Ephemera: Bubble Representations as Metaphors for Endangered Species

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Abstract

The effects of a hierarchical relationship of humans with non-humans are now more pronounced than ever. Anthropogenic ecological stressors, including high levels of carbon dioxide, water scarcity, habitat fragmentation have led to disruption of climate systems, in turn endangering many local and global species. ephemera is an installation composed of glass vessels that show bubble images representing animals from all continents and ecologies currently under threat as per the IUCN Red list. These self-assembling bubble pictures, formed by nucleation of CO2 bubbles in water, are in a homeostasis at the beginning of the installation and shrink each hour to eventually disappear in a few days. The tension between the present endangerment and the urgency of the future action, manifests in the shrinking of these bubbles, invoking unnatural ephemerality due to the human effect. The fauna pictures in this installation, composed of carbon dioxide bubbles, symbolize the transitoriness of now threatened species.

Keywords

climate change, biological functions, endangered species, iucn, ephemeral art.

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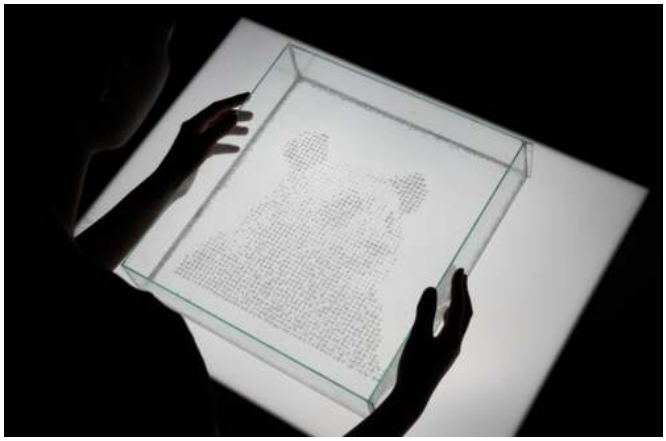
Introduction

In 2015, Hawai'i was called as the extinction capital of the world.[1] Occupying a small land mass (0.25%), the islands had 25% of the endangered species in the US.[2] In intertwined ecosystems, direct and indirect effects human activities—monoculture, greenhouse emissions, extraction, and urbanization—on the biological diversity in a different location are significant[3] but often hidden from sheltered lives of humans in another place.[4, 5] Separated from nature in this manner, our thinking of endangered species is cultural, and public engagement with endangered species going forward depends on new structures of imagination. How then should we invest culturally in the fate of endangered species? What emotions do we collectively engender?

This work, an installation composed of ephemerality and melancholy, focuses not particularly on the beauty of imperiled fauna but on their current transience. Glucksmann's philosophy of the ephemeral[6] is particularly relevant where the moment is not static, but modulated and resonant. Drawing parallels with flux-images, where the process takes precedence, Glucksmann calls out the aesthetics of the ephemeral as fluid and polysensorial. In the context of this installation, images of various endangered species form with carbon dioxide bubbles—bubbles that shrink in a few days gradually waning the entire image. Materials within this installation's cultural context are designed not for absolute control but for its relegation.

Concept

Jean-Louis Boissier called out the roles of images as an interface,[7] which we can act upon, manipulate, and transform—an image that vectorizes a relationship. We focus on such a relationship through evocative material with embedded cultural context of greenhouse gases and their effect on fauna. Specifically, the focus is on the ephemerality of the images. In prior transient works [8,9,10,11,12] durability is determined by the intrinsic material properties in combination with the surrounding ecosystem, often deliberately designed to offer only partial or imperfect control. Material semantics - original meaning of a material - shape the perception and overall experience. The ambiguous ontological status of the ephemeral also makes it a "powerful metaphor for expressing nuances of memory, time and knowledge."[13] Interpretation of ephemeral meanings and consequences is thus beyond the object itself.[15]



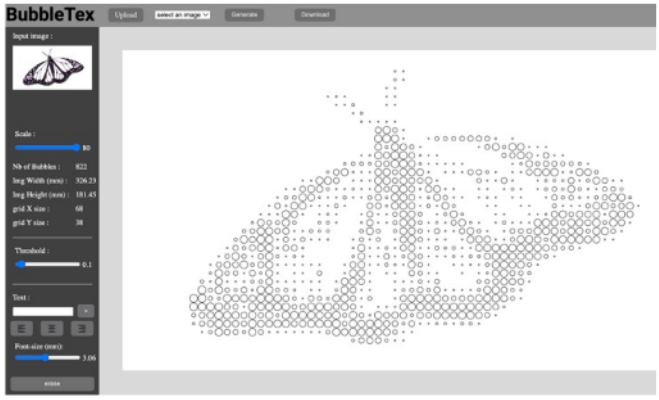
1. Glass surface (13" x 13") with image of a panda made through ~6000 nucleated and controlled bubbles in a carbonated liquid. © Harpreet Sareen, Yibo Fu, Yasuaki Kakehi.

In this work, images of endangered animals form on glass vessels through thousands of carbon dioxide bubbles. These bubble formations shrink by the hour to eventually disappear in a few days. The bubbles are formed by nucleation of CO2 bubbles in water and are representational images of animals from continents and ecologies currently under threat.

The installation is composed of ten glass vessels that are hydrophobically treated for controlled micro/nanostructures on surfaces. When carbonated liquid media is poured onto the surface, bubble generation is activated and bubbles of carbon dioxide of various sizes stick at defined points on the surface. Inspired by Sylvester et al., who mentioned bubbles as a material[16] between "neither real nor fully virtual," we extend the temporality of bubbles in this work. The process from initial nucleation to stabilization takes an average of twenty minutes, depending on the saturation of carbon dioxide in the liquids. Bubble images and patterns are stable for one day before they start to gradually shrink, completely disappearing in five days.

System Design

We created a novel fabrication technique to selectively modify hydrophobicity properties of surfaces (glass/plastic) such that bubbles in carbonated liquids nucleate at specific positions on surfaces.



2. Custom p5.js based design tool that converts images into bubble patterns based on original contrast to be then used for fabrication on a vinyl cutter. © Harpreet Sareen, Yibo Fu, Yasuaki Kakehi

Figure 3. Sample bubble pixelation. Left: Grayscale photo of a sea turtle. Right: Bubble-pixelated photo with visible features © Harpreet Sareen, Yibo Fu, Yasuaki Kakehi

This turns stochastic nucleation into controlled nucleation of bubbles for images, patterns, and text on various surfaces. Such surface modifications are initially invisible to the human eye. On pouring carbonated water in containers of various shapes (horizontal/vertical) and sizes, bubbles nucleate, coalesce, and grow to accurate sizes (1.0 mm – 5.5 mm) thus creating patterns, images, or text on surfaces. Such bubbles are highly stable and can keep sticking to the surfaces for longer than a week without significant disturbance.

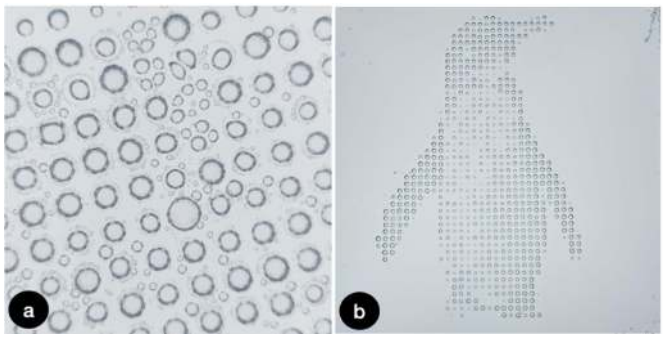


Figure 4. a) Small bubbles nucleating and merging to predefined sizes, b) Penguin representation through bubbles. © Harpreet Sareen, Yibo Fu, Yasuaki Kakehi.

To fabricate the glass vessels, we use Regular (Home Depot, 599047) glass as a substrate which is initially hydrophilic (wettable) in nature. An illustration software (Adobe Illustrator) or our custom design tool is used to create desired patterns and print out an image mask using a vinyl cutter (Cricut Maker 3). The sticker mask is pasted on the surface and a ceramic hydrophobic coating is applied manually on the glass surface using a zigzag technique before drying for 24 hours. This creates a surface with distinct wettability regions that are invisible to the human eye.

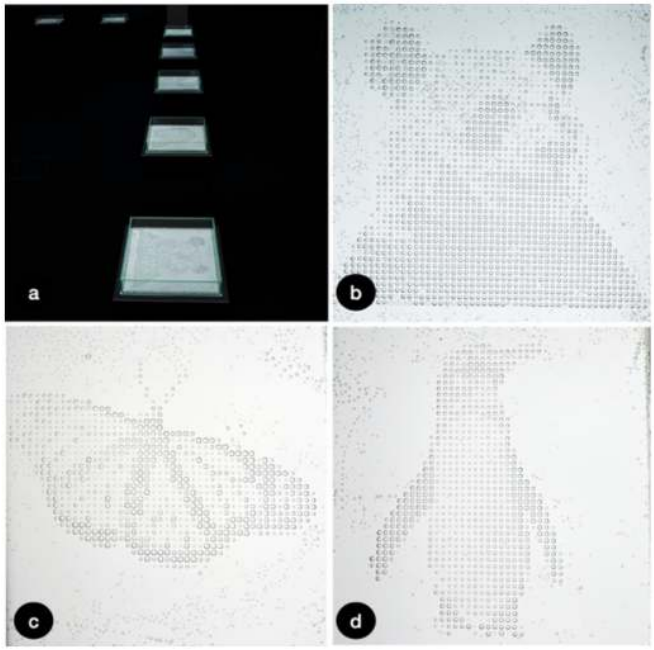


Figure 5. a) Arrangement of ten glass vessels on the floor during the exhibition, b)-d) Photos of animals after stabilized bubble patterns were formed on the surface. © Harpreet Sareen, Yibo Fu, Yasuaki Kakehi

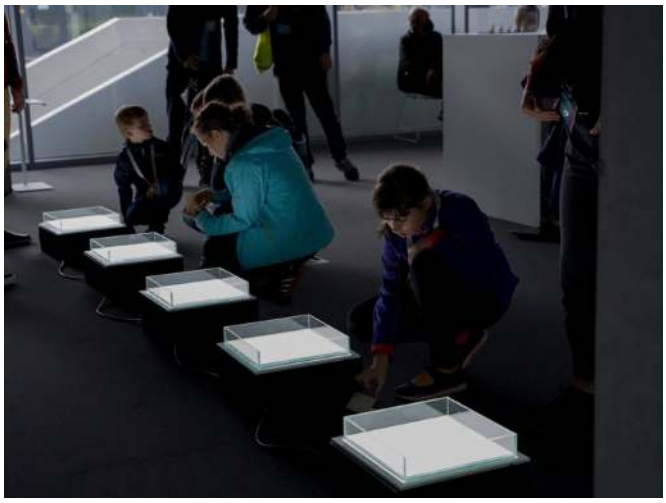


Figure 6. Viewers looking at bubble representations of animals in a kneeling position. © Harpreet Sareen, Yibo Fu, Yasuaki Kakehi

When carbonated water is poured into the containers, small bubbles nucleate first coalescing into each other becoming large in size corresponding with the size of the coating on the surface. These large bubbles may become buoyant at first due to the saturation level of CO2 in the liquid. As levels of gas normalize, bubbles

stabilize at nucleation sites adhering to the hydrophobic regions with an attractive force[17]. Such stabilized configurations of bubbles last for five to seven days.

To design the bubbles patterns for this installation, we create a custom tool based on p5.JS that allows automatically generated wettability patterns by consolidating image import (color or grayscale), grayscale conversion and corresponding bubbles pixelation in a single pipeline. User imported images are analyzed against the background. Our algorithm analyzes the input image to create a comparative brightness map, following which darker areas of images are tagged as proportionately dense in bubble density and lighter areas are sparse in bubble density. For easy accessibility, the tool may be used online and outputs a .svg directly compatible with the fabrication machine for cutting the masks.

Exhibition and Experience Walkthrough

Purpura et al. have previously called ephemeral art been as "good to think with."[14] Their impermanence is a constitutive part of their aesthetic, and of the ways in which they come to act on the world. In the context of the exhibition shown at a major venue, our intention was to generate emotions of sadness or mourning among the viewers, over the endangerment of species. We reviewed the IUCN Red List of imperiled species at various threatened levels and chose ten species from marine, land and amphibious domains across all continents. The vessels were fabricated as per techniques described before, bottom lit for contrast of bubbles in liquid and setup in an L-shape. These were specifically separated from each other and laid on the floor for two key purposes: a) For viewers to bow their heads down or kneel as if paying homage, and b) To portray the vessels as final mementos of threatened species.

Such an exhibition design was shaped with a perspective of higher-levels of abstraction, focusing on carbon dioxide bubbles as material from a cultural perspective. This work is thus not temporary, rather has a directive intent to survive in the memory.

Conclusion

We presented *ephemera*, an installation where ephemeral images of endangered species are composed through bubbles of carbon dioxide. Bubbles with extended lifetimes slowly disappear in five to seven days, representing the images of endangered species as final mementos for humans. Through our exhibition, we intended the viewers to observe images in a drifting state and to be involved in the relationship depicted by the image. Glass vessels arranged onto the floor and viewed by the audience while kneeling are meant to invoke mourning or sadness among viewers—emotions that were listed over aspects of nature during the rapid modernization progress. Through this work, we explore a new ephemeral material and its aesthetic of affect, and believe that the ephemerality in this work represents a shift from the art object to a communicative act.

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