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Aer( )sculpture:
Inventing skies and micro-clouds into diaphanous sculptures made of the space technology nanomaterial silica aerogel

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Abstract
“It suddenly struck me that that tiny pea, pretty and blue, was the Earth. I put up my thumb and shut one eye, and my thumb blotted out the planet Earth. I didn't feel like a giant. I felt very, very small”. When astronaut Neil Armstrong said those words on his experience setting foot on the moon, he acted strictly as a visual artist: shutting one eye and attempting to measure the Earth in front of him. And he perceived the scaling of the giant planet as a tiny pea. If Cosmos will be the muse of the future, what are the dimensions of Space Beauty? Why, on Earth, do we prefer massive artworks/totems and we underestimate miniatures? What could be the relations between climax (the Greek word for scale and ladder) and climate change? In this paper the author will attend to answer these questions presenting the allegories and symbolisms of two of his artworks, Skymarket and Ephebos Head. The author’s research and artworks are all about the nanomaterial silica aerogel an ethereal (im)material resembling our sky. Living and realizing his research in three different countries/climates the last four years, he has initiated collaborative interdisciplinary research with MIT’s Department of Earth, Atmospheric and Planetary Sciences on possibilities to imitate moving micro clouds inside the diaphanous body of his sculptures made of the space nanotechnology silica aerogel. The creative venture of this interdisciplinary research also has technological applications as it could drive to a scientific visualization on bio-mimicry of microclimatic experimentations on greenhouse and climate change phenomena.

Keywords: scale, nanomaterial, microclimate, miniature, space art, silica aerogel

1. Introduction
Firstly the authors outline the way that early space exploration and our growing relationship with space has changed our perspectives about our world and ourselves. Secondly, they discuss the way this new perspective is informed by the devices of scale, space, colour and pattern of our artistic history and furthermore, how this new perspective has influenced innovative art making practices. The authors go on to discuss the sky as a metaphor for space, reflecting on its influence on their research and art making. Finally ‘climax change’ is suggested as a term to describe the shift in perspective that humankind must make if we were to heed the warnings of the scientific community and resolve the growing problem of climate change.

2. Navigation by Stars
Kanzo was king of his lugger, master and diver in one,
Diving wherever it pleased him, taking instructions from none;
Hither and thither he wandered, steering by stars and by sun.
Banjo Patterson, The Pearl Diver

The cave painters of Lascaux in France looked to the stars and the heavens for guidance and documented their discoveries. Lacking landmarks for direction, night-time navigators; mariners and Bedouin used stars as map-points to guide them across the shimmering surface of the Earth. With feet firmly planted on earth and tide, humanity has moved and settled across the globe with faces turned toward sun, moon and stars. The earth is our rock and we were born of it. The art of our ancient ancestors, shaped from earth and stone is a reminder of our umbilical connection to the earth.
But is our experience of what it is to be human changing? And will this change the way we create art? When Apollo 8 astronauts, on the first-ever lunar orbit manned by humans photographed, revealing the “earthrise” (Fig.1), humankind was finally able to look down. The act of looking back on our blue home planet did not initially provoke a narcissistic response. Instead it bought on a climax changing shift in perspective that allowed us to finally envisage the earth as a unique entity within vast space.

Fig. 1: Earthrise, Dec. 24, 1968, NASA http://www.nasa.gov/multimedia/imagegallery/image_feature_1249.html. Accessed 03/7/16

Before this unique moment in history, humans had always been surrounded by their world but through early space travel it was revealed that the moon as a perfect viewing platform for the Earth. This viewpoint confirmed Aristotle’s notion that beauty depends on a particular size and order. “Something is not beautiful if it is too small to be seen not can anything be beautiful if it is so large that its unity and wholeness cannot be perceived. Beautiful things, on the contrary, are large enough to be seen but small enough to be seen in their entirety”[1]. This new revelation of the Earth as a beautiful object in its entirety was a “climax change” credited with the beginning of a global change in attitude toward the environment and a movement to protect the earth and atmosphere [2].

Today, we are conscious of being constantly monitored from above. Fast forward 40 years from the first documented image of the earthrise and we now live with all pervasive satellite technology. This contemporary reality has shifted our view once again; no longer do we navigate by the stars, but from them. Today, when we look into the blue void of the heavens, we no longer envisage a creator staring back but ourselves. When our faces are turned towards the night sky we see ourselves observed by the steady star-like gleam of satellites.

3. The Authority of Colour

"...It suddenly struck me that that tiny pea, pretty and blue, was the Earth...”
Neil Armstrong

In many cultures, blue symbolises spirituality; human transcendence from the everyday and ordinary. In Christian visual arts, blue is associated with the Virgin Mary, Hindu gods are regularly depicted as blue, Mosques are often tiled in sublime aquamarine geometry. Kandinsky wrote that when we view the colour blue, we “feel a call to the infinite, a desire for purity and transcendence” [3]

Did our sudden ‘discovery’ of the earth from space as a tiny blue object stir a collective reaction based on the connotations created by our artistic and religious associations with the colour blue? Until the Apollo 8 photographs, artists had been accustomed to looking up through the atmosphere into a blue void, the unknown. The innovation of satellite photography provided the opportunity to shift perspective much farther to the statosphere and experience the last and most ephemeral layer, the blue breath of the planet. “Even the sublime lyric poetry of three explorers gift-wrapping the moon on Christmas Eve—was not the most indelibly affecting image of the mission. It was a single picture the crew took earlier that morning, during their fourth orbit of the moon … It was Earthrise—the iconic Earthrise—the living, blue planet rising over the dead lunar horizon.” [2]

Ioannis Michaloudis’ artwork “Bottled Nymph” (Fig 2.), made from silica aerogel, which has an ethereal (im)material quality, resembling our sky. Michaloudis’ “aer()sculpture appears blue only when its background is black. The same optic phenomenon – raylight scattering – explains why our sky is blue, as behind it lays the darkness of chaos” [4]. The colour and quality of the work speak to this experience of viewing, consciously, the ephemeral nature of our sky and the consciousness that this creates in us as human beings about our relationship and interdependence with our planet.
Fig. 2, Michaloudis, *Bottled Nymph*, silica aerogel, glass, rubber, aluminium, 22cmX4cmX4cm. ©Michalous, 2008. This artwork is selected and will be rocketed to the moon as part of the MoonArk Project. The sculpture/capsule will be shuttled to the moon from Cape Kennedy on an Astrobotic Robotic Lunar mission aboard a SpaceX Falcon 9 rocket, and exist there for potentially billions of years.

Bronwyn Dann employs the colour blue to depict water and sky as transposable (Fig.4). The blue of our planet is created by the vast oceans and water vapours in the atmosphere. When the droplets of water in the atmosphere scatter light to present us with a heavenly azure they form an ocean of the deepest indigo.

Blue is captured in the lustre of south sea pearls and the *Pinctada Maxima* pearl shell found in the tropical waters along the monsoon coast of northern Australia and into Indonesia. The humidity of this tropical coastal environment causes sea and sky to appear as if they were merging at the horizon, which creates a sense of floating in atmosphere. Dann uses these different perspectives as symbols representing the elemental forces that controlled the formation of pearl shell and the industry that relied on it.

“O God, I could be bounded in a nutshell, and count myself a king of infinite space—were it not that I have bad dreams.”  
Shakespeare: Hamlet

4. The Stimulus of Scale.

“I put up my thumb and shut one eye, and my thumb blotted out the planet earth. I didn’t feel like a giant, I felt very, very small”  [4]. In his account
of his trip on Apollo 11, Neil Armstrong laconically details the profound effect such a momentous shift in perspective as space travel affords a person. One would suppose that the ability to blot out our home planet with a thumb would warrant a response of powerfull dominance but instead Armstrong spoke of feeling the opposite. If Earth is so tiny in the enormity of space, what is a mere human? The artistic practice of changing scale shifts our perspective in a similar (very emotional and perturbing) fashion.


Fig.6 Michaloudis, A Piece of Sky Between Your Fingers, silica aerogel, photo and ©Michalous, 21st March 2004. Dr Ioannis Michalou (di) s inspects the aerogel sample containing the first encapsulated cumulus cloud created when invited as an Artist in Residence at Shivaji University, Maharashtra, India.

Armstrong was humbled by his experience of witnessing a tiny, gleaming Earth from afar and this is the effect that a miniature, precious artwork can have on us. While the original purpose/s of goddess figurines such as the Cycladic figurines produced throughout the early Bronze Age in Greece are unclear, various theories suggest roles for them as “mythological characters, deities, adorants or apotropaic figures [5].

Regardless of their original purpose, in a contemporary context they connect us with the reality of our humanity through a connection with our most ancient ancestors. Because their significance is immeasurable, we view them as spiritual objects and equate them with the spirituality of our early human ancestors. Like the Earth viewed from space, they are also tiny, miraculous and precious in their singularity. However, while tiny objects can humble us, we also dominate them simply through our ability to hold them.

On the other hand, massive artworks are symbolic of human domination of earth. The production of the Egyptian pyramids, Stonehenge and the Moai statues of Easter Island are considered outstanding creative and physical feats of our ancestors. We equate them with masculine constructs of power and prestige “The bigger the better”. But why?

In February 1969, only 2 months after the Apollo 8 mission that revealed the miracle of the Earth rise, the exhibition “Earth-Art” opened at the Andrew Dickson White Museum of Art at Cornell University, Ithaca, New York. The exhibition featured, among others, prominent land artist Robert Smithson who later created the famous “Spiral Jetty” (Fig 5). Was the emergence of the Land Art movement an artistic reaction to our realisation of human insignificance? The concurrence of the events and the fact that the “earthrise” images are credited with starting the environmental movement in the 60’s [2] suggest that artists felt the need to create monumental works of art so large they could almost be viewed by astronauts from space.

But this is not merely and never is as simple as equating power and dominance with size. In the words of Hans Hoffman, “Monumentality is an affair of relativity” [6]. Michaloudis works in small-scale with the material silica aerogel in which he captures a sense of vast space. Like spiritual talismans these works are powerful not despite but
because of their scale. Unlike the ancient, tiny stone figurines we can dominate with our comparative human scale, Michaloudis’ work is mysterious in its delicateness so stands aloof, unassailable from the viewer. Despite an ability to stand back, and “blot the work out with a thumb”, on close inspection a miniature universe is revealed and the viewer is left feeling very, very tiny. In its exploration of space, Michaloudis’ work prompts a human spiritual reaction to scale and form of his works (Fig 6).

5. The Sway of Space.

In his work *Ephebos Head* (Fig.7), Michaloudis also begins to explore the possibility of re-contextualising the space an artwork can inhabit. In extra-terrestrial space, the frame does not exist. For an artist, particularly a sculptor, the space around an artwork is as important to the conception of an artwork as the work itself. In other words, we frame our images to conceptualise how our sculptures inhabit space. “Form must be balanced by space” [6]. Space informs and interacts with form, giving meaning to the work, our images do not exist in infinity. Michaloudis’ art&science research considers the extra-terrestrial space as a new frame and a new medium for his artworks, He is proposing new possibilities for redefining the traditional roles of scientist and artist by suggesting interdisciplinary collaborations between artists and scientists. If we choose to shift our perspective we could leap to the conclusion that there should not be any dichotomous separation between the identity of the artist and scientist whatsoever.

While Michaloudis’ work inhabits and speaks of the extra-terrestrial, Dann’s work is firmly grounded on earth and in the muddy waters of human history. In particular, the history of the pearling industry along Australia’s monsoon coast. However, despite seeming vastly different, the art practices of both the author and the co-author centre on questions of scale and climax-changing perspective.

Dann’s artwork explores the overwhelming effect that a tiny button can have on a culture and history of a nation. Like the butterfly effect of chaos theory, the sharp rise in demand for pearl shell buttons seeded a frequently brutal industry which occupied the vast northern coastline of Australia and exported across the globe to Europe [7]. Dann uses the shapes of carved pearl shell traditionally worn and used ceremonially by Indigenous inhabitants of the North West coast of Australia as miniature motifs for the large scale commodification of the shelling labour force that was drawn from the indigenous people of Australia, right across South East Asia and as far away as Japan.

Contrasting with the miniature scale of the pearl shell motif, Dann creates vast sky-scapes that depict not only the physical environment the industry operated in but act as metaphors for the luminous construction of pearl shell that happens in minute, geometric layering below the surface of the ocean. (Fig 8). Dann regularly shifts her work between the very large and very small and this constant ebb and flow between the micro and macro scale creates a climax change of perspective for the viewer, designed to draw attention to the similarities between the immense and the miniature in history and nature.

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The glamorous accident of the pearl in the wild oyster shell, constructed from layers of iridescent nacre has long been associated with the moon and sky “The pearl might also be imaginatively compared to the moon, which in turn was associated with water and particularly with dew” [8] However by shifting perspective by the observing Earth from space, we can just as easily imagine the earth as a pearl. When we observe the planet through the palimpsest of luminous atmosphere, refracting and diffracting light like the layers of nacre that coat a pearl, we can imagine this planet as an exquisite, organic gem. From this scale it is tiny, miraculous, and precious. It is miniature.

Dann is building a body of work that aims to subtly shift viewers perspectives from traditionally associating the pearl with the moon and dew to seeing the pearl as symbolic of our earth. The traditional mythology and stories that drew these original connections can be borrowed and enhanced with modern technology. Now that we are able to view both the moon and the earth from afar, we can see that the pearl/moon and pearl/earth associations are equally valid and the creation of a new is a way to highlight the precious and rare quality of our planet in the imagination of the viewer symbolic union between the pearl and the Earth

6. Controlling Patterns and Repetitions

*Be humble for you are made of earth.*
*Be noble for you are made of stars.*

In his work on natural patterns, Plato reasoned that ideal forms, such as the circle, existed as an archetypal truth. The physical manifestations of these ideal forms were imperfect reproductions. Plato was dismissive of the artist reproducing natural forms as he disregarded them as mere forgers of nature, which in itself was the copy of the archetypal truth. But what if the artist, as a force of nature, is actually a conduit for the archetype asserting itself and appearing in observable form?

Art “need not reinforce people's illusions by providing an easy form of escapism. Indeed, it may help to communicate and reveal the nature of reality” [9]. The artist does not copy but instead repeats and becomes a participant in the patterns of nature that assert themselves through the art making process. “Artists have perennially discovered in the doubt, uncertainty and haphazard of life a harmony that goes straight to the essence of being” [10]
We are captured by coincidence that appears divine but mathematics suggests that nature steadily repeats itself in fractal auto similarity. Pattern seems to have magnetism for the human eye and we have a tendency to seek out and recognise patterns. “The mind looks for permanent, recurrent patterns as points of reference for finding a coherent order in the confusion of the world” [11]. The tidal flats of Roebuck bay, where the largest fleets of pearling vessels would moor and beach for the “lay-up” between pearling seasons, when viewed from a different perspective by satellite imagery from space appear to mimic the shape of the pearl oyster (Fig. 10, Fig 11); Dann uses this fractal scaling in the realisation of her artwork. The land and seascape of the pearl shelling zone is reflected in the shape of the pearl shell, the luminous dance of light through the atmosphere is depicted as the geometric layering of nacre the mollusc uses to grow pearl shell. By changing perspective using distance, zooming out on the land and sky scape and zooming in on the pearl oyster, Dann is able to use this tendency to find patterns where they do not otherwise exist to create new associations and form new understandings that derive their power from our inbuilt attraction to pattern.

Similarly, Naoko Tosa does not copy nature, but instead reinterprets the unforeseeable movements of its patterns with a “collaboration between the physical phenomenon and an artist’s sensitivity” [12] to create a climax change of perspective for her audience. By capturing the natural shapes formed by liquid when it is vibrated with sound and pairing them with evocative haiku, Tosa becomes a participant in the recurring patterns of nature. Tosa illuminates connections between her work and the patterns of nature, allowing her audience a new, revealing perspective on something known. “In art, self-similarity – which can come in infinite variety – is not created by a slavish permutation of some form at different scales… It is the artist’s task to find and express this significant relation between forms and qualities that are simultaneously self-similar and self-different so as to create an artwork that allows us to glimpse the holistic nature of our universe and our being in it” [13]. By revealing a new perspective on something seemingly understood through comparison of the wondrous patterns of nature, Tosa and Dann are able to evoke a sense of curiosity and appreciation in their audience.

7. The Sky and Climax Change

The contemplation of celestial things will make a man both speak and think more sublimely and magnificently when he descends to human affairs.
— Marcus Tullius Cicero, c. 30 BCE

Michaloudis and Dann also share the common “ground” of the sky. Both artists explore the fractal nature of clouds and the way light creates form by a refracting/scattering, iridescent dance

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Fig 10: Roebuck Bay: Google Maps. Accessed 3/5/16

Fig. 12, Michalous Skymarket (shadow), silica aerogel, metal 50x2030 cm, photo & © Michalous 2015
with the chaotic arrangement of particles in the atmosphere.

“Observing a vial containing silica aerogel that encapsulates a cloud-form is like viewing a portion of the sky contained within a bottle.” [14]. While Michaloudis’ work uses silica aerogel as an apt metaphor for the sky, aerogel being almost as light as air, Dann uses the sky as a metaphor for pearl shell and seeks to lead the viewer into making connections between the elemental patterns of nature.

While Dann’s work references the decimation of naturally occurring pearl beds along Australian and South East Asian coasts wrought by the early pearling industry in its voracious hunger for the commodity of pearl shell, Michaloudis’ work, Skymarket (Fig.12) may be read as an allegorical portent of the future danger faced by humanity if the unfettered commodification (and commercialisation) of the sky and space beyond is permitted. Human want to be at the apex of the ladder, to have and own everything in their power. Skymarket adds an accessible visual voice to sciences suggestion that to address climate change, human beings need a “climax change” to perspective on what they want and “need” in order to preserve the finite resources available to humanity.

The author propose the ladder – or the climax – to the sky as a metaphor for creating a change of perspective needed by humanity to arrest the destructive effects of climate change. When we watch the night sky and see those gleaming satellites reflecting back on us, rather than imagining ourselves as observed from above by others, the artists propose that we all re-imagine observing ourselves from above, as the world initially did when viewing the Apollo 8 pictures, through the gleaming, pearlescent atmosphere. The tools we need, drones and satellite photography give us the ability to constantly view and imagine our actions from another perspective. With technology now allowing us to climb this metaphorical ladder and view ourselves as individual pixels in a world-size picture, do we now have the potential to act adequately to solve the problems facing the Earth?

8. Conclusion

For years, humans have been striving to reach the apex of the climax (or ladder) of our collective potential. However this inbuilt striving to be at the peak of our existence is having some disastrous side effects for our planet. This paper has discussed the way that art, science and history suggest that humanity is within the capacity of achieving a vitally needed change in perspective on what it means to “have it all” if we are to preserve our planet.

The first documented images of the earthrise proved that we are susceptible to the power of beauty and this can have a profound influence on the behaviour of an audience. The artistic conventions discussed in this paper are used to create beauty and thus generate a climax change in the viewer. The artwork of the author stands as an emblem for the potential for human beings to continue to the climax of the ladder where art and science meet to reach for even greater knowledge and understanding for our species and planet. Embroiled within this struggle is also a critique of what we do not need. Michaloudis’ work promises that art and science combined can be part of the solution to some of the most pressing issues facing our world today. These possibilities are posited as two of Michaloudis’ images will soon be rocketed

Fig 14, Michalous, Stairway to Heaven, burned readymade wooden mirror frame, fabric, silica aerogel, aluminium, 2011, Fulbright Foundation’s collection, Greece.
to the moon as part of Carnegie Mellon University’s Robotics Institute MoonArk project.

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