WHAT BIODESIGN MEANS TO ME ELIZABETH HÉNAFF 07.2020

I was formally trained in the sciences—computer science, plant biology, cancer genomics, and then metagenomics.

For the 15 years that it took to earn the label of "scientist," the scientific method was the way I knew the world around me. This method of knowing is designed to remove the human from the equation. Indeed, the language in scientific papers removes the subject: "the reaction was performed" not "I performed the reaction." There are very good reasons why this is the case, the best one being that experiments are only believable if they are repeatable by others, and so the "who" doing the experiment should not matter. However, the practice of science remains a human endeavor.

Scientists and the institutions they comprise come with their own biases that drive what they study and inform them how to do it. It is a human being who invents the instruments, designs the studies, and performs the experiments. As a result, science and humanity are inextricably entwined.

In the sciences, instruments are cast as impartial extensions of the human sensory system. They gather and measure frequencies, molecules, and currents, at a granularity that our senses alone cannot register. Metrics are paired with invisible phenomena to make them legible. These instruments are *designed* with a specific goal in mind, engendered with a particular point of view.

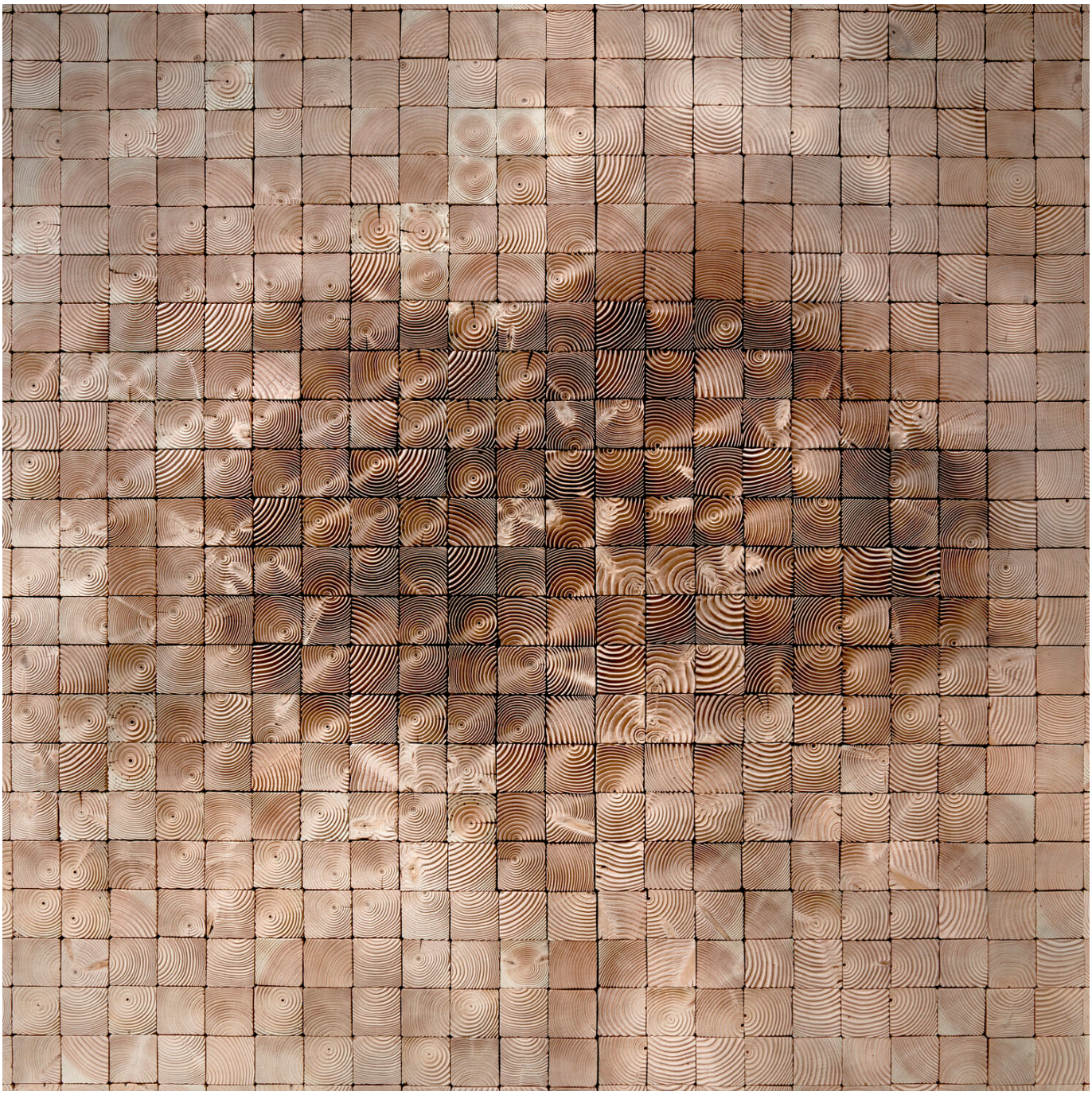
The scientist's relationship to the object of study is mediated by a relationship with the instrument. For example, our ways of knowing microbial communities are completely mediated by the instruments we use for sample collection, DNA extraction, and algorithmic sequence analysis. Science insists these instruments are impartial, but they are not [1].

During my participation in the MetaSub subway research study, I witnessed a compelling instance of this inconsistency. After the yearly Global City Sampling Day in June 2015, researchers were not just bringing in microbial samples of subway cars and surfaces, they had also collected stories and reactions of the many people who rely on the subway in their daily lives. Many passengers had asked, "Are you monitoring for an epidemic?" and "Are you implanting HIV in the subway?" I suspect that they were reacting to an instrument, the tool of study—a nylon, clinical-looking swab and its white, medically labeled container.

That an object (in this case, the instrument) has the power to make you feel one way or another will be nothing new to a designer or artist. What would be another way to interact with microbes that feels different than a swab? Grabbing a handful of dirt, for example. Biologically the same process of collection, the swab carries negative connotations of contagion, distance, or fear, while the handful of dirt might evoke warm connotations of earthiness, groundedness, or connection.

While the swab is not changing the microbes it is collecting, it is influencing the person who is doing the collecting, just as it did the bystanders observing the subway swabs. This perception can also influence their role and further interactions or interventions. As a result, humans, their objects of study, and their instruments are inextricably bound. The discipline of biology can take a lesson from the field of design, and work toward an

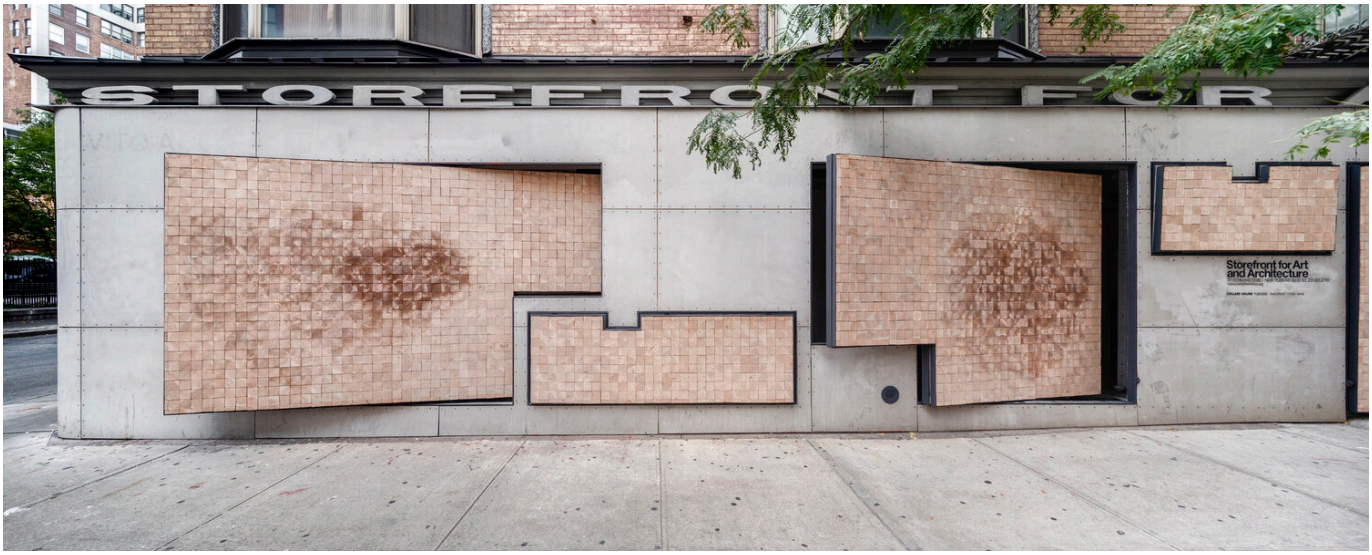
acceptance that instruments are not impartial, and incorporate that understanding into the development of their processes and instrumentation.



SUBCULTURE: MICROBIAL METRICS AND THE MULTI-SPECIES CITY BY KEVIN SLAVIN, ELIZABETH HÉNAFF, AND DAVID BENJAMIN / THE LIVING. PHOTO BY RAFAEL GAMO. COMMISSIONED BY STOREFRONT FOR ART AND ARCHITECTURE, 2018.

In turn, how can the discipline of design, an inherently human-centered practice, learn from the field of biology? Biological metrics help us contextualize human health and well-being within the ecosystems they inhabit. Design for humans will become design for the more-than-human [2]. Relational inclusion, as opposed to eradication, of microbes, for example, will impact choices of materials, clothing, architecture, climate control systems—the interface technologies that mediate our physical presence in ecosystems.

So far, scientists have mapped the microbial populations of cities, buildings, soils, and systems [3] using the quantitative metrics of DNA sequence analysis, but beyond the management of pathogens, planners are just beginning to integrate that information into architectural and urban design. For example, in a collaboration with the Yale Center for Ecosystems in Architecture, my lab is using microbial metrics to assess the impact of indoor green wall infrastructure.



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In my work with Kevin Slavin and The Living, we aimed to get a sense for microbial and human cohabitation implemented at an architectural scale when we created a bio-receptive facade for the Storefront for Art and Architecture in New York City. SUBCULTURE transformed the Storefront facade into an urban metagenomic sensor and bioreceptive environment. The facade was both a design inquiry and scientific instrument.

Explorations like these should help us get a 'feeling for the organism', to use a term favored by Barbara McClintock [4]. Here *feeling* is about developing an intuitive understanding through continued and careful observation alongside an empathy that grows with establishing a relationship. For me, biodesign can develop instruments and interfaces that mediate this new understanding.

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[1] Several theorists have articulated that instruments have agency to affect both the experimenter and the experiment, including contemporary physicist and philosopher Karen Barad in "Agential Realism Feminist Interventions in Understanding Scientific Practice." Barad builds on the work of Niels Bohr and others. Bohr found that the instruments used in quantum physics modified the material they studied. The act of observation itself changed the material observed.

[2] Alaimo, Stacy. *Bodily Natures: Science, Environment, and the Material Self*. Indiana University Press, 2010.

[3] Horve, P.F., Lloyd, S., Mhuireach, G.A. *et al*., "Building upon current knowledge and techniques of indoor microbiology to construct the next era of theory into microorganisms, health, and the built environment." *Journal of Exposure Science & Environmental Epidemiology,* vol. 30, March 2019, pp. 219–35, https://doi.org/10.1038/s41370-019-0157-y.

[4] Henry, Elizabeth. "Toward a 'Feeling for the Organism.'" *NWSA Journal,* vol. 9, no. 3, 1997, pp. 156–62.

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