LIFE IN EXPLODED VIEW:

Sara Hendren is an artist, design researcher, and writer based at Olin College of Engineering. Her work includes assistive and adaptive technologies, social design projects, and mixed media collaborations that engage technology and the human body. At Olin, she is Principal Investigator for the Sketch Model initiative, funded by the Mellon Foundation, designed to bring three years of programming and partnerships with practitioner in the arts and humanities to engineering students and faculty. She also leads the adaptation + ability group, which explores encounters between humans and the built environment.

GEORGINA VOSS: I've been thinking about how we articulate technological systems, in teaching as well as through practice, and why that's so important. What we do through design is materialise; we think about the world as we materialise the world. But I sense a lack of systems literacy or understanding of what it means for technologies to work in this way. That's what's keeping me up at night at the moment. Does that resonate with you?

SARA HENDREN: I find myself talking to students a lot about what is dispositional about design. We agree that there's something really compelling about materialising and externalising ideas; but equally I'm trying to cultivate in students a sense of, on one hand, commitment, and on the other hand, provisionality. It's one thing to externalise the ideas that are in your mind; it's another to have the kind of deep cognitive and affective elasticity needed to commit to an idea, to externalise it in a way that says, this is a software issue and I'm going to commit to this idea and see if I can mock it up in software, hardware, or whatever.

But provisionality is difficult to hold in tandem with commitment. Can I dial back from that thing, can I rip it open at the seams? Then can I re-commit to another direction? And then can I do it again, and can I do it again? That's the hardest thing for students to understand: it's not only not falling in love with a special technology because it's there, but also not falling in love with your own first idea, while not being afraid to flesh out an idea because you don't want to waste time on half-finishing something. This approach is about deep dynamism and trying things out.

Someone asked me recently, "I hear about design thinking everywhere, what do people mean by that?" and I said, "At its best, it's an agility with questions, like inverting problems. You are presented with one thing as a challenge and you can see it as parts of a whole; you can redesign the box, the supply chain, and the footprint entirely." He said, "Isn't that first principles thinking?" and I said, "You're right. It describes something rather simple—the capacity to think systemically when you're looking at a product, to think ecologically about how everything affects everything else and therefore is responsible to everything else."

But thinking in first principles is really quite different from getting shit done. In some issues, you're not just materialising: you're materialising in a world where it's eventually going to be delivered. Maybe that's scalability, maybe not—but it's going to have a life. And you have to hold onto your first principles and do this dance of commitment and provisionality—and, by the way, round up all the stakeholders and work with them and their material, institutional, and governmental constraints.

That's the difference between designers and armchair philosophers, for whom first principles are simple ways of thinking. It's hard for designers to hang on to them—not because they forget, but because of the commitment and provisionality.

There's something to recover here historically, at least in the American tradi-tion, from pragmatism and John Dewey and those folks. In Richard Sennet's new book on cities, he points out that the pragmatists were not about practi-cality. What defined them was their continuous will to iterate, to prototype, to see the world being actively prototyped.

I never get over how rare it is, even today, for people to see systems as unfixed. When presented with a challenge of some kind, people say, "Well, what are you going to do?" These are the options, Box A, Box B or Box C. People do not think of themselves as co-creators in an emergent type of future, nor do they see the constituent parts of that future as malleable and transformable.

The best thing about engineers and technology people is that they see the world in exploded view, that beautiful form of drawing. They see the constituent parts turning and sparkling in their un-fixedness. They can tell that the world is up for grabs. That's what I'm trying to harness for students, but the commitment-provisionality approach eludes them. It has to do with this contextual or social stuff. Can you stay plastic in the face of new information—especially in the face of overwhelmingly difficult information about, say, climate change, in your developmental moment at 19 or 20, or 26 or 27 years of age?

GV: I've been thinking about how we experience and articulate systems themselves. The engineering point of view is super interesting—that exploded view, that CAD diagram where everything is coming apart. I saw a talk recently by David Ha from Google on machine learning where he referenced John Berger and talked about seeing the constituent parts of a system. But we can never see the whole system—the political, contextual, and so on. Instead, we have rubrics to "see" with. It's not just seeing each nut and bolt exploded out but developing a partial framing, bringing together a set of metaphors that are deeply politically and culturally and personally loaded. What parts are you pulling out? Because you're not getting everything. Think about machine learning: there's a road with some white dots on it, are they sheep or something else?

SH: That's where the "exploded view" analogy falls apart. The important part is not the idea of omniscient representation of all the elements, but the disposition to understand that there are spokes to all this other stuff. These days I am haunted by how people talk about interdisciplinary or transdisciplinary new media, hybrid practice, or antidisciplinarity. I hear a lot of backlash towards that as a kind of neoliberal erasure of disciplines. I really think people want to know, "Can I actually give my students a literacy about the implications of exploded view?" Look at your practice through super-wide filters: if you're trying to deal with the environment, you're trying to deal with healthcare. Your little piece is finite and spoked by all this other stuff. You may not be able to intervene right now, but I'm hoping that ten years down the road, when you find yourself as a civic actor, you're actually going to make the right phone calls to the right people. That's pretty elaborate as a deliverable at the end of education.

But it's unclear how much disciplinary knowledge students really need in order to do interdisciplinary work. At an engineering school where everybody majors in engineering, no matter how interested they are in the arts, they're still a paltry preparation. Students don't understand the richness of the way symbols are acting in the world or think with history in mind.
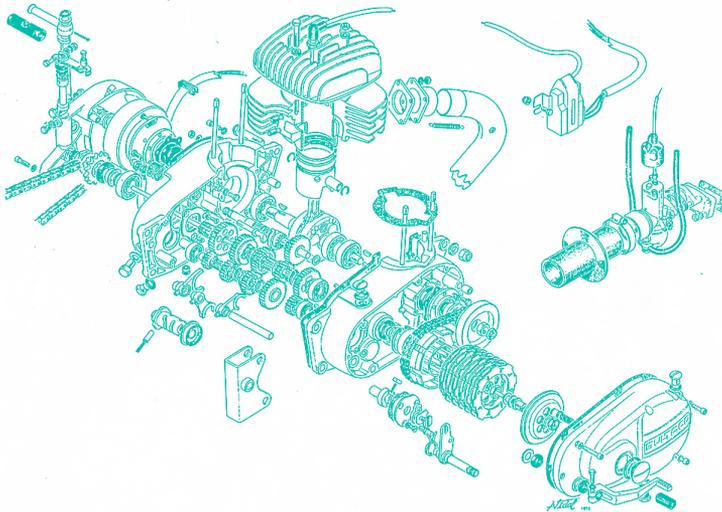
GV: People rightly say that we can't conceive of AI as a technical problem; that the problem is not technology, it's capitalism. Fine—but what do you do with that? Do you burn it all down and conceive of a post-capitalist Internet? Or do you take as your starting point the material world we live in now, our human lifespan, our impending death?

SH: Talk about a first principles trump card. This is why I love the pragmatism of engineers; I suppose it's a pathological optimism. To what end do we dedicate our energy and dignity and consciousness?

GV: I keep coming back to your advice for young engineers to court humility. In design education we challenge the idea of the lone hero, looking instead at these processes as networked and part of a larger system. But we also challenge the heroic narrative in technology and engineering. When it comes back to, "Why design?" I'm nervous about saying, "Only design can do these things for us!" I did my PhD in a policy school; I recognise what a well-crafted piece of legislation does to many buildings.

SH: That is the essence of "courting humility". A lot of us are secretly wired to believe that our way of describing the world gets at the most essential parts of the world. The mathematicians I know are delighted by the capacity of distilled mathematics to describe the world, and they're attracted to its purity and abstraction, that it's not involved in what Stephen Toulmin would call the local, the particular, the oral. People who go into psychology think, "Why doesn't

everyone study this? We're studying the foundations. If I'm studying psychology, I'm studying human behaviour - what could be more foundational than that?" And if I'm studying food science, what could be more foundational than that? Everybody needs it to live. If I'm studying medicine, what could be more foundational?

And I think designers are just as subject to that same impulse, particularly because designers are interveners. I've been reading a lot of Maxine Greene who was a philosopher of aesthetics. She would say that when we talk about arts or artefacts, what's really important is social imagination. When people gather around an artefact in some frame, making meaning with each other emergently through that thing, that's social imagination. She described it as "thinking as if things could be otherwise". It's like a launchpad for stuff to be other than it is.

What interests me in the implication of the exploded view is how young technologists are part of a larger ecosystem attempting to repair the world or build a better one. Their part may be foregrounded at some points and muted at others. Can you cultivate the kind of self-awareness to see that design is a compelling way to describe the world, but we're at a point where we need policy or doctors? It's about being a civic actor. That brings us back to the question: what is education for? Can you see yourself as a product of your own history and therefore an agent in your future? Perhaps engineers and designers need to hear that more than other people—especially in the U.S., where engineers are given so much cultural prestige and monetary rewards. I'm also thinking about Donella Meadows—have you read much of her stuff?

GV: She was how the exhibition was named! She has that great line in her Systems Primer that "systems happen all at once" and from there it was a straight jump into "everything happens so much".

"Systems happen all at once": when I think about how we experience and conceive of them, both the exploded view and the metaphors, I look to her.

SH: I had read little excerpts of hers for years, but not until January did I actually dig into *Places to Intervene in a System*. Everything about her prose sparkled with intelligence and wit, because it was informed by this humility. In *Places to Intervene*, the pinnacle is: be detached from the idea of paradigms altogether. Hold everything in the provisional—the joke's on you because your view is so partial. I was so moved by that, I had to put the book down and take a walk. I can't believe the world lost this person, what a bright light.

GV: We have always had systems and we will always have systems. Why do this work now?

SH: I'm of two minds about this. When I worry about very particular kinds of network technologies and being outpaced in terms of ethics or logical understanding of what they mean, my historian friends say, "But isn't attributing so much agency and power and effect to those technologies a technocratic inheritance?" I am so immersed in an engineering environment that I may be subject to that. But then I look at Meredith Whittaker's recent work on Project Maven, and ask myself: what are our specific responsibilities?

GV: I'm going to rewind to industrial economics. One big notion in innovation studies is the idea of technological regimes and sectoral patterns of technical change. Technologies do have different affordances: if you look at the way that biotech has developed industrially, it's a very different system to IT or to construction, which again comes back to materiality and presence. The question I'm interested in is, "What is specifically different about the articulation and quality of these networked technologies?"

SH: When I hear you articulate that, I think that it's precisely the wrong thing to do, to land in just one kind of system—particularly for undergraduates in engineering. Even if you err on the side of relevance and specificity, even if you have a thousand social, contextual, and ethical qualifiers, you will still be constrained by the particular. And this is where historians always win.

This gets back to disciplinarity. Mimi Onuoha is our incoming artist-in-residence at Olin, and what makes her work so compelling is that she's an anthropology undergraduate from Princeton. She understands that these systems have specificities and you can attend to these specificities, and therefore her practice responds to those things by taking a multi-pronged approach—journalism, installations, collaborative community work.

What should I point my students toward as an ideal of bringing one's whole identity and civic ideals and convictions into a system that has these particularities, while also attending to them? What do you need in your toolbox? You need disciplinary literacy and chops—narrativity and aesthetics, but also practical communication about engagement, to say nothing of the broad humility of a historical view.

I think the utmost that we can do in the classroom in design or technology is to rehearse this relationship to systems thinking, to try and enact a kind of alternating, provisionally committed approach to questions.

GV: There's the "prehearsal" aspect of the classroom as a place for exploration, messiness, uncertainty, and failure as well, before heading out into the world. I've been thinking about how SSS can produce critically engaged but publicly facing work, particularly in the face of demands for "industry responsiveness".

SH: You have to keep claiming the latitude for exploration and articulation. This is why design matters so much. It's not only articulating a utopian world in which you name the relationships and the policies by which these technologies will operate; you need to prototype the future with an unapologetic latitude about what needs to lead. That is the argument for speculative design: you stay way out in front, not just in terms of scenarios, but also training and rehearsals and prehearsals to sculpt how these technologies look and feel and connect to one another. This is the hill that I'm willing to die on, I think.

But how are you going to test this proposition to lead networked technologies instead of responding to industry demand? How are you going to do that unless you're at a place where people nominally came to get into industry?

GV: There's something about the need to work at industry speed, with responsiveness and urgency, that traditional academic styles struggle with. We're always going to be bound to some extent by funding and support; but it's also that when something happens fast, it happens really fucking fast. I was talking to a colleague about how coming up with an idea has to happen pretty quickly, because making it is going to be so hard and everything is going to go wrong. As much as we think about retaining plasticity and consider political and ethical forms, once you hit the material realm you've to move and keep going. There's always a lack of time.

SH: That's exactly right.

GV: I love working in a space that inhabits those properties, but it's a really specific way of doing things.

SH: You learn why first principles—or design thinking—always fall apart when you understand that the exploded view is only half the road. You learn that when you iterate through and account for all the parts and execute the thing you think will work in a certain way. Of course, invariably it doesn't work in that way, even though it follows all the rules you've learned from sociology and anthropology and wayfinding and everything else. The energy and willingness to do that is difficult to teach. It's the resilience to do that, when so much of our time here is about artificially elongating the research, ethnography, and anthropology parts just to teach slow time and slow thinking.

(Interview conducted on June 8, 2018, and edited and condensed for clarity)