

Artists, Data and Climate Change: Distilled messages, multiple entry points, layered metaphor

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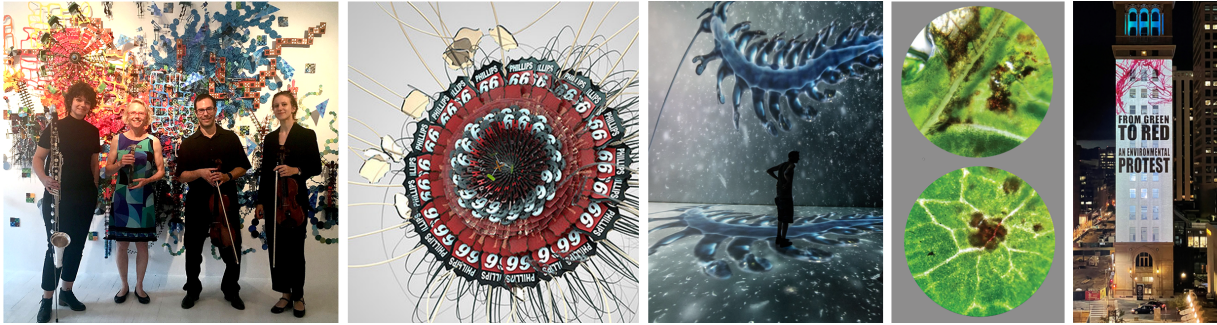


Figure 1: Nathalie Mielbach, Ocean data and musical accompaniment; Jon McCormack, custom machine-learning generated flora; Victoria Vensa, Noise Aquarium, immersion in the sounds of the ocean; Deitmar Offerhuber, Dust Zone, auto-generated atmospheric data; Beatie Wolfe, Green to Red, multimedia installations using music, data and more, reflecting our rapidly changing planet.

ABSTRACT

Artists have been speaking to, and creating paths for reflection on, fundamental threats to society and our lives as far back as we can document. Our changing climate is one such threat demanding meaningful narratives. In this short paper, we present the work of six internationally recognized artists addressing climate change, along with an analysis of their common work threads, toward the goal of promoting adoption of some of the "tools" in their toolkit. By doing so, we hope we can assist the visualization community in creating content that moves beyond intellectual understand toward an emotional adoption and thus action.

Index Terms: climate change, climate data, data physicalization, environmental art, immersive art, installation art, multimedia art

1 INTRODUCTION

Artists around the globe have turned their attention to climate data and climate phenomena, motivated to communicate their perspective on what climate change means to humanity [7, 8, 23, 26]. Scientific communication about climate change often focuses on the research and the specific findings, which are critical but are often intimidating and or overwhelming. Artists look for the key drivers — the images and prose that will resonate with their audience — connecting their lives to our changing planet. To promote changes in behavior we must explain the facts using our intellect but also touch our emotions. Artists employ visual analogies and metaphor that are a path through which viewers can connect the life experiences to our changing planet. While to many in the scientific community this may seem less direct, this approach enables viewers to enter the subject via their life experiences. Art and story are the means by which societies throughout human history have addressed life's biggest threats specifically for this reason. Think about the fairy

tales and fables we are read as children. They educate us about major threats to one's life, enabling the listeners to absorb the content gently over time rather than abruptly, rising up our defenses.

Here we present six artists and an analysis of their work for discussions aimed at incorporation of artists' communication processes and means of bringing connection and affect to climate data visualizations, be they information visualization, scientific visualization, interactive, immersive or physical, all toward the goal of raising awareness of the state of our planet's rapidly changing ecosystems and on identifying methods for pursuing healing and sustainable practice. Much work has been done in this area exploring the impact of art as a medium as well as an education tool addressing climate change, environmental communication and sustainability [2, 5, 6, 8, 9, 10]. We highlight six well-documented artists who can spur on a discussion regarding relevant artistic practice well.

Houser's Infowhelm details many well-known artists addressing climate change but there is a vast range of other work and research on the topic [1, 3, 6, 7, 15, 19, 22, 23, 24]. The environmental artists we have selected herein draw from earth's ecosystems to assist in fostering engagement by using the tools within an "artist's toolkit". Our contribution is a distillation of the fundamental components of these "toolkits" common to their work. By identifying the commonalities of successful, widely-distributed, accomplished artists who have drawn hundreds of thousands of visitors to their work, we have created a road map for employing some of their methods. Our analysis distills common characteristics of their work as a starting point for a discussion on artistic practices able to aid in the embodied understanding of climate change.

Primary and common to all of the works, we find layers of entry points and diversity of content and elements within the work that enable engagement within broad audiences. Also common across the artists are: images and objects that pique our curiosity through non-conventional use of materials and or medium; content presentation from a novel dimension or unexpected perspective; the use of metaphor and analogy; and use multiple sensory modes such as sound and touch. Other common threads defined by the artists include: the role and power of beauty; a connection to nature itself; and an invitation for learning.

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Figure 2: Nathalie Mielbach's, Ian and Nicole, speaks to the destruction and rebuilding of Daytona Beach after the Hurricane Ian and Nicole of 2022. [12].

Tools in the artist's toolkit:

- Curiosity: Does it stop us in our tracks? Do we want to explore and decode the work? Does it offer us a view of something unseen or unfamiliar?
- Real-time/Interactive: Does it reflect the present, thus connecting with our lives? Does it enable us to engage with the work, either by interaction or immersion?
- Communal Experience: Does the work address concepts bigger than ourselves? Does it facilitate a shared experience of wonder, knowledge or controversy?
- Multi-sensory/Immersive: Can we perceive and interpret the work using multiple senses: see, hear, touch, smell, feel?
- Interpretations and Perspectives: Are there multiple points of entry, and dimensions that can speak to a wide audience, facets of curiosity or wonder? Are there layers of metaphor to explore and ponder? Does it draw in a wide audience through multiple channels?
- Test of Time/Evaluation: Does it continue to draw and resonate with audiences over time?

Within the review, we provide links to engage further consideration of the artists.

2 ARTISTS

Over the last decade, we have interviewed artists at working with data, science and technology. Many of these artists focus on climate communication. Our selection of artists and the analysis of artists' toolkits are drawn from these interviews, in support of an Art on Graphics department of IEEE Computer Graphics and Applications [4].

2.1 Nathalie Mielbach - Scuplural Storytelling

Mielbach's work is a visual web of textures, forms and notations all representing data she has collected from natural environments, which are primarily coastal [12, 16]. The intricate entangled sculpture elements that explode with life, pique our curiosity and draw us into decoding the cascade of data presented. Seeking to capture extreme weather events, we are drawn in by: the whimsical visual presentation, antithetical to the content; the enormity and intricacy of the data; and our human desire to unravel the clues within the puzzles enveloping our view. Her exhibitions attract large audiences, leading to conversations with strangers and friends about the

events depicted and turn our attention to our changing coastlines. The sculptures are often complemented with musical events, which have scores developed by Meilbach based on the data within the sculptures [13]. The various layers of straw, wood notations, and more culminate in whimsically engaging and visually curious puzzles, while also faithfully presenting geospatial data of a storms and other extreme coastal events. Meilbach's weaving of data, material and documentation produces ""Sculptural Storytelling"" [14].

2.2 Andrea Polli, Real-time environmental data

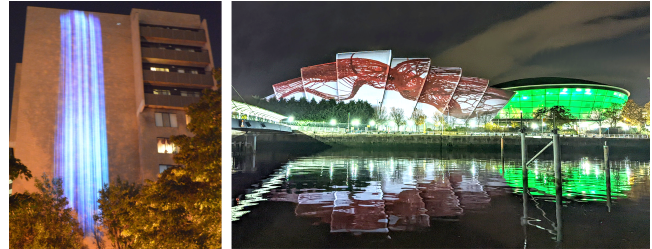


Figure 3: Andrea Polli's *Particle Falls*, left, and Beatie Wolfe's *Green to Red*, right, are both large outdoor installations drawing the attention of a large audiences.

Particles Falls, illuminates, literally, the particulate matter in the air which we cannot see [20] as shown in Figure 3. Air pollution sensors show us the conditions of the air we are breathing in real-time. As a plane flies overhead we watch the "Falls" change in volume and composition, showing us the direct impacts of our transportation choices, in a mesmerising, curious community-engaging presentation. The focus on air quality provides a visceral connection to our lungs. Her visual connection to urban sources of air particulates expands effectively to discussion of global air quality, while using a waterfall projection to reinforce the connection of human dependencies. Particle Falls, large scale and real-time animations, create focal points in the outdoor spaces across the globe, captivating audiences and promoting dialogue between friends and strangers[21].

2.3 Victoria Vensa - Immersion into that we can not see

Noise Aquarium, provides entry and insights into a critical but unseen sector of our planetary biota — marine plankton, which generate 25 percent of the oxygen on the planet and are the base of the ocean food chain on which all other aquatic fauna feed [25]. These immersive environments, shown in the third panel of Figure 1, not only submerge us in an environment where few can go but they bring to life the complexities and diversity of the plankton on which ocean life depends.

Noise Aquarium is a visual presentation, but the key component is sound - the brash cacophony of unnatural sounds in the ocean, primarily fossil fuel related — extends beyond the well-known aspects of carbon driven acidification and warming temperatures. The volume of sound generated from ships and equipment has an enormous impact on marine life. The environment mimics the man-made sounds that creates an inescapable cacophony in the ocean. Vensa is creating an experience of the ocean that we cannot see or experience from the perspective of aquatic life. Working closely with scientists, the themes and content of her work are drawn directly from the research within the labs and the world at large. Victoria's artistic practice aims at exposing how much environmental degradation is correlated to a culture enamored with fossil fuels.

2.4 Dietmar Offenhuber - Collecting autographic data

Autographic data collection means collecting data that is produced by our environment. As Dietmar's artistic practice demonstrates,

"this data is everywhere, we just have to know how to collect it. The environment is speaking to us, if we put out the right sensors that can translate it."

Offenhuber's work, his data and physicalizations, emerge from the environments in which they are seeded [17, 18]. Dust Zone is comprised of a set of circles that emerge on concrete walls in public settings. The interaction between the chemical applied to the concrete and the levels of pollution document the state of the air quality at that location. Installed in several public locations, one either stumbles on them in their daily life or sets out to compare the locations and pollution levels over time. The exhibit processes data in real-time as it is collected by the environment itself. Being in public spaces, audiences encounter the work changing over time. Installed in public settings, unannounced, it enables a surprise encounter with the unexpected. As the work directly relates to the air we breathe, it speaks to the audience as if an autobiographical part of their lives, more directly than something being simulated or data being recorded. Offenhuber works in many mediums including plants as seen in Figure 1, where the environmental conditions leave tattoos on each leaf's surface. More on Offenhuber's work can be found in his recently published "The Matter of Data in a Self-inscribing World" [17].

2.5 Jon McCormack - Algorithmically grown art

McCormack's 50 Sisters, while straightforward in appearance, is packed with layers of content about society, humanity and the history of fossil fuels. It doesn't preach but from these complex engaging images we are given entry points to think about a vast range of topics such as, the cycle of plants into fossil fuels into driving new species and conditions across the globe. McCormack reminds us that the current dominance of oil commerce originated from plants. What once took evolutionary time scales of millions of years can now be superficially replicated by technology in an instant. But while we can evolve new species and technologies that satisfy our unsustainable desires, those technologies can have unintended consequences. The piece suggests a useful artistic practice of interaction between artificial intelligence and creativity, which he takes forward into current day genAI potential.

50 Sisters, a series of plant forms, are grown from the shapes and symbols within oil company logos. Structuring of the plant forms draws on McCormack's knowledge of Australia's flora during his time exploring natural environments [11]. His algorithm, analogous to digital "DNA", creates the visual structures of that plants — the idea being that oil came from Mesozoic plants and thus the connection between oil and plants, as well as the commentary on the role our oil consumption is playing on the evolution of life on the planet. McCormack's work, rich with layered analogies drawing upon nature, speaks of our natural environment as well as the beauty, intrigue and curious construction that contains most of the elements within our analysis. While not directly interactive, the large public renditions of the work are evolving in front of us and the series of still images speaks of an evolution during our time. The easily identifiable logo elements, while deftly reconfigured, speak clearly to the message of the work.

2.6 Beatie Wolfe - A sensory alchemist

Wolfe's work is constantly calling our attention to our existence as part of nature not apart from nature, through work that is ripe with metaphor, symbols and references. Green to Red is built from a musical composition and supported by large outdoor presentations and interactive displays of unraveling yarn that present climate-related environmental data [27]. Wolfe's exhibits draw large audiences though her use of music, imagery, tactile interfaces, participatory affordances, and targeted immersion. Digital versions of her work provide touch screen interactivity when interaction is highlighted. Her longer timelines, while not real-time, immerse her audience in



Figure 4: A public installation based on the 50 Sister's series, generated by McCormack ML algorithm from the components of oil company logos.



Figure 5: Offenhuber's Dust Zone physicalizes the otherwise unseen.

a visceral sense of the present moment. Shorter time-line installations support real-time presence through use of multiple sensory layers.

A sensory alchemist, Wolfe's curiosity for life as we do or don't know it is like a primordial ooze that surges through her, manifesting itself in innovation after innovation in the tangible world. Most well-known for pioneering new formats for music and art that unite the physical and digital—like her Space Beam and wearable record jacket—her artistic practice constantly stretches the constructs of not only creativity, but what it means to be a tenant on Planet Earth.

3 DISCUSSION

Our reflections and analysis are drawn from knowledge gained over a decade researching artists and conducting extended interviews. The contribution of this work lies in the observations and synthesized of the common threads drawn from this work, intended to seed discussions on how artistic practices can drive wide audience engagement and contribute to an internalized engagement with the challenges of climate change.

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