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Jake studies bees; we went to them so they didn't have to fly to us. Jake keeps his bees at his friend's farm, allowing them to pollinate almond groves. This allows him to understand his chosen subject in all dimensions, observing their behaviors and nurturing their hives while he maps these aspects through theory in his academic work. This was our most baroque set-up to date (FIG. 1), with musical accompaniment and an unmanned drone joining us amidst the almond trees, pigs, and organic produce. The accordionist played a seventeenth-century piece written by an earlier scholar who wanted to understand his chosen subject of bees in many dimensions, replicating their sound through music in an attempt to communicate with them. The music seemingly calmed the 30,000 bees that we had disrupted, some of which sat in Jake's lap while the drone flew in to take aerial photos of the scene, its remote controlling far from precise. Jake wanted no blanket, preferring to be in *the field, literally in the dirt, gesturing to a continuum between himself, his work, and the land, fitting for a geographer who not only keeps bees but owns his own farm.*

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MICHAEL: Where do you situate your work in relation to the *Powers of Ten*?

JAKE: When thinking conceptually about what I do, it would have to be at zero, at the picnic blanket. Part of the reason for this is a dedication politically and intellectually to being in the muck and in that moment in that place. Also, there is the way in which the *Powers of Ten* assumes a certain position – a god's-eye view – above and outside, that puts the limits of our knowledge outside of our embodied ways of knowing. We can only know through our minds and through the situated cultural and political milieus in which we live. The objective space of the film makes it appear that the scale of knowledge is somehow outside of this milieu. This is the powerful fiction of the scale and discourse of science in which it is imbedded, which are at the heart of the fiction of the film. Ironically, the film is about the limits of our knowledge, but it portrays our knowledge as almost entirely beyond the scale at which this knowledge is produced, its meanings struggled over, and the scale at which this knowledge is lived.

Ultimately, there is no other scale of human knowledge except that of the picnic blanket. Everything else, in a sense, is an illusion of technology and of the disembodied notion of an objective science outside of the conditions of its making. It doesn't mean that there aren't different places and perspectives, but the notion that we are above and outside, and that we see something more objectively or as more real by being above and outside, is a way of bracketing the world and often escaping the world of depolitizing knowledge. And what I am interested in are the intimate, gritty details, the contested and bitterly fought-over dirt, the politics of the making of that scale, and who is served by that illusion.

I am also interested in questioning how those scales in *Powers of Ten* are produced. What is the reason IBM produced the film? What are the conditions under which they wanted to give these scales? Where are the satellites that are made to make this view? What are the perspectives and how did they come about – through what technologies and through what purposes that are all part of making that view?

As a geographer, I know there is a long history to cartography and cartographic perspective. Early maps oriented along the horizon more than from above, more like how you would see from a mountain overlooking a town. And then along the time of the Enlightenment, the orientation shifted to that above and outside position, which corresponded with the developments in science, in the sense the viewer or the researcher had the vision of God and could see the "real" position from above and outside. So there is a search for objectivity, a search that is linked to certain ideas of religion, but also to a certain idea of absolute truth that is really clean. But it simplifies things way too much – what's put on the map, what's left off the map, how are the lines drawn, how we map colonies as being empty, like the early maps of Australia that showed the continent as being *Terras Nullus,* erasing all native claims to the land that are only recently being challenged legally. Or the way that Africa gets carved up by Germany on its maps which then has huge impacts, transforming the continent, splitting families, tribes, and histories into different administrative and new geopolitical units with deep contemporary consequences. That is all part of what maps and their scale enable, and so it makes me wary of that disembodied view from above. So going up in the film raises those types of questions and going down in perspective should raise the same type of concerns. We can somehow, if we keep pushing stuff away, get to something "real" eventually, and we will get to the basis of

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everything in the end, and this is elementalism. There is a similar moment in physics and chemistry where you transform thought from alchemy to elementalism.

For example, Lavoisier is widely considered the father of modern chemistry because he transforms alchemy to an elemental form by proposing the principle that chemical knowledge should mean knowing the behavior of individual elements in isolation (an approach that will ultimately become the foundation for the periodic table). This is helpful, no question. We understand how many things work; it allows us to make things from plastics to Vicodin, but it doesn't do anything to talk about the relationships of how things work together. This is a significant blind spot to this day of modern chemistry. How do we understand mixtures and metabolites? How can we understand the new ways that these combinations create new forms? Simply put, is sugar water still just sugar and water? It has it own forms, reactions, and tendencies that are different from the qualities of each individually; is it a new substance or should and can it be known simply by the qualities of it parental forms? In this, Lavoisier transforms a way of thinking. I can see the utility and the possibilities of those perspectives, but I spend more of my time looking at the costs of the notions of objectivity that come with those perspectives and the bracketing that comes from leaving the muddy plane of unruly mixtures in which we occupy our lives.

Amy: What are the edges of your understanding in your field now as opposed to 1968?

Jake: In terms of what I am doing, it involves thinking about a critical return to natural history. With the honeybee, which I am working on now, I want to take political philosophy – Thomas Hobbes, Charles Darwin, Karl Marx, Frantz Fanon, W.E.B. Dubois – people who have thought deeply about nature in the broadest sense, as human nature and nature in the world beyond that, and use those ideas to deal with a very practical and direct problem of the bee, whose population is declining. Everyone goes to a virologist or a toxicologist to look for a bacteria or a specific cause in relation to mites, but very few people step back and think through political philosophy about the crisis of the bee in a way that might allow us to intervene and understand epidemiology differently. So my work with the bee is an epidemiology of this crisis, but through political philosophy. If you want to think differently about the bee's vulnerabilities to mites, you want to think about how the bee itself is a product of a long and political history, one that makes it vulnerable to contemporary conditions under which it is forced to exist. This requires knowing the changes to the size and shape of the bee, knowing the political history of its exoskeleton, the economic struggles over changes in size of comb, which have changed the size of the bee, the transformation of the time and space under which the bee exists in late modern capitalism (sixty to seventy percent of the total bees in this country, for example, are put on the backs of semis, fed corn syrup, and shipped around the country to pollinate monocrops etc.).

This industrialization has affected the bee's survival in other ways. Bees cannot survive in the wild here anymore because of the diseases that exist. So you may find one in a tree, but they can't survive without being treated and taken care of and managed *(FIG. 2 & FIG. 3)*.

So I look back at the ways in which the hive was modeled on the factory, and the factory modeled on the hive, and became something that transformed the behavior and physical characteristics of the bee. The bee is a different size, a different

shape, has a different thickness of exoskeleton so it could be shipped, and has more hair so it can collect pollen more efficiently. And it is bigger, so it can be a more efficient pollinator for industrialization. So the bee becomes transformed over time, and to understand that, you can't just say, well, the current moment of the crisis of the bee is the bee is dying. Its guts are different, its microbes in its gut are different because of what it is fed, and how it is fed, and how long its life is. Its life expectancy is a lot shorter than thirty years ago.

Maybe it's partly tied to a virus, but really for me it is important to see the decimation in relation to a whole different set of philosophical concerns. The difficulty of that is trying to bring this knowledge together in an integrated way. For instance, I have hives, I do research on bees, and I'm also reading political theory and thinking about how political theory comes out of the bee.

Really, I want to do a natural history of political economics, and a political history of the bee at the same time. For example, I look at how Bernard Mandeville talked about bees. His book, *The Fable of the Bees*, became Adam Smith's model for moral rectitude and the logic of the market, and neoliberal ideas of economics came out of debates about the bee and what the bee's public virtues and private vices were. One of the reasons I chose Marx's *Capital* is that I still find it one of the most influential books to me, and to critical thinking at the current moment. One of the reasons I teach it is that it offers, still, the most powerful critiques of our current economic situation that are out there.

Michael: So thinking about what's in the picnic, I am interested in this idea of hidden histories in objects. I'm curious if you could pick one of those food items and bring it through a Marxist critique?

Jake: We are talking about bees and honey, so why not start with the honey? Honey, in a sense, is a product that comes from bees. It seems pretty straightforward. Who's making it? Well, the bees. There is probably no better example of Marx's idea about surplus labor than the beehive. Marx's idea is that people work, and there's nothing wrong with working, making money from it, buying and selling things. But you have to look at the value in a commodity and in particular where that value comes from.

So how do you determine value, comparing for example five dollars of honey and five dollars of cheese? You can say that value probably comes from labor that's put into it, at least in part. The beekeeper had to put a bunch of time into it, building the hive, taking care of the bees, moving the bees. Then there's the investment in equipment and technology, so at the end of the day, your five dollars should be more or less all those different inputs: labor, resources, investments. In capitalism, the someone who owns the means of production has to hire the workers, but to make a profit has to squeeze as much productivity out of labor as possible. So the less you pay your workers, the more you skimp on regenerating the resources you use, the more profit you will make. The incentive of the structure is constantly to rob a little bit and make it a little bit more efficient, get people to work a little bit more, get things to be a little more efficient by reorganizing the factory. In so doing, you are increasing that surplus value. The workers get poorer, and the owner basically tries to get as much as possible. So for the honey, then, the questions are the same: Who owns the means of production? How about the workers who work for the beehive?

There are beekeepers with workforces of hundreds of people, alongside more

family-run businesses. There's a bunch of people competing from all over the world, many of whom can exploit workers more even if many of them are owner-operators, so it's not the same as owning a factory.

The interesting thing about beekeeping is that it mirrors this process. What the beekeeper does to the bees is exactly this. You basically put in a bunch of inputs, and you steal all this excess honey from the bee. That bee put the honey there to survive through the winter, but you take as much as you can, just like someone who owns a factory would do, and leave just enough for them to survive. You always leave honey in the hive; you don't want to kill your bees. But you want to extract as much as possible. So the idea of surplus value in economic theory plays itself out right there.

Amy: When we asked you which magazines you wanted on the picnic blanket you requested a bee symphony of sorts instead. Can you talk about that?

Jake: Yes, it's from a book called *The Feminine Monarchie*, by Charles Butler, written in the 1600s. He was a well-known beekeeper. He was one of the first people to argue that the queen was not male; previously it was thought to be a king bee. So *The Feminine Monarchie* was a statement. The gender relations of the hive were in crisis in this moment, because all the sudden, the king was a queen. This led to questions about the bees actually doing the work: what gender were they? Well, they can lay eggs, so maybe they're females, too, and then the drones are the males? What does this mean for the monarchy and gender roles ideas of work and productivity? There was a crisis around a nature that did not fit the norms of the time, and it forced new narratives of the hive.

But Butler was also a musician, and he tried to write down the sound of the bees with musical notation. And what I love about this book is how this natural history meets his identity as a musician. He wants to know his bees and the sound of bees. So of course, he set it to music and put words to it, and it represents an intimate relationship with the bees. It's not an objective relationship where I stand above and outside, but rather his desire to know his bees through an intimate 10^0 scale, right? I always thought Butler's score was kind of a strange aside, but as I think about it more, it just speaks so much to a different way of knowing your research subject. I love to hear it played.

(FIG. 4) Seth Murchison playing a score by Charles Butler.

Amy: So, it brings us to this question about framing. I was reading your *Understories* book, which looks at forests through the frame of politics. Can you talk a little about how framing plays into the work you're doing?

Jake: If you take the question of pesticides, one can start with discussions of elementalism via Antoine Lavoisier in the eighteenth century. He frames the chemical element as a separate unit, and it was a necessary thing for him to do at the time. It was the French revolution, and he was afraid of getting his head cut off, which did actually happen. But through elementalism, he tried to frame science as being outside of the chaos that is the complexities and mixtures of interactions that is life. Because if you brought science into that chaos – the politics of the French revolution – it was going to destroy everything: you, your lab, etc. But if you could say, well, that chaos is over *here*, and what I'm doing is separate over *here* – you could understand why, at that very tense time, he might do that within that social milieu.

Actually, the debates about chemistry were about air, about whether air was a fundamental

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element, or whether it had components, which we now call oxygen and nitrogen. At the time, Lavoisier used the bee to as a sort of scientific instrument to discern the different elements of air. He places a bee in a vacuum glass pump and suffocates it and watches it die, and knows that there are other gasses, good air and bad air, and determines the qualities of "fire air" and "foul air."

Fast forward a bit, and Fritz Haber invents this process that carries forward the concept of air from Lavoisier's elementalism and finds a way to fix nitrogen. He's credited with a lot, saving millions from starvation, because he basically allows for the production of chemical nitrogen, or fixed nitrogen from the air, and that becomes the basis of our agricultural production, period.

But his understanding of air makes him central also to World War I. He becomes the father of gas warfare, not just because he's a chemist, but because he understands how air works. So he goes back to these elemental equations, uses gasses that were discovered in the eighteenth century by Lavoisier and Schiele, these guys who were fighting over air, and knows their weights and their elemental characteristics and says, okay, what's going to sink in a foxhole? And what's going to stay long enough? What are the effects of these things? In his book *Spheres*, Peter Sloterdijk says this is one of the central elements of modernity in the last century, this understanding of air, and how it is transformed through gas warfare. That is the way that air and the environment itself become mobilized as weapons: Rather than targeting an individual, we transform the environment, and that then in turn is what is made lethal. People become implicated in their own deaths because they breathe in the very toxin that kills them. They kill themselves in a sense. But they have no choice because they have to breathe. Air is not context air is weapon.

Haber's understanding of air is a rethinking of what and how air is, and so he reframes what a weapon can be. It's no longer a bullet, but the actual environment. A million people eventually died in the war from gas attacks. Haber led these attacks. But the transformation of air and the environment into something that can be weaponized was a fundamental transformation of how we think about air, and how we think about the environment.

A history of pesticides follows the same understanding, and so after World War I, the same scientists, using the same chemicals, trying to justify what they're going to do after the war meet with the Department of Agriculture. They basically say, we have all of these things that might help agriculture, we need to industrialize agriculture. So he brings this work into agriculture to keep this institute alive after the war, and develops all these new chemicals alongside some of the old ones. And those very chemicals developed in this interwar period, in the name of agriculture, become the chemicals of warfare in World War II. Zyklon B, an insecticide developed by Haber's scientists to kill lice, was used to kill people as if they were lice, actually dehumanizing the enemy as insects.

Framing enables certain things, but it does so much harm in the ways in which it limits things. Think about Sloterdijk's argument about air. He says this is about the transformation of air into weapons and how we think about air.

MICHAEL: Will you talk a little bit about bees as a new military tool?

JAKE: So returning to the bees, we talked about them biologically and economically; let's think of this question about their militarization. When I was working on *Understories*, I was interviewing

some people at Los Alamos because the book looks at forests in northern New Mexico. Around our other discussions, they were talking about bees and how they were tracing chemicals in the environment through bees. Bees become an indicator, so they actually used bees on the most basic level, to trace the chemicals. Bees will set up a hive, and then within two miles or so, the bees will sample just about every plant, every water source. They have an electromagnetic charge on their bodies, so dust sticks to them, and they bring it back to the hive and concentrate it. And so from that hive, you can find out what's going on in the area by examining the chemical residues collected by bees and deposited in the comb.

So this use of bees started as an environmental monitoring tool. But then DARPA (Defense Advanced Research Projects Agency), and the Department of Energy realized that they could monitor chemicals and biological weapons the same way, so they started deploying and funding research on bees and nature. When I was talking to them in 1999, there were at least 300 hives deployed in sites around the world where they thought there might be weapons. In a sense, the bees were now involved in espionage. In another experiment, they used bees to detect landmines. Bees have a very incredible sense of smell, as much as dogs or more. But you can train bees quicker than you can train a dog, with sugar water, to become sensitized to a certain smell. So they used infrared technology to follow bee flight paths over mines that have this chemical that they've been trained to sense. The bees are making maps of the minefields, and they too become part of this military complex.

More research money now is spent on bees for military purposes than for agriculture, which is an incredible statistic for me. In one project, they're trying to embed devices that allow you to control a bee's flight. During the larval stage, a stimulator is grown into the larva, and you can remotely control your bee from a distance.

Beyond these practical applications, there's a philosophical and tactical use of bees. There's a huge amount of energy that goes into swarm tactics, a whole transformation in the last fifteen years of tactical strategy has been oriented towards the swarm. They actually go back to entomologists to try to understand how swarms behave, how these different things communicate and go from being individuals to collectives without a central command. These strategies become part of the very new operation of troop management. Bees are becoming militarized, while militarization is becoming apiary or becoming entomologized in powerful ways.

Amy: This idea of the individual and the collective, swarming behavior, bees as surveillance devices, how does this affect discussions of society at large outside of the military?

Jake: I think this is one of the most interesting parts of the bee and the hive, and one of questions that I will be exploring in the next chapter of the book I am working on. Is the unit of the organism the individual bee or the collective hive? What is the relationship between the individual and the collective? It is widely commented on that individual bees are fairly dumb but collectively, the hive is very clever. The consequence of how you understand the bee varies depending on how you understand whether the bee is the individual or the hive. The FDA regulates the bee as the central unit of analysis of safety, while the EPA regulates the hive with very different understandings of the safety and threat to bees, depending on the institution's unit of analysis. Think about how a collective group of bees or birds or fish somehow let go

of themselves to become part of a collective enterprise. The suspension of what is normally a set of individuated motivations and choices to the collective choice of a group to move and respond together is a remarkable and beautiful phenomenon, a very precarious one that is powerful and that requires profound trust. There is a suspension of the individual, a letting-go that is a necessary part of social relationships. To give oneself to the collective and the decisions that are not entirely your making is both delicate and precarious and staggering powerful.

At this moment of individual atomization in human society, the fiction of the autonomous actor, and the consideration of the collective holds metaphoric and political possibilities that I think are profound.

The acceleration and proliferation of surveillance is one of our craziest current realities. Take Total Information Awareness, the initiative spearheaded by DARPA in 2002 to use phone records, emails, social networking, etc. to collect information on everyone, all without warrants or due procedures. Theoretically, they could know what people's actions were all the time, and who everybody was. I was reading about the number of requests to wireless companies, how AT&T and Verizon and Sprint all make money by police or CIA asking for our information. Sprint, I heard, had 600,000 requests, and made a huge amount of money by giving the government information about locations and access to conversations. The way they do it is just so unbelievably insidious. And it's so pervasive that you just have to walk through the world like this. The scale is amazing.

Also, the number of new technologies around surveillance is remarkable. One question could be, could a figure like Martin Luther King, Jr. emerge now with the surveillance that exists? No, there's no way King could've done what he did in Birmingham, given the police control. It would've been squashed so quickly. And every conversation, they would've known. The cameras, they're everywhere. I've heard that if you walk through San Francisco, your picture is taken 300 times within an hour. Chicago wants a camera on every street corner by 2014!? And, there's one camera for every twelve people in England. This is much more invasive than Orwell ever imagined, right?

And now there are all these drones. Protestors have used them – there's this great footage of a strike in Hungary, was it in November, where the protestors flew the drone over the police to follow them from up above. And of course, the police can do that now. They're the only ones who can do it now in the U.S.; they've outlawed it for citizens. Now the police alone can operate them for two or three years, and at that point it's supposed to open up to the public, so, the number of drones that are going to be operating is just going to be crazy! Right now you can go onto the Apple website and buy a drone for $250! Isn't that crazy?

(FIG. 5 & FIG. 6) The commercially available Parrot AR Drone, and stills from its built-in video camera.

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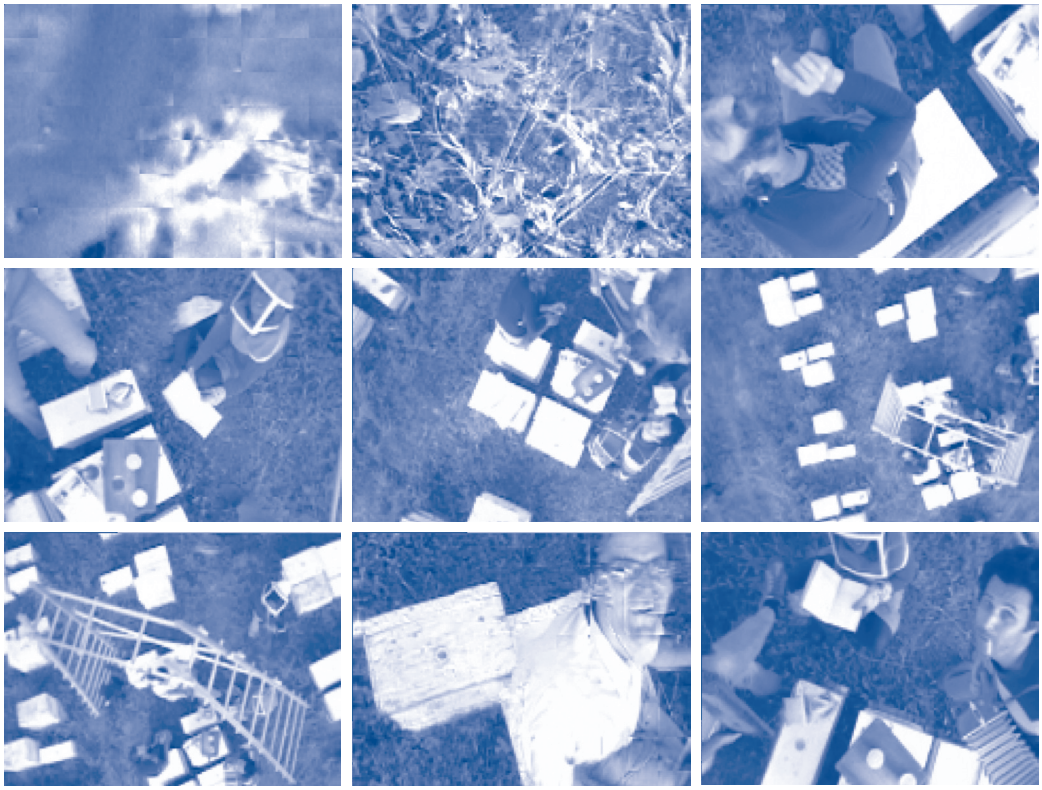
Amy: Why did you choose Marx's first volume of *Capital* to be in the picnic?

Jake: All three volumes are great, but that is one of the books that changed the way I looked at the world. If you sit down with a group of people and work through this book, you will not see the world in the same way. That is a powerful thing. You can't even read the paper without thinking about what he said. That is what I want to do with my teaching. How do I disrupt ways of thinking, how do I get sand in the oyster of my students



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that's going to irritate them for a long period of time, with the slight hope that it will fester and become something of a pearl at another moment of their life?

Another article here is Audre Lorde's *The Master's Tools Will Never Dismantle the Master's House*. She's a lesbian Afro-Caribbean feminist who wrote a staggering critique of a certain class and privileged version of the women's movement. She's pointed out, in not-so-subtle ways, that the movement was not dealing with questions of race and class. That these issues were impossible to separate from the feminist movement and could not be suspended until later in the movement, effectively demonstrating that gender, sexuality, and race and class were not separate fields of difference but constituted together, so must be addressed together. As such, she deepened the feminist movement in ways that were uncompromising and fundamentally transformative.

She's raising questions of tactics and technology. She asked "can the master's tools," the tools and tactics of colonialism, patriarchy, and capitalism, be used by feminists for their own movement to "dismantle the master's house," these very institutions that feminists were fighting? She concluded they could not. The tactics and strategies would only reproduce the same institutions themselves. So, among many other things, it's actually a powerful critique of the ways in which technology can be used and appropriated in political struggles. For me, reading this too was a major transformative moment, or a base that I always want to come back to, thinking about how we frame discussions.

Michael: I think that's a nice entry point into some of our interest in reconfiguring this scene from *Powers of Ten*, or breaking the frame.

Jake: I love the research part of my job, but I really love teaching. I have taught in a variety of contexts. Take San Quentin Prison, where I taught for two years. Every other teacher there was teaching things that are very useful, like Economics 101, math, etc., college-level courses. And I thought, fuck, what do I teach? I can't really teach geography because I don't teach geography in the sense that people know it. I don't teach map-reading skills. What I realized is that I teach a form of critical thinking. I was not teaching how to think like everyone else, but how to think against what the norms of society are, or least to think them for oneself. I felt liberated, and so did the students. I started teaching philosophy and political theory to prisoners, and they were, once they understood the stakes, among the most deft readers I have ever worked with.

I realized then that what I want to do is undermine common sense. I want to take ideas that have become commonsensical and show people that they have a history and that other ways of knowing are possible. To critically undermine the assumptions of society can be incredibly depressing, but it's also incredibly liberating to think outside of binaries, to think and demonstrate that our most commonly held beliefs can be and should be challenged.