Light in a Socio-Cultural Perspective

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Edited by

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INTRODUCTION

What is light? This question is so profound that it demands the compounded wisdom of different realms of thought to address the various facets of its meaning and implications. A physicist will discuss the physical properties of light, such as speed, wavelength, and the wave-particle duality, whereas a biologist will venerate its foundational role in the creation and perpetuation of life. Yet, the principal significance of light traverses the confines of the material world and is mirrored in the nonphysical one.

Since the dawn of civilization, the concept of light has been central to cultural processes and formulations. Light was regarded not merely as a physical phenomenon, but also as a moral concept, charged – in relation to darkness – with dialectical meaning –good/bad, enlightened/barbaric, and so on. We are aware of the significant role played by the concept of light through a range of societal and cultural phenomena, beginning with the naming of historical periods (i.e., the Dark Ages, the Age of Enlightenment) through religious perceptions evident in texts and works of art that figure God as the source of light and contemporary scientific discoveries that acknowledge the importance of light in the shaping of human mental states.

The United Nations declared 2015 the International Year of Light, with the goal of illuminating the achievements of light-science and of stressing its importance to humankind. Ben-Gurion University of the Negev in Israel participated in the UN program and organized a range of activities and events for various types of audiences. Parallel to a rich program dedicated to science per se, the president of the university, Prof. Rivka Carmi, together with UNESCO, supported the establishment of a lively theoretical discourse, which probed the perception and conceptual function of light in cultural history and the arts. In April 2015 the University's Department of the Arts organized a large exhibition of works by Israeli artists around the concept of light (curated by Prof. Haim Maor), alongside an international symposium designed to provide a comprehensive interdisciplinary perspective on the theme.

The nine chapters in this volume are based on papers delivered at that symposium. They provide various perspectives on the concept of light derived from different disciplinary methodologies within the Humanities,

including cultural history, philosophy and intellectual history, literature, and visual culture, and probe the concept of light across history, from the Middle Ages through to the present. The collection is divided into four thematic – cross-disciplinary and cross-periodic – units. The first, *Between Image and Truth*, points to the role of light in the relationship between vision and knowledge. In her essay on stargazing in the twenty-first century, Romi Mikulinsky surveys the transition from the act of tracing light to the admiration of data, defining both as parallel practices of stargazing. This shift from the physical to the virtual, or from the object to the image, she argues, symbolizes a contemporary phenomenon by which representation is perceived as truth. This idea of light – whether sunlight or computer-screen light – as an agent of vision, and subsequently of truth, resonates in Stephen Gregory's discussion of Descartes's theories of light and vision. Investigating the bilateral relationship between light and truth, he defines the Cartesian understanding of light as a metaphor situated between viewing and knowing.

The second unit, *Exposing Reality*, offers three interpretations of light as a means of revealing reality. Niharika Dinkar analyzes a sculpture in St. Paul's Cathedral that presents the unveiling through lighting of an image associated with the mysterious Hindu tradition. Through her analysis, she draws a parallel between light and reason and situates the work and its narrative as part of the Enlightenment project of the West, which promoted the reasonable and realistic over the mysterious and spiritual. The theoretic correlation between light and reality is evident in the visual arts throughout history, but it gained particular resonance in the nineteenth century through the work of the Impressionists. In a continuation of the Realist Movement that celebrated modern reality, Impressionism focused on light as an agent of vision and of truth. Merav Fima, analyzing the motif of light in *Madame Bovary* by Gustave Flaubert, who was part of the Realist Movement, suggests that the novel anticipated the Impressionist aesthetics. By comparing Flaubert's literary representations to Claude Monet's art, she identifies the former as a pioneer of literary Impressionism. Taking the light-truth discourse to a practical level, Ruth Lubashevsky-Amar reflects on the role of infrared technology in the process of attribution in art history. In her essay, which focuses on Lucas Cranach the Elder, she suggests a model of attribution based on a combination of visual analysis and the power of light-based technology.

The section on *Creation and Embodiment* comprises two chapters that delve into the theological realm of Jewish tradition and Kabbalah. Susan Nashman-Fraiman studies the feminine tradition of candle lighting in Judaism, arguing that this practice resulted in the formation of a feminine

understanding of creation, related to the making of light by women. Whereas Nashman-Fraiman interprets the light-creation trajectory in a gender-related context, Sandra Valabregue-Perry turns to medieval theosophical Kabbalah to show how images of light functioned as embodiments of such concepts as creation, emanation, and prophecy. In a further look at the potential functions of light in cultural and intellectual history, the forth and concluding unit, *Conceptual Functions of Light*, offers two scholarly attempts to redefine light. Yair Barak's essay deals with the metaphysics of the thirteenth-century theologian St. Bonaventure. Following Bonaventure's perception of light as a formal component of the structure of the universe, Barak discusses light as a measure, defining it as the quantifier of the spiritual distance from God. In the volume's concluding essay, Rina Jean Baroukh offers another perspective on light as a structural element in a discussion of the novel *The Wedding Gifts* (2014) by Israeli writer Shimon Adaf. Pointing to the idea of light as its leitmotif, she acknowledges its thematic function in the novel, but argues that at the same time the concept is presented as a structure of continuity and is comparable to the concept of time.

As a whole, this volume is the culmination of a project that was designed to provide a theoretical backdrop for the scientific developments illuminated in The Year of Light. It is our belief that these developments cannot be fully comprehended outside their cultural context and without considering their resonance in the epistemological sphere. The nine essays that follow reflect our desire to provide the contemporary reader with a diverse and interdisciplinary appreciation of the theoretical cultural and historic aspects of light.

SHARRON HASS, "THEFT," FROM *DAYLIGHT*

TRANSLATION TSIPI KELLER[1]

In the middle of the night, in one of the folds of night
pivoting for many years
on one thought
the hand draws twelve doors on the wall
for how can you leave the house
within a house wherein each step forward
is also a step downward

In the middle of the night, in one of the folds of night
visions that fade in the sun leave behind
dark matter, the sorrow of unlived lives.
Even the Leopard, prince of Salina,
will succumb to it. I have read.
I keep reading the same books again and again
(they are yellow-eyed and their joy is contained) –
in search of a throat for my slowest writing ever,
for what is forbidden to behold

(Somewhere nature prepares to watch me,
to transform me if I dare fill up
empty lines of poetry, since I did behold)

There's a woman in the woman who wants what she does not want
and she walks in the heat wearing a red wool coat
toward the impossible, to set on fire what the fire has refused.
All that is lacking the sweetness of a double and a shadow
yields to the grandest of lusts, the lust for beauty,
and to what is granted to god alone –
to bind defeat with ecstasy, to stamp the mark of disgrace
on those who see and are unseen, and to sing

[1] *Daylight* was published in 2011 by Bialik Institute (Jerusalem), and was awarded the Bialik Prize in 2012.

"The terrorist Wafa-al-Bass undresses
exposing her 'explosive underpants'
she attempts to detonate the bomb and fails
yesterday in a designated area near the Erez Roadblock"

If the messenger were to sing to the king
who had slept with his mother and killed his father
and, like a monster-magician, made blood entanglements
disappear, would the king still have the strength to say
"This terrible creature of darkness is me" and would not
his spirit, in face of a singing strophe of fate,
be disfigured in the humiliation of pain

There is night in the noon of day.
What is seen at a glance may become a fact
of the spirit. A madness lurking in pity.
I bent over the newspaper and saw your defeat,
like Maria's, elevated to the miracle of my life,
your failed death a marvel to our eyes – here, the double
has been revealed in a land of no shadows, traveling
within the borders of its dreams, with a wound as offering

PART 1:

BETWEEN IMAGE AND TRUTH

CHAPTER ONE

FROM THE OVERVIEW EFFECT TO THE DATA SUBLIME: STARGAZING IN THE TWENTY-FIRST CENTURY

ROMI MIKULINSKY

Humanity must rise above the Earth – to the top of the atmosphere and beyond – for only thus will he fully understand the world in which he lives.
—Plato[1]

Only an orbital perspection allows us to become new constructors of the globe. In the orbital sphere the closedness of the world opens towards the endless universe.
—Peter Weibel[2]

The photographic overview effect was caused by the broadcast of the first images of the Earth from outer space in the late 1960s. These, I suggest, transformed our worldview. This article proposes that this effect is now being mirrored in society's preoccupation with data and its visualization. In support of this claim, I present several examples from contemporary Western culture and arts that demonstrate the co-dependency that exists between the explosion of information technology and human imagination, focusing specifically on stargazing, astronomy, and celestial imaging.

The human desire for self-knowledge has a long relationship with stargazing that dates back to ancient Babylon and classical Greece. Since the beginning of civilization, man has lifted his gaze to the sky, attempting to find meanings and omens to explain and predict natural phenomena and elucidate the human condition. Not only has knowledge of our own planet often been dependent on human understanding of other planets, but our knowledge of ourselves and our environment is dependent on the subsequent development of visual aids for astronomical imaging and communication technologies.

This tendency, I argue, has intensified in the information age, in which data has become both the material and the tool with which we comprehend

our world and our relationship to it. The more we rely on new technologies, the more they replace the old-fashioned direct human observation of celestial objects. For example, decoding information captured and retrieved by computers has replaced the traditional tracing of light. Radio telescopes intercept radiation – information – at wavelengths imperceptible to the human eye, and computers drive optical telescopes with their ever-larger mirrors and use "active optics" to "continuously compensate for subtle changes in the balance of the mirror and in the atmosphere above the instrument."[3]

The twentieth century saw increasingly rapid advances in the scientific study of stars. Direct observation of the night sky is often mediated by instruments easily available to amateur astronomers (e.g., cameras, telescopes, and binoculars), and astronomical research is now the work of teams of scientists and engineers that rely increasingly on the analysis of digital, rather than optical data. Our knowledge of our own planet and of the universe is thereby almost always mediated and depends on technologies that emerged to serve the needs of governments and their military and intelligence establishments.

This article begins with the campaign initiated in the mid-1960s by the *Whole Earth Catalog* founder Stewart Brand.[4] I discuss the meanings and paradoxes inherent in the one-Earth symbolism, which is reflected in these images' central role in the aesthetics of the environmental movement and counterculture. More recently, fascination with the sky took a new direction given the multitude of objects overcrowding the sky above us, be they satellites, drones, or other surveillance machinery. I then proceed by describing two exhibitions that attempt to theorize the shift from "planetary thinking" to orbitization, as Peter Weibel suggests.

Thanks to the objects that orbit around us and capable of managing and governing information flows, new possibilities for seeing are now available. These complex relations of seeing and being seen are unique conditions created at the end of the twentieth century that have become more complicated in the twenty-first. We have become accustomed to "seeing with machines" and regularly look at our world through our screens, navigating between online maps, livestreams of CCTV and surveillance cameras, and of course Google Earth and Street View. We can now leave Earth and venture into deep space using datasets made up of a million galaxies imaged by the Sloan Digital Sky Survey,[5] or see billions-of-years-old light from galaxies through the Hubble Space Telescope.[6] Our growing reliance on data and computerized processing of information is also apparent in Galaxy Zoo[7] a citizen science project for planet discovery and galaxy research. This project, which is part of the

Zooniverse[8] platform, invites volunteers to classify distant galaxies or discover planets around stars by detecting light curve changes and to take an active role in distant planet research.

I then attempt to explain the growing reliance on data in our data-driven society and discuss data-art and visualization. I focus on two projects that bring together the act of looking at data and stargazing: the first, July Freeman's *We Need Us* (2014), is a real-time sonification and visualization based on the metadata produced by the users of Zooniverse. The second artwork is *Black Shoals: Dark Matter* (2015) where financial data is presented like constellations of stars, looking and behaving like celestial objects. These artworks thereby inquire into stargazing today and introduce new meanings into it, illustrating the potency of space imagery and the extent to which our society is permeated with a fascination with data.

Until the late nineteen sixties, pictures of planets were scarce. In fact, the first photographs of the Earth became available only around 1968. Nowadays, space imagery is virtually ubiquitous. Apple regularly includes images of galaxies on personal computer screens and shots of the Earth as default iPhone wallpapers.[9] *Wired* publishes a daily photo from space.[10] With NASA's public outreach growing ever stronger on social media channels and the opening up of their archives and databases to the public,[11] we have access to both images from space and data and metadata about their production. Art critic Jonathan Jones hails space imagery as "the most important art" made today, and celebrates these images' ubiquity as proof of the extent to which science communication has transformed the way in which we gain knowledge about the universe and how we see it.[12] In this paper, I review the transition from the tracing of light to the admiration of data and information gathered about celestial bodies.

"Why Haven't We Seen a Photograph of the Whole Earth Yet?": *Whole Earth Catalog* and Planetary Thinking

It all starts with an image, a missing image in fact. The birth of what we now call cosmological consciousness is tightly connected to the birth of environmentalism, a geocentric perspective gained by being able to see Earth in full. In the 1960s, Stewart Brand initiated a protest demanding the release of Earth images. Both the Americans and the Russians had already deployed manned spacecraft that hovered above the Earth. Their cameras were directed – at least according to public announcements - to the depths of space rather than backwards to the direction of Earth. This campaign started with a vision. One night in 1966, 28 year-old Brand, a Stanford graduate and environmentalist, sat on a rooftop in San Francisco and

looked at the night sky. High on LSD, he felt that what humanity needed most in order to acquire a sense of shared destiny was an image of Earth as seen from the outside.

> I imagined going farther and farther into orbit and soon realized that the sight of the entire planet, seen at once, would be quite dramatic and would make a point that Buckminster Fuller was always ranting about: that people act as if the earth is flat, when in reality it is spherical and extremely finite, and until we learn to treat it as a finite thing, we will never get civilization right . . . and I figured a photograph—a color photograph—would help make that happen.[13]

Inspired by his vision, Brand set himself up as a one-man protest movement, and started passing out buttons saying, "Why haven't we seen a photograph of the whole earth yet?" around the University of California campuses. He sent the buttons to NASA officials, congress members, scientists, and prominent thinkers such as Marshall McLuhan and Buckminster Fuller. Brand's campaign may or may not have influenced NASA, but a few months later the Apollo 8 astronauts, the first human beings to observe Earth from outside its planetary orbit, photographed their home planet from a lunar orbit. This image, released on December 24, 1968, came to be known as "Earthrise" (see Fig. 1.1).

Fig. 1.1: Earthrise Revisited. December 24, 1968. NASA Apollo 8 photo by Bill Anders, data visualization courtesy Ernie Wright, NASA Scientific Visualization Studio.

Photo-historian Robin Kelsey claims that no one anticipated the implications of the whole-earth photographs more accurately than Brand. The founder of the *Whole Earth Catalog* and the Long Now movement placed "Earthrise" on the cover of the fall 1969 edition of the catalogue. Since there were no available photos of the Earth in its entirety before "Earthrise," the catalogue's inaugural edition bore a satellite image of the Earth. For Brand, Kelsey continues, "these images were symbolic of a new economy that would respect ecological limits and yet reward entrepreneurial verve. The Whole Earth Catalog, subtitled 'Access to Tools,' linked the image of the earth to new distributive systems, and its global approach to information and product dissemination foreshadowed the powers of the internet."[14]

The *Whole Earth Catalog* is considered to have foreseen the digital age. It is also an important landmark in the birth of environmentalism and globalism. As John Markoff puts it, the catalogue was "the internet before the internet. It was the book of the future. It was a web in newsprint."[15] Not only prophetic, the catalogue was also hugely successful: it was published regularly between from 1968 to 1972, and its last edition sold more than 2 million copies.[16] In 1972, it won the first U.S. National Book Award in the category of contemporary affairs. For Brand and his fellow editors and writers, the planetary idea became a means to articulate a new universalism; once the image of whole Earth began to circulate, it illustrated that Earth was a fragile global village. The perspective gained by that photograph altered human consciousness and sense of place in the universe, and the catalogue as a directory of ideas and tools combined individual empowerment and education with whole systems concepts. According to Fred Turner "Brand's reader enjoys the power of a god to survey the whole earth below him. The front cover of many editions of the Whole Earth Catalog featured an image of the earth seen from space . . . In the Whole Earth Catalog, cold war technocracy itself had granted its opponents the power to see the world in which they lived as a single whole."[17]

The fact that whole-Earth or one-Earth symbolism became so potent is also tied to the fragility of Earth as conveyed by the photos that show it in isolation. It was the first time man could see Earth from afar, and the gaze back to Earth became a reminder of the planet's finitude and ecological vulnerability. Kelsey reminds us of the deep ironies inherent in the whole Earth images, viewed in the context of the race to the moon: "an image anointed as the sign of a universal humanity and ecological fragility had emerged from an intensely militarized international rivalry and a space

program every bit as environmentally profligate as the society that produced it."[18]

There are many paradoxes inherent in the Whole Earth Catalog. A central one is, of course, the desire to go beyond cultural and political boundaries that was a fundamental concept for counterculture.[19] Brand's vision and quixotic campaign for the release of Earth images indicates yet another paradox: the conflation of the journey to inner space and outer space. This, I argue, is the meeting point of imagination and fantasy intermingle with the progress of technology, science is filled with dreaming and overcoming accepted boundaries.

Jon Palmesino and Ann-Sofi Rönnskog consider the Apollo 8 image as reaffirming, securing and fixing the planet, "albeit acting as a call for direct action, intervention and urgent reorganization."[20] They read "Earthrise" as an image shaped by the scientific technology of vision as well as by the surveying and measurement impetus and the accounting processes of Western empiricism.[21]

"We are as gods and might as well get good at it",[22] wrote Brand in the introduction to the first Whole Earth Catalog. Brand's cosmic view of Earth his sense that expanded consciousness was required for the next step in the evolution of humanity, and his call for personal freedom are all expressed in his ambition to equip his readers with knowledge and tools to transform their world. All these are encapsulated in the "Blue Marble" image.

The Overview Effect and the Effects of Orbitization

In 1972, four years after "Earthrise" was snapped by Apollo 8, the famous "Blue Marble" image was shot by the Apollo 17 astronauts (see Fig. 1.2). "Blue Marble" lent legitimacy to both the space program and twentieth-century concerns for the Earth's ecosystems and became emblematic of the "total systems" cybernetic view.[23] Both "Earthrise" and "Blue Marble" became iconic images and their effect on viewers was one of both awe and promise, proving the viability of leaving the planet to explore the unknown.[24]

Significantly, the visibility of the planet as a whole also made one's gaze visible. After all, in looking at something that was one's own Earth, one was also looking at oneself. As cultural geographer Denis Cosgrove emphasized, these images "have become the image of the globe, simultaneously 'true' representations and virtual spaces."[25] Moreover, Cosgrove argues that because they adopt the "one-world" approach, these images are charged, since they also contain the backwards-looking gaze of

the astronauts that took them. Thus, they serve as a reminder of our common humanity and the artificiality of geopolitical boundaries.

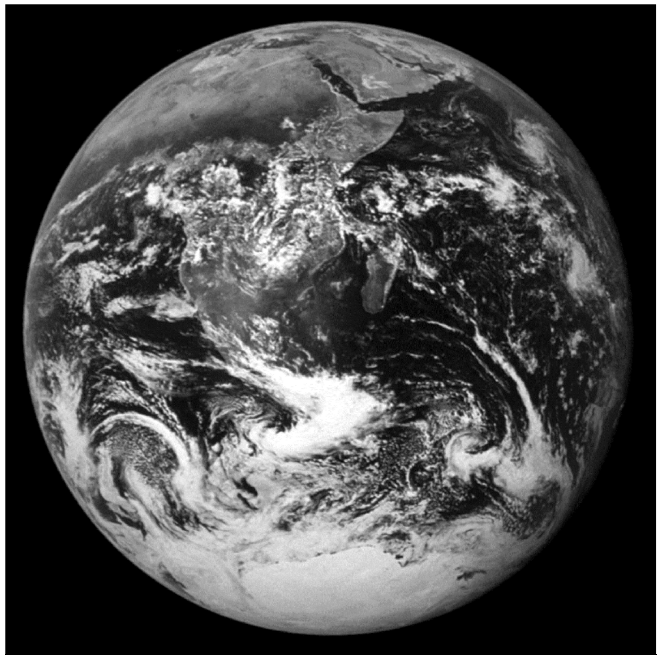

Fig. 1.2: The Blue Marble from Apollo 17. December 17, 1972. Credit: Image courtesy NASA Johnson Space Center Gateway to Astronaut Photography of Earth

The astronauts' gaze and the great impression that seeing Earth from space left on them – and on those who have never risen beyond Earth's atmosphere – are at the heart of Frank White's book, *The Overview Effect*.[26] The book argues that the goal of reaching out into space is not merely to use extraterrestrial resources. Rather, humanity is laying the foundation for a potentially new civilization that will eventually push the evolution of human society forward. The astronauts' backward gaze is therefore at the same time also that of a forward-looking human race. Moreover, space exploration may serve an even a higher purpose by performing a vital function for the universe as a whole.

This sense of self-transcendence is articulated in our optimism regarding the human capacity to influence not only Earth, but the entire universe. The planetary idea that environmentalist groups hailed shifted in the nineteen eighties with the rise of globalization and communication

networks and the resulting "flattening" of the Earth. The desire to overcome the boundaries of the atmosphere and what Peter Weibel calls the "law of the Earth" was the subject of "The Orbital Age," a 1986 symposium curated by Peter Weibel in Linz. He opens the catalogue text prepared for the symposium by heralding the beginning of a new era:

> We find ourselves at the end of a planetary thinking, where our globe was considered the "Nomos" of history. This has resulted in creating a world-spanning, unifying order of Earth and Space. This global order, though, tended towards a dangerous universalization, towards a totalitary One-World, the World State, taking away any possibility for emigration. With the orbital sphere we are now leaving the "Nomos of Earth", the Laws of our planet Earth, and humanity is offered the chance of doing away with the dangers of planetarization and universalization of a mono-world and a mono-culture.[27]

Whereas the Whole Earth Catalog sought to collapse boundaries between people and enable individual projects to alter life on a global scale, in the era of orbitization, the scale became larger. The inhabitants of Earth now aspire to unite Earth and Space and to celebrate the multitudes of opportunities this new horizon offers. Weibel describes a "starwards shifting of the borders" attested to by some 1500 satellites moving in orbit at the time of the exhibition.[28] These "1500 orbital ambassadors" also testify to the dislocation caused by the opening up, if not the abolition, of global boundaries. He considers globalization as flattening Earth cultures and warns of the creation of one unified society – a "mono-world and a mono-culture."

According to Weibel planetary thinking has been overtaken by orbital consciousness, and the orbital era opens new possibilities for the human race; we can now go beyond stargazing and looking at the light of the stars and think about new planets to live on. The colonization of space could even bring about the restoration of the Earth by making it possible to relocate to space. The symposium sought to explore the new possibilities opened up by overcoming gravitation and "launch[ing] out into the cosmic choreography of planetary movement."[29]

Some ten years after "The Orbital Age," "SpacePlace: Art in The Age of Orbitization" was launched at ZKM, co-curated by Weibel and Philip Pocock. In the time between the symposium and the exhibition, many more new satellites had been placed in orbit and not only the globe but also globalization itself had become a marketable commodity. Pocock and Weibel argue that selling often takes place through a cryptic orbital marketplace virtually invisible to many and overseen by supra-orbitant

bodies, usually the military.[30] Globalization is no longer our most far-reaching context, they write, "no longer the border guard containing our world. The global village [is] now surrounded by a territory that is orbital in nature. Its nucleus no longer residing at the system's geometrical centre but rather a collective of city centres, financial hubs, parliament forums, even art centres to which orbital culture both gravitates and attempts escape."[31]

"SpacePlace" included both space and orbital artworks physically exhibited in Munich and Karlsruhe, as well as an online and mobile platform featuring a database of related projects. The platform envisioned by Pocock invited the audience to contribute items, entries, and artwork to the database. This participatory platform is based on Web 2.0 principles and semantic technology, and each node in the network of users/contributors is connected to another, creating a constellation-like structure. Following legendary video artist and satellite art pioneer Nam June Paik's 1988 statement regarding the need to subvert the military use of satellites and use them for pacifist purposes, ZKM calls for active public participation and aspires to raise public awareness of space policies dictated by military considerations.[32] Pocock openly writes that "appealing as it does to the thinking eye and the curiosity that space art has always sparked," the exhibition called attention to broader space concerns by focusing on cultural and peaceful uses of satellites and spacecrafts. Orbitization, according to the curators, means leaving the Earth's boundaries and expanding man's reach to the near earth orbit as well as to deeper space.[33] Looking at the sky therefore acquired new meanings that address the needs of citizens of the twenty-first century.

Survey and Surveillance: Data Art and Mediated Stargazing

Twenty years have passed since "SpacePlace." In the interim, we have seen the emergence of the information age and information society. Now that orbitization has taken command of the market, globalization is visible, "like a product on the shelf," and its effects are felt on both economic and cultural levels, writes Pocock.[34] Satellites and other geospatial systems collect and disseminate data, and also create images of Earth that are in fact artificial composites of massive quantities of data collected remotely by satellite-borne sensors .[35] According to South African architect Laura Kurgan, these composites are located at the "intersection between physical space and its representation, virtual space and its realization", raising fundamental questions about them.[36]

These new techniques that create images of Earth and other planets wrought from data and often provided in real-time articulate the new trends and obsessions that have by now become commonplace – what Viktor Mayer-Schöberger and Kenneth Cukier call "the datafication of everything."[37] Thanks to the internet, social networking, and smartphones, more data is being collected and stored than ever before. By analysing huge amounts of information, it is possible to discover patterns and relationships that were inaccessible and even invisible to us before. Nowadays, almost anything can be datafied – from pressure points across a retail floor, through sentiments expressed in speech or tweets, to sleep patterns or jogging heartbeats measured by smartphones. Tiny movement sensors can be integrated in commercial or public buildings to generate insights about employees, customers, visitors – and of course, suspects – and biometric data can be easily collected, stored, analysed and mobilized in service of predictive algorithms.

Moreover, unique 21st century ways of seeing have been developed with the availability of recent technological breakthroughs such as Google Earth and Street View. Nowadays anyone with an internet-connected computer or device can collapse time and space. Furthermore, the new survey and surveillance systems evaluate and calibrate – and thereby accelerate – the very flows they set out to measure, as described by Palmesino and Rönnskog.[38] They do so by creating more data on the data accumulated and adding complexity and detail to the info-scape.

The advent of imaging technologies has had a great impact not only on the way we see our place in the universe but also on the way we ascribe meaning to outer space and its impact on both the individual and collective imagination. Imagining and re-imagining space is now for the most part dependent and almost inseparable from digital technology. Similar to the possibility of exploring the Earth from the comfort of one's home, planet discovery and "space travel" have been made accessible thanks to the Internet. And since data is at the heart of contemporary digital culture, there are also records and statistics of reading and viewing habits, of access and public interest in space-related websites, video channels and crowdsourcing platforms.

For artist Julie Freeman, data about looking and analysing data about distant galaxies is the locus of inquiry: she considers this as the conjecture of art and science, of data and looking. One of her projects is *We Need Us*, launched in 2014 on the digital art platform TheSpace.org (see Fig. 1.3).[39] Freeman is interested in "life data" – the name she gives to the real-time data from living things. Freeman's work explores how we can use data to translate nature and generate new perspectives. For her, *We Need Us* is a

thought experiment designed to reveal currently unknown "living" qualities of data and metadata. An article written with her research group refers to the material qualities of data and to the aspiration to use raw material to "expose more knowledge than ever before" in order to "gain insight beyond expectations of the past."[40]

We Need Us illustrates this ambition by giving sound and image to metadata retrieved from the Zooniverse website. Featuring a score of websites that crowdsource scientific problems that cannot be solved by computers alone, Zooniverse invites users to participate in various projects such as NASA's mission to spot stars in the early stages of forming planetary systems, or characterize surfaces on Mars. Freeman created algorithms that manipulate data on the activity within the website. Zooniverse enables anyone who logs into it to classify large scientific datasets – every action is recorded – so that whenever a Zooniverse user clicks or swipes online their actions are documented. The code Freeman created for *We Need Us* captures, collects and exposes the real-time activity of the platform's users. She thereby explores the real-time metadata of the galaxy research platform and transforms the work behind the live research into art. Each time a volunteer helps classify data, the shapes and sounds of the work change in accordance to the trail of metadata produced. This, she hopes, will remind visitors of the humanity in technology – the data needs us, just as much as we need them.

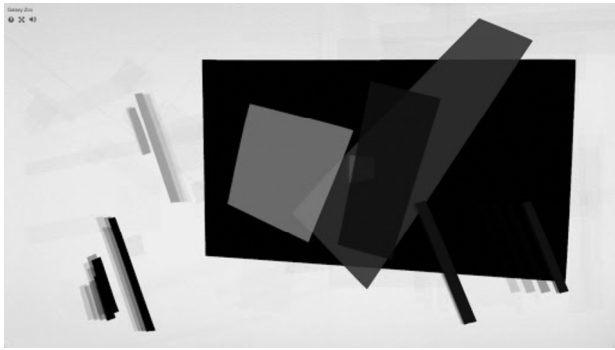

Fig. 1.3 Julie Freeman, Galaxy Zoo© CC BY-NC 4.0 Julie Freeman

The final example I wish to discuss is Lise Autogena and Joshua Portway's *Black Shoals* – an ongoing artwork conceived in 2000 that has gone through several renditions and is still exhibited worldwide, as part of the exhibition "Big Bang Data."[41] *Black Shoals: Dark Matter* (see Fig.

1.4) is a stock market planetarium: viewers are invited to gaze at a computerized night sky projected onto a domed ceiling above their heads. The sky is in fact a live representation of the world's stock markets, with each star representing a traded company. The stars in the planetarium slowly move across the sky, forming constellations, galaxies or even black holes in response to market fluctuations.

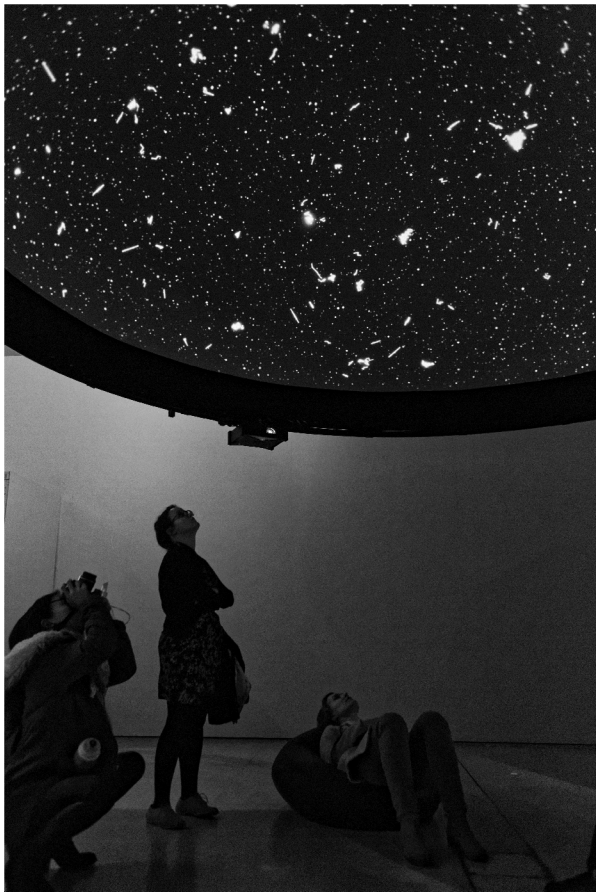

Fig. 1.4: *Black Shoals; Dark Matter* by Lise Autogena and Joshua Portway, Somerset House 2016. Photo credit: Joshua Portway

According to art historian Julian Stallabrass, the planetarium metaphor "encourages viewers to think about people's ancient relation to the stars as

harbingers of fate, and the myriad vain methods of reading them to predict the future."[42] He refers to this spectacle of financial data visualization as a display of the "data sublime", in which the viewer is carried off imaginatively on waves of ungraspable data, reminiscent of how people used to be awed by "gigantic majestic or apocalyptic landscape paintings, or still are by safe(ish) views of mountains, storms and the sea." It is the pulsing of the data packets, he writes, that gives the requisite feeling of vertigo before a display of unconceivable complexity and speed.[43]

The data sublime, I argue, has replaced the sense of wonder felt while looking at Earth images. Whereas the "Overview Effect" involved an understanding of the fragility of our planet and at the same time inspired a promise of self-transcendence and overcoming of boundaries, the data sublime express the contemporary fascination with and fetishization of computers. The new way of seeing through machines and our growing dependence on screens breeds a new addiction to measurability, to resolution and to optimization. In a way, we have given up on seeing independently and trust the computer's eyes and measurements more than we trust our own. We know that computers can bring us that we cannot see – radiation, information, light curves and statistics and probabilities about them – but there is a price to our disavowal of unmediated, independent seeing.

Conclusion

The more we instrument the world through sensors, mass measurement and computation, the more we come to depend on data. Data becomes the material and textual infrastructure through which we read the universe that is gradually becoming an object for us to manipulate. With data streams and images composed of data streams, we have become accustomed to looking at the representation as if it were "truth." Conflating the physical and virtual spaces, we became accustomed not to think about the relationship between the representation and the represented, in fact, for many the latter has become epistemically irrelevant.

Data visualization and art projects such as *We Need Us* and *Black Shoals* remind us of our age-old fascination with the night sky. Even though we now rely on machines to mediate the sky for us, and have grown accustomed to looking at the stars mainly through screens, the hold stargazing has on our imagination is still powerful. The sense of awe is maintained and with it, mixed feelings about our place in the universe and our worshipping of the machines we have built to better understand the world. On the one hand, we are as gods, as Brand wrote back in 1968, and

on the other, the enormity of the universe evokes an immanent sense of humility that is replicated by the data sublime. Looking at the sky in an attempt to trace stars, solve mysteries or predict the future still enchants us and as technology continues to, develop it will surely acquire new meanings. We know not what the next phase of visual technology will bring, and whether man will keep looking at the sky above Earth or raise his gaze to the sky stretched above other planets. Nevertheless, the spectacle that is the night sky, filled with promise and mystery continues to captivate human imagination.

Notes

[1] Quoted in "Declaration of Vision and Principles." The Overview Institute. Available at: http://www.overviewinstitute.org/about-us/declaration-of-vision-and-principles. Accessed on July 28, 2016.

[2] Peter Weibel, "Introduction," *The Orbital Age*. Ars Electronica, 1986. Available at: http://90.146.8.18/en/archives/festival_archive/festival_catalogs/festival_artikel.asp?iProjectID=9204 . Accessed on July 28, 2016.

[3] Michael A. Hoskin, *The History of Astronomy: A Very Short Introduction* (Oxford: Oxford University Press, 2003), 110.

[4] Stewart Brand. "'Whole Earth' Origin..." sb.longnow.org/SB_homepage/WholeEarth_buton.html accessed August 10, 2016.

[5] Sloan Digital Sky Surveys, www.sdss.org/surveys/. Accessed August 10, 2016.

[6] Hubble Space Telescope, http://hubblesite.org/gallery/. Accessed August 10, 2016.

[7] Galaxy Zoo, https://www.galaxyzoo.org. Accessed August 10, 2016.

[8] Zooniverse, https://www.zooniverse.org. Accessed August 10, 2016.

[9] See Jeff Richardson, "Blue Marble," *iPhone J.D.*, March 10, 2010. Available at: http://www.iphonejd.com/iphone_jd/2010/03/blue-marble.html. Accessed August 10, 2016.

[10] See "Wired Space Photo of the Day," *Wired*, www.wired.com/tag/space-photo-of-the-day/. Accessed August 10, 2016.

[11] See "Social Media at NASA," National Aeronautics and Space Administration. www.nasa-usa.de/socialmedia. Accessed August 10, 2016.
Mark Boyd, "NASA Launches API Portal to Encourage Use of Data Sets," *ProgrammableWeb*. May. 26, 2015. Available at: www.programmableweb.com/news/nasa-launches-api-portal-to-encourage-use-data-sets/2015/05/26. Accessed August 15, 2016.

[12] Jonathan Jones, "Out of this World: Why the Most Important Art Today is Made in Space," *The Guardian.* June 12, 2016. Available at: https://www.theguardian.com/artanddesign/2016/jun/12/why-most-important-art-today-made-in-space. Accessed August 25, 2016.

[13] Stewart Brand, "Photography Changes our Relationship to Our Planet," *Click! Photography Changes Everything*, a Smithsonian Photography Initiative: