities most impacted by them, and best poised to intervene, go unheard as powerful actors profit from their data and labor exploitation. These companies warn of hyperbolic coming dangers in order to distract from the current dangers they perpetuate. Already-toothless policy recommendations are quickly watered down and ignored. Meanwhile more and more data represent less and less diversity, more and more processing power destroys more and more planet. [What is treated as glib fun on one side of the globe is pennies a day and life or death on the other.] But why must it be this way?

> "We must begin with the knowledge that new technologies will not simply redistribute power equitably within already established hierarchies of difference. The idea that they will is the stuff of utopian naivete and technological determinism that got us here to begin with."[1]

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[1](Sharma 2020)

We cannot expect technology to solve the problems of technology. But we can reclaim [technology as a human craft.] With critical engagement, we can work to return more access, investment, and community agency to technology by viewing it through different lenses. We can transform technologies themselves rather than accepting their current shapes.

> "Anyone who has ever woven or knitted knows that one can change patterns [...] but, more importantly, they know *there are other patterns*. The web of technology can indeed be woven differently, but even to discuss such intentional changes of pattern requires an examination of the features of the current pattern and an understanding of the origins and the purpose of the present design." (Franklin 2004)

Yet, how do we participate on our own terms, in order to change systems to suit us? Especially when learning programming and engaging with tech is often so intimidating? How do we keep from further marginalizing those whose perspectives are most necessary in order to face the challenges of emerging technologies and to change them?

1.1 Critical AI must be intersectional

> "Questions like 'is a computer creative' or 'is a computer an artist' or the like should not be considered serious questions, period. In the light of the problems we are facing at the end of the 20th century, those are irrelevant questions. Computers can and should be used in art in order to draw attention to new circumstances and connections and to forget 'art'."

> –Frieder Nake, "There Should Be No Computer Art" (1971)

Questions about art, creativity, and labor in relation to AI are fundamentally questions trying to define humanity — *What makes us creative or empathetic? What makes us different from machines? What makes us human?* They are old, old questions. They also emerge from centuries of colonialized framings of 'man' as an idealized, individualized white western subject. Hyped AI discourse explores limited questions about AI because it continues to draw from limited perspectives, letting status quo narratives about humans and automated systems frame the terms of debate. "Machine learning [...] is an expression of that which has already been categorized," says digital culture researcher Ramon Amaro(2022). Not to think to train on a variety of faces, or not to raise concerns about training on faces at all, happens because there is not a variety of perspectives in the room when these very

human decisions are being made — before, during, and after the data is being collected; and before, during, and after the code is being written and run.

Automated decision-making systems disproportionately harm the marginalized majority. We are subject to these systems whenever we lend our data by clicking terms of service pop-ups to make them go away; and whenever we must be recognized by borders, banks, and bureaucracies of any kind. Our varying degrees of vulnerability in these moments are exploited and profited on — from testing biometric facial technologies in refugee camps (Nedden and Dongus 2017) to reinforcement learning reliant on chatbot user responses and content moderation. Much amazing research has highlighted the increasing impacts of AI systems and surveillance capitalism (Bender et al. 2021; Benjamin 2019; Buolamwini and Gebru 2018; Browne 2015; Gebru 2021; Noble 2018).

[Yet] AI hype describes machine learning systems as impenetrable black boxes. Black box thinking permeates the interfaces with which we engage its tools; it claims the proprietary restrictions that hide its data (our data); and it influences the regulations that keep its power in the hands of a select few. We only break out of those boxes when we refuse to engage on those terms. "Artificial intelligence uses classification to encode power," says critical AI researcher Kate Crawford. She argues that computational "ways of seeing depend on the twin moves of abstraction and extraction. But these logics can be challenged, just as systems that perpetuate oppression can be rejected" (2021). The task of critical AI researchers and makers is to engage these systems as sociotechncial objects embedded in their historical, social, context, argue [XXX-ID] Rita Raley and Jennifer Rhee. We must be "situated in proximity to the thing itself, cultivating some degree of participatory and embodied expertise, whether archival, ethnographic, or applied. (Raley and Rhee 2023)

This requires interdisciplinary and intersectional perspectives. It also requires what rhetorician Adam Banks calls "transformative access." He argues that access is more than owning or using tools, participating in processes or even critiquing their failings. Transformative access is "always an attempt to *both* change the interfaces [where people use that system] and fundamentally change the codes that determine how that system works." Banks highlights the important role Black people play in technology's transformations, saying, "Black people have hacked or jacked access to *and* transformed the technologies of American life to serve the needs of Black people and all of its citizens" (Banks 2006). As many Black feminist and intersectional theories argue, supporting the needs of multiply marginalized people often leads to more effective support for many others.

Intersectionality, Kimberlé Crenshaw's iconic analysis of institutional power (Crenshaw 1989),

"critiques systems of power and how those systems structure themselves to impact groups and individuals unequally" (Cooper 2016). Intersectionality can reveal the tangible human and more-than-human costs entangled in these algorithmic systems – their proliferating data and its material infrastructures, as well as their consolidating power and its sociocultural infrastructures. Such power is differential by design. Conversations about AI fairness, transparency, explainability, ethics, public good, and the hype cycles of new technologies are grossly incomplete without intersectional analyses of power and intersectional tactics of (and beyond) equity and inclusion. No change *about* us *without* us.

Yet industry implementations of so-called ethical tech reduce complex concepts into flattened ideas of fairness and representation (Ovalle et al. 2023). Machine learning, as a mass production, produces certainty from uncertainty. More precisely, argues political geographer Louise Amoore, it produces a false sense of certainty from millions or billions of small uncertainties, through its reductionist logics of probability as prediction (Amoore 2020). These uncertainties are also claims about "what we should know, how we should know what we know, and how that knowledge should be deployed. Each exposure to a dataset occurs because someone concluded that the information in that dataset should be used to determine a possible future" (Hakopian 2022). Since an algorithm is at its most simple a set of instructions, of course it will contain the assumptions of those who wrote those instructions. It will follow their beliefs about how to implement that procedure. There are many ways to do any task, informed by minute choices at every step. As these choices scale exponentially with computation, the impact of these choices magnifies exponentially too.[2] They are compounded by the computational speeds that allow thousands of operations to run per second. Yet, because they are processed through algorithmic systems (and a mythology of the black box), these choices get normalized, naturalized, and neutralized.

Yes, in many cases it would be nice to have more, better data. But the very valid criticism that algorithmic systems are biased because their data are biased — often summed up "garbage in, garbage out" — sets up a quest already doomed to fail. What would be better data? Or an optimized system? For what goal, and for whom exactly? There is no such thing as unbiased, there is only the

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[2]Because generative AI models have become so large, and training processes so slow and expensive, they frequently rely on foundation models — previous models, often designed for other tasks, used as the building block or sourdough starter for new models. Foundation models carry with them the histories of how their datasets were designed and for what purpose, whose data was included or excluded, and the choices their creators made when preprocessing them. These are often decades-old "benchmarks" leaving debunked or erroneous information in cutting-edge models' outputs.

right tool for the particular job, or a given slice of information from a particular perspective with just enough context for the purposes of a specific task. There is only "good enough" data — and only sometimes, for some tasks. When the stakes are too high, no data could be good enough to make life or death decisions. We need a different approach. We cannot rely on computational systems for infallibility and rationality, as we have been, nor can we look to these technologies uncritically as bandaids for the problems they exacerbate.

While the need for AI oversight is clear, many have been calling for total overhaul and algorithmic justice, like computer scientist Joy Buolamwini (Buolamwini n.d.). [Still, practical applications of these valid critiques remain difficult to implement.] How do we get there? Intersectional AI calls for demystifying normative AI systems and learning from marginalized ethics and tactics, in order to fundamentally transform AI. It requires multimodal, polyvocal, experimental approaches that cut through the technological solutionism (Ciston 2019b). It requires slow, long-term investments in algorithmic justice, rather than extractive, performative forms of inclusion that erase friction, context, and agency as they scale up for machine learning tasks (Sloane et al. 2022). As a term, 'Trans*formative' looks for root causes and radical alternatives to the computational logics that perpetuate [harmful systemic inequities].

1.2 Critical, intersectional approaches mean creative, caring approaches

How do we reconnect the communities of practice who are building technologies and those who are equipped with the knowledge to consider its most urgent questions?

Caring, creative, and critical approaches must be combined in order to adapt the spaces where technologies are discussed, designed, and implemented. Those spaces are missing the essential perspective of those pushed to the margins, who are most capable of addressing the urgent issues facing technology. These concerns are not new, nor strictly digital. They have been addressed by a wide range of communities with different types of knowledge for centuries. Many are calling urgently for Indigenous ("CARE Principles of Indigenous Data Governance" n.d.; "INDIGENOUS AI" n.d.; "A New Vision of Artificial Intelligence for the People" n.d.; Escoffery 2023), antiracist ("Anti-Racist HCI: Notes on an Emerging Critical Technical Practice | Extended Abstracts of the 2022 CHI Conference on Human Factors in Computing Systems" n.d.), antiableist (Hamraie and Fritsch

2019), decolonialist (Chakravartty and Mills 2018; Raval 2019; Rights 2020), neurodiverse (Goodman, n.d.), queer (Keeling -01-22 2014; Klipphahn-Karge and Koster, n.d.), intersectional (Ciston 2019b; Klumbytė, Draude, and Taylor 2022), and other knowledge systems to be applied to AI and emergent technologies. Yet intimidating, isolating cultures around the specialization of computation and programming practices have left so many of us out of these conversations.

As code makes contact with the world with increasing complexity, code literacy becomes increasingly essential. Yet if we want to imagine different systems, code literacies should not be defined only on the narrow terms of those creating existing systems (Vee 2017). We know that bootcamps and hiring initiatives, though useful, do not support the goal of shifting a variety of voices into positions where can effectively make change (Abbate 2021; Hicks 2021; Dunbar-Hester 2019; Vee 2017). They do not acknowledge the many people already participating in the production of technologies in the global majority, from those harvesting of rare earth minerals and circuit board manufacturers (AI Now Institute n.d.; Nakamura 2014) to the content moderators (Roberts 2016) to the crowd workers (Sunder 2022). [Joining an 'elite' tech field is a moving target, entangled with race, gender, and globalization politics.] Communications scholar Christina Dunbar-Hester and others call for interventions that go deeper than training more people in tech jobs, pointing out that this does little to examine the structures that organize and value work sectors. She argues this calls for "a larger reevaluation and appropriation of categories themselves—the boundaries of what is 'social' and what is 'technical' are flexible categories" (Dunbar-Hester 2019). As a term, 'TechnoCraft' looks more invitingly at how many more people are potentially already engaged with sociotechnical practices and implicated by them, as user-practitioners, data subjects and subjectees, skilled crafters and critics.

We know code means more, if we let it. Code is collaborative, says Mark C. Marino, who helped develop the practice of Critical Code Studies. Code can be an inviting, interpretive practice: "Code's meaning is communal, subjective, opened through discussion and mutual inquiry, to be contested and questioned, requiring creativity and interdisciplinarity, enriched through the variety of its readers and their backgrounds, intellectually and culturally" (Marino 2020). Such approaches invite the creation of hybrid communities that acknowledge the interdisciplinary capacities of programming, and the diverse capacities for knowledge.

This requires we reunite the divisions between theory and practice, between user and programmer, which were artificially split from the start ("Always-Already-Programming.md" n.d.a; Artist n.d.; Nardi

1993). It requires un-siloing domains and disciplines, the artificial boundaries that divide technologists from activists and critics from creators. It requires we find common language and common values that come with working knowledge of the whole system. The technical how-to means (coding skills) and the critical/analytical how-to means (analytical, political, aesthetic, ethical contexts) and the material how-to means (data, energy, hardware) have to combine and are inseparable.

> "By reinforcing the idea that there is a split between theory and practice or by creating such a split, both groups [elite academia and anti-intellectuals] deny the power of liberatory education for critical consciousness, thereby perpetuating conditions that reinforce our collective exploitation and repression. >–bell hooks (1994)

All making, all writing, all coding is a hybrid practice of creation (poetics), critique (politics), and code (platforms and programmatic systems).

How do we reunite these? We need access. We need everyone's contributions to be valued, for the effort toward understanding to be mutual because all participants know that we each have important contributions to make. Access includes many aspects. It requires connecting an individual's current understanding and circumstances to the new knowledge step by step. It considers material, financial, intellectual, social resources that allow for a variety of entry points. I may be capable of understanding how a machine learning system works, but not have the prerequisite vocabulary to enter a conversation in order to learn about it. I may understand how to operate a machine learning system, but not have the financial resources needed to run a resource-intensive devices in order to use one. I may have knowledge and resources to share, but not be able to participate because barrier-free access, transcription, gender-inclusive language, or other inclusive aspects were not prioritized by the organizers.

> "any theory that cannot be shared in everyday conversation cannot be used to educate the public." (hooks 1994)

Prioritizing access here means prioritizing common language. These works are written as jargon-free as possible to allow them to travel as broadly as possible. They also vary in methodology and modality in order to access different audiences and spaces. They show how different ways of knowing are necessary to engage the same questions, as well as how different aspects of the questions must be addressed simultaneously.

This approach makes creativity and care part of its argument. These are not additions, affectations, or antonyms to critical theory or technical savvy, but rather they are central fortifications to the work. Code work is critical work is care work is creative work.

Each of the works in *Trans*formative TechnoCraft* finds a different balance of these elements but includes all four. *Coding.Care: Field Notes for Making Friends with Code* gives courage to pick up unfamiliar tools, find resources to kick off a new programming project, pose questions critically, or solve problems creatively. Its pocket-guide form discusses how to build a cooperative, interdisciplinary community for co-learning coding like the one I have facilitated since 2019. The *Intersectional AI Toolkit*'s co-authored zines are accessible guides to both AI and intersectionality, bringing together artists, activists, academics, makers, technologists, and anyone who wants to understand the automated systems that impact them. The work argues that established but marginalized tactics are necessary for reimagining more critical and ethical machine learning. Together these tools and resources ask: *Whose voices, visions, and stories are captured by automated systems? Whose are excluded, harmed, or undermined? How can AI systems be accessible for anyone to engage and intervene in?* And *A Critical Field Guide for Working with Machine Learning Datasets* translates critical AI theories and data science concepts into practical tips for dataset stewardship. Along with the *Inclusive Datasets Research Guide*, both guides combine technical skillbuilding and critical thinking for scholars and practitioners beginning to work with datasets, because datasets remain the foundation of machine learning as it grows rapidly in impact. And brief lyric essays offer interludes to the major works as oblique refractions of their topics.

These works emerge from my artistic research (also called research-creation or arts-based research in different lineages and regions). Artistic research is neither research that produces art, nor a scholarly presentation of art, nor a creative presentation of research, but instead a hybrid practice of "creation-as-research" and research-as-creation:

> "By bringing research and creation together in such a way that they unpredictably contaminate and remake each other, in such a way that they render each other uncanny, research-creation makes space in the university for research practices that are grounded in nonhegemonic literacies [...]" "in failing to fully belong, and allowing that nonbelonging to denaturalize, emergently, its givens, research-creation tells other stories, uncanny stories, that (have the potential to) carry within them [...] other ethics" (Loveless 2019).

Strategies for combining creative and critical practices have been eloquently described elsewhere (Willis 2016; Loveless 2019; Fournier 2021). In my own artistic research, I am particularly interested in process-oriented experimentation and in how artistic experiments can challenge paradigms in machine learning, data science, and technology communities. I have found artistic research practices can interrogate systems and imagine new ones. For me, artistic research combines rigorous scholarly investigation, deep community building and activism, and creative play in ways that facilitate connections to broader non-academic audiences.

Art has been the space where I am able to unpack complex ideas for myself, because I can treat them more freely as artistic materials. It is where I am able to follow instinct and feel into how my tools, platforms, and forms shape their outputs and outcomes. It is also the space where I feel able to imagine wildly, creating digital objects that should exist but don't, or couldn't exist but might.

Artistic research opens space beyond research questions, where research tensions live. In that space, I can sit a bit longer with questions I know I cannot answer, questions that make me uneasy. I can hold two contradictory ideas simultaneously and let them push–pull me, forgiving myself imperatives and outcomes, productivity and proven hypotheses. I can put myself into the trouble, because I already embody these questions in my lived experience.

In my experience, this imaginative work is central to supporting very practical next steps and strategies. It is central to supporting more open access to communities of practice where others can continue the kinds of artistic experimentation that challenge paradigms in new forms I might never imagine. In such contexts, argues [XXX-ID] Holly Willis, "arts-based research is rooted in critical theory, framing the research process within the context of power, emancipation and a deep questioning of the ethical and ideological implications of knowledge and change" (Willis 2016).

> "Bots can make arguments. [...] bots exist to shine a light on how things already work, but also to test the edge cases, and to propose alternatives. [...] bots are procedures against procedures." -Allison Parrish, "Procedure vs Procedure"

> "artists, and artist-activists, have introduced new ways of knowing—ways of apprehending how learning machines learn, and what they do with what they know. In the process, they've also initiated learning machines into new ways of doing. [...] artists have shown how we might visualize what is not yet here. [...] Artistic practice opens up knowledge systems beyond those canonized in the institutions of the early 21st century.

> […] the history of aesthetic practice also contains other histories, and diagrams of other possible futures." (Hakopian 2022)

2 What is Trans*formative TechnoCraft?

What does Trans*formative Technocraft look like? How could it operate? Where does happen it already? What is it exactly? I hope we can figure that out together. The works of *Trans*formative TechnoCraft* are experiments and instructions for myself/ves, past-present-future, gathering tactics from many traditions, making connections, collecting strategies, and wayfinding for the kinds of worlds and systems I want to [be part of/join/create]. As a phrase, 'Trans*formative TechnoCraft' both proposes and describes a present possibility — an intersectional [trans*feminist] approach to [reading and relating to] emergent technological systems. Each part of the phrase says so much more about the whole.

2.1 Trans*formative

Trans*formative here means emergent, embodied, embedded practices. It means process-oriented, community-oriented practices. It means making space for and honoring what we figure out as we go along, [adjusting and tailoring to the needs and goals of our specific situations as we operate in community].

'Transformative' includes transformative justice, which recognizes that oppressive systems are at the root of technological harms. It argues that acknowledging systemic oppression is essential to addressing those harms and shifting away from carceral logics and toward healing systems. Transformative justice seeks repair beyond punishment, focusing not only on remedying wrongs but more broadly on instituting infrastructures of care [3] and reorienting the values embedded within technical objects and practices so that harm can no longer be perpetuated ("What Is Transformative

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[3]The phrase "infrastructures of care" comes from Christina Dunbar-Hester's *Hacking Diversity*, in which she refers specifically to the work done in open-source and hacker communities to create "more inclusive spaces for women, trans, and gender non-conforming people." I use the term "infrastructures of care" in this work to discuss such communities below, but I also use the term more broadly to refer to mutual aid and other forms of community in practice.

Justice?" 2020).[4] It is not just a question of what bias to remove from technology, but of what to build in its place.

> "From the design to the production to the deployment to the outcome, there is constantly bias built in. It's not just the biases of the people themselves; it's the inherent bias within the system. There's so many points of influence that, quite frankly, our fight is not for cleaning up the data. Our fight is not for an unbiased algorithm, because we don't believe that even mathematically, there could be an unbiased algorithm for policing at all." [...] "The goal is always to be building power toward abolition of these programs, because you can't reform them. There is no such thing as kinder, gentler racism, and these programs have to be dismantled." (Hamid Khan interviewed in (Ryan-Mosley and Strong 2020))

Trans*formative is an active, prefigurative[5] stance. It brings `programming` closer to its synonym `processing`, combining computational practices with emotional ones, digital with digestive. Trans*formative processing refers both to processing units (CPUs, GPUs, NPUs) and also to processing personal, communal, and generational trauma. It means both works-in-progress and algorithmic processes. Ongoing processing not fixed programmed states. Let's inspect further...

> "Revolutionary movements require a teleological pool from which to draw. The imagination is that teleological pool: it not only creates liberatory drives; it sustains, justifies and legitimises them. It undoes entire epistemes and clears a space for us to create something new. Though this 'newness', or the demand for something else, can never fully be realised in the realm of the discursive, it exists in other registers: it can be felt, heard, touched, tasted. The structural limits of this world restrict our ability to articulate all that the imagination is capable of conceiving. Do not forget this." (Olufemi 2021)

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[4]Reparative and restorative processing are part of this work, but the terms 'reparative' and 'restorative' in relationship to justice movements and to LGBTQIA+ histories are fraught. Instead I find the broader sense of 'transformative' resonates for me with trans*, intersectional, and inclusive approaches to identities and [sn-politics][— as well as to this project, its participants, its influences, and its intentions].

[5]'Prefigurative' just means embodying our values, making it "a daily endeavor of creating the world we want." and "our actions create the world we want right now, we don't have to wait for the revolution to start another, better world." (Branson 2022). "Prefiguration provides a basis for collaborators to suggest the sort of world they might like to inhabit and, in contrast to such a world, identify those features of the prevailing world which differ from that which is desired." (Nicholson 2023)

2.1.1 Transformers

Transformers are a current type of machine learning architecture being employed to create large models like ChatGPT and Stable Diffusion.[6] They are good at digesting large clumps of text, images, video — all interpreted as numbers — and reconstituting them. Transformers main parts are called encoders and decoders, and it's often said that even their designers don't know what exactly is going on in these hidden layers. We can discuss the specifics of that elsewhere (see Interstitial: Codes for Un/Knowing). I find it more interesting that the *transformers themselves* do not know what is going on in these hidden layers of the own architecture — despite all the anthropomorphizing of AI systems, with widespread use of terms like "learning" and "understanding." While they process and produce meaning (input and output), transformers are never "aware" of the meaning of the content they are processing along the way. They are just crunching numbers.

Transformers are the latest, but won't be the last, in a long string of systems that ask data subjects and data subjectees[7] to submit to their "superior" logics. With every iteration on their forms, we repeat their hype but lose trace of their histories in "race science" and colonizing power that captures what it means to know and be known. (Browne 2015; Benjamin 2019; Joque 2022)

The paper that launched a thousand transformer models was called "Attention Is All You Need." Transformer language models incorporate text context through a mechanism called "self-attention" that examines a selection of word-units surrounding each word-unit they interpret. (Vaswani et al. 2023) As they proceed, they use this interpretation to predict the next most likely word to appear in a sentence, based on the words that have commonly appeared near the last few words before.

But we need more than self-attention. We need self-reflection and co-regulation. We need systems that, in their very architectures, celebrate difference - rather than erase it.

2.1.2 Trans*

To move from the "transformer" model architecture to trans*formative tech (and from tech to technocraft) means to acknowledge the requisite entanglement of community building and [critical

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[6]For more explanation of terms, see "A Critical Field Guide for Working with Machine Learning Datasets" and "Intersectional AI Toolkit."

[7]For more explanation of terms, see "A Critical Field Guide for Working with Machine Learning Datasets" and "Intersectional AI Toolkit."

sociotechnical systems]. It means knowing the material we are transforming — by sharing in, speaking nearby, walking beside, being constituted and supported by, and supporting in turn.

This work is about trans*formation through trans*lation and trans*disciplinarity[8] and trans*gression.[9] It lays the groundwork to imagine trans*formers otherwise, to imagine [emergent/co-existing technological systems] at a slant, on the bias rather than always-already biased. It calls for queerer systems (queer as a politics, as in fuck you, as in QueerOS, as in queer-enough)(Dog Park Dissidents n.d.; Keeling -01-22 2014).

> "queer as [in] being about the self that is at odds with everything around it and has to invent, create and find a place to speak, and to thrive and to live." (hooks 1994)

This approach to technological trans*lation and trans*formation has no prerequisites. We are already queer-enough, coder-enough, valued-enough to participate in continually becoming. We are "always-already programming" ("Always-Already-Programming.md" n.d.b). (See "Coding.Care")

Trans* can be inclusive, fluid, in motion, outside binary logics, self-identifying, evolving, emergent, embodied. *Trans*formative TechnoCraft* imagines systems that can also have these qualities, that can trans*cend the logics constructed by capitalist, militaristic, racist, ableist, misogynistic lineages.

> "queerness is itself inherent within [the history of] computational logic, [...yet] there exists a structuring logic to computational systems that, while nearly totalizing, does not account for all forms of knowledge, and which excludes certain acts, behaviors, and modes of being." (Gaboury 2013)

(See also trans*feminist and crip technosciences below)

Trans* also finds queer reverberations in the transducers all around us that constitute and reinforce computational systems. A transducer (from Latin for 'lead across') converts physical signals into electrical signals, or vice versa. Trans*ducers are intermediaries that allow the trans*fer between analogue to digital. Every time information gets trans*mitted from an environmental sensor to a digital device — sound waves into audio files, optical variation into heart rate — trans*duction has occurred, and thus some kind of trans*formation. (Note how many times trans*-ness appears in sites of cybernetic knowing.) These reimaginings of information's forms are always interventions,

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[8]Trans*disciplinary includes multidisciplinary and interdisciplinary — across and combined and between — plus what emerges when those diffractions become more than the sum of their parts (Vis 2021).
[9]As in "teaching that enables transgressions – a movement against and beyond boundaries" (hooks 1994).

informed by the device designers' decisions as well as both contemporary and historical approaches to computational knowing. The material conversions required to power the logics of computation (turning qualities into voltages into quantities) all pass through gates of trans* thinking.

2.1.3 * (asterisk)

The * after `trans` longs for anything that follows; it opens up space for the layered and undefinable becoming, and as such can include anyone who wonders if they belong, who wonders what they contribute, who wonders what "this whole thing" is about (be it gender, sexuality, technology, whatever).

Combined with trans, or at large, the asterisk is the interstitial. It is a footnote that defines our terms, and also it is the invitation to extend beyond any definition given.

The asterisk is a perturbation, a pebble in the shoe. In the German language, the gendering of nouns and verbs is haphazardly addressed by an asterisk that breaks the word, introduces a glottal stop between its 'masculine' and 'feminine' formations. `Student` or `Studentin` becomes `Student*in`; `Bäcker` or `Bäckerin` becomes `Bäcker*in`. This brief interruption can be read as a faulty solution that maintains gender-as-binary, it's true. And also, this hesitation adds a frequent awkwardness that highlights how often conversation is about gender unnecessarily. It physically opens up a space (in the mouth) where gender is unknown/unstable/all.

A French or English apostrophe may mark an omission of letters, but this elision also joins together, suturing up the distance it creates. The asterisk shares this tension here, as a clot that heals, an unspeakable but audible gasp.

Like the apostrophe at the start of `'pataphysics`, which gestures to the absurdity from which it springs, the asterisk is the instigator and the multiplier, the pivot and the punctum and the portal.

It is not the data point, reduced to numerical expressivelessness. It is not the node in the network, defined by its links and relations, abstracted away. It's not a redaction which the asterisk marks, but the possibilities of unknown language underneath. Or the tension of knowing and not saying, as in the marking of `sw*@r` words. [Again, queer as a politics, "queer as in fuck you."]

The asterisk is risk (just a step), is starry-eyed, A-star pathfinding, ASCII joy, a wry smile, and a mark of possibility on a treasure map. In mathematics the asterisk is duality, mirrors mirroring each other,

points connecting to make lines and lines crossing to make points, weak-star topologies [10] and infinite vector space. This returns us to the word vectors and latent spaces of transformers.[11]

2.1.4 Formative

What is formative shapes us. Our early experiences make us who we are. These are the foundations we can't see, the scaffolding of our thought, the infrastructures of our being. I am interested in the formative aspects of sociotechncial systems, produced in entangled loops of human networks, codified language, and rare earth. How we become. How we become with and through sociotechnical systems.

Each of the works [that follow/collected here] asks: What are the fundamental assumptions that go into the design and implementation of a dataset, a machine learning system, or programmers themselves? What are the formative assumptions underlying any technology or way of being? These works tease out the metaphors we have relied on so long we can no longer see them; they ask what other metaphors might make space for new forms or reforms.

Form in-forms content. The shape of the container decides what can fill it. [I work in code and in art because I believe:] If I know how to make forms, or even platforms, not only the content to plug into existing forms, I am more free to work both form and content in iterative, ongoing relationships. This is how I knead the dough — form and content and form and content and form. They are inseparable.

In this way, the material I work with also in-forms what I make, through its insistence, resistence, grain, thread tension. It in-forms itself into content as I try to bring forth some kind of form. It also re-forms me through this mutual process:

"In both carpentry and textiles, the form of a thing does not stand over it or lie behind it

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[10]With thanks to Miller Puckette for expansive discussions about weak-star topologies, splines, the asterisk, and Claude Shannon.

[11]As of this writing, the newly announced Q*, Open AI's latest project, promises again to accelerate machine learning before addressing its current concerns (Milmo and editor 2023), at the same time as "The Gospel" AI system is used in Isreal to select and increase its bombing targets [hand over fist] (Davies, McKernan, and Sabbagh 2023). [The snake eats itself, the war tech that was being developed at the same time as the beginning of AI, now AI being used for war.] (Warning of the future dangers of AI is a marketing strategy (GPT-2 was a 'too big and too dangerous to release technology and GPT-4 is pay-to-play) and worse it is a distraction from the current dangers they impose, like The Gospel and in more subtle forms.)[XXX]

but emerges from this mutual shaping, within a gathering of forces, both tensile and frictional, established through the engagement of the practitioner with materials that have their own inclinations and vitality." (Ingold 2015)

Form activates. No form is neutral, although if we use it long enough we begin to look through it, like the blank page, or the MS Word 'blank page'. Each interface or material enables or encourages particular experiences and outcomes, and denies or deflects others — whether through predictive text in search, syntax highlighting in code, or the constraint of an eight-page paper zine. Some forms invite us to collaborate in imagining the usefulness of their limits and the boundlessness in their constraints. [Through time spent in process, working with and against form, our focus can shift from producing outputs that meet the brief of the form, to working with the form to reshape both the form and ourselves in new understandings and new orientations.]

Yet current modes of computational logic are not mutually constitutive in trans*formative ways. Instead, they impose form on us as data subjects and subjectees. Computation requires information to take any output formations. Its orderly logic is a shape imposed by and reflecting the world. It requires contortion to represent us. As media theorist Sarah Sharma reminds us, for the 'Broken Machines' who do not quite fit these regimes, "to represent is also to be filed away" (Sharma 2020).

"In order to understand and thus accept you, I have to measure your solidity with the ideal scale providing me with grounds to make comparisons and, perhaps, judgments. I have to reduce. [...] perhaps we need to bring an end to the very notion of a scale. Displace all reduction. Agree not merely to the right to difference but, carrying this further, agree also to the right to opacity that is [not enclosure within an impenetrable autarchy but] subsistence within an irreducible singularity. Opacities can coexist and converge, weaving fabrics. To understand these truly one must focus on the texture of the weave and not on the nature of its components. For the time being, perhaps, give up this oid obsession with discovering what lies at the bottom of natures. There would be something great and noble about initiating such a movement, referring not to Humanity but ta the exultant divergence of humanities. Thought of self and thought of other here become obsolete in their duality. Every Other is a citizen and no longer a barbarian. What is here is open, as much as this there. 1 would be incapable of projecting from one to the other. This-here is the weave, and it weaves no boundaries. The right to opacity would not establish autism; it would be the real foundation of Relation, in freedoms." (Glissant 2009)

To understand through computation is to reduce to categorization's logics (Crawford 2021; Amaro 2022). The formative structures we create (taxonomies, schemas, ways of knowing) support unknowing. They ease and smooth passage through our days and our systems. This is why we must imagine new forms — and this is why it is so hard to imagine new forms.

Code forms, then calcifies. Pattern turns to template. In the procedures of object-oriented programming languages, the pattern runs: `init --> name --> get --> set`[12].

> "The more a path is used the more a path is used. [...] When an effort becomes normal, a form is acquired." (Ahmed 2018, 2006)

If forms shape content, and vice versa, of course tools also shape forms. Equipping ourselves with the knowledge, resources, and agency to make the tools (to make the platforms to make the forms to make the content) is necessary for a more holistic approach to researching formative tech and creating trans*formative tech. Toolmaking includes collecting sets of tools, documenting and creating guides to existing tools as well. It also includes the infrastructures and support systems necessary to make any of these practices possible.

> "tools and infrastructure are not only the preconditions for the work; at their best, they are also part and parcel of the work, deeply integrated into its methods and outcomes. Our tools and infrastructures are rich objects to think with." (McPherson 2018)

> "instruments develop through engaged and contingent practices. Instrumentalism involves setting in motion, operationalizing, and potentially transforming. Instruments—whether in the form of concepts or sensors—are instrumental to the unfolding, the doing, and the transforming" (Gabrys 2019)

We think with our tools, instruments, sensors and the surrounding systems that enable them and maintain them. All of these layers are entangled. Susan Leigh Star calls infrastructure a "fundamentally relational concept," but one that despite its embeddedness operates invisibly unless

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[12]Creating classes in object-oriented programming lets the programmer instantiate each instance of an object with a pre-determined form, adjustable only within those limits. These processes indicate what prior schemas you'll pull from, what parts you'll write over, what qualities you'll predetermine. They indicate what aspects will be qualities of the entire class, and what qualities will be specific to each object. They determine what actions each 'object' will 'know' how to do, and how the programmer or user will establish and retreive information. There's a language for all this in "object-oriented" programming, which requires a different sense of relationality than "functional" programming.

broken. She also argues that infrastructure marks membership in relational groups, as we "acquire a naturalized familiarity with its objects," practices, and standards (1999). Thus infrastructure — and the tools, platforms, forms, and content that it consists of — also marks us as belonging, knowing, capable, welcome, or not.

How do we think critically through re/making infrastructures, when they exist beyond any one of us, always relational and often invisible? By returning to, and reattuning to, the solidarities we find within and across communities, and the frictions we find within and across materials.

Those who are left unsupported by infrastructures, those who are left out of representations or who are targeted disproportionately by digital systems, already know in deeply embodied ways about the friction they feel as they move through systems that do not easily contain their forms. Scholars Aimi Hamraie and Kelly Fritsche, authors of the "Crip Technoscience Manifesto" (2019), call these infrastructures "frictioned technologies" and emphasize:

> "the skills, wisdom, resources, and hacks disabled people utilize for navigating and altering inaccessible worlds. In pushing crip technoscience as a field of research and a practice of critical 'knowing-making', we conjure frictional practices of access production, acknowledging that science and technology can be used to both produce and dismantle injustice." (2019)

Their manifesto reminds us that disabled people are not minoritized users of technologies created by experts but instead are experts themselves at actively adapting technologies to their needs. [This holds true for many other minoritized communities as well.] By centering their community as knowledge holders and creators, and by seeing "interdependence as a political technology," they shift the design goals for technology. Rather than outsiders providing services to achieve normalized individual independence, they reorient toward kinship building (2019).

Louise Hickman's ethnographic work on the ethics of access foregrounds access workers' key role in the production of crip technoscientific knowledge. She examines the highly customized dictionaries developed by her own Communication Access Real-Time Translation operator working in academic spaces, in order to show how their captioning work for the d/Deaf and hard of hearing community is "both the practice of crip technoscience as well as its product." Hickman highlights the collaborative, embedded nature of the work and the crip technoscience emphasis on "knowledge-from-below." (Hickman 2019)

Thus, form is always forming from within complex systems of interrelation. Formative and transformative technologies are more (and less) than their forms. They must emerge on our own terms — from the formats and methods of the communities they serve, with our values, goals, and approaches leading the way.

Interdependence has been my intuitive compass, my frustration and fascination, for as long as I remember. I have searched for the means to describe this feeling, through art, literature, touch, and other means. Slowly and repeatedly, I keep finding that the best resources for describing this sense of interdependence come from Indigenous sources. I keep returning to the realization that `Interdependence is indigenous knowledge.`

> "an object or thing is not as important as one's relationship to it. [...] reality *is* relationships or sets of relationships." (Wilson 2008)

Fundamentally reorienting our understanding of objects and knowledge and ourselves as consituted by our relationships necessarily also reorients our work and the forms it takes, in deeply formative ways. Re-prioritizing relationships fundamentally reshapes the forms and functions of research, artmaking, valuemaking, worldmaking. To see form (shape, object) as relation (connection) is to position it in time and place. It is also to take "form" from its noun form (shape, object) into its verb form (mold, press, begin to exist). [As Erin Manning says of the spiral, it is "more duration than form" (Manning 2013).] Like all verbs, then, the verb form implies subjects — the entities enacting and impressing a form into being, responsible for it, caring for it. Relationships. [This negates object-oriented ontologies and object-oriented programs that want to encapsulate and abstract away objects' entanglements with the world.]

> "There can, of course, be no knots without the performance of knotting: we should therefore commence with the verb 'to knot' and view knotting as an activity of which 'knots' are the emergent outcomes. Thus conceived, knotting is about how contrary forces of tension and friction, as in pulling tight, are generative of new forms. And it is about how forms are held in place within such a force-field or, in short, about 'making things stick'. Accordingly, our focus should be on forces and materials rather than form and content." (Ingold 2015)

To frame research through relationships is also to foreground accountability by asking, as Shawn Wilson offers in *Research Is Ceremony*, "What am I contributing or giving back to the relationship? Is

the sharing, growth and learning that is taking place reciprocal?" Wilson says that in an Indigenous Research Paradigm, "What is more important and meaningful is fulfilling a role and obligations in the research relationship—that is, being accountable to your relations" (2008).

In this sense of reciprocity, the question of form takes shape as an offering. What does our creative work offer back, and in what form will that offering be most legible and accessible? Some forms I have tried: manifesto, toolkit, zine, prototype, platform, black box, machine, labyrinth, server, service, sentence, story, interface, guide, document, cauldron, process.

As form moves into its verb shapes, identity too moves into practice. Johanna Hedva marks this as a pivot from identity politics to practices and methods, inextricably coupled as theory-practice:

> "Disability, queerness, open source — not as identities, or groups I belong to, but as modes of doing, of how I practice myself. Being an outsider means that the question of theory and practice — how practice is affected by theory, how theory is constructed by practice — becomes the most important one. Membership to particular groups and experiences is often predicated on the visual — whether someone 'looks like' they belong or not — which means that my membership to most groups must rely on something else. My belonging has more to do with how I enact that group's politic" (Hedva 2018)

Our being-in-process is both the means to "be" (prefiguratively) and also the means of being-in-relation, -in-politic, -in-identity, in-between.

> "this form is really just the web of relationships that have taken on a familiar shape. Every individual thing that you see around you is really just a huge knot-a point where thousands and millions of relationships come together." (Wilson 2008)

> "a node of relation expressing itself momentarily as this or that—an edging into object, a swerving into body." (Manning 2013)

I dream of a form that can hold everything. A form that can reveal how each part is connected. No parts, no compartments. Just connections.[13] Network graphs don't do it for me. Anna Munster

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[13]I dream of a platform where I can write and code and share and cite and annotate and highlight and collage and print and remix and machine-read and connect. [In my dream notes, I have written "semantic web layer cake?" and "Gollum platform?" I rarely imagine I am the only one imagining such things, until I try to explain them to others. I expect it to be easy, that these hybrid forms already exist — becaue they seem so small and obvious to me, how complicated could they be? But when I try to find some preexisting version, I come up empty, frustrated, confused. And I am left without tools or language

suggests that the form of networks numbs us to their relationality. Because every network looks like every other, in trying to understand a system by depicting it as a network, we lose sense of what's within. Munster suggests focusing less on `forms` and more on `forces`: "the closures and openings of relations to one another. It is at this level of imperceptible flux—of things unforming and reforming relationally—that we discover the real experience of networks" (Munster 2013). The un/forming of relationality, these trans*formative practices are active, ongoing, prefigurative, emergent, embodied, and embedded — taking shape and making change.

> "Relation is open totality; totality would be relation at rest. […] Relation is movement."
> (Glissant 2009)

Just as a paper snowflake or a tie-dyed garment contains in its pattern the re-foldable traces of its making — a flattened, temporarily static version of its coming-into-shape, marking the places it once touched against itself as it held different forms (Sedgwick 2012) — trans*formative technocraft aims to "decipher the history of the making" and the future shapes it might take.

2.2 TechnoCraft

2.2.1 Techno-?

Technosolutionist… Techno-optimist… Technodystopian… Technocrat… Like 'cyber' before it, the prefix 'techno' teems with possibilities and portends varieties of doom. Bubbling experiments and launching spacecrafts, self-driving vehicles and buzzwords like 'big data' dominate the imaginary while signaling in-groups and out-groups, zones of mystification and fear, as well as economic opportunism and exploitation.

Yet, tech begins with techne, begins with texture and fiber, begins with the meshy matrix that sustains us (Plant 1998). Tech means any tool. It means not only clay tablets but the tools of language becoming discrete objects: the change from a chorus of cycling breath to individuated letters written on divided pages with simple handtools (Carson -07-14 2014). It includes the histories of technology erased and rewritten by narratives of conquest and power (Crawford and Joler 2023). It includes unseen technologies of passing, of obfuscation, of survival (Browne 2015; feministkilljoys

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to begin building such a connected and connecting form on my own.]

2018; Gaboury 2018; Brunton and Nissenbaum 2015; Keeling -01-22 2014). Tech includes craft and crafters. Tech includes us. It comes from us.

Though "TechnoCraft" reads like an oxymoron, technology-as-craftsmanship is nothing new. In an ethnography of AI developers, Lucy Suchman and Randall Trigg referred to artificial intelligence as 'craftwork'. In what they called "socially organized craftsmanship," they saw "the work of designing intelligent machines as a specific form of social practice - a form made the more interesting by AI's own concern with the delegation of social practice to machines" (Suchman and Trigg 1993). Suchman and Trigg invoke craft as an opening for critique, noting the distance between the formalist constraints on AI problem design and the innumerable variables of its real-world applications.

Here, I apply craft lenses to tech concerns both as a critique and also as a return. TechnoCraft, here, is an expression of the theories, ethics, and tactics of intersectionality and sustainability, grounded in tangible practices which grow out of community. Re-binding craft to technology evokes slow, circular, cooperative, inclusive, caring practices that can transform materials and practitioners alike.

Here, I invoke the phrase "TechnoCraft" to bring technology off its awe-inducing pedestal and put it back into our hands — recalling the human agency, access, and scale which emerging technologies [always-already] require. Reframing tech as craft moves the focus of technologies like programming and machine learning back onto their practitioners and their material relationships. Physicist and activist Ursula M. Franklin compares "holistic technologies" like artisan crafts which center on the practitioner, to "prescriptive technologes," which are focused on production, scale, effectiveness and management. She says that under the effects of prescriptive technologies, "we live in a culture of compliance, that we are ever more conditioned to accept orthodoxy as normal, and to accept that there is only one way of doing 'it.'" Meanwhile holistic technologies require muscle memory and instinct; they allow the practitioner to "draw on their own experience, each time applying it to a unique situation" (Franklin 2004). Pairing 'tech' with 'craft' returns focus to the human-scale aspects of the technological imaginary, from the labor required to produce and maintain technological objects, to the impacts and harms it produces as part of human-driven sociotechnical systems, to the knowledge adapted (and co-opted) from unacknowledged domains and communities of practice.

TechnoCraft remembers that technology are procedures and protocols, as well as tools and materials. Franklin frames technology as a practice: It is the way things are done, not only the tools with which they are done — a system that includes "far more than its individual material components. Technology involves organization, procedures, symbols, new words, equations, and,

most of all, a mindset." This shows technology's deep link with culture (Franklin 2004). While the English language separates object from practice from person, in German, `die Technik` means both 'the technology' (object) and also 'the technique', 'the method', or 'the procedure'. In Spanish, `la técnica` means all of these, as well as the 'the engineer' or 'the repairwoman'.

TechnoCraft remembers technology is made through practices, by people and for people, meant to care for people, and we can learn from people in its making and implementation. Holding these [components/correspondences] in relation lets us examine and address the issues of technologies more comprehensively and holistically:

> "It is in these mechanisms, logics, techniques, and practices, not merely in the machines, that we must locate our current predicament. And it is in these that we shall find surprising connections that locate differently." (Dhaliwal 2022)

TechnoCraft remembers how to operate by slow consideration in and for community, in contrast to ego-driven technocratic prostheletizing that believes technology can fix technology by moving faster and breaking more.

TechnoCraft places the seemingly contrasting terms 'tech' and 'craft' together to show how they are not contradictory, after all. TechnoCraft can be analog or hybrid, systems-oriented, process-oriented, human- and more-than-human. Technology and Craft are two complementary approaches, two aspects of the same effort that build on one another.

> "a craft approach to digital technologies supports intuitive practice that operates creative and aesthetic knowing, leading to technical or scientific insight and ultimately innovation." (Nimkulrat, Kane, and Walton 2016)

2.2.2 What craft allows

Many have paired code with craft, or talked about the similarities of knitting or weaving with programming. Yes, TechnoCraft celebrates these similarities and wants to decontextualize the linear histories of computer programming, but also wants to push this argument further. It argues that not only should we bring craft's materials into coding spaces, but also we should bring craft's ethos and ethics into coding spaces as well. It's not enough to weave electronics into our fiber arts as a way to build technical literacy; we need to weave intersectional methods and mindsets into technical

arts. Craft carries many of these methods and mindsets in its material culture. This section will discuss a few of these aspects.

Focusing on craft means noticing the material, handworked, skilled, tinkered, iterative, process-oriented, embodied (intersectional) practices of knowledge and production that technologies emerge from. It means noticing how such practices can intervene in existing technologies and reshape emerging ones. It acknowledges human choices; built skills, tacit knowledge, and material needs; networks and communities of practice.

(First, a note on what craft is not)   While this text aruges for craft as a materialization of intersectional theories, ethics, and tactics, which can help apply them to emerging technologies — craft is not the only way to do intersectional practice, and not all craft is intersectional practice.

Craft includes many forms, from fiber arts to woodworking to programming to writing — but craft here refers to practice, process, making, and learning, rather than mastery over a skill in order to gain status or maintain status quo. In contrast to process-oriented crafting, performance artist and poet Fargo Nissim Tbakhi says that literary craft "is a counterrevolutionary machine." High-art notions of craft use "aesthetics" to refine work toward the polite and proper, in order to rob them of political power. Tbakhi explains:

> "The Craft which is taught in Western institutions, taken up and reproduced by Western publishers, literary institutions, and awards bodies, is a set of regulatory ideas which curtail forms of speech that might enact real danger to the constellation of economic and social values which are, as I write this, facilitating genocide in Palestine and elsewhere across the globe. [...] Craft is the process by which our own real liberatory tools are dulled, confiscated, and replaced. We believe our words sharper than they turn out to be. [...] what Craft does to our writing: pressures and pressures until what matters, what we need to say, gets pushed to the margins or disappeared entirely." (Magazine 2023)

Tbakhi speaks of craft that responds to (and enacts) institutional measuring, monitoring, regard, and power. This is the craft of euphemism and nihilism. Such craft is the milquetoast technical fix to machine learning's 'fairness' problems that replaces offending text like 'dyke', because it cannot tell the difference between a slur and a community. It replaces offending text with boilerplate diversity speak that comes out both toothless and simultaneously 'too woke'. It replaces offending text but

offers nothing intsead, and the chasm that remains is all some of us get to know of ourselves from generative AI systems. I agree with Tbakhi about this kind of craft, when he says,

> "Craft is what keeps us polite while the boot is on our neck or on somebody else's. And we cannot afford that, not now and not going forward." (Magazine 2023)

But craft need not stay polite or straighten its rough edges. "Anticolonial writers in the U.S. and across the globe have long modeled alternative crafts which reject these priorities, and continue to do so in this present moment. Yet Craft still haunts our writing" (Magazine 2023) Despite this haunting, other engagements with craft — craft as community, craft as lineage, craft as experimentation, craft as resistance — can also help us to reject the institutional and infrastructural claims to our voices.

Reclaiming craft does not mean [becoming/focusing] so small that we cannot be effective nor so precious [about aesthetics] that we lose the cause. It does not mean a return to luddite nostalgia: Everything was *not* simpler in the past, except for the few people who held more power over others (same as now). Reclaiming craft from its feminized, domesticized, racialized pejoratives and applying craft as a lens for technology practices means embracing its scrappy imperfections and [revolutionary] potentials.

Scale   Craft scales much differently than a machine learning system, and these frictions can be used for aesthetic investigation and activist resistence. Detailed hand labor is a critical tactic available to tackle the seemingly insurmountable scale of the increasingly giant datasets, obscured models, and complex infrastructures. For example, Everest Pipkin viewed every single video in a large dataset over the course of months and turned this labor into a series of artistic investigations (Pipkin 2020). At the Knowing Machines research project (I discuss my work with them more in the "Formative" section), interdisciplinary researchers from journalists to programmers to lawyers work together to create tools to explore changes in foundational image datasets like ImageNet (Crawford et al., n.d.). These practices apply human-scale attention to machine-scale systems in order to reveal their obscured innerworkings. Just because a system is larger than life does not make it impossible to apply human techniques to investigate it. While the gargantuan computational scale makes it more tedious, this human-scale labor is still an incredibly important response for understanding and confronting algorithmic harms.

For Eve Kosofsky Sedgwick, texture is a way of talking about the space between dimensions or scales, or the transition between them. I have found her metaphoric comparison useful and have extended it to machine learning: * From point to line to cube to cube in space-time to multidimensional universes of vibrating strings. * From ball to string to loop to fabric to garment. * From scalar to vector to matrix to tensors in many dimensions.

Sedgwick describes the many directions of touch and contact across a surface and between dimensions, warp and weft of all kinds. She builds on this a theory of relationality, which understands the reciprocity of contact, the reciprocity of creating and being, and the fractal nature of scale:

> "the sense of touch makes nonsense out of any dualistic understanding of agency and passivity; to touch is always already to reach out, to fondle, to heft, to tap or enfold, and always also to understand other people or natural forces as having effectually done so before oneself, if only in the making of the textured object." (Sedgwick 2012)

Here Sedgwick connects the experience of making craftwork with experiencing the made craft, with touching and being touched by, and with multidimensional sense and scale. I also see this as a way of understanding machine learning modeling through new, non-hierarchical metaphors of TechnoCraft. What is the scale and dimensionality of machine learning? Does it "dramatize its dimensional betweenness," as Sedgwick describes the way a folded dyed fabric or a paper snowflake, once unfolded, retains the memory of past shapes? (Sedgwick 2012). Or Ingold similarly describes the way once knotted ropes retain their bends: "But the knot remembers everything, and has everything to forget" [Ingold (2015)][, and Laura Marks says "electrons remember" (Marks 2002)]? These material memories, as marks of their current and past states simultaneously, could be tangible metaphors for understanding machine learning, or even quantum computing (folding was a fascination of quantum physicist David Bohm). They show that, when working with any material, the material works back.

Thinking through technology with a TechnoCraft lens opens more points of reference for addressing complexity and complex systems that prexist the emergent techonlogies we are encountering now. It reminds us that we can slip between scales to find apt materials and metaphors for grappling with the complexity of systems more approachably and sustainably. Movements across scales, and finding the spaces between and resistances to scale, are also useful explorations. What gets lost in

the increase, and what is gained (to whose benefit) as we move either direction?

> "human care can't scale up. Care happens in small-scale moments of human interaction; scale is achieved by tireless and impersonal machinery" (Seaver 2021)

> "As hand knitting inclined to the margins as a [large-scale] viable manufacturing process, it was its long history of connecting people with their environment that came to the fore—from material source to the makers' largely unwritten generational knowledge of patterns and techniques—in clearly locating the craft of knitting against distinct communities and indigenous practices." (Steed in Nimkulrat, Kane, and Walton 2016)

Sustain(ability)

> "The mere act of owning real tools and having the power to use them is a radical and rare idea that can help change the world around us." (Schwarz 2010)

Craft suggests more time spent with one's objects and materials — allowing for repair, error, and air. For woodworker Christopher Schwarz, it means simple tools known well, a small collection of tools in a toolbox that can be carried with you anywhere in order to complete your work, providing freedom and autonomy (Schwarz 2010). It accumulates through simple gestures repeated until they become habit (muscle memory, durational practices, implicit knowledge), repeated until they become complex patterns (quilts, quines rice kolams), repeated until they make space for other things to happen in their presence (sewing circles, hacker spaces, political action). Imagine a simple machine learning tool as easy to pick up as a garden trowel. Would this be an all-purpose 'multi-tool' like today's resource-hungry giant language models? No. But its users would have freedom to imagine their own goals and outcomes from a broad range of possibilities they design themselves. Imagine if machine learning systems were built from these operating principles instead of requiring such massive financial resources, natural resource, and human resources to operate that only a few huge conglomerates can particpate in their creation.

> "the pre-Industrial craftsman didn't seem to have secret tricks as much as he had lots of opportunities to practice and become swift." (Schwarz 2010)

Builder Alexander Langland returns to the older definition of 'craeft' as a lifesustaining skill built over generations. He sees craftwork as holistic interrelation rather than individual objects or skills. He

says, "Crafts have always been determined by the immediate environment, and indexed to the resources of the natural world." Imagine if we saw technology's global supply chains as the integrated lifecycle of care that Langland describes, which starts with:

> "tended landscape > sustainable production of raw materials > intelligently processed > beautifully made > fit for purpose > fondly used > ingeniously reused > considerately discarded > given back to the earth" (Langlands 2019)

> "Casualized labor begets commodity toolsets, frictionless and uncritical engagement with content, and shallow practices of use." []

Infrastructures of care   Approaching technology through the lens of craft slows it down and asks it to sustain. It also [organizes people, labor, and relations] differently. Anthropolgist Gabriella (Biella) Coleman aligns hacking with crafting, focusing on the "intellectual guile" required for both and the guild-like communities that form. "[A]ll hackers fit the bill as quintessential 'craftspeople,' [...] Even if craftspeople tend to work in solitude, crafting is by definition a collectivist pursuit based on shared rules of engagement and standards for quality" (Coleman Tue, 06/07/2016 - 12:00). Consider the transfeminist server, which approaches its technology as a crafted, social, interrelational object:

> "rosa [travelling server] is not only constituted in hardware or sotware, but also the multitude of relations that are created around the making, maintaining and passing on of this infrastructure: the processes that are performed, the affective charge of their actioning, the community around them." ("A Traversal Network of Feminist Servers" n.d.)

Feminist servers run slowly. Sustaining them takes "years of intense collective learning," replete with uncomfortable tensions and messy differences. These very ambivalances, argues Ines Kleesattle, are crucial for Feminist Server Art, because they demonstrate the relational labor going unseen in other approaches to technology. "All kinds of infrastructures involve service, maintenance, and care labor" (Kleesattel in (Sollfrank, Stalder, and Niederberger 2021)). When giant data centers run in a far-flung artic landscapes, and large language models siphon water and energy and human effort for their training, these "cloud" technologies are not ephemeral or immaterial – and feminist projects move slowly to enact the material, relational stakes in all digital interactions, to show how they might be organized with more awareness and care.

In "A Traversal Network of Feminist Servers," six communities Constant, varia, Hypha, Lurk, Esc Mkl,

Feminist Hack Meetings. Additional projects in the spirit of or related: Open Source Kitchen, Anarchaserver. connected to discuss their feminist infrastructure projects, which ask questions such as:

> "How can the labour behind hosting be made inclusive, convivial, shared, visible not only in moments when things go wrong? In what ways does the language embedded in server administration influence the practices and interactions around it? How can servers be pedagogical spaces for experimentation for those with different knowledges?" [varia email list 28.11.2023]

Craft requires taking care and caretaking, as does technology. Transfeminist infrastructure work shows how the logics and ethics of craft – especially its domestic and feminized aspects – emerge out of intersectional feminist approaches and apply to technological questions. To consider technology as entangled with its affective and labor relations, as feminist infrastructures do, resituates tech back into a variety of communities of practice and reframes its relationship to caretaking. Although many have looked to technological solutions like bots to address issues of labor and caretaking, more often technology itself requires caretakers and creates more care labor. To respond to this, feminist infrastructures show how care is generated through human networks and how care might also be generated in, rather than depleted by, digital ones. They place technology within a circuit of human relations rather than as a replacement for it.

> "The point is not only to expose or reveal invisible labours of care, but also to generate care. [... G]enerating care means counting in participants and issues who have not managed or are not likely to succeed in articulating their concerns, or whose modes of articulation indicate a politics that is 'imperceptible' within prevalent ways of understanding." (de la Bellacasa 2011)

Along with the traveling Raspberry Pi server "rosa" that acted as their working hub, the Traversal Network project culminated in a print and digital publication that reflected on the different groups' shared and diverse approaches. By choosing "low-effort publishing tools" like varia etherdump, by providing strategic services like analog infrastructure for mutual aid, as well as digital infrastructure like hosting archives and zombie sites of ongoing work, feminist servers like Anarchaserver create and codify solidarity networks using multiple mediums and tactics. These are forms of "feminist convergence" that embody their values through their choice of methods and material offerings:

> "For us feminist infrastructure enables the systematization, the maintenance and the
> circulation of good ideas, practice and care. For us, solidarity networks are an example of
> feminist infrastructure. And we think it represents one of our earliest feminist
> technologies, perhaps the oldest and the most widespread."
> ("ATNOFS-Radio-Broadcast-Spideralex-Danae-Tapia | Variapad!" n.d.)

For infrastructures of care, communities themselves are the essential networks; the servers,
databases, workshops, services, both digital and analog are all tools toward building and means of
expressing those community networks.

> "The internet can bring us very close, yes, but it is even better to meet *cuerpa*-to-*cuerpa*.
> The presence of the others gives us the feeling of ecstacy, makes us float. Meeting gives
> us power and energy, facilitates processes, and intensifies networks of trust and
> cooperation. Sometimes we converge in our disputed territories, the street the networks,
> and the servers, and other times in places where we can create spaces of security,
> confidence, and relaxation." (Spideralex in Sollfrank 2018)

Access & boundaries   Credit: USC Libraries ONE Archives

A variety of forms and modalities allows for more kinds of access. Craft, and other means of creating
forms, helps imagine what access is possible and who might be missing out. For example,
zine-making and zine distribution networks precede digital networks, provide models for digital
practices while subsisting alongside them. This publishing craft is a counterinfrastructure used to
build counterpublics and underground communities, to create counterarchives or living texts
(Adema 350AD), and to clarify information to new audiences. Feminist media historian Cait
McKinney's research into underground lesbian networks, both analog and digital, shows that
"lesbian-feminist information infrastructures are built and sustained through networks that facilitate
collaboration and resource-sharing amid precarious conditions" (McKinney 2020). Marginalized,
precarious conditions of queer communities has called for interventions by alternative means.
Graphic designer Paul Soulellis, who maintains the Queer Archive Work project, suggests that zines
are archives of crisis: "evidence of queer life persists in the urgent artifacts that emerge in crisis —
artifacts that arise expediently as part of efforts to advocate for slowness, care, mutuality, queer joy,
pleasure, refusal, and community" (Soulellis 2023). The precarity of these communities requires
more care and more flexible materials, and it also facilitates innovation. McKinney argues that "ways

Figure 1: zine page from ONE Archives

of thinking digitally about information were embedded in lesbian-feminist work with paper, in the ways lesbian feminists learned computing and imagined and built networks and databases for storing and sharing information" (McKinney 2020). Such innovation continues today in the alternative uses of digital networks seen during protests like Arab Spring, as well as in the continued use of analog zines to discuss technological objects like machine learning (in the Intersectional AI Toolkit or in Elvia Vasconcelos's "A Visual Introduction to AI" (Vasconcelos n.d.)).

Zine publisher, activist, and artist Be Oakley says that part of the appeal of the zine is that the zine form allows for more egalitarian access across economic boundaries: "A zine is made to be disseminated to publics otherwise forgotten by hardcover books. [...] Class is built into its format. A zine communicates a level of accessibility through its materials and its form. [...] A zine evokes a legacy of authorship that is not exclusively written by straight, cis, white men. [...]" (Oakley 2023).

Providing more access can also enable more nuanced access, by setting access boundaries. Take for example the work of Local Contexts, who help Indigenous communities protect their data rights by creating tools to inform researchers of their boundaries. They offer data labels that help researchers understand how data are meant to be used (and not used) according to more granular criteria. Rather than using a simple license agreement, which does not address their needs, Indigenous communities can reinforce their rights by applying "Traditional Knowledge" and "Biocultural" labels to data and collections, which provide context, provenance, metadata, protocols, and permissions for use. These include designating specific community members or times of year for access, or designating materials as sacred to the community or open for collaboration. Local Contexts also provides notices for researchers and institutions to contextualize their collections with labels like "Authorization," "Belonging," "Caring," "Gender Aware," "Leave Undisturbed," and others ("Local Contexts – Grounding Indigenous Rights" n.d.). The expansiveness of the forms that a Craft lens can take means that more communities can participate, but more importantly more communities can participate by creating their own terms and contexts for participation.

Legacies & contexts

"Written out of an official history which draws them in as its minor footnotes to itself, cloths, weavers, and their skills turn out to be far in advance of the art forms digitization supersedes." (Plant 1998)

Technology, as reframed through intersectional and craft lenses, is is always contingent and contextual. *TechnoCraft* honors historically dismissed and feminized practices of craft — which emphasize process, duration, ongoingness, community — and aligns them with the aspects of technology which frequently get overlooked: namely, the contributions to the materiality of tech from the global majority and Women of Color.

> "Our bodies are archives and sites of memory that cannot and will not be overwritten, despite technological attempts to render them as such." (Aliyu 2023)

TechnoCraft attends to the counterhistories still alive in our present technologies and potentially reemerging in many futures. These include Hilda G. Carpenter, a Black lab technican whose "core rope memory" techniques advanced computing and supported the Apollo moon landings, by physically encoding information using copper wire and rings. Author Zainab Aliyu compares Carpenter's physical memory-weaving processes to the Yoruban oracle system called Ifá, which also uses binary encoding and draws on "collective memory" for divination(Aliyu 2023). American Artist details the history of the graphical user interface (GUI) as a turning point in the history of computing, at which point screens changed from black to white. This was when the "user" was defined for the stated purpose of easing use, but this also narrowed and limited use, enacting white supremacist values: "Blackness has, so to say, formed the ground for white, with black gooey being antithetical to the values of the white screen" (Artist n.d.). Those with more power have frequently appropriated knowledge or extracted labor and resources to develop technologies, such as the recruitment of Navajo women to 'weave' circuit boards for IBM (Nakamura 2014). Such examples open the unacknowledged archives of technology that connect to craft, to ritual, to community in order to — as Xin Xin and Katherine Moriwaki say — perceive "history as a messy entanglement rather than a linear graph" (Shih and Moriwaki 2022).

These entanglements wind through material and conceptual spheres, which micha cárdenas demonstrates with her description of the stitch as emblematic of lived intersectional feminist work and of all practices of craft and technology:

> "As sewing is a technique of making that has been used primarily by women throughout history, and continues to be primarily the task of women in sweatshops in the global South, [...] the stitch as a material and conceptual operation can be seen as feminist, a way of generating new concepts by learning from people who have been subject to

material inequalities because of their gender, their race, and their geographic location. The stitch can be thought of as the basis for a theory of feminist making, which values the forms of knowledge practiced daily by oppressed people as they make their lives in the face of violence." (cárdenas 2016)

Technocraft expands the definition of what "counts" as creating or participating in technology, including what labor is valued in the accounting of it. It destabilizes static ideas of technologies and their outputs as infallable and handed-down, by reminding us they are in fact crafted by people and contingent on contexts. The invisible labor of data creation and data maintenance is no different from the invisible labor of infrastructure in this way. Yanni Loukissas argues for the inherently "local" nature of data, saying that "data-driven systems [...] are locally contingent and even fragile. Designs dependent on data must be maintained and repaired on a regular basis to ensure that they are in sync with changes in the data themselves or the encompassing infrastructure of the place. [...] When data do seem to confer transparency, it is because we are shielded from important details about the context of their creation or display" (Loukissas 2019). Loukissas suggests the term "data settings" instead of "data sets" to emphasize the ways data are always shaped by both their creation and their use. He argues for remembering how data always index something else and are themselves incomplete. This destabilization of data helps to recall their human impacts, and it asks us to care for them responsibly within their shifting contexts as part of various communities and legacies.

Reentangled theory and practice   Practice and theory are tangibly intertwined in craft as TechnoCraft. While craft is not the only domain where theory and practice merge, it is useful to draw on craft metaphorically and literally of how it merges the two accessibly while reaching across domains.

"The protocols of knitting are thus situated *in-between* the looped thread, in the loops themselves. This interconnection protocol of the thread could be seen as a catalyst, as it produces a bigger whole from the single thread. [...] One could say that the protocol of the looped thread 'echoes' throughout the final knitted piece as the catalyst produces the conditions for emergent behavior (the inter-loops of the thread)." (Von Busch 2013)

Craft shows — through maker processes — how doing becomes being and being becomes doing. It may seem too simple but it is important: As actions of making yield creations, craft reemphasizes the making alongside objects made. It shows how theories of objects (be they media, tech, or craft

objects) emerge from and are embedded in the actions that produce them. Attending to craft as process — and to technology as its processes, its people, its protocols — expands beyond the crafting of objects to include communities of practice and sociotechnical systems: "as in crafting an identity, or crafting a community" (Fountain 2021).

Craft is also means of thought. Textile designer Nithikul Nimkulrat describes craft, "not only as a way of making things by hand, but also as a way of thinking through the hand manipulating a material." She suggests that in craft, thinking is a sensory act, inextricable from doing. "Knowledge of a creative practice thus lies in and can be acquired from within the practice itself. In other words, thinking and knowing are inseparable from making in any craft or designerly practices." This makes it imbued with responsibility to ourselves and each other.

These are not metaphors only. They are material, infrastructural systems that undergird and uphold power — woven into the warp and weft of all processes. With fiber art this is literal, and it demonstrates concretely the ways these processes operate in other mediums too. Cyberfeminist Sadie Plant says:

> "[Garments] process and store data. Because there is no difference between the process of weaving and the woven design, cloths persist as records of the processes which fed into their production: how many women worked on them, the techniques they used, the skills they employed. The visible pattern is integral to the process which produced it; the program and the pattern are continuous." (Plant 1998)

Echoes of this concept can be seen in current research methods like Critical Code Studies, an approach to reading code that situates it within its material, cultural contexts rather than viewing it as a neutral static object (Marino 2020). Through such material reckonings, we can not only use different lenses to reflect on existing technologies but also gain the means to reimagine them for different purposes. As queer craft art historian Daniel Fountain says, "craft, or more broadly the notion of crafting, is an essential strategy for living and loving 'otherwise'" (Fountain 2021). What does this 'otherwise' look like and how does it come about?

Artist-researchers Ren Loren Britton and Helen V. Pritchard call for "queer playfulness and promiscuous metaphorical practice" that can expand beyond passive strategies for remaking technoscience, reusing its terms in order to imagine new forms: "as a speculative practice of working with metaphor, we propose to replace CS (Computer Science) with CS (Careful Slugs), forthcoming

could be CS (Cushions and Stargazing), CS (Crying Sabotage), and/or CS (Chancer Scientist). We propose that the metaphors of Careful Slugs might create possibilities for new kinds of work in Computer Science. Possibilities in which unknowing itself become disoriented, disassembled, and undone in its conventional forms." They suggest that metaphor can be a powerful tool for finding gaps and expanding cracks in violent structures, and that metaphor works in concert with not in lieu of material practices, to restructure physical systems. "Through working with metaphor, we generate a series of speculative fictions for CS––Careful Slugs stories that reconfigure relations and introduce scandals and chances into Computer Science, Design, and STS processes that might lead to other sorts of project plans, research questions, and technical inquiries"(Britton and Pritchard 2022).

Refusal & material resistance

"Make technology ridiculous." >–Nam June Paik, *We Are in Open Circuits*

TechnoCraft can emphasize the "NO" in technology as a resistance or refusal to operate by the terms and conditions of technology as it has been handed down: inaccessible, obtuse, large-scale, platformatized, proprietary, profit-seeking, and so on. Technological tools need not be the purview of only the narrow band of [users/creators/?] with the most access, and 'craftiness' is both an intellectual and a material strategy in response. Although craft approaches are also applied in other contexts, when they are used as methods for refusal they also can become forms of "tactical media."

Tactical media are works that resist, revise, reverse, reimagine their materials to engage political potentials. As "an investment in a multiplicity of actions, practices, performances, and interventions," says Rita Raley, "tactical media activities provide models of opposition rather than revolution and aim to undermine a system that, as de Certeau reminds us, 'itself remains intact'." The technological gestures of tactical media artworks operate in the world as it is now, while reflecting upon, resisting, and offering alternatives to it. Raley says that tactica media is a "mutable category" that includes "practices such as reverse engineering, hacktivism, [...] the digital hijack, [...] collaborative software, and open-access technology labs [...]" (Raley 2009). In its many forms, tactical media [(like craft)] consists not only of its material objects, but also its communities, networks, protocols, and processes of disturbance and resistance.

Crafters and other artists know that resistance can emerge from the properties of the materials themselves, and that creation is a cooperative effort between maker and material. Digital

humanities researcher Bethany Nowviskie argues that this resistance is a reminder of "the material nature of every generative or transformative textual process" most useful when makers have deep knowledge of their environment, including the time and access allows them to make and refine their own tools: "the material nature of every generative or transformative textual process" (Nowviskie 2013).

Queer use is a form of resistance, both material resistance and cultural resistance. It can be a way of 'living otherwise' and might be read in some cases as a form of tactical media. Feminist writer Sara Ahmed describes queer use as both a refusal of normative use and an embrace of the unused:

> "To queer use is to linger on the material qualities of that which you are supposed to pass over; it is to recover a potential from materials that have been left behind, all the things you can do with paper if you refuse the instructions. That recovery can be dangerous. The creativity of queer use becomes an act of destruction, whether intended or not; not digesting something, spitting it out; putting it about." (Ahmed 2018)

In Ahmed's reading, normative use and resistance has much to do with fit and form: "I think of an institution as an old garment: it has acquired the shape of those who tend to wear it such that it is easier to wear if you have that shape. And this is why I think of privilege as an energy saving device; less effort is required to pass through when a world has been assembled around you" (Ahmed 2018). In a machine learning parlance, we might say that infrastructures and institutions are overfitting for select populations — not only overrepresenting them but designed to suit them — while unable to account for others. With the capacity to craft our own garments, technologies, systems, institutions, we can create new fits.

A "lace card" was used in early punch-card computers to jam the systems.

> "Pranking an AI — giving it a task and watching it fail — is a great way to learn about it" (Shane 2021)

Let's briefly discuss some techniques employed in craftiness as refusal and resistance: adversarial use, extreme use, handcraft practices, and esoteric/DIY systems. These techniques often overlap, reflect one another, or are used in tandem. Of course they are not the only techniques, but a few I have spotted in the wild and have used myself.

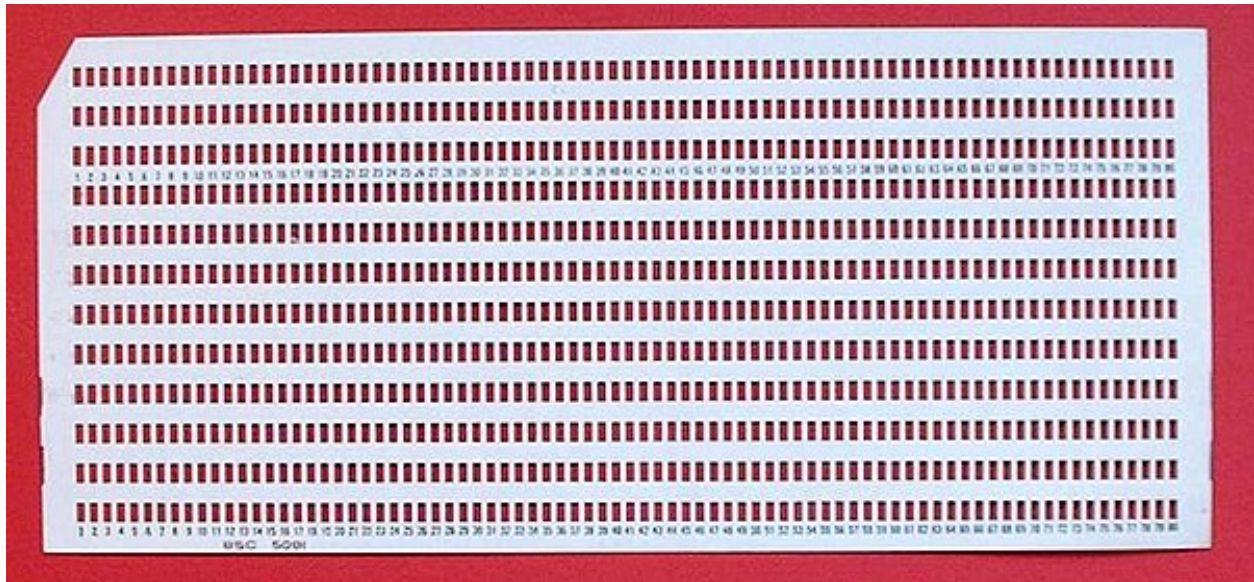**Adversarial use** uses technology against the grain or against the goals of its creators. In

Figure 2: Lace cards

"Autonomous Trap 001", James Bridle used a salt circle drawn in the pattern of highway lines to trap a self-driving car in one spot, nodding to ritual magic while showing the ease with which 'smart' systems could be fooled (Bridle, n.d.). In an obfuscation technique called 'baysean flooding', machine-reading platforms are prevented from interpreting data by mixing in an overwhelming amount of false data which cannot be distinguished from 'true' data — such as posting a thousand nonsense social media posts with false locations for every accurate one (Brunton and Nissenbaum 2015). In "ladymouth", I created a bot to participate in misogynist online forums in order to post feminist texts, then collected the responses from forum participants and performed these responses at poetry readings. Both are examples of adversarial use (Ciston 2019a). Other forms might also include desire lines, the non-designated paths in parks and natural spaces that are created by human or animal use.

Extreme use, also known as breaking, looks to what is already broken, concerning, or confusing in existing systems and plunges into those gulfs. By highlighting (or causing) errors and glitches, these works step into the trouble. They hyperbolize aspects of a system in order to attend to the problems this exposes. In her "Manifesto of the Broken Machine," Sarah Sharma shows how we might work *with* outliers and errors — and with perceptions of women and others as outliers and errors — in order to work *against* the systems that frame them as such:

"the idea of our contemporary social-political-economic system as an already-broken

machine full of the incompatibly queer, raced, classed, and sexed broken-down machines is politically exciting for feminism. [...] A feminism of the Broken Machine focuses on and uses the logic of the machines to highlight current power dynamics that are otherwise hard to pinpoint. The Broken Machine uncovers and incites new power moves." (Sharma 2020)

In "Google Maps Hack (Traffic Jam)", Simon Weckert walked through the city pulling a handcart full of mobile phones running Google Maps in order to cause the app to display traffic jams where there were not any (Weckert, n.d.). Sadie Benning created their short films like "Girl Power" on a camera originally produced by Fisher Price as a toy, which made videos on an audio cassette. Benning's films pushed the limited form to the brink, documenting their experience as a 1990s teenage lesbian while sampling a wide range of music, other video, and text on its glitchy black and white surface, all from inside their bedroom (Benning, Sadie 2023). In "innervoiceover", I chained together speech-to-text and text-to-speech tools in a participatory gallery installation, with the understanding that this would amplify the errors, because I wanted to make visible these processes as well as to explore the potential for poetic effect (Ciston 2022).

Handcraft practices may involve craft tools or may involve handcraft approaches taken up with high-tech materials, or both! In "The Internet of Towels — Knotty Articulations", Anuradha Reddy used the process of crocheting a towel to study lenticular images and the production of QR codes. The result was a 3D-textured towel which, only when viewed from an angle, can be read as a valid QR code by a QR reader or phone (Reddy 2021). Elisa Giardina Papa documented her work as a human trainer for AI systems in *Leaking Subjects & Bounding Boxes: On Training AI*, collecting images and instructions from some of the thousands of tasks she was assigned "which seemed to resist AI's orderly impulse." By turning this labor-intensive work into an art object, the book asks its readers to reconsider the work of classification as a handcraft ("EGP" n.d.). In "No Knots, Only Loops", I documented the months I took to produce a crochet sculpture. The work offers a tangible means to grappled with the uncanny scale of large language models, by comparing the number of stitches in a huge sculpture to the number of parameters in a model (finding them still insufficient to "model" the model).

Esoteric systems, or DIY systems, are often a response from artists or communities when they cannot find the tools or resources they need in existing forms or formats. Creating their own alternatives in response to the lack they perceive, artists' esoteric systems can be inventive and

generative, investigative and critical, or justice-seeking and recooperative, among other things. In "Coem", Katherine Yang created an esoteric programming language that "imagines poetry as purposeful and code as emotional," working against general-purpose languages that prioritize efficiency over feeling. Developing a language with different core values demonstrates how value systems drive code design and inform the functions a language allows as well as what operations and outputs it can produce (Yang, n.d.). In "ImageNet Roulette", Kate Crawford and Trevor Paglan created an interface for exploring a popular dataset used in many machine learning foundation models, in order to reveal the dataset's problematic taxonomies that classified people as, for example, "slattern, slut, slovenly woman, trollop" or "failure, loser, non-starter, unsuccessful person" (Crawford and Paglen 2019). By building a system that let public audiences explore the dataset in an accessible way, they could bring personal understanding to the issues with how such datasets are created and used in many kinds of machine learning tasks. In my upcoming research project "Unsupervised Pleasures", developed in collaboration with Emily Martinez, we are developing alternative approaches to conscientious dataset development based on intersectional principles and practices, in hopes that these shift the outputs when applied to language models (and as a provocation for imagining different model architectures as well).

These forms of refusal replace what they reject with alterative visions for more liberatory technologies. Creative and social computing scholar and activist Dan McQuillan argues current AI systems exacerbates existing aspects of society that act violently to exclude and enclose. He calls for an anti-facist approach to AI that can [enact/enforce/instantiate] "a positive refusal, a rejection of certain forms of apparatus and a commitment to radical alternatives. [...] Our ambition should stretch beyond the timid idea of AI governance, which accepts what we're already being subjected to, and instead look to transform our apparatuses into a technical practice that supports the common good" (McQuillan n.d.). We can start with looking at how existing models, methods, and methodologies indicate the changes that need to be made, not in the models alone but in the world, argues digital democracy scholar Wendy H. K. Chun: "Machine learning and predictive models as they currently exist can also resist reduction, but only if we treat the gaps between their results and our realties as spaces for political action, not errors to be fixed. [We need to treat these models as we do global climate change models. GCC models offer us the most probable future, given past actions, not so that we accept that future, but so we work to change it. Only global climate change deniers seek to fix the model, rather than the world.]" (Chun 2021). As Chun and McQuillan suggest, we need more than the mere governance of emerging technologies as they are currently conceived,

and instead require moves towards prefigurative practices. Crafty tactical media can queer the use of machine learning systems and other emergent technologies in order to reveal their classificatory, reductionist logics. By applying techniques like aversarial use, extreme use, handcraft practices, and esoteric systems, a TechnoCraft lens helps imagine and enact "a committment to radical alternatives." As TechnoCraft suggests, such alternatives already exist, if we are willing to write, build, create, and cooperate in ways that reveal them and allow them to flourish.

> "Embracing the nuances of crafted art forms […] exemplifies the non-linear, embodied, diffractive ways of reading, interpreting, and understanding the world while questioning what AI tools can do and the extent to which craftspeople have a say in what AI tools should be doing instead. I contend that AI does not produce newness but rather 'newly' suggests how craftspeople have always been creative agents for shaping the future of culturally and visually-informed algorithmic systems." (Reddy 2023)

3 What's included

Each section of Trans*formative TechnoCraft puts its thinking into action — tackling related aspects in different forms and for different audiences. The parts combine to enact the ethics and tactics described in this introduction. Together these public-facing resources provide plainspoken translations of technical, critical, aesthetic, and ethical concepts relevant to technology. They are written in approachable, non-academic formats like zines, and produced in contexts like workshops, in order to support discussions across communities of practice — including code creators, AI researchers, and marginalized outsiders — toward understanding the urgency of the issues facing automated technologies and the necessity of each other's skill sets in facing these issue.

3.0.1 CRAFT: Coding.Care: Field Notes for Making Friends with Code

Coding.Care is a pocket guide to sustaining friendly coding communities — why we need them, how to build them, how to let them thrive. It focuses on lessons I learned from Code Collective, the diverse hack lab that I started in 2019 when I yearned for the adaptable, encouraging environment I had needed when I was first struggling to learn to program. In gratitude to teachers like Brett Stalbaum, at UC San Diego's Computing in the Arts program, who had showed me code could feel

creative instead of prescriptive, I wanted to make a space where I wouldn't feel like an outsider for 'not knowing everything' about programming, and I suspected others might feel the same.I wondered how to recreate that experience.

In Code Collective, a mix of media artists, activists, makers, scientists, scholars, and engineers gather to co-work and co-learn, thinking critically with code in an inclusive, interdisciplinary space that supports many kinds of learners. The Collective unites students who may have zero technical experience with those who may have lots of technical experience but perhaps lack a critical or creative lens; and we value their experiences equally, reinforcing the idea: **"We all have something to teach each other."**

This guide looks at a variety of the strategies and tools we have explored and developed as we have grown. It discusses how we have adapted to meet the needs of our community — from hosted workshops to hybrid-format meetups, from pandemic support to alumni programming. Code Collective's approaches draw on many existing methodologies and methods from intersectional queer, feminist, anti-ableist, and anti-racist theories. The guide connects these approaches to cooperative organizations Varia and p5.js, and to Critical Code Studies and to TechnoCraft practices like working iteratively and breaking critically.

As a guide for making friends with code, *Coding.Care* discusses how practices such as process-oriented skillbuilding, co-teaching and co-learning, and snacks (always snacks) embody the Collective's guiding values, such as **"scrappy artistic strategies not perfect code."** The guide shares projects and feedback from members of the Collective, who report how these values and practices have shaped them as emerging makers and thinkers. Personally, I have found this community to be the strongest influence on my own research, above and beyond my role as facilitator. Code Collective has become a joyful space for creative risk-taking that nourishes my practice. The guide offers practical advice for getting comfortable with code, while situating these approaches and groups within an **ethics of coding care** — grounded in shared embodied knowledge, embedded co-creation, and programming with and for community — as an antidote to technocratic values and as an enactment of Trans*formative Technocraft.

In her book, *Coding Literacy*, Annette Vee argues that, "Changing 'how the system works' would move beyond material access to education and into a critical examination of the values and ideologies embedded in that education. [...] Programming is a literacy practice with many applications beyond a profession defined by a limited set of values" (Vee 2017). Vee calls this kind of programming access

"transformative." Through *Coding.Care*'s intimidation-free, learner-led, process-oriented approaches, it both theorizes and models the creation of caring communities and innovative spaces that can transfer knowledge across social strata and intellectual disciplines in order to reshape technological systems.

OBJECTIVES: Through *Coding.Care*, understand how to approach programming with less fear and more fun, with less constraint and more community support. Think creatively and critically about the kinds of technologies you want to make and support. Learn to choose and use tools, languages, and platforms that match your goals and ethics. Create or join communities of practice that feel supportive and generative.

3.0.2 FORMATIVE: A Critical Field Guide for Working with Machine Learning Datasets and Inclusive Datasets Research Guide

Datasets provide the foundation for all of the large-scale machine learning systems we encounter today, and they are increasingly part of many other research fields and daily life. Many technical guides exist for learning to work with datasets, and much scholarship has emerged to study datasets critically (Corry et al., n.d.; Gillespie and Seaver 2015). Yet no guides attempt to combine technical and critical approaches comprehensively. Every dataset is partial, imperfect, and historically and socially contingent — yet the abundance of [problematic datasets and models] shows how little attention is given to these critical concerns in typical use.

A Critical Field Guide for Working with Machine Learning Datasets helps navigate the complexity of working with giant datasets. Its accessible tone and zero assumed knowledge support direct use by practitioners of all stripes — activists, artists, journalists, scholars, students — anyone who is interacting with datasets in the wild and wants to use them in their work, while being mindful of their impacts. Developed with Kate Crawford and Mike Ananny, as part of their research team Knowing Machines, the field guide discusses parts and types of datasets, how they are transformed, why bias cannot be eliminated, and questions to ask at every stage of the dataset lifecycle. Importantly, it shares benefits of working critically with datasets when (on the surface) it may seem just as easy not to.

The *Inclusive Datasets Research Guide* is an interactive digital guide for academic researchers working with datasets, that supports them with an overview of key concepts and considerations for working

with datasets, as well as providing tools and software, books and tutorials, and recommendations for thinking inclusively. Like the Critical Field Guide, the Inclusive Datasets Research Guide focuses on a blend of technical and critical decisions that arise when working with datasets. Because this guide is aimed at students and teachers, the format is brief collections of resources rather than conceptual deep-dives. The guide appears on the USC Libraries' website along with its other research guides on many topics.

Developed by a team at USC Libraries, with the support of a grant from the USC Office of Research, this research guide was written as part of a grant to acquire core research datasets to support areas of inquiry by USC researchers into arts, humanities, and machine learning. I was recruited to provide interdisciplinary perspective on inclusive approaches to machine learning, and I joined a team including a chief library technologist, data science graduate students, special collections librarians, a research communications specialist, and a multimedia digital humanities specialist. We conducted 18 interviews with faculty across campus who worked with datasets in order to develop an internal rubric to support collection development. Through this process, we found that the need was less for dataset acquisition, because researchers did not look to libraries for their datasets but of course had access to many elsewhere. Still, the rubric we developed was utilized to acquire approximately 50 collections identified for being more accessible, inclusive, 'datafiable', and meaningfully engaged. Instead, we found the need existed for more curated resources and more training on how to select and use datasets critically, while remaining mindful of their origins and impacts — which led to the expanded aim of the grant and the development of the *Inclusive Datasets Research Guide*

Both the Critical Field Guide and the Inclusive Datasets Research Guide reflect on the stakes of datasets and the human choices they relies on. Reframing the information in two different forms shows that it can be more effective in different contexts, depending on the audiences and the rhetorical tone they require. Both works are examples of how concepts and processes researched in the *Intersectional AI Toolkit* (below) can be reworked for new institutional contexts. Adapting the Toolkit to new audiences in library science, data science, and the social sciences posed interesting challenges that both expanded and refined the work. It required the ideas be scaled up and applied, and sometimes renegotiated until their rewordings no longer felt like watering down. So much of [the work] I am still learning, is about [people where they are][which means remembering that I have as much or more to learn from others than the other way around.] In each project, I got to learn how another field has addressed the problems of knowledge organization and bias,

historically and in the present. Library scientists, of course, have at least a century of practice considering questions of how to categorize, curate, and archive. Social scientists have been asking how and what to measure for just as long. None of this is perfect, either, but learning from each institution, and combining thse with what machine learning is trying to ask, helps me understand better how we got where we are today. Combining these with what other intersectional practices may already understand helps me understand better what each domain might learn from the other.

OBJECTIVES: Through the *Critical Field Guide for Working with Machine Learning Datasets* and the *Inclusive Datasets Research Guide*, understand the importance of working critically with datasets as part of any machine learning practice. Identify the parts, types, and functions of datasets as you encounter them. Determine whether a particular dataset is a good fit for your project by asking understanding critical questions to ask at each phase of the dataset lifecycle. [Work with the communities impacted by your research to create strategies for addressing potential harms in the datasets you utilize.]

3.0.3 *: Interstitial Portals, NO: Tactical Refusals, *: Reverse Portals

- (Un)Limiting: ?? // Rebecca Horn

- (Un)Raveling: No Knots // (Sonya Rapoport?)

- [(Un/Re)Forming: ?? // VALIE EXPORT / Glitch Feminism / Broken Machines]

- (Un)Knowing: Ladymouth // Pipilotti Rist / Ashby's black box

- (Un)Living: InnerVoiceOver // On Kawara

Michel de Montaigne called the essay form a 'trial' or 'attempt'. These interstitial essays are attempts to speak in the nearbyness of *Trans*formative TechnoCraft*. They are trials, in the sense of struggles, to get closer to the core of the creature by sneaking between its ribs. An oblique strategy, they glance against logical modes of critical analysis or direct address, in order to become the [thing] and probe the [thing] and interrupt the [thing] [simultaneously].

As an alternate take on "bias" (because bias cannot be "optimized" out of systems), these are bias cuts moving diagonally or diffractively across the warp and weft of the fabric of the other texts here. Cutting and sewing on the bias puts fabric in tension, making garments that take the shape of the

bodies they surround. Bias cuts are ways of working with and against materials, acknowledging their limits and not resolving them to right angles. Thus, these essays sustain the research tensions of *Trans*formative TechnoCraft*, unfurling the questions in the materials rather than folding them away.

Locating (and writing in) "a correspondence, not an assemblage," the essays join together by "living with" concepts (Ingold 2015). They are portals to a co-existing "past-present-future" (Olufemi 2021) for exploring our relationships with systems differently and intimately, in which "the past is not lost, however, but rather a space of potential" (Chun 2021). [This is the threading together of nearbyness.]

> "the future is not in front of us, it is everywhere simultaneously: multidirectional, variant, spontaneous. We only have to *turn around*. Relational solidarities, even in their failure, reveal the plurality of the future-present, help us to see through the impasse, help temporarily eschew what is stagnant, help build and then prepare to shatter the many windows of the here and now." (Olufemi 2021)

As part of locating correspondences, the essays also use correspondance as a form, relying on epistolary address to conjure up analogue antecedents to the digital media discussed in other sections of *Trans*formative TechnoCraft*. I read the works of several 20th century media artists as pre-responses to automated systems. Their wide range of practices — from minimalist daily rituals to queer feminist body art and performance — show how we have always—already been living in, talking about, performing with the questions amplified by automated systems, classification, and datification. Their works offer a breadth of artistic possibilities for reconsidering our relationships with computational systems — and these responses were already being established in parallel to the development of those systems. They help me reimagine how I want to respond now.

The essay form is a kind of embodied processing that moves the [corpus through the corpus], a reckoning in throat and gut that pairs bodily processing with computational processing. These interstitial essays serve, as queer scholar KJ Cerankowski writes, "to let this book be the crisis rather than about the crisis or crises, rather, a plurality of traumas and pains felt collectively and individually" (Cerankowski 2021). Long traditions of artistic and literary outliers have maintained the need for such forms, like autotheory and lyric essay, which bridge aesthetic, personal, and political concerns. From these traditions, I am interested both in the constitutive act of form-making (as prefiguration) and in the reconsitituion of critical forms into poetic, personalized, or approachable forms (Fournier 2021).

3.0.4 TECH: The Intersectional AI Toolkit

The *Intersectional AI Toolkit* argues that anyone should be able to understand AI and help shape its futures. Through collaborative sine-making workshops, it aims to find common vocabularies to connect diverse communities around AI's urgent questions. It clarifies, without math or jargon, the inner workings of AI systems and the ways in which they operate always as sociotechnical systems. The Toolkit celebrates intersectional work done by many other researchers and artists working to address these issues in interdisciplinary fields; and it gathers and synthesizes legacies of anti-racist, queer, transfeminist, neurodiverse, anti-ableist theories, ethics, and tactics that can contribute valuable perspective. Its three formats allow for multiple entry points: The digital wiki offers a forum for others to discuss and expand upon its topics. The collection of printed zines share AI topics at a concise, approachable scale. And the in-person and hybrid-online workshops invite multiple communities to participate directly in the systems that impact them.

As Trans*formative TechnoCraft, the format of the toolkit was highly considered as part of the process of developing the *Intersectional AI Toolkit*. The toolkit form taken up here was first modeled after Ahmed's 'Killjoy Survival Kit' (Ahmed 2017).[14]. The term 'toolkit' was thoroughly contested — too instrumental and object-oriented — but settled upon after nothing else quite suited. Not compendium or catalogue or care package, not index or hub or gazetteer, not manifesto or knapsack or portal. The technologies used went through many iterations, from git repo to wiki to self-hosted hybrid back to repo again, in search of a platform that would facilitate guest user access without heavy onboarding, track edits, and adapt to multimedia zine forms. I am still remaking the work and searching for the perfect form. I suspect I will have to create it, and it will continue to change. In its various iterations, the Toolkit has grown into eleven zine-making workshops, compiled into eight printed zines, plus [xxx][eight][online topic pages]. Work on the Toolkit also resulted in the two related datasets projects, which reflected back to inform the Toolkit. Citizen data researcher Jennifer Gabrys says toolkits "provide instructions not just for assembly and use but also for attending to the social and political ramifications of digital devices." She says they are spaces of "instruction, contingency, action, and alternative engagement" (Gabrys 2019). As such, the *Intersectional AI Toolkit* hopes to provide resources and access points for engaging differently with machine learning systems in non-intimidating ways that connect different audiences.

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[14]Ahmed says in *Living a Feminist Life* that the killjoy survival kit should contain books, things, tools, time, life, permission notes, other killjoys, humor, feelings, bodies, and your own survival kit.

OBJECTIVES: Through the Intersectional AI Toolkit, the need for plural perspectives on AI systems. Understand key terminology related to machine learning and to intersectionality. Share perspectives on the impact of emerging technology as it relates to you. Choose critically which AI tools and resources you will engage and how.

3.0.5 TRANS: Conclusions by way of trajectories

3.0.6 Similarity & nearness

The * emphasizes an unspoken interstitial — interjection, interruption, insertion, interpolation — this work happening in between and nearby, underneath and overhead and throughout. In digital contexts this may be called `lerp` (short for 'linear interpolation' and much more fun to say) or `tween` or `spline`[15] or smoothing. These methods of interpolation are methods of creating or locating nearness and of smoothing the rough journey between. To `interpolate` in math is to create new knowledge (datapoints) based on existing knowledge (datapoints), or to estimate value at a position based on values from nearby positions.

But I always mix up the terms `interpolate` and `interpellate`. To `interpellate` is to interrupt or intercede (again like interstitial) or to summon, cite, call out. Shall I interpolate the distance between `interpolate` and `interpellate`? Political philosopher Frantz Fanon describes being called out as a racialized body and witnessing himself as another person's brutal interpretation (Fanon 1967). Marxist philosopher Louis Althusser describes being hailed by a representative of the State apparatus and understanding it is himself who is meant (Althusser 1970). Both these interpellations are about being seen, about the necessity of submitting to this seeing, about shame. These interpellations are also crossing a distance, creating a nearness, pulling close under duress. This distance is a street or sidewalk, and it is also the conceptual distance between how someone else understands us and how we wish to be known.

Interpolation divides up distance, quantifies it, makes it possible to cross (it leaps Zeno's paradox with stepping stones). Interpolation makes interpellation possible in computational regimes, because it helps map (define) an individual, through generalization. It pins one down to

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[15]Splines were originally the physical, flexible materials used to create curves between points, used for calculations involved in arches, domes, and ship building. The principle relies on the resistance in materials, on the energy required to bend.

classificatory schemas (created from collections of other interpellated individuals). [These are weak-star topologies.] Computationally, proximity helps us jump to conclusions about each other:

> "a reliable link between the addressor and the addressee is the precondition of not only computing but also [...] of modern disciplinary states and their sociotechnicalities, and addressability emerges as a key shared operational logic." (Dhaliwal 2022)

> "[The algorithm] presents something as a singular optimal output, when it is actually generated through multiple and contingent relations. [...] I understand the spatial logic of algorithms to be an arrangement of propositions that significantly generates what matters in the world." (Amoore 2020)

> "Data, in this sense, are more than operative forms of value; they establish the values of difference as the subject and object of organization."(Amaro 2022)

All this reduces to nearness and distance. how similarity and difference are mapped onto nearness and distance. What if the polarities were reversed — nearness and difference, similarity and distance? What if different values took priority instead of only matching like with like? How about all other intuitions that bring us together, including but not only what make us the same? What activation functions might activate other intuitions, or tamper with expectations, beyond or between the X and Y axes?

How many kinds of measurements of distance are there? How many dimensions and ways to fold them?

[We have created so many algorithms for pathfinding. We use these constantly to optimize our ways across spaces and even to optimize our relations to each other. We've created everything about space and time, and how to make more and less of it.] What if — instead of using proximity as a shortcut to sameness — we looked to "radical otherness as the driver of adaptability" (Bridle 2022). What if we found other models and values to guide what questions we ask and what [things] we compare, what [relations] we highlight and [what futures we shape]?

3.0.7 Nearbyness

> "not to speak about but rather to speak nearby" (Chen 1992)

I want to write a theory of nearbyness (near-bi-ness) that is not a theory of nearness. Not nearness as measures and scores, not proximity and similarity, not K-means and K-nearest-neighbors. Filmmaker Trinh T. Minh Ha describes 'speaking nearby' as "a speaking that does not objectify, does not point to an object as if it is distant from the speaking subject or absent from the speaking place. A speaking that reflects on itself and can come very close to a subject without, however, seizing or claiming it" (Chen 1992). This is nearbyness as a practice of attending-to, not nearness as the foundation for assumption-making. Through what it places in conversation, in contact, in texture, in tension, nearbyness enacts via poetic logics and "forms of indirectness" that, and how, and why its elements require each other. Nearbyness prefigures the more-than which this closeness creates. This is a trans*disciplinary practice, as more than the sum of its combined fields or niches, and it is a trans*formative practice too.

I want to take up Trinh's argument — that the nearby "is an attitude in life, a way of positioning oneself in relation to the world. Thus, the challenge is to materialize it" (Chen 1992) — in order to suggest that this nearbyness can respond to computational values of compartmentalizing, modularity, and encapsulation, which silo off data from the code that operates on it.

These values separate disciplinary discourses from politics and from each other. They separate for efficiency and understanding, security and containment. As [XXX-ID] Tara McPherson says, computation's modular values emerged simultaneously with and in response to the civil rights movement in the US: "the very structures of digital computation correspond to larger cultural shifts that seek to cordon off race and to contain it" (2018). McPherson's metaphor of "lenticular" postcards, which show two separate images when viewed from different angles, demonstrate how modularity allows for invisibility, despite proximity. She argues that lenticular perspectives position "our understandings of race in very narrow registers, fixating on sameness or difference while forestalling connection and interrelation. [...] A lenticular logic is a logic of the fragment or the chunk, a way of seeing the world as discrete modules or levels, a mode that suppresses relation and context." From object-oriented programming to object-oriented ontology, from global supply chains to machine learning architectures, such projects deny their entanglements. They reduce these entanglements to magnitudes of distance in vector dimensions.

Even "meaning" in language has become increasingly defined by these numerical representations of proximity. Through natural language processing, nearness becomes co-occurance becomes word vector becomes fact and prediction. The [modus operandi/battle cry] of predictive language

systems, underlying tools like AdSense and GhatGPT, is a 1957 quip from linguist JR Firth: "the meaning of a word can be inferred by the company it keeps" (Firth 1957).

`Nearbyness` resists this denial of complex entanglements by reuniting them in conversation, bringing close without collapsing distinctions. It is a different way of placing side by side, making note of more than frequency and sameness, with the aim to replace knowing-as-conquering with other kinds of understanding: frisson, spark, and activation; disparity, tension, and curiosity; cooperation and commitment, for example. [XXX-ID] Romi Morrison's work on flesh and unknowability describes alternative ways of knowing:

> "leaving open the unresolved space of coming to know something that is relational: taking into consideration the specific context of the speaker, the place from which they speak, the closeness they share, and the mode through which that speaking happens. To know in this context is not a territorial claim to be made, enclosed, and defended but an endured practice of proximity. To speak nearby is a gesture of knowing that requires engagement, perforating the hermetic encapsulation of totality." (Morrison 2021)

Critical theorist Lauren Berlant also details how such relations can maintain closeness, without capitulating to machine learning's reductionism, through the same "non-sovereign" knowing Trihn describes:

> "The space between and the spaces among involve distances created by the disturbance of being close without being joined, and without mistaking the other's flesh for one's own or any object world as identical to oneself. Nonsovereignty is not here the dissolution of a boundary. It's the experience of affect, of being receptive, in real time." (Berlant 2016)

These operations of nearbyness [bring us to form and formative]. The assembling logic here is of accretion and coalition – an *Arcades Project* of wandering, filing, putting like with like, but also unlike and other aspects together, or at least nearby. It is a machine learning task, an un-`machine` un-`learning` task, to decide how information goes together or does not, to find patterns in a system. It is also a very human activity. [This project enacts the process through intuitive and counter-intuitive feeling [Campt (2017)][weirdpivothere?].] For some, like Vilém Flusser,[16] writing is a

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[16]"[Writing] has nothing to do with constructing. It is, on the contrary, a taking away, a de-structing. It is, both structurally and historically, closer to sculpture than to architecture. It is a gesture of making holes, of digging, of perforating. A penetrating gesture. To write is to in-scribe, to penetrate a surface," [CITE]

sculptor's cutting away. For others, like Walter Benjamin, writing is a collector's fever dream. I believe it is both, collecting fragments when you cannot yet see a form, when you cannot do anything else; then cutting away at them until what has already formed becomes clearer. Anuradha Reddy describes the process of working with varied materials similarly as a process of "adjacency":

> "The materiality of yarn and AI are vastly different, despite making them work adjacent to each other. Adjacency may offer lessons for understanding the possibilities and limitations of AI systems, especially when the outcomes deviate from one's expectations of what the system can or will do. [...] Rather than aiming for generalization, adjacency is better understood as a mode of creativity for seeking unfamiliar and unexpected insights into AI systems and to enhance confidence in the maker/crafter in reformatting the AI system in ways that widen and deepen their collaborative capabilities. In other words, adjacent practices with AI signifies the potential to transform AI from a mere tool to a hybrid material for artificial everyday creativity practices." (Reddy 2022)

This ability to work with machine learning, or any technology, as a concrete material — as an artist or craftsperson would — is a way of moving into curiosity, poetics, aesthetics: nearbyness.

3.0.8 Computing new computations

From the works in this collection, I have begun to get an inkling of a 'compu-poetics' of Nearbyness. What would nearbyness ask of TechnoCraft in order to transform technologies — for example, to move from foundation models that have been built on narrow slices of data and classificatory logics, to transformative models that might unravel them? What does Nearbyness and Trans*formative TechnoCraft ask of me?

At least, at first, to ask better questions, to get my hands dirty, to get closer. Transformation pulls us up from the roots. What does trans*formative computing look like? Probably many things, with many different goals, created specifically by the communities who will use it. For example, based on knowledge and intelligence that is "not classificatory but storied," not totalizing but exploratory (Ingold 2015), can we imagine a phenomenological model of language, instead of a stochastic one (Bender et al. 2021)? What does it look like to code nearby, to code relationally?

Through lenses of Trans*formative TechnoCraft we have discussed, I hope this sounds less far-fetched than before. We know that computation did not start out binary and does not have to

stay that way. Voltage begins as an analogue signal. Nature's nonclassificatory logics offer many other forms of calculation: Soap film computers ("The Soap Film: An Analogue Computer" 2017), mushroom computers (Maddukuri 2021), slime moulds and liquid state machines (Bridle 2022) all produce complex, non-binary operations. Artist Stephanie Dinkins says, "Widely deployed AI can support bottom-up decision making and provide the public means to directly inform the systems that govern us while also empowering the governed" (Köerner et al. 2020). By rethinking AI and all emergent technologies as TechnoCraft — available for our intervention and imagination — we have the opportunity to [[reconfigure/transform]] our relationships to these technologies and each other].

> "Part of the construction of dominator privilege is you don't have to think about what are those other people thinking, feeling, hoping, dreaming. I think part of transformation is when you open yourself to wanting to know what those people who are not like you are doing, thinking, being." (*Why Famed Feminist Bell Hooks Reads Patriarchal Writing* 2018)

3.0.9 What's after?

New projects are growing from the seeds of these works. [XXX][this list won't stay in the diss but i'd like to talk about them in relation to the diss]

- **"A Critical Field Guide for Working with Generative AI Models and Systems":** Follow-up to "A Critical Field Guide for Working with Machine Learning Datasets"

- **Unsupervised Pleasures:** Conscientious datasets and intersectional methodologies for queer and diverse futures

- **"How Words Became Vectors":** Research mapping the sociotechnical histories of computational language representation

- **Future Feminist Machine Musueum:** Institution for realizing critical–creative community projects on machine learning through intersectional lenses

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