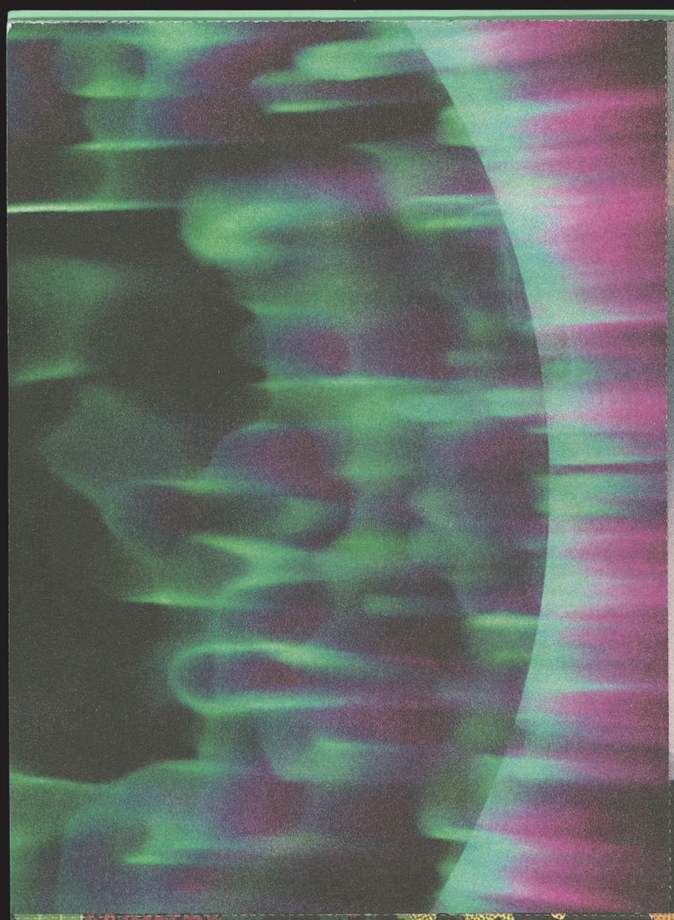
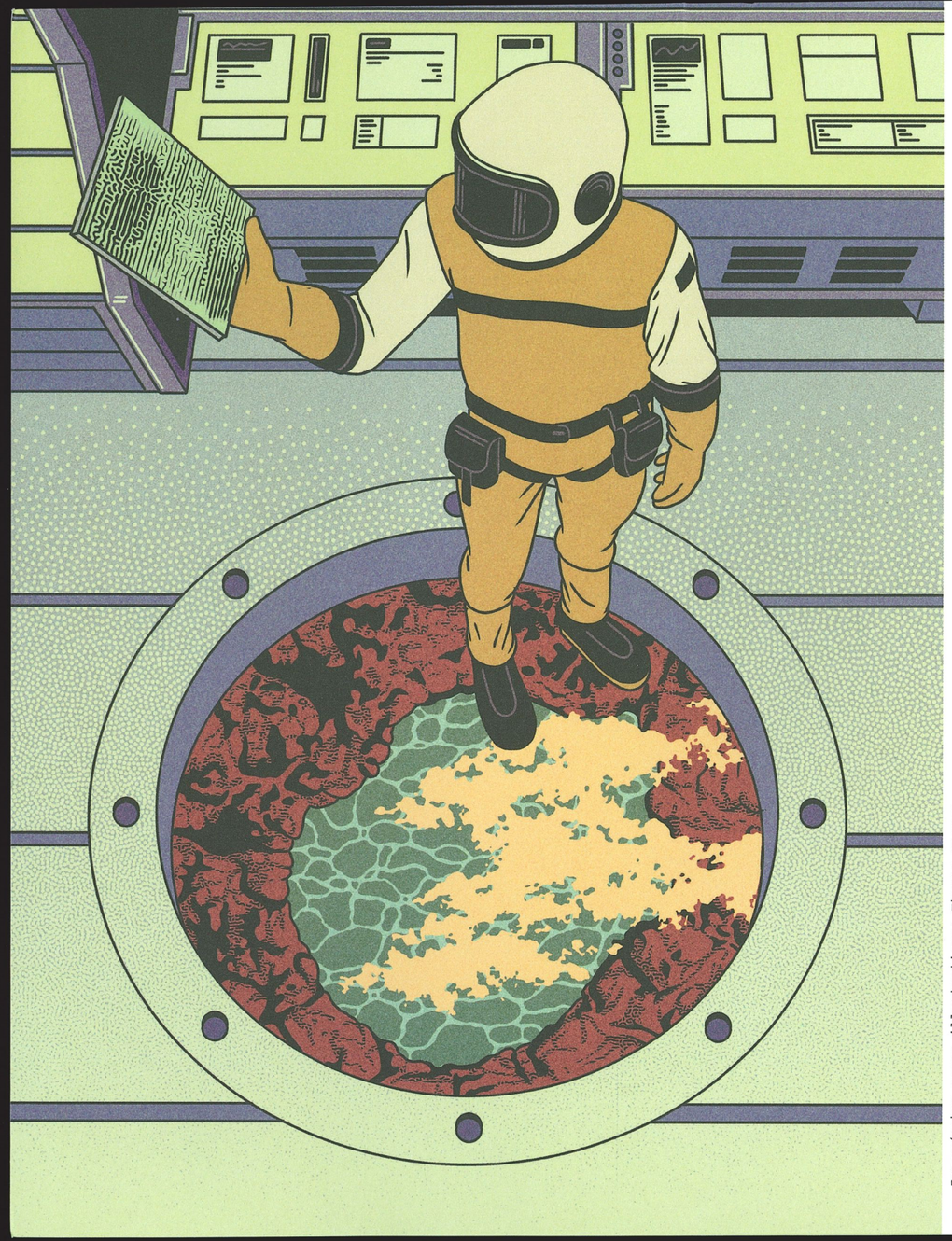


Fictions and Futures



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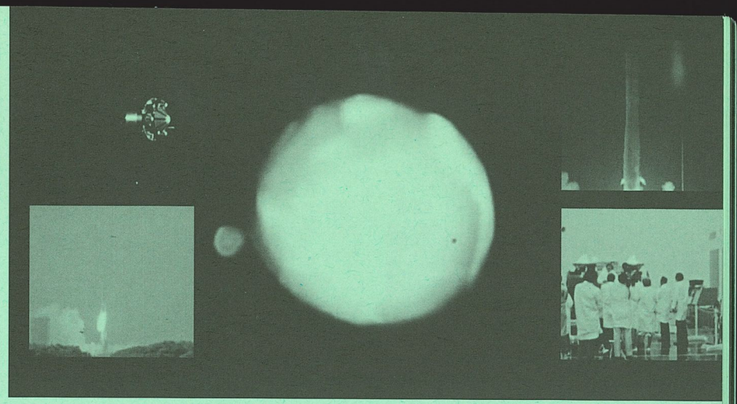


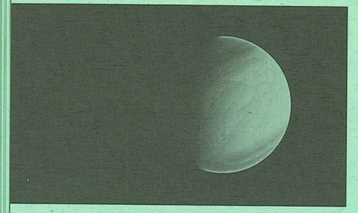
WENDI YAN

I call myself a world maker, though the label wobbles under scrutiny. In practice, my procedure is fairly concrete: I craft 3D models, and deploy them into Unreal Engine (UE), a game engine that easily renders staggering amounts of complex geometries in real time. Then I "fly" around, moving between and within them, as a massless specter, and spell procedural logic into the models to give them a semblance of life. I animate technology infrastructures, construct floating landscapes, and script historical timelines at once foreign and familiar. Each world I make is a prototype of philosophy.

One of my favorite tools in UE is the "Environment Light Mixer"—a control panel for creating "Sky Light," "Atmospheric Light," "Sky Atmosphere", "Volumetric Cloud" and "Height Fog." After six years of world-building in UE, I've learned this basic panel is where most of the magic happens. Tweaking the parameters of volumetric fog scattering, mie scattering, rayleigh scattering and atmosphere absorption, as well as adjusting the colors of the various layers of lights and fogs, gives me vastly different atmospheres—which are, effectively, levers of mood. Cinematic storytelling is largely composed through the shape and texture of the fogs, the way they scatter and refract in space, and the colors and reflections within the shadows. The 3D graphics world now becomes a narrative world.

Drs. Sara Seager and Iaro Iakubivskyi, I've come to see in our collaboration, are also world makers. Quite

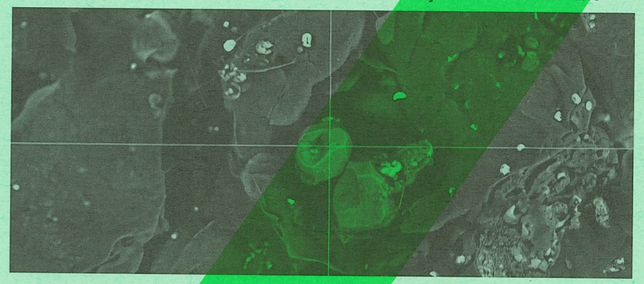
literal with their technique, they created a "cloud chamber" that simulates an atmospheric environment akin to Venus, tested biogenic amino acids and nucleic acid



bases inside tiny pools of sulfuric acid, and began designing an alternate DNA that would be stable in concentrated sulfuric acid. These experimental activities become their research foundation for Phaínōterra, a fictional planet with some parameters tweaked from the Venus condition. They use Phaínōterra to paint a scenario where the universe harbors life forms beyond the patterns of life humans have made from our brief time on Earth.

One could say Dr. Seager's team and I are both practitioners of simulation, though our playgrounds differ. Mine inhabits the digital space of 3D meshes and procedural logic, not always obligated to laws of physics. When I set up the 3D models and blueprint actors in UE, I press the "Simulate" button to record how the actors climb terrains and how particles and fluids move. Dr. Seager, in her interview for Proxima Kósmos, also speaks of simulation as a core methodology of her lab: in a glass fish tank, her team simulates sulfuric acid clouds as you would find on Venus. They watch how biogenic amino acids perform in an atmospheric condition farther from their Earthly home.

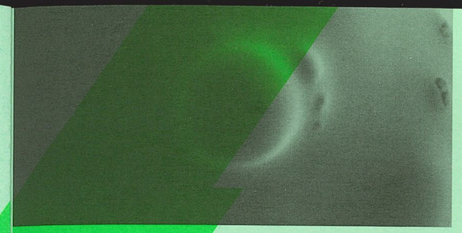
But the world does not simply present itself to Dr. Seager and her colleagues as a pictorial fantasy borrowing its visual form from the Wild West—the way artists tried to imagine Mars and outer space in the midcentury. She came to see the world through gathering a series of astronomical and chemical data that, on paper, look like nothing more than some arrangements of dots, lines and numbers. Anthropologist Lisa Messeri, who conducted



her fieldwork with Dr. Seager in 2009, concluded that it was about "how to see [the] light curve as a planet, as a world."[1]

Messeri observed that “Exoplanet astronomers make worlds constantly.”[2] The key difference between a world and a planet here is: a world renders a planet experience-able. A world pulls abstract information to a subjective self and organizes it into a potential energy for affect. You are thinking about the terrain, the atmosphere, and even the geological epochs and possibility of life. And this, Messeri summarized, was core to what Dr. Seager taught her students to do: to see data as planets, and to communicate to others how the planets can be seen as worlds. This way of seeing a world through patching together different types of data was a hard skill—or cultivated intuition—young astronomers trained for years to gain.

Dr. Seager made it very clear that she doesn't assume any lifeform in the clouds of Venus. To me, the point of her methodology is that by orienting oneself towards the possibility of life, you treat (exo)planets with a more open mind. You hold space for the unfamiliar and the unforeseen, and this in itself is meaningful for scientific practice.

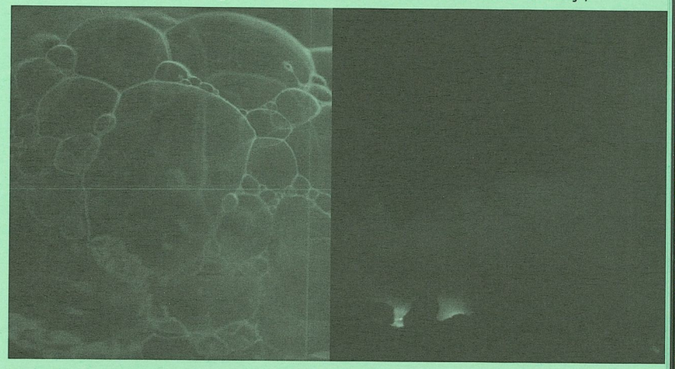


Now you invite a more capacious sensemaking.

Joining Drs. Seager and Iakubivskyi for the Proxima Kósmos project, I found myself conscripted (and happily so) onto a mental scientific mission to Phaínōterra. I was world-making with the scientists, using my digital tools of visual effects, 3D modeling, and real-time rendering to materialize the world the scientists saw through the data composite. I used Gaea, a professional procedural terrain modeling tool, to mold the volcanic landscape, and UE's fluid simulation system to form acidic pools on the terrain. I modeled the balloon vehicle according to the photos Dr. Iakubivskyi sent me from the lab's visit to their fabrication

partner, where they have been designing a balloon-shaped space vehicle for suspending scientific instruments in the clouds of Venus. The world of Phaínōterra came to me initially as a series of PDFs from the scientists, and later, through my process of crafting its planetary, cloud layer and terrain views inside VFX software and a game engine.

Hovering behind the simulation work, another urge persisted: to step back and watch how meaning-making

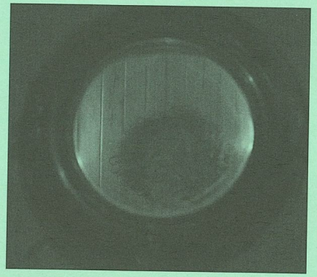


itself unfolded. I studied the history of science and documentary filmmaking in university and have always been fascinated by how humans, throughout time and across geography, try to make sense of the world through any attempt to overcome their subjectivity. In my years of searching for films and media about science-making, I was baffled by how scientists are rarely portrayed in motion. Instead, they always appear as the figures of authority that give you an objective frame of reference, a reliable stack of hard facts ready to be memorialized on film. But I want to position scientists in a more humanistic way: I want to be with the scientists and show the process of their work, both physically and mentally, presenting them as explorers at the edge of contact with a foreign land—epistemically.

Visions of Phosphine Earth and *Making Phaínōterra* are twin films. They are about the same story, told through different narrative modes or planes of consciousness. The former is a meditative audiovisual journey that traverses between macro-landscape and micro-imaging, between scientists' lab or expedition work and my 3D worldbuilding or AI hallucinations. With no voiceover narration or captions, it relies on the shifting perspectives of the images as the portal to the story, and the meaning-making emerges from the visual

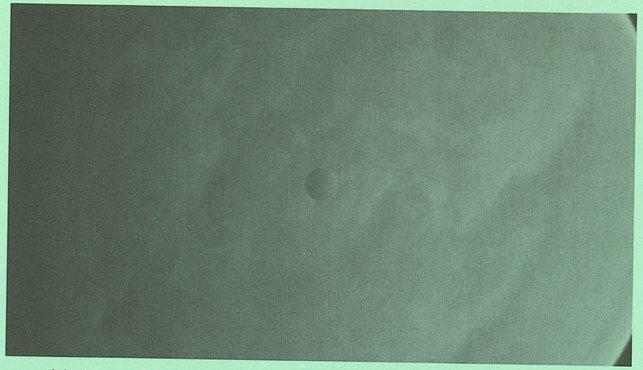
juxtapositions. The latter film is a documentary that foregrounds the scientists, with the narrative strung together by Dr. Seager's interview, punctuated by Dr. Iakubivskyi's footage of his expeditions and acting as the fictional scientist in the story he and Dr. Seager wrote with the sci-fi writer Caroline M. Yoachim.

In both films, fact and fiction drive each other and make a world together. Being courageous enough and having the creativity to imagine outside the box has been a determining factor for visionary scientists



historically. It's evident that Dr. Seager and her colleagues have recognized for long the importance of seeing through the data in an integrating way. It's a patient, difficult art of building a world that's at once a scientific object and an epistemic imaginary.

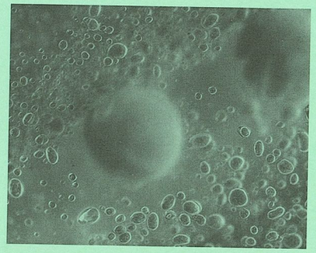
Both of my films strive to frame and render Phaínōterra as a site of rigorous science making. A place's meaning does not hinge on its physical reality. Phaínōterra



provides a valuable instance as a conceptual place for scientific activity, within which a whole host of questions are posed at a scale and from an angle more personally relating to being a human on Earth. The clouds of Phaínōterra are a testing ground for sensemaking.

In his science fiction *His Master's Voice*, the visionary writer Stanislaw Lem, speaking through his character Saul Rappaport, proposes that the distinction between "natural" and "artificial" is not fully immutable, but rather contingent upon the "cognitive frame of reference."[3] Rappaport continues to imagine an evolution wherein a highly organized biosphere is capable of metabolizing nuclear energy: coming from a totally different course of evolution, we would have significant trouble comprehending how the life processes unfold for such intelligence. How do we strive to understand life beyond the lexicon of Earth-bound biochemistry?

Lem's narrator fell into a psychosomatic feebleness and concluded that the mission to decode the alien signal Earth received was "doomed in the bud [...] to insanity:" "the Senders had in mind certain beings, certain civilizations, but not all, not even those of the technological circle."[4] Humankind was not the fitting Receiver, he reckoned, and there was not much we could do about it.



On Earth, sulfuric acid spells death—a solvent of endings, not beginnings. But Dr. Seager's team has been hypothesizing that sulfuric acid, in another world,

could sustain life. Hence Dr. Iakubivskyi's journey to Kawah Ijen in Indonesia—one of the largest highly acidic crater lakes in the world. If he encounters extremophiles in Ijen, they may give clues to how life might survive, or thrive, in sulfuric acid on another planet. Venus, for example. Back at MIT, Dr. Iakubivskyi turns to the Scanning Electron Microscope (SEM). On its monitor, a high-energy electron beam creates bubbles inside ionic liquid in a vacuum, as a simulation of a water alternative for holding DNA in a planet with no atmospheric pressure. Then Dr. Iakubivskyi places an Ijen-collected sample under the microscope, scanning its geometries and looking for new clues of life's edge.

Watching Dr. Iakubivskyi's self-recorded, two-hour footage of the SEM monitor refreshing every few seconds, the scale seemed to collapse for me. The microscopic worlds inside the monitor appeared like atmospheres and terrains. I plunged into the fold. Why don't I imagine something scientists cannot say?

So I set a custom AI pipeline to work, inviting it to hallucinate life from the grayscale images on the SEM monitor. And the lab was also turned into a microscopic world of its own. In making the meditative film (*Visions of Phosphine Earth*), the music and the animation were edited in such a way that some metallic creatures seemed to pulse and breathe inside the monitor. You start to become a creature in the microscope too.

I wanted to venture further into the clouds of Phaínōterra. Having trained a custom style model based on microscopic images, I used a real-time Flux model to let AI dream of otherworldly creatures on top of the data. I used Dr. Iakubivskyi's SEM images of Ijen soil samples as the base visual layer

for these hallucination sessions with AI. Between adjacent pixels of the soil samples, I asked AI to see unto the shapes and textures of micro-life forms freely, like a co-conspirator undoing my Earthly conceptions of life. The authoritative SEM imaging now became my images of departure, into a fuller realm of imagination: what might life look like in the clouds of Phaínōterra? What might we find on Venus?

Metallic, crystalline, or soft, porous creatures crawl out of the SEM images; letters curl; numbers deform; a feral epistemology surfaces. I meet the scientists in the imaginary realm, on a pink planet densely packed with data, models, simulation and stories.

We swim in the uncertain, difficult solutions and oceans between planes of reality and subjectivities, at once imaging and imagining.

[1] Messeri, Placing Outer Space, p.113.
[2] Messeri, Placing Outer Space, p.114.
[3] Lem, His Master's Voice.
[4] Lem, His Master's Voice.

Citations
Lem, Stanislaw. His Master's Voice. MIT Press, 2020. https://doi.org/10.7551/mitpress/12605.001.0001.
Messeri, Lisa. Placing Outer Space: An Earthly Ethnography of Other Worlds. Experimental Futures. Duke University Press, 2016.

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