

# Feral data visualization: A manifesto for cultivating livable worlds with visual sensemaking practices

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Figure 1: An old growth hemlock tree's roots (left), known for sharing nutrients among fellow hemlocks, and a visualization (right)—inspired by hemlock roots' communal solidarity—that represents a (human) community's vivaciousness

## ABSTRACT

Feral data visualization is a posture offering theories and practices for designing data visualizations for collaborative survival in the midst of ecological and social turmoil. Feral data visualization demands an embrace of situated, embodied, vegetized, and feral forms of visual pattern making that might allow us to take up the task of building livability in our surrounding ecologies and communities. We demonstrate how these imperatives might unfold in practice through *Tsuga Convictio*, a research through design project. Feral data visualization calls designers to action, outlining three paths for crafting data visualizations for the feminine, vegetal, and embodied.

**Keywords:** data visualization, ecology, forests, storytelling, feminism, plurality, ontology, community, conversation, data dramatization, art

**Index Terms:** Human-centered computing—Visualization—Visualization techniques; Human-centered computing—Visualization—Visualization design and evaluation methods

## 1 THE TASK AT HAND IS TO MAKE LIVABLE WORLDS WITH SENSEMAKING TOOLS BEYOND IMMEDIATE GRASP

In the face of climate destruction and civilizational turmoil, the task at hand is to make livable worlds on a wounded planet [10, 22]. Embedded in this task are key shifts in Western settler cultures: from anthropocentric autopoiesis towards holobionts and sympoiesis, from a posture of extraction towards one of collaboration, and from detached rationality towards response-ability. These shifts are ongoing and entangled with feminist, anti-racist, LGBTQ+ rights, disability rights, decolonializing, and other intersecting anti-oppression movements cultivated by humans.

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For Haraway, livable worlds require us to turn away from the rationality and autopoiesis of anthropocentrism, towards the idea that “human beings are with and of the earth” and the “...powers of this earth are the main story;” rethinking ourselves as holobionts [10]. Humans only live through collaborations, relying upon each other to make the planet livable. As opposed to extracting from organisms in and around us, we must de-estrane ourselves in collaborations for survival with our neighbors (non-human and more), or sympoiesis. Material practices for de-estrangement means becoming familiar with the non-human: microbiomes, birds, weeds, and so on. Sympoiesis means we can only survive with (often unusual) partners; we “become-with each other”—or, “not at all” [10] We must discover collaborations with organisms, non-human and more; we must make kin to survive.

Instead of detached rationality, we must cultivate the collective ability to observe, feel, and act in response to danger, a visceral response-ability. Response-ability, as characterized by Haraway, is necessary because it is our capability for building livable worlds [10]. In particular, cultivating response-ability requires at least three moves.

First, response-ability in collaboration with many bodies only has purchase if the knowledge is situated and embodied, instead of detached and logical. Knowledge is embodied is in the feminist sense: situated in organism, time and space, and only meaningful if resonating with the body, and interrogated through the lens of power [6, 9]. A situated take on knowledge also affords us to understand the limits of our perspective, opening possibilities for ever-changing response-ability in ever-changing circumstances negotiated by ever-changing bodies. Situated knowledges resonate with Watt's articulation of indigenous idea of Place-Thought, in which land and thought are untangleable and intertwined [23].

Second, collective response-ability is woven together by belonging: the feeling of interconnectedness, nourished by humans through intimate conversation [2, 4, 25]. In fostering belonging we set ourselves towards caring for one another in our collaborations; love as praxis in making possible free, livable worlds [11, 14]. Belonging fuels the fire of kin and community, in practices that de-estrane us through building trust and coalescing our hearts and minds to act and respond together.

Last, response-ability requires tools that serve the ever-emergent forms of collaborative sensemaking, or knowledge practices, that enable us to become response-able, make sense-with, our neighbors—human and nonhuman alike. These practices require what Haraway calls string figuring, or tracking, thinking, and making connections with humans (and more) in our communities. Necessary are the sensemaking tools to help us detect those patterns, over time and space, that we can respond to and build collaborations from [10].

The project Tsuga Convictio emerged from the nexus of these moves, in the interest of making visual sensemaking tools towards fostering belonging for collaborative resilience. Tsuga Convictio is a masters' thesis consisting of data collection and visualization experiments, aimed at supporting the intimate community conversations hosted weekly for the Carnegie Mellon School of Design masters' cohort [21]. Conversations like these serve as a fecund context to interrogate data visualizations as collaborative sensemaking tools; a place through which the shifts from autopoiesis to sympoiesis can be negotiated through visual pattern sensemaking.

In this work, we asked: could data visualization, with its strengths in showing us patterns over time and space, help us become response-able with each other in community? From the lessons of Tsuga Convictio emerged feral data visualization, a manifesto provoking the role data visualization might take up, as a sensemaking tool, in the task of opening the possibility for livable worlds. In this paper, we use “we” to improve readability, though Ploehn, embedded in the community as a masters' student, led the design process, with mentorship from Steenson and Byrne.

## 2 DATA VISUALIZATIONS AS WORLDMAKING TOOLS

Data visualizations make certain patterns visible in certain ways (through data), shaping our relationships with the entities those patterns refer to. It matters what relationships unfurl from our visual displays and the worlds that are wrought by those patterns we choose to see (or don't). In other words, data visualization is ontological in the same sense Willis and Escobar characterize design as ontological [8, 27]. The data visualizations we design shape our minds, how we understand the world, and thus, how we might live.

Subsequently, data visualizations are thickly implied in material practices; the things we work on everyday. Data visualizations cultivate certain forms of response-ability, helping us make “kin”, or collaborators, with certain folks (and not others). These relationships at stake deserve to be examined.

## 3 DATA VISUALIZATIONS WREAK WORLDS OF EXTRACTION AND EXPLOITATION

What worlds do commonplace data visualization practices bring? A deluge of critique from scholars and artists underline some of the harm that emerges from commonplace data visualization theories and practices. First, data, as a concept, is often left undefined, or interpreted as a “given,” and objective, which obscures the wielder of data and encloses away the possibility for plurality [7]. Next, data is often gathered to extract wealth from and exert control over populations, or conversely, is often not gathered and acted upon to aid populations [3, 18, 20]. Data (and its) collection is often imagined with rigid structures, often essentializing and categorizing neatly that which resists categorization [19].

Meanwhile, visualizations often create distant relationships with their referents, framed in a way obscure labor and bodies—both of their subjects and their creators [6]. Specifically, geometric patterns tend to essentialize, disembodify, and emit an unwarranted aesthetic of truthfulness [6, 13, 26]. On the whole, violence in data visualization practices emerge from the veneer of rationalism where there is none, exacerbated by unexamined relationships emerging between reader and world-as-told-by-data [12].

We see these patterns of violence, driven by the logic of rationality, in both the hands of bad actors, but also embraced as commonplace

and favorable data visualization practices.

Practices that extract, divide, and essentialize are at odds with the urgent task of creating the livable worlds we yearn for. In the words of Myers, the “worlds built by colonialism and capitalism are unlivable for us all,” and those logics keep us locked in the “same rhythms of extraction and dispossession” [16]. While useful in many contexts, data visualization practices solely driven by these logics keep us making worlds in the key of extraction and essentialism; violent worlds.

## 4 FERAL DATA VISUALIZATION: HOW TO WIELD VISUAL SENSEMAKING TOOLS TO BUILD LIVABLE WORLDS

How do we ferment data visualization practices away from these logics, towards a material practice of collaborative response-ability and co-habitation on a damaged planet? This notion loomed near as we developed Tsuga Convictio, a research through design project in the context of intimate conversations (wherein each person gets a chance to share their experience) in a/our masters' cohort. Conversations like these are a balm of belonging to the unique manifestation of extractive logics in graduate school (isolation, competition, etc.) flourishing only with the posture of collaborative response-ability (embracing various situated, embodied experiences).

In making data visualization for this context, we attempted to forge an alternative path, away from extractive and essentializing practices. The lessons we unearthed serve as possible theories and practices for wielding data visualization in service of response-ability and belonging in other contexts; a starting point. Collect these lessons under the term feral data visualization.

Feral data visualization is a posture for creating visualizations for livable worlds. It questions data visualization theories and practices, particularly those that exude from the logics of rational, objective, and universal truths. Instead, feral data visualization aims to make legible our human and more-than-human collaborators (and our entanglements with them). Feral data visualization is feral, or monstrous, in that it aims data visualization as a catalyst for opening gateways “to more unfamiliar worldings” that might evoke visceral feelings of awe and/or disgust [24]. It takes up Tsing's call to search and tell stories of contamination and survival on our damaged planet as part of our sensemaking practices—through the visual patterning language of data visualization [22]. To do this, it embraces situated, embodied, vegetized, and feral forms of visual pattern making.

Feral data visualization begins with two theories, or intuitions. First, data visualization, as a sensemaking tool, changes the way we understand our worlds, and thus, how we live and enact worlds. Therefore, we must—at all costs—make known and explicit the worlds and relationships we design for, examining those that emerge from our work. In building Tsuga Convictio, we made explicit its purpose in supporting intimate conversations aimed at developing kin. We examined our position in developing Tsuga Convictio for this community: as embedded within the cohort, but embarking on the project as an experimental research (instead of attempting to insert the visualization into the community) to address the extractive quality of design masters' project might have.

Second, many worlds must coexist in a feral data visualization posture, reaching towards a pluriverse, or a “world where many worlds fit” [8]. We must evaluate data visualizations through the worlds they bring, in which no singular design offers an end-all, be-all truth. Thus, data is defined in the spirit of feminist knowledge practices: situated, ever-tied to the observer, ever subjected to scrutiny to the power balances and the existence (of absence) of bodies within its construction [6, 7, 9].

From these theories, feral data visualization manifests in practices that seek collaboration with the organisms (humans and more) rendering the surrounding bioregion livable. Or, as Despret asserts, strives to render non-human collaborators capable [5]. In particular, feral data visualization designers take up Myers' call to “vegetize

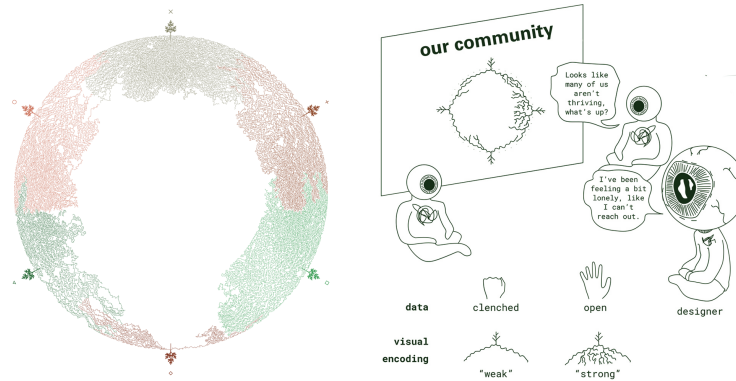


Figure 2: Cellular automata roots that visualize vivaciousness (left), and its data encoding schema and context of use and (right)

our sensorium,” to “learn with and alongside plants,” making them our co-conspirators [16]. Thus, feral data viz designers imbue the lessons of plants into the visual patterns of data visualizations, to design visuals in the tune of collaborative survival, instead of mere control and extraction (see Figure 1). In *Tsuga Convictio*, we visualized the felt experience of conversation participants through the metaphor of local (and prominent) Hemlock trees, aiming to develop a sense of kin and belonging (not only between humans) between those critical members of the surrounding bioregion—particularly need of collaboration in the face of hardship due to a warming climate. Humans can work to conserve and protect Hemlock trees (increasingly vulnerable to the hemlock woolly adelgid), while the trees as a collective cool the air and provide livable, active habitat for humans and much more [1].

Practicing feral data visualization means working through a series of cyclical flows. As we developed *Tsuga Convictio*, the following helpful moves emerged as we developed data collection and visualization experiments for intimate conversations, pointing toward a possible way of practicing data visualization for the feminine, vegetal, and embodied. A feral data visualization practice may be layered upon existing processes, such as the *Design Activity Framework for Visualization Design*, to attune designers towards collective response-ability and kin-making in their craft [15].

#### 4.1 Purpose

In deciding what data to use, we must imagine the worlds we wish to build, asking: What data brings this world to life? What power is exerted through the data and its collection?

*Tsuga Convictio* is focused on the world wrought by intimate community conversations, a site of transformational change towards belonging and justice, as articulated by Brown, Wheatley, and Block [2, 4, 25]. We explored what kinds of data was important here (the visceral feeling), which informed what should be recorded as data (feeling, in terms of growth or decay—captured as the “openness” of each community member’s hand captured via webcam and ML model), and who might have the agency to do so (everyone present in the conversation, on their own terms).

#### 4.2 Attunement

When we attune to the data, we examine the flows and feelings necessary to take the data into our felt experience—to be deeply meaningful—asking: what modes of thinking / seeing / feeling are required for the body to make meaning out of data?

Attunement to feeling grounds visual metaphor in the realm of the embodied. Philosopher Todes asserts “only those elements that have some kind of affinity to the human become known” [17]. Therefore,



Figure 3: The old growth hemlock trees of the Allegheny Plateau.

designers must, as Neely asserts, “offer primary interaction or secondary metaphor to foster” meaning that deeply resonates with how a human body understands the world [17]. In other words, metaphors should begin with the articulation of feeling: heaviness, lightness, tightness, looseness, etc.

While crafting a data visualization for *Tsuga Convictio*, we focused on the articulation of felt experience—feelings of strength and weakness—as the patterns we would design data visualizations for. We attuned to the flows of feelings during a community conversation, a process of: gathering as a group, easing into silent reflection, culminating in a sharing of experiences (see Figure 3). The data collection (via detecting a hand’s “openness” via webcam) would take place during (and enhance) a moment of silent reflection and connection to the feelings (of possible stress) in the body. The data visualization would appear during the verbal sharing of experiences with peers, displaying the patterns of thriving or wilting the community at large is experiencing.

#### 4.3 Relationship

In examining our relationship with the data, we explicitly articulate how our unique position as designers might meet (and channel) the world described by the data, asking: What power dynamics emerge from your role in telling the story of the data? How might the story of the data change as channeled through you?

Also, we examine the relationships with our vegetal context, asking: In what ways can we learn of both your bioregion and of the data? In what ways can we, as Haraway invites us to, create “intimacy without proximity” through creating visual patterning inspired by the organisms around us [10]? Or, as Westerlaken puts it, how can we use data visualization technologies to “wonder, articulate, enable, nourish, and connect?” [24].

In Tsuga Convictio, we note the extractive relationship between the designer of a typical thesis and subject of study [21]. A typical design thesis has an imperative to extract insights and deliver a design solution. Indeed, conflict of interests seemed to exist in designing a thesis around the same community we organized. Instead of imposing a (possibly extractive) typical design process upon a community where none might be needed, we framed Tsuga Convictio as a research through design project, in which our experiences in organizing were instead channeled into exploring data visualization discursively, focusing on what was possible.

We (the designers) also explored the historical and biological place in which the project was situated. In particular, we discovered the old growth forests that call the Allegheny Plateau (situated in Western Pennsylvania) their home. We visited the Hemlock trees within that thrive in solidarity with one another, sharing nutrients between their roots and mycelium networks (see Figure 4). We learned that roots made tangible and visible the exchange of care hard to grasp in human communities. In Tsuga Convictio, we centered these stories of rhizomatic collaborative survival at the center of our data visualization metaphor.

#### 4.4 Manifest

In manifesting visual patterns, we can draw from our knowledge: the purpose of the data, our attunement with its flows and feelings, and how we might channel our place as a designer. As we begin to create, we ask: what tools and visuals speak to those purposes and feelings? In what ways can I bring this world to life through this data?

In Tsuga Convictio, we landed upon two tools particularly helpful in bringing visceral feeling into a visual form. In our data visualizations, generative systems—or simulations—(cellular automata in particular) brought to life roots that grow with varying levels of vivaciousness [21]. Generative systems and simulations like these offer a poetic, embodied (by living roots) display of feeling that affords ambiguity and eludes neat categorization. Manifested as a forest metaphorically representing the community members in conversation, each tree (representing a person) has cellular automata roots reaching out to one another, bringing to life (our vision of) their world of interconnectedness and interdependence.

#### 5 A CALL TO ACTION

We invite those crafting visual representations of data to join us in the task of building livable worlds. In concert with a posture for feral data visualization, we outline some (of many) opportunities for designers to become involved in cultivating response-ability in their practices, already embraced by many.

First, question the power and the logics of extraction in data, as it flows through your hands as a designer [6, 18]. Work with activists in visualizing data that empowers and gives agency in representation, instead of disempowerment in surveillance.

Second, embrace the visceral and embodied sensemaking to create graphics that resound in our hearts as deeply meaningful. Designers already embrace the embodied in building animated, dynamic, and simulated data visualizations [28]. In encountering data beyond our immediate grasp, (e.g., COVID-19 data) designing for the embodied allows us to grasp and imagine the personalities of systems we must respond to.

Finally, make kin. Become sensitive to—and responsive towards—efforts of collective survival happening around us. Become involved within the issues (human and more) of their local communities, entangled with the histories of the caretakers that allowed that land to flourish. Vegetal grammars of graphics, situated within place, make possible a practice of data visualization for collaboration, livability and survival. Learn from the trees, dirt, mycelium around us, interpreting them into modes of pattern representation. Tools such as generative systems and machine learning nurture our capability

in bringing these botanical metaphors to life. If we can do this, we can ground our work in context and place, cultivating our capacities as designers to build the free and livable worlds we yearn for.

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#### REFERENCES

- [1] Hemlock Woolly Adelgid (HWA).
- [2] P. Block. *Community the structure of belonging*. Berrett-Koehler Publishers Inca BK Business book, second edition. ed.
- [3] J. Bridle. *New dark age: Technology and the end of the future*. Verso Books.
- [4] A. M. Brown. *Emergent strategy*. AK Press.
- [5] V. Despret. The becomings of subjectivity in animal worlds. 23(1):123–139. doi: 10.1057/sub.2008.15
- [6] C. D’Ignazio and L. F. Klein. *Data feminism*. MIT Press.
- [7] J. Drucker. Humanities approaches to graphical display. 5(1):1–21.
- [8] A. Escobar. *Designs for the pluriverse: Radical interdependence, autonomy, and the making of worlds*. Duke University Press.
- [9] D. Haraway. Situated knowledges: The science question in feminism and the privilege of partial perspective. 14(3):575–599. Publisher: Feminist Studies, Inc. doi: 10.2307/3178066
- [10] D. Haraway. *Staying with the Trouble: Making Kin in the Chthulucene*. Duke University Press. Pages: dup:9780822373780/1. doi: 10.1215/9780822373780
- [11] B. Hooks. Love as the practice of freedom. pp. 243–250.
- [12] S. Žižek. *Violence : six sideways reflections*. Picador.
- [13] H. Kennedy, R. L. Hill, G. Aiello, and W. Allen. The work that visualisation conventions do. 19(6):715–735. Publisher: Routledge .eprint: <https://doi.org/10.1080/1369118X.2016.1153126>. doi: 10.1080/1369118X.2016.1153126
- [14] J. Macy. *World as lover, world as self*. Parallax Press.
- [15] S. McKenna, D. Mazur, J. Agutter, and M. Meyer. Design Activity Framework for Visualization Design. *IEEE Transactions on Visualization and Computer Graphics*, 20(12):2191–2200, Dec. 2014. doi: 10.1109/TVCG.2014.2346331
- [16] N. Myers. How to grow livable worlds: Ten not-so-easy steps. pp. 53–63.
- [17] S. Neely. SOMA LITERATE DESIGN recentering the interstitiality of experience.
- [18] S. U. Noble. *Algorithms of Oppression*. NYU Press. doi: 10.2307/j.ctt1pwt9w5
- [19] J. Odell. Jenny odell - KIKK festival 2018.
- [20] M. Onuoha. The library of missing datasets. Library Catalog: [mimion-uoah.com](http://mimion-uoah.com).
- [21] C. Ploehn, M. Steenson, and D. Byrne. Tsuga convictio: Visualizing for the ecological, feminine, and embodied. In *2020 IEEE VIS Arts Program (VISAP)*, pp. 9–18. IEEE. doi: 10.1109/VISAP51628.2020.00008
- [22] A. L. Tsing, ed. *Arts of living on a damaged planet*. University of Minnesota Press.
- [23] V. Watts. Indigenous place-thought and agency amongst humans and non humans (first woman and sky woman go on a european world tour!). 2(1).
- [24] M. Westerlaken. *Imagining multispecies worlds*. ISBN: 9789178771059. doi: 10.24834/isbn.9789178771059
- [25] M. J. Wheatley. *Turning to one another simple conversations to restore hope to the future*. Berrett-Koehler Publishers, expanded 2nd. ed. ed.
- [26] M. Wihbey, J. Sarah, P. Cruz, and B. Welles. 22. visualizing diversity: Data deficiencies and semiotic strategies. In *Data Visualization in Society*, pp. 369–390. Amsterdam University Press. doi: 10.2307/j.ctvzgb8c7
- [27] A.-M. Willis. Ontological designing. 4(2):69–92. doi: 10.2752/144871306X13966268131514
- [28] S. Wu and S. Osserman. People of the pandemic | a hyperlocal cooperative simulation game.