

Aesthetics, string figures, and the politics of the visible in science and education

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Abstract

This paper positions Aesthetics, specifically the politics of Aesthetics, as a frame for approaching traditionally conservative subfields of education, such as science education. Drawing primarily from Jacques Rancière's work on Aesthetics and Politics, and Donna Haraway's work with String Figures (SF), we outline the political stakes of engaging, transforming, and 'playing-with' the aesthetic dimensions of what science education (and education more broadly) might look like. In the first part of the article, we highlight the political potentiality of a turn toward aesthetics in (science) education, which includes a discussion of theory that supports this shift. We aim to, in part, disrupt the current distribution of the sensible to more deeply, and visibly, entangle science education with multi-species justice and a politics of equality writ large. In the second part of this article, we present our own string figure, an example of what we mean by a radical aesthetic shift in terms of what it allows students to see as visible, possible, and sensible in the world through science and education. We weave a string figure/SF story about our bee companions, who are/have been deeply affected by the Anthropocene, while simultaneously world-making in the Chthulucene. In concluding, we revisit our primary goal which is to open up new forms of political engagement in science education toward the goal of multi-species justice.

Key words: aesthetics; string figures; science education; dissensus; politics; transdisciplinary education; bees

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A 'surface' is not simply a geometric composition of lines. It is a certain distribution of the sensible.

Jacques Rancière (2013)

It matters what thoughts think thoughts. It matters what knowledges know knowledges. It matters what relations relate relations. It matters what worlds world worlds. It matters what stories tell stories.

Donna Haraway (2016a)

The aim of this paper is to outline how sociopolitical engagement in science education must be accompanied by significant shifts in the everyday aesthetics of science teaching and learning. To do this we draw together the seemingly disparate work of Jacques Rancière and Donna Haraway to outline the how aesthetics and politics are intricately tied together. The field of science education, the way it has largely been practiced and conceived, has been described as myopic and politically conservative (Lemke, 2011). For example, science education has failed to recognize its heteronormativity, anthropocentrism, sexism, and inherent racisms (Bazzul, 2016; Basile and Lopez, 2015; Russell & Hodson, 2002; Morales Doyle, 2017; Strong et al., 2016; Tolbert and Bazzul, 2017). Our goal is to open up a discussion around aesthetics, science, and education that focuses primarily on politics, rather than the role aesthetic experience and affect play in scientific practice and science learning (see McAllister, 2002; Dewey, 2005; Bellocchi, Quigley, and Otrell-Cass, 2017), though we recognize the interconnectedness of these topics. Specifically, we argue that the political and democratic potential of science teaching and learning is not just a question of ideology and discourse, or the distribution of goods through institutions, but a question of aesthetics--that is, what is sensible or possible to see, do, feel, and sense. Intertwining concepts like aesthetics, politics¹, science, and education simultaneously involves wearing science-egghead-hats, painter smocks, and the messy politics of thinkers-who-care on our sleeves. To be clear, we are largely writing about the institutionalized apparatus of science education, which links together scientific knowledge production with the institutional (bio)power of modern governance.

Educators have come to recognize aesthetics and the arts as key components for learning and doing science (Girod, 2007). Steve Alsop (2017) has challenged science education to consider aesthetics insofar as it demarcates what counts, and that this demarcation always comes with an associated politics. Following Jacques Rancière, we suggest that aesthetics (what is sensible/visible) and aesthetic experience(s) comprise a vital location for sociopolitical engagement in education. In other words, how education makes certain things visible and invisible *is* the very substrate of politics. Using Donna Haraway's (2016) creative concept of String Figures (SF)--a proliferating string of dynamic story forms--we will demonstrate how transdisciplinary aesthetic shifts, what we make sensible and visible, can lead to possibilities for political engagement and entangled response-ability. Since politics is simultaneously a question of aesthetics, political engagement involves the work of (re)storying (re)telling,

¹ While the word politics is an open signifier, we think of politics here in Rancière's terms: Disrupting the domain of the sensible in order to include those who have been excluded (that part of no part) in the name of radical equality.

(re)casting worlds that make life without hierarchy and environmental destruction thinkable, and therefore possible.

We recognize that there is not a straightforward connection between Rancière's work on aesthetics and politics and Haraway's String Figures. For us, Haraway is an example of scholarly work that breaks the aesthetics of the status quo in the name of multispecies equality; and Rancière's work explains how Haraway creates political potential in this regard.

In the second part of this article we present a String Figure as an example of a radical aesthetic shift in terms of the visibilities, possibilities, and sensibilities it may offer science education communities. String figuring is an approach put forth by Haraway (2016) to bring together science, art, and activism as part of a project of making kin, or "making oddkin" with human and non-human companions--a project Haraway refers to as "storytelling for Earthly survival" (Haraway, 2017). In this sense, we draw on the concept of thinking-with-care from Maria Puig de la Bellacasa (2012), which "involves cutting across fixed theoretical and academic divides...inciting us to enlarge our ontological and political sense of kinship and alliance, to dare in exercises of category transgression..." (p. 200-201). We feel this stance is necessary to aesthetically disrupt what has been given as sensible and possible and what it can mean to engage in political dissensus. We also see the bringing together of Haraway's and Rancière's work as a kind of unruly string figure in itself.

One of the overall points we want to stress is that there is always a particular aesthetic, a way of orienting, to science and science education such that certain practices, modes of communication, scholarship, and pedagogies are rendered commonsensical through a domain of the sensible. Therefore, any emergent political engagement in science and science education must draw from this surface, what can be sensed, thereby making creative work that shifts what is sensible and doable vitally important. Again, shifting what is visible in science and education is the very ground for sociopolitical engagement in science education (Tolbert and Bazzul, 2017). The kind of pedagogical, community, and scholarly work we feel will help facilitate 'aesthetic revolutions' in science education must be transgressive and transdisciplinary in the way it opens different ways "to see"; ways that are often cast as "not scientific" or "not science education" by dominant Eurocentric, masculinist, and neoliberal institutions and academic cultures²(Strong et al., 2016). More specifically, we want to visibly entangle science education with multi-species justice writ large. Using string figuring as a method (Haraway, 2016), we draw from theory, personal reflection, and poetry as we set out to imagine a range of new possibilities for science and science education.

Part 1: Science Education and the Politics of Aesthetics

In this section we offer a reading of Jacques Rancière's (2013) *Politics of Aesthetics: the Distribution of the sensible* in order to center aesthetics as a key component of a justice oriented science education. Since everything is, on some level, aesthetic, we can easily become trapped by platitudes such as "everything is political", "art is everywhere" and "all art is political." While all art and aesthetic experience are entangled with politics, we follow Rancière in

² The Science Wars of the 1990's can be thought of as a debate over the aesthetics/politics of knowledge, rather than epistemology: the stakes for scientific realists being a loss of a hierarchal and representational regime of thought that kept things (and certain people) in a specific place.

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allowing for difference between art, aesthetics, and politics. Things can be simultaneously co-existent, yet different.

According to Rancière (2013), “Aesthetics is a series of a priori forms that determine what presents itself as sense experience, speech and noise, visible and invisible. These determine the stakes of politics as a form of experience” (p. 8). Aesthetics has less to do with beauty than it does with experience. Art, especially since the 19th century, consists of “ways of doing and making that intervene in the general distribution of ways of doing and making as well as in the relationships they maintain to modes of being and forms of visibility” (p. 13). Writing, for example, reconstitutes relationships between bodies and shared space. A certain equality emerges when signs on a page become free(ing), and are potentially available to everyone’s eyes (respecting of course the politics of knowledge and accessibility). This equality has the potential to destroy hierarchies and establish a community of readers free from any pre-given legitimacy about what counts as art/writing. What establishes art’s potential to make different things visible and possible is what Rancière calls the *Aesthetic Regime of the Arts*. In modernity, what is possible politically follows directly from aesthetic experience that shifts what is sayable and visible (whether this experience comes from art or labour, etc.). In order to see how aesthetics and politics are entangled it is helpful to consider how art as aesthetic experience has changed over time (albeit from a Eurocentric perspective).

Rancière (2013) describes some of the limitations of art and aesthetic experience in the past in terms of what he calls the *Ethical Regime* and *Regime of Representation* in Art. In the Ethical Regime, which he associates with a Platonist view, Art is largely a question of origins and purpose. The semiotic sign of a piece of art, and its proper use value, comprise how it is to be viewed and created. In the Ethical Regime art can be easily banned, and only certain people, for example a clergy class, have the right to produce works of art. As Rancière (2013) puts it, “In this regime, it is a matter of knowing in what way images’ mode of being affects the ethos, the mode of being of individuals and communities. This question prevents ‘art’ from individualizing itself as such.” (p. 16). The Representative Regime of Art is associated with mimesis or making-representations (e.g. Art in European Renaissance). Art here is divided into high and low forms, and is meant to evoke a particular affect by portraying art as a representation of real life, and not the other way around. It is not about making copies, but involves defining appropriate ways of doing, as well as identifying forgeries. Art is rendered more autonomous than in the Ethical Regime, but is cemented within a social order of labour and ways of doing; which includes what it means to build, dance, write or paint. Art in the Representative Regime, like the Ethical Regime, remains subordinated to analogy and social hierarchy. That is, there is a casting of a completely hierarchical community through these regimes of the arts.

Breaking with the Representative Regime is the modern/postmodern *Aesthetic Regime of Art*, where what is ‘sensible’ through art is no longer cast along rigid sociopolitical divisions. Rather, art becomes much more specific to the mode and context of its production. For Rancière the modern Aesthetic Regime emphasizes heterogeneity; such that art and its associated aesthetic experiences now carry a heterogeneous power. That is, they have greater freedom to be heterogeneous from the sociopolitical order that produced them because the norms for making art now become blurred. Unlike the Ethical and Representative Regimes: “The

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Aesthetic Regime of the Arts is the regime that strictly identifies art in the singular and frees it from any specific rule, from any hierarchy of the arts, subject matter and genres (p. 17-18). In the modern Aesthetic Regime art retains a kind of singularity (as art), and any a priori criteria for grounding this singularity becomes impossible to establish. As Joseph Tanke (2011) puts it, “The aesthetic is thus that constant reminder that what presents itself to our senses cannot be reduced to a single meaning or purpose” (p 8). Therefore, in the Modern Western tradition, from antiquity to (post)modernity, art and aesthetics move beyond the ethical status of images and representations of a hierarchical social order. A break with art-as-representation means that the relationship between art, aesthetics and daily life is no longer fixed; it is whatever can be imagined. In turn, life itself can take new paths derived from art and aesthetic experience, as they become autonomous and heteronomous. Life and art are now “two sides of the same coin” (p. 8). This is more than an iconoclastic break with the power--but an opening of the political questions of: *what can be experienced and who can experience it?* In this way, aesthetics has everything to do with sharing a common world and demonstrating that there is no such thing as a private ontology (Hardt and Negri, 2009). Art and aesthetics disrupt what Rancière (1999) calls the distribution of the sensible, the way communities have already been drawn up and divided, and open new opportunities for those that have not been counted to count equally.

While modernism, in its immanent manifestation (Hardt and Negri, 2000), works to free art from constraints, Rancière also argues that the controlling aspects of modernism, which establish rigid knowledges and histories to art, mask potential relationships between art and visceral everyday life. Educators can see the difference in these two effects of modernism when organic community projects based on justice issues do not transfer easily into the rigid categorizing disciplines of mathematics or science education. To Rancière, postmodernism does not necessarily release any more of Art’s potential, but helps us see that modernity can stifle Art by tying it to specific features or a historical teleology. Modernity as a controlling force can mask Art as an immanent experience; much like modern science has difficulty understanding itself if its sticks to one rigid history and way of organizing itself--as Ulrich Beck argues (1992).

It is important to retain art and aesthetic experience’s potential to ‘stand out’ from daily life in order to mark or ‘realize’ an experience. Yet a priori rules for art and aesthetic experience must be jettisoned, which includes the tendency to isolate art and aesthetic experience as something that can only be understood in its singularity. Art as a disruption must be able to create a breach within the sensible. The Aesthetic Regime of Art is actually subversive to the idea of innovation insofar as innovation is beholden to a teleological logic. Art under the Aesthetic Regime is not confined to simple representation, or for that matter postmodern melancholia where Art is indistinguishable from daily life. While art is produced within a grid of intelligibility, it has the power to pull the rug out from under this intelligibility at any time--hence its political power. The Aesthetic Regime continually intervenes and reconfigures the political scape, its discourses, objects, and sensibilities (Lewis, 2013).

An open approach to art might actually be threatening to scientific and educational practices if they rely heavily on representative and ethical regimes of aesthetic experience. Scientific realism holds the world hostage to representations that can reenforce oppressive social hierarchies, because a rigid knowledge system casts the world as static. As teachers we

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have the choice of casting education in terms of what can already be sensed (status quo) or in ways that disrupt sensibilities for the purposes of justice. A modern political animal is at first a literary animal (Rancière 1999); and it is this horizon of *literarity* that educators might incorporate into science pedagogies. An educator's efforts to pursue science for justice, explore Indigenous knowledges, and engage activist projects with their students involves disrupting the aesthetic of what science classrooms look like and feel like. In climate change education, there is a vital aesthetic semblance that situates the Global North in terms of what they see, who is speaking to them, and the communities outlined for their consideration (and it is a sanitized, racialized, white-washed version of reality). And while art and aesthetics are the substrate for politics they are not a replacement for political engagement. As Rancière (2013) puts it, "...the democracy of the written word is not yet democracy as a political form." (p. 49). He goes on to say: "Nonetheless neither art in book nor art in life is synonymous with democracy as a form for constructing dissensus over the 'given' in public life" (p. 52). The democratic potential of the arts is not yet a politics of equality. The arts for Rancière contribute to projects of both emancipation and domination what they possibly can--discourses, relationships between bodies, and affect--and nothing more or less.

Part 2: Haraway's String Figures as Aesthetic Revolution(s)

"A common livable world must be composed, bit by bit, or not at all." Haraway, 2016a, p. 40

Donna Haraway's *Staying with the Trouble: Making Kin in the Chthulucene* was a compelling work for us because it reconfigure sites of knowing and being. Its orienting forces are tentacular. Palpating other-than-humans and humans alike, it moves like a rhizome with organs not yet formed. One way of reading Haraway's work is to see it oscillating between the coextensive realms of politics and art. Haraway's SF Figures encompass Science Fictions, Science Facts, Speculative Fabulations/Feminisms, and String Figures. Think of threading diverse phenomena and a purposeful pulling of these strings to stay with the trouble of our times. Constructing string figures can be seen as an art form that affords political possibilities for multispecies justice. Entangled SF's are useful for recasting science and education precisely because they attend to, and can shift, aesthetic experience toward acts of dissensus. Haraway illustrates that vast and often unpredictable possibilities for material/ethico/political engagements across multiple contexts of environmental degradation, political oppression, when humans, with our located material-discursive histories and more-than-human companions, constitute new ways of surviving on a damaged planet. Haraway's work is a call to recast relationships we consider secondary to human relationships, as well as those stories secondary to capital accumulation, and White, Western, and "Modern" modes of life:

At a Guest Lecture at the University of Alberta, Haraway (2014) begins with the following question: "What happens when human exceptionalism and methodological individualism become literally unthinkable in the best scientific practices of our day"? In times called the Anthropocene (for Haraway a label too rich with anthropocentric irony) we must begin to cast things in ways that open new ways of living on an abused planet. This includes different pedagogies (Gough, 2017; Higgins and Tolbert, 2018; Holmes and Tolbert, in press;

Lloro-Bidart, 2017; Russell, 2017; Strong et al., 2016); ones that allow/force us to make new kin in a myriad of material entanglements, both actual and virtual (see also Cole, 2019; Erev, 2018). Haraway creatively casts this time as the Chthulucene, a now-time of new beginnings and ‘ongoingness’ that desires to leave behind the anthropos in Anthropocene, and capital in Capitalocene (Moore, 2017). Beings of the Chthulucene play in muck; they are humus on earth.

We are humus, not Homo, not anthropos; we are compost, not posthuman...unlike either the Anthropocene or the Capitalocene, the Chthulucene is made up of ongoing multispecies stories and practices of becoming-with in times that remain at stake, in precarious times, in which the world is not finished and the sky has not fallen--yet. We are at stake to each other.... (p. 55, Haraway, 2016)

Changes to fields like science education that render entangled relationships visible are, again, of a radical aesthetic order. Indeed, “the first lesson for a political education is always on the level of the senses themselves. Before cognition, there is already an aesthetic-political partitioning of the sensible” (Lewis, 2013, p. 52).

Speculative futures, dissensual communities, and science in the Chthulucene

Our aim in this paper is to draw attention to how an aesthetic disruption of what is visible (or has not been visible) can be integral to scientific practice, education, and political engagement. Haraway (2016a) reminds us that, “We are all responsible to and for shaping conditions for multispecies flourishing in the face of terrible histories, and sometimes joyful histories, too, but we are not all response-able in the same ways...The differences matter -- in ecologies, economies, and species...” (p. 29). Following Haraway, one thing we can do within our material, social and political locations is create, weave, make visible and our own speculative fabulations, re/storying, mappings in order to collectively survive “troubled time[s] and places”.

Insert Fig 1

Figure 1. Tying together aesthetic and political dimensions of becoming

Figure 1 can be seen as the beginning of our experiment in tentacular thinking and tying string figures for multi-species justice. Our aim is to re-distribute the sensible aesthetically in place-stories involving homelands, passion, art, resistance/activisms, mournings, play, etc. -- a collective and creative becoming-with. In the figure above, we attempt to lay out a conceptual foundation for potential aesthetic-political transformations in education. We work-play within a humus that is both the world as it currently is, as well as a world to come, within the muck of troubled spaces to decompose and recompose new worlds--a complicated caring act of both mourning and repair (Haraway, 2016a).

We also continue to draw on Rancière here to make links between passion, politics and the aesthetico-political possibilities of weaving SF stories.

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What the artist does is weave a new sensory fabric by tearing percepts and affects out of the perceptions and affections that constitute the fabric of ordinary experience...human beings are tied together by a certain sensory fabric...a certain distribution of the sensible, which defines their way of being together and politics is about the transformation of the sensory fabric of 'being together.'...The artistic 'voice of the people' is the voice of the people to come. (Rancière, 2008, p. 3-4).

We affirm that passion is required for such work. Passion is an essential element to creating new worlds, to rejecting the current modes of production and acceptable sensibilities (Bazzul and Tolbert, 2019; Lewis, 2013). Aesthetic shifts in science and education also mean radical disidentifications with current "sensibilities" or accepted practices (Rancière, 2008, 2013). For example, as critical science educators, we must engage in radical disidentification with what counts as science, what counts as education, what counts as professionalism, as so on. Weaving together poetry, personal narrative, and activism, we consider how we might continue to disidentify with currently established practices in our fields, from learning "about" to learning "with," bending the sensory fabric of our collective experiences toward multispecies justice. In our string figure below, we take up our entanglements with insect companions--all too often vilified members of our more-than-human communities.

what i learned from her about (making kin with) bugs

*as we were eating breakfast, i shouted "go away, fly!!"
she scolded me for yelling at the fly, who is probably "just looking for food."
"housefly," she said, "wherever you are, i'm so sorry about my mom."*

"mom, she says to me, did you know that mosquitoes only bite you so they can make their babies?"

"yes," i told her.

a newfound understanding, a kinship

settled onto her tiny face.

"well, she said disappointedly, "why didn't you tell me that before?"

that night tears filled her eyes

when i flushed a "palmetto bug" (i.e., the American cockroach) down the toilet.

"they only want to find homes."

i promised not to do it again.

"there's a bee on your head," i told her.

she smiled at me, waiting for instructions.

i drew in my breath as the bee crawled from her head beneath her dress.

"don't move," i warned,

*“it tickles, ”she giggled.
i gently lifted up her dress,
the bee flew off
“you’re so brave,” i said.
“it tickled,” she reminded me.
she’s barely five.
one can only be brave
in the face of fear,
after all.*

Bees in the Anthropocene

We begin our string figure with a story about good-mindedness (White, 2019). (We draw on the Haudenosaunee Mohawk value of good-mindedness to characterize a way of relating to/within the more-than-human world, a way of relating that has roots in Indigenous ethics. See Kevin White 2018 for a more detailed description.) Our string figure begins with a poem-story, grounded in the experiences of a young child (Sara’s daughter). In the poem-story is a teaching about inter-relatedness, a teaching in which a young child’s ethics of care re-orient her mom (Sara) to good-minded relationships with our insect companions. We use this example for its affective-aesthetic power, for the way in which the raw, connected-to-the-world empathy of a young child helped make visible and unsettle her mother’s former socialization into a dualistic human-insect orientation, or seeing humans as separate from, unlike insects.

As we continue to draw our string figure, we weave together aesthetic experience, bee stories, technoscience, and activism to make visible new possibilities for multispecies justice. We have much to learn from making visible the stories of our bee companions, who are/have been deeply affected by the Anthropocene, while simultaneously re/worlding (in) the Chthulhucene.

Living with “Killer” Bees

Growing up, I remember periodically seeing glimpses of news reporters on the nightly news showing maps of how Africanized bees were migrating northward from South America. The news reports of the aggressive nature of these attack bees left me, as a child, feeling particularly paranoid about bees. Now as an adult living in southern Arizona, dealing with Africanized bees has become a summer routine. The first time we found a hive in our roof, we wanted to have the first hive extracted as a live removal--a 70-lb hive as it turned out. The bee service provider indicated that it would be impossible, causing a potentially life-threatening hazard to our small children or elderly neighbors. He shared with us that in fact all the hives were Africanized in Arizona, except for local beekeepers who raise the American honeybee. I remember him exclaiming, “These [Africanized] bees are NOT the good guys!”

In another incident the following year, we discovered a hive on the other side of our house. This time, we shared with the service provider our concerns about live removal after

learning from the last experience that essentially all honeybees (unless they are raised by beekeepers) in Arizona are Africanized. Though she agreed that live removal certainly had its risks, she also shared that while the Africanized bees are aggressive pollinators, they are seemingly taking on more of the American honeybee's gentler/lazier disposition as they migrate north and continue to interbreed with the American honeybee, while at the same time maintaining the Africanized bee's rigorous work ethic. The Africanized bee also appears less susceptible to colony collapse disorder. At the same time, they are still widely considered a serious public health threat, responsible for a handful of deaths each year in Arizona, mostly among hikers and pets. (Meanwhile, Arizona ranks as one of the top twenty states with the highest rates of death by gun, yet not a "public health threat.")

Bees play a central role in weaving together the natural and social worlds, beautiful and dangerous, traversing nature-culture boundaries, existing both in the wild, and under the care of beekeepers, and contributing "free labor" to the pollination of multiple species of plants, fruits, etc.--including those plants/crops cultivated by humans and those that are not (see Marshman, 2019). Africanized bees were introduced as a technoscientific innovation to increase honey production in South America. As their so-called aggressive dispositions became apparent, they were quarantined. Some of those swarms escaped quarantine and have been migrating north ever since, interbreeding with, or "Africanizing," the Western honeybee. Generally speaking, Africanized bee swarms are actually not defensive, though aesthetically quite frightening for some, while colonies (in which most of the bees are not visible) will aggressively defend their hives. Bee populations in general are declining as a result of colony collapse disorder (due to a combination of loosely regulated technical innovations gone equally awry, as well as climate change), which could have devastating effects on ecologies, food production, and the continued survival of interconnected species, including our own. A dominant narrative with regard to both human techno-intervention/innovation is again, either Progress or Despair.

In this particular case, whereas in the mid 19th century the transplanting of Africanized bees were generally regarded as an ingenious biotechnical innovation, and novel hybrids are still viewed as such in Brazil (Progress), we can trace news stories throughout more recent history of the deadly "killer bees," as they began to migrate north from South America, as the source of our impending doom (Despair). Now, in Arizona, they are largely regarded as a public nuisance, yet as we've come to, out of necessity, re-orient ourselves to the "crisis," we see how stories of science fact/fiction (SFs) have a potential to alter the equation. In the case of the (second) bee technician, whether or not the bees are taking on less aggressive qualities, as she mentioned, is likely debatable and appears to vary regionally. We are more interested in how her story, embodied in her own experiences working-with-bees, has a potential to alter the aesthetic dimensions and therefore the material-semiotic nature of the phenomenon, as well as how the "Africanized" bees and Western honeybees have altered it through their own stories, entanglements and modes of becoming-with. The Africanized bee in this SF has re-drawn an entangled natureculture future, as well as a kind of resistance against its characterization as

“evil,” or “killer,” with a potential to work in solidarity among human and more-than-human species against a particular impending doom. The “killer” bees compel us, then, to reconfigure, or redraw, our material-discursive-semiotic relationship with them (and vice versa).

Making bees visible through political dissensus

The bumble bee is also an important pollinator, even more efficient than the honeybee, pollinating wildflowers as well as approximately one-third of crops in the United States. Since 1990 alone, however, its population had declined in abundance by 90%. Activists, led by the Xerces Society and Natural Resources Defense Council, petitioned the U.S. Interior Department to get the rusty patched bumble bee listed as an endangered species, and after no response, sued the U.S. Fish and Wildlife Service and Interior Departments, resulting in the first species of bee (the rusty patched bumble bee) officially designated as an endangered species, with full protections under the Endangered Species Act. (Meanwhile, local lawmakers are seeking to set limits on urban beekeeping).

In the final part of our string figure, we highlight the efforts of activists as fundamental to any multispecies justice project. We recognize the potential of science-art-storytelling to help disrupt the current aesthetics of what is sensible, what can be seen/experienced. We see this potential as one that can help “counter radical exclusion [and] emphasize human continuity with the more-than-human world, in order to challenge human conceptions of identity” (patrice jones, 2019). We also want to underscore that a multispecies justice agenda must also include ongoing engagement in political activism.

A young child (Sara’s daughter), the activists, and the bee technician weave material-semiotic stories of becoming that are essential to world-making in troubled times, through the connected efforts of activists organizing against the state toward the production of a protected species of bumble bee; a child who teaches others through her own orientations toward more-than-human companions about making kin with bees and other insects; and a local, inter/bio/eco/personal bee/human/house/hive entanglement—a re-drawing of the “killer” Africanized bee as hard workers, gentle, and quite possibly integral (and certainly inevitable) to human/more-than-human species survival. Haraway states that, “each time a story helps me remember what I thought I knew, or introduces me to a new knowledge, a muscle critical for caring about flourishing gets some aerobic exercise. Such exercise enhances collective thinking and movement in complexity” (p. 29, 2016). We use this story/-ies as one form of speculative fabulation, science fact/fiction, one example of re-drawing the sensible, of attending to ethico-political-aesthetic dimensions of socio/scientific phenomena, or world-making as critical and caring labor among assemblies of people, plants, animals, abiotia, affects, knowledges.

Science and science education have traditionally relied on conscious rationalism as a core value for understanding and teaching about the natural world. Indigenous scholars, radical ecologists and ecofeminists have critiqued this value, this centering of rationalism, for its

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reliance on a disembodiment, a sort of human exceptionalism, that separates human from nature (e.g., Plumwood, 1991). patrice jones (2019) in her Val Plumwood Memorial Lecture, points out that

A focus on conscious rationalism leads to atrophy in other kinds of thinking. We could do more to allow ourselves to think without words. That will help us solve this crisis of imagination and help us think ecologically.... [and help us] create things to unsettle people.

We wonder how crafting, identifying, and enacting SF stories such as the one we have drawn here can contribute to an unsettling of science and education. How might we engage SF stories and other art forms to help re/orient our aesthetic sensibilities toward those struggles, assemblies, and journeys that have remained invisible within science education?

Storytelling and the politics of aesthetics in science and education

“SF is story telling and fact telling; It is the patterning of possible worlds and possible times, material-semiotic worlds, gone, here, and yet to come.” (Haraway, 2016b, Kindle location 765/5287).

We return to our earlier political question regarding what can be experienced in the world and who can experience it. In our string figure above, we show that a young child, a “pest control” technician, and environmental activists (among others) are doers and teachers of science, in profound ways that help redistribute what can be seen and experienced. For many of us, however, a common shared experience of assimilation into the sciences., the field of science education, and the Academy has been a painful distancing from personal experience toward pre-established notions of rationality and universality. Drawing on Haraway’s string figures for inspiration (and feminist scholarship more broadly), we affirm that personal and aesthetic experiences, rather than being forcibly removed, can instead be strung together with other scientific and philosophical discourses (and materialities) in way that can redistribute what is visible, and sensible, toward constructing sustainable interdependent futures. String figuring can be viewed as an aesthetic and political act to redistribute the sensible, to make visible unseen modes of engagement within academic settings—in the service of creating an “artistic ‘dissensual community’” (Rancière, 2008).

Science and education must make (aesthetically) visible whatever is necessary to pursue multispecies justice and collaborative survival through “attentive practices of thought, love, rage, and care” (p. 56, Haraway, 2016a). It is our opinion that SF stories must not diminish the need for resistance/activisms. We draw on both Haraway’s SF stories and Rancière’s notion of the politics of aesthetics – because we see how both can work to create dissensual communities, re/drawing the sensible, revealing the lines of flights, multiplicities and agencies of human and other-than-human/more-than-human actors, expanding our realms of possibilities, in a time of great political-ecological crisis. While some might see Rancière’s politics of aesthetics and Haraway’s string figures as strange bedfellows, we feel that both of these concepts together help reveal ways in which humans and more-than-humans (can)

collectively uncover new entangled possibilities for worldmaking and survival—for example, drawing from aesthetic experience to redistribute what is visible in academic or other educational settings, disrupting accepted norms and practices of engagement, making new kin with more-than-human companions--on a damaged planet. What we aspire to render visible and create in our future work (this paper is only a beginning) is a disruption of the current modes of being in science education, a shattering and re-crafting, foraging with care through the humus of possibilities.

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