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From Spaceship Earth to Google Ocean: Planetary Icons, Indexes, and Infrastructures

WHAT SORT OF IMAGE DOES THE PLANET EARTH POSSESS AT THE opening of the twenty-first century? If in the 1960s the Whole Earth, the planet as seen from space, became a cold war, proto-environmentalist icon for a fragile ocean planet, in the 2010s Google Earth, the globe encountered as a manipulable virtual object on our computer screens, has become an index for multiple and socially various interpretations and interventions; its thicket of satellite images, text legends, and street-level photographs can all be tagged, commented upon, modified. Digital media scholar Jason Farman (2010) writes that Google Earth offers the opportunity for users—not simply "viewers," note—to debate and augment representations of the world, and to do so at a variety of scales. In this essay, I examine a kindred image-object, Google Ocean, and ask what sort of representation of the planetary sea is in the making in our digital days. Stirring up the century-old classification of signs by semiotician Charles Sanders Peirce, I argue that Google Ocean is a mottled mash of icons, indexes, and symbols of the marine and maritime world as well as a simultaneously dystopian and utopian (that is to say, heterotopian) diagram of the sea—though one that floats in a media ecology that tends to occlude its infrastructural history and conditions of possibility.

Figure 1: Dymaxion Projection of "Our Spaceship Earth: One Island in One Ocean . . . From Space." © 2002 Buckminster Fuller Institute and Jim Knighton. Coordinate transformation software written by Robert W. Gray and modified by Jim Knighton.

To begin my story, I reach back to the 1960s, to a tale about the architecture of a ship.

SPACESHIP EARTH

In 1968, Buckminster Fuller argued in *Operating Manual for Spaceship Earth* that the modern world was first connected by those he called the Great Pirates, agents who in traversing the sea comprehended how the globe could be connected and created through the lines of their repeated routes between nations and empires. Using such practices as triangulation—the taking of bearings from two sites such that a third can be fixed—they filled the world with imaginary triangles, shapes that sliced the earth into segments that could be mapped *to scale*, and that could therefore allow the Pirates to scale up their own traveling enterprises. Fuller names Great Britain not the center of an empire,

but a ship fixed in place by Pirates who commanded compliance (global Earth, of course, was also fashioned out of a more terrible, not unrelated, geometry called the triangle trade). Fuller's geometric vision of world history inspired his invention of the geodesic sphere, a ball constructed of triangles, as well as his dymaxion projection map of the planet (figure 1). Ultimately, his tale of equally sized triangles was a utopian one, a diagonal, diagrammatic modernity that offered a coming planetary unity. His ship shapes scaled up to the planet, providing an armature for what Quaker economist Kenneth Boulding, in 1966, in his search for new images of world economy, had called "Spaceship Earth" (a term used that same year to title a book about planetary conservation penned by British economist Barbara Ward [1966]). On "Spaceship Earth," Fuller maintained, we Earthlings were "all astronauts."

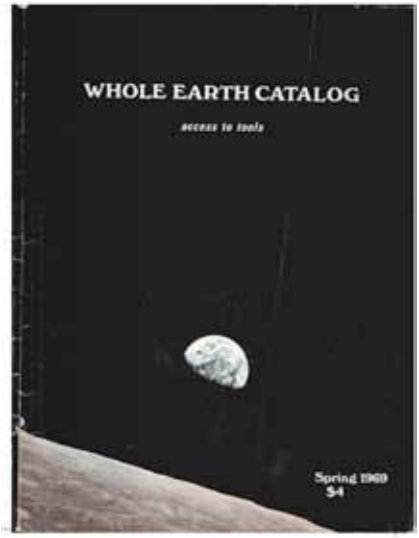

Figure 2: Cover of *Whole Earth Catalog,* Spring 1969, with Earthrise picture.

"Spaceship Earth" came to have a more documentary, smoothly spherical, visual life with 1968's *Earthrise* photo, taken from the Apollo 8 spacecraft. This was an image of Earth emerging from behind the Moon (figure 2). This picture, taken by astronauts on the first lunar orbital flight, famously graced the cover of the *Whole Earth Catalog*, a manual for a back-to-the land counterculture. A photo of the full Earth taken by Apollo 17 in 1972—known as the "Blue Marble"—became even more iconic, concretizing Boulding's claim that "gradually . . . man has been accustoming himself to the notion of the spherical earth and a closed sphere of human activity" (1966: 3) (figure 3). Much has been written on the Earth-from-space photos (Garb 1985; Cosgrove 1994; Haraway 1995; McGuirk 1997; Jasanoff 2004; Welter 2011; Lazier 2011). In the

Figure 3: Blue Marble photo. Taken from Apollo 17, December 7, 1972. NASA.

usual story, Earth seen from space fixes a moment when "the globe" emerges as an eco-object—a world delivered by the techno-eye of a cold war superpower and appropriated into environmentalist iconography. President Lyndon Johnson's distribution of the Earthrise photo as a gift to other world leaders staked a nationalist claim, while simultaneously sending the picture into globalizing orbit (McDougall 1985).

The capture of the Earthrise image by globalized environmentalism was not inevitable (Garb 1985; Messeri 2008). Readings of the whole Earth as alienating, irresponsibly transcendent, and ungrounding also circulated. Heidegger, speaking of a 1966 black-and-white picture of an

Earthrise taken by the unmanned Lunar Orbiter 1 (figure 4), reported that he was "scared" when he saw the image, seeing not a grounding "home," but a vertiginous unmooring (see Lazier 2011 for a definitive reading of Heidegger's response to the image of Earth from space). The orientation is important here: the moon is not a self-evidently horizontal grounding for the Earth, but a vast and looming presence threatening to eclipse the grainy gray Earth (and note that the later Earthrise image was originally presented "sideways"; it was only put into a landscape orientation when it arrived on the cover of the *Whole Earth Catalog*) (Lazier 2011). In a less romantic idiom, Sheila Jasanoff suggests that "the planetary image [may] . . . convey . . . a serene (some might say contemptuous) . . . disregard for the day-to-day environmental insults suffered by billions of the world's poorest citizens: dirty air, polluted

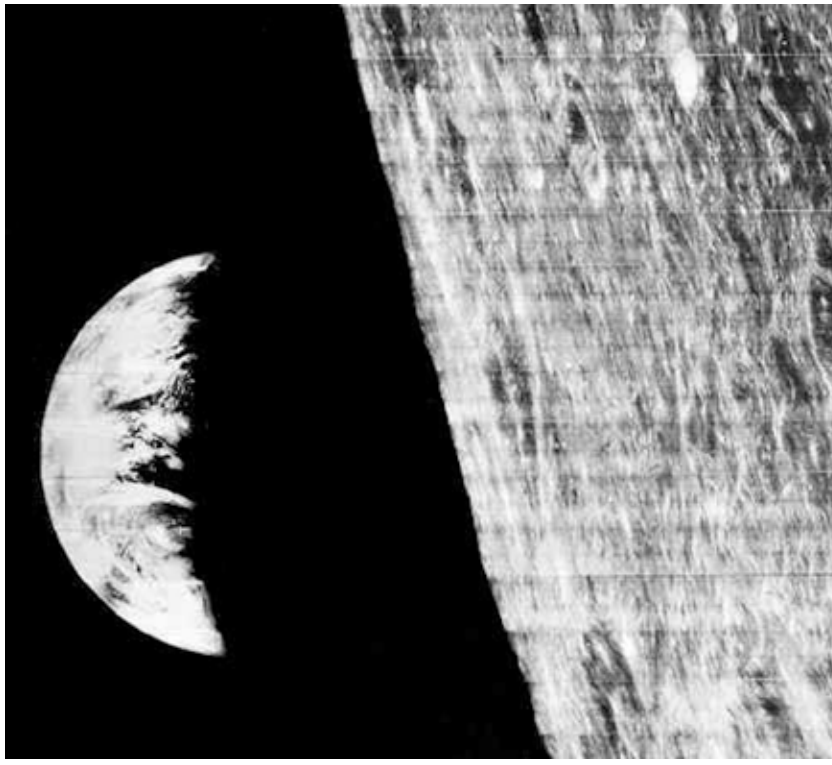

Figure 4: Image of Earth and Moon from Lunar Orbiter 1, 1966. NASA.

water, inadequate sanitation, infectious diseases, damaged crops, loss of green spaces, and the decay of built environments" (2001: 335). This interpretation points to a semiotic unsteadiness in the image.

As a photograph of the Earth, Whole Earth is what semiotician Charles Sanders Peirce would have called an *index*, a sign that stands for (or points to) its object by virtue of the object having made an impression on the carrier of the sign. A footprint is an index, and so, in a material fashion, is a photograph, an impression made by light on a medium. But the Whole Earth also exists as a kind of *icon*, a diagrammatic representation of a *quality* of Earth, namely its "wholeness." It is an index with iconic features. We might go further and position the image as an icon in a more sacred sense, too; one might say about it what anthropologist Karen Strassler observes about photographs of holy personages: "Revelatory traces, such photographs also retain the aura of their originals through a property of indexical 'contagion' or 'contact.' Within this semiotic ideology, the indexical nature of the photographic image—its physical connection to its referent—enables it to embody and transmit the power of the photographed subject" (2010: 282). The Whole Earth was certainly touted in its day—particularly by Stewart Brand, editor of the *Whole Earth Catalog*—as a revelatory image, pregnant with power in and of itself, an "icon" in the religious sense (and see Turner 2006).[1] That would make it also into what Peirce called a *symbol*, a sign that stands for something by interpretative convention. Whole Earth is icon, index, and symbol of unity and planetary vitality and fragility—though it may, of course, as Jasanoff points out, be melted back via critical viewing into a swarm of other sorts of indexes pointing to colonialism, imperialism, economic inequality, and the like.

I am more interested in another reading that has circulated. For many viewers, the image of the Earth from space is not an image of Earth as ground (or unground), but an image of *earth as sea*. The caption of the Buckminster Fuller dymaxion Spaceship Earth poster underlines this reading: "one island in one ocean . . . from space." Science fiction author Arthur C. Clarke is said to have famously pronounced (in an

impossible-to-source quotation one finds everywhere people write about oceans these days), "How inappropriate to call this planet Earth when it is quite clearly Ocean." Lifted above the ocean that Edmund Burke in 1757 named as the signature symbol of the sublime—that which overwhelms with terror and beauty—viewers in the 1960s came to name Earth the "blue planet." In the January 14, 1966, issue of *Life* magazine, Gemini 7 astronaut Frank Borman suggests, "Anyone on Mars looking at Earth would call it the Blue Planet" (Borman and Lovell 1966: 70; the use of this term "blue planet" skyrockets in popular use from then forward). Earth is redone as Ocean. Spaceship Earth both floats in and contains a Sea.[2]

Photographs of Ocean Earth from space became, in the years following the first Earth Day in 1970, rallying points for environmentalist arguments. The image of a homey, extraterrestrial Earth sounds a call to intimacy with the planet, what Donna Haraway names a "yearning for the physical sensuousness of a wet and blue-green Earth" (1995: 174). Fast forward to the millennium and a bit beyond. The fragility and finitude so fastened to Earth's marbled image is nowadays leveraged into warnings of an irreversibly changed planet, of a state of permanent crisis to which humans must now adapt. In 2010's *The Vanishing Face of Gaia: A Final Warning*, James Lovelock—who re-envisioned Earth as the self-regulating "Gaia" after imagining how it would appear spectrographically from space—argues that global warming is shifting Earth into a long-term "hot state." Bill McKibben (2010) agrees, and suggests that "we no longer live" on the planet represented by the 1968 Earthrise photo. His book, *Eaarth*, points to melting ice caps and increasingly acidic oceans. McKibben, respelling "Earth" with two a's to flag a silent but significant change—akin, perhaps, to what Derrida did with *différance*—tells readers that there is no going back to Earth (with one a). In the images of Earth on the covers of *The Vanishing Face of Gaia* and *Eaarth*, the Blue Marble turns red, suggesting oceans aflame or filled with blood (see figures 5 and 6) (these pictures also share aesthetics with apocalyptic imagery on popular evangelical Christian books about the rapture, for example, the *Left Behind* series; cf. Lazier 2011

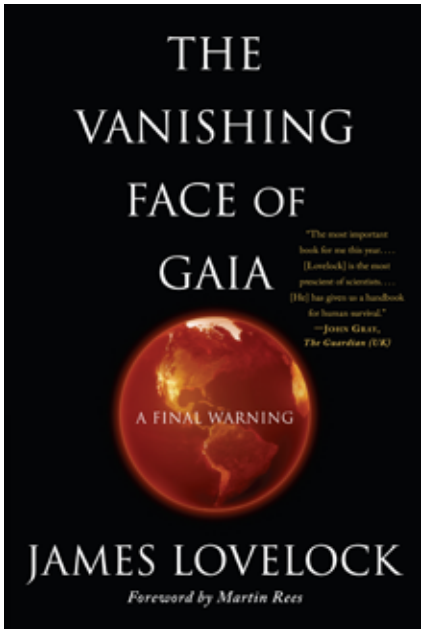

Figure 5: Gaia in peril on *The Vanishing Face of Gaia.* Reproduced with permission of Basic Books/ Basic Civitas/Nation Books.

on Gaia as the avenging avatar of Whole Earth).

What representations of Ocean Earth animate these warnings? Those delivered by such objects as the OrbView-2 spacecraft, which produce data compiled into "Sea-viewing Wide Field-of-view-Sensor" (SeaWiFS) false-color representations of chlorophyll concentrations (see figure 7), which can be used as proxies for changing temperatures. Graphs of increasing atmospheric temperature fill out this picture (Edwards 2010). Such technologies of "overview," made epistemologically possible by space-age accounts of the Earth, have become increasingly digital—and, importantly, less photographic, even as—like SeaWiFS images—they rely on conventions of realist indexical and iconic representation established by 1960s images of Earth from space (the Earth as closed sphere, seen from somewhere between Earth and Moon; the Earth as a colorful ball against a black background). But such technologies of representation have also become increasingly available to a variety of viewerships and readerships—which brings me to today's offspring of Spaceship Ocean-Earth: Google Earth and Google Ocean.

GOOGLE EARTH

Google Earth is a virtual 3D globe patched together from satellite imagery, aerial photos, and Geographic Information System (GIS) data.[3] In Google Earth, users start with a composite satellite image of Earth that hovers on their (2D) computer screen (or smart phone, or tablet)

at about the same virtual distance as Earth did from the Apollo 17 astronauts who snapped the Blue Marble image (about 28,000 miles into space). Google Earth is a weightless virtual object that one can "spin" with a wave of one's mouse (with a cursor icon shaped like a hand, a virtualization of the gesture of spinning a globe with one's fingers). Google Earth is thus a descendent of the playful inflatable Earth beach balls that made their way into outdoor countercultural events in the 1960s. In his analysis of such bouncy Earth toys, Volker Welter writes, "In antiquity, Atlas could barely move, so heavy weighed the planet on his shoulders. . . . Modernity gradually took that weight off man until space travel tore apart his final ties to Earth. . ." (2011: 25).

Figure 6: A graphic depicting "Eaarth," the post-Earth planet described by McKibben 2010.

But if Spaceship Earth is a photographic record of a ball floating in space, Google Earth virtualizes this flotation device into a computationally generated sphere of representations pieced together from software whose particulars remain out of view of the user interface. (As Arjun Appadurai put it in the call for papers for this special issue, screens both occlude and display, both enable and mask the objects they would reveal.) Google Earth thus shares with Spaceship Earth something of the quality of a fetish (see Mitchell 1987 on icons, ideologies, and fetishes), a shimmering image meant to be consumed, perhaps as an icon of nostalgia for an Earth we may be about to lose (though, as we will see, Google Earth can invite more hands-on—or fingers-on-the-mouse—thought-experimenting, too, some of which may interdigitate with forms of online and offline political organizing).

Google Earth's interface permits users, as if in a dream, to "fly to" (or zoom in on) features of the planet that they may find of interest

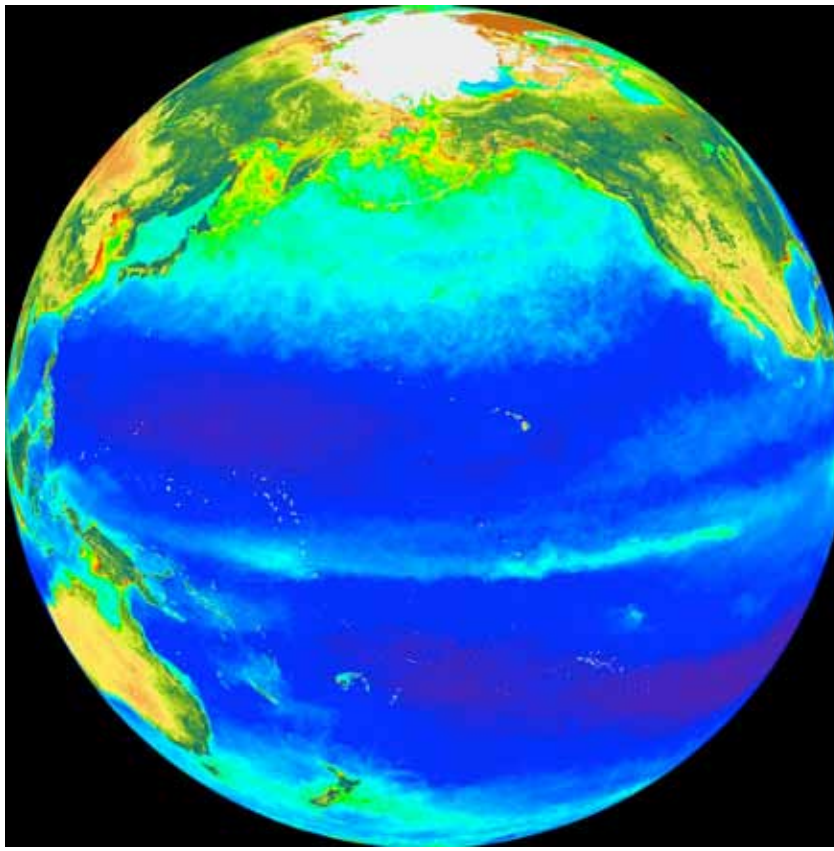

Figure 7: "Sea-viewing Wide Field-of-view-Sensor" (SeaWiFS) representation of chlorophyll concentration. GeoEye satellite image.

(tourist destinations, their own homes) and to do so at various degrees of resolution (as of 2010, the "average zoom in major cities such as San Francisco, London, and Tokyo is around 90 meters before pixilation" [Farman 2010: 872]). "Street level" images appear in many locales, first visible as bubbles into which one can virtually leap with a click of the mouse, maneuvering into a 360-degree panoramic image. 3D representations of skyscrapers and large-scale natural features abound. Google Earth offers a number of "layers," graphics that the user can toggle on and off to superimpose on the basic globe digital portraits of weather, tracings of international borders, maps of highways, and

the like ("layers" themselves have an earlier pedigree in such tools as Adobe Photoshop, though also in a longer history of overlays on maps, especially in geology [see Rudwich 1976]).

Google Earth is a very personal and personalizable Earth, a quintessentially contemporary computational object, an app. We could as well call it iEarth. It invites individuals to have their own unique encounters. In her writing on software, however, media studies scholar Wendy Chun suggests that

> interfaces—as mediators of the visible and the invisible, as a means of navigation—have been key to creating "informed" individuals who can overcome the chaos of global capitalism by mapping their relation to the totality of the global capitalist system. . . . The dream is: the resurgence of the *seemingly* sovereign individual, the subject driven to know, driven to map, to zoom in and out, to manipulate, and to act" (2011: 8).

Chun may overstate her case here—not all of the Facebook and Twitter traffic coincident with the overthrow of President Hosni Mubarak in Egypt in spring 2011, for example, may be so easily boiled down to stories of people possessed by a false consciousness about capitalism. But Chun does remind us of the infrastructure behind something like Google Earth. If the graphic user interface produces a sense of mastery over the globe (this is different from the Whole Earth image, which was usually spun rhetorically to shock people into their finitude and dependence on a fragile ball), this mastery depends on the institutions that produce the imagery. Google Earth was launched from a US-based company, Google. It relies largely on representations made by the office of the US Department of State Geographer and therefore necessarily embeds the traces of US mapping concerns and conventions—including keeping low-resolution or blurry images of areas containing US military facilities. Google's attempts to stay on the good side of the Chinese government have also had effects: Tibet does not

appear on Google maps. While Google Earth has moved beyond older politics of map projection (no one worries about the Eurocentrism of Mercator projections here), it is certainly, for all its spherical, photographic and photo-realist representation, far from shutting the door on cartographic controversy. It is also worth noting that Google relies not only on US military and imperial infrastructures, but also crucially depends on public works funded by the US government (geodetic surveys undertaken to determine the shape of the planet [cf. Fischer 2005], the interstate highway system, and the like), works that are then treated as given, almost "natural" facts and features of the landscape. Google Earth may give us cause to worry, with Siva Vaidhyanathan (2011), about the "Googlization of everything," the work of a private company to absorb other people's public, historical infrastructural work into its own network.

Google Earth is a mixture of representational forms. Indexical: satellite images. Iconic: road maps. Symbolic: nation-state boundaries. But in the days of computational imagery, Google Earth exceeds the usual frames of representation even within canonical Peirceian categories. So, for example, one might at first glance say that the satellite photos in Google Earth are indexical. But, as Chun reminds us, computers do not show pictures; they generate them (2011: 17). More, if we think of Google Earth as giving us a kind of movie (of, say, a zoom into a landscape, or a spin around the globe) this neglects the fact that having computational processes happen in "real time" requires that programs keep up, prioritize what count as important elements in an event. (Chun explains: "Software's temporality . . . is converted in part to spatiality, process in time conceived in terms of a process in space" [2011: 3]). There is no "transparency" here: "Computers have fostered both a decline in and a frenzy of visual knowledge. Opaque yet transparent, incomprehensible yet logical, they reveal that the less we know the more we show (or are shown)" (15). Google Earth offers an oscillation between the hypermediated and the immediate (see Bolter and Grusin 1999). In the process, the program secures an odd realism, with "unmediated" photos grounding the analytic frames superimposed

upon them, which in turn reinforce the "empiricism" of the photos they diagram (see Lynch 1991). As scholar of scientific visualization Tom Schilling suggests, "few other genres of cartography force their users/viewers to navigate, manage, or systematically ignore such a profusion of labels, boundaries, models, photos, drawings, or diagrams as Googlers must" (pers. comm.).

Insofar as what we see in Google Earth appear to be like photographs, we might think of these items as haunted by all the representational techniques that have to be erased for them to appear this way. We might also inquire into what sort of notion of indexicality animates our vision of Google Earth. In *Refracted Visions,* Karen Strassler tells the story of the Indonesian Queen of the South Sea, Ratu Kidul, "ruler of the unseen spirit realm and traditional lover of Javanese kings" and she reports (with surprise) that some of her Javanese interlocutors spoke of oil paintings of Ratu Kidul as "photographs"—indexical traces of the spirit queen's presence, impressions made on a medium. Strassler finally accepts that, yes, these *are* photographs within an "ideology of indexicality" that does not require that an emulsion of silver halide that can register light (or a charge coupled device that can digitally register photons) count as the only medium for "photography," light-drawing (2010: 284). Taking things in the reverse direction, we might consider the photos in Google Earth not as photos, but as drawings, results of the use of instruments to mark a two-dimensional surface.

For Peirce, Google Earth would not properly be what he would have called an *image*, which for him was simply an expression of qualities. Peirce might have called it a diagram, an icon that represents "a set of rationally related objects," which themselves may be represented by icons and indexes (Peirce 1976 [1906]: 316). We also could be more playful and call it a *calligram*, a decorative arrangement of letters, taking the shape of the thing that the letters spell out (cf. Pottage and Sherman 2010)—though a calligram made of icons, indexes, and symbols. Or perhaps this representation is a rebus—"a cryptic representation of a word or phrase by pictures, symbols, arrangement of letters, etc., which suggest the word or phrase, or the syllables of which it is made up"

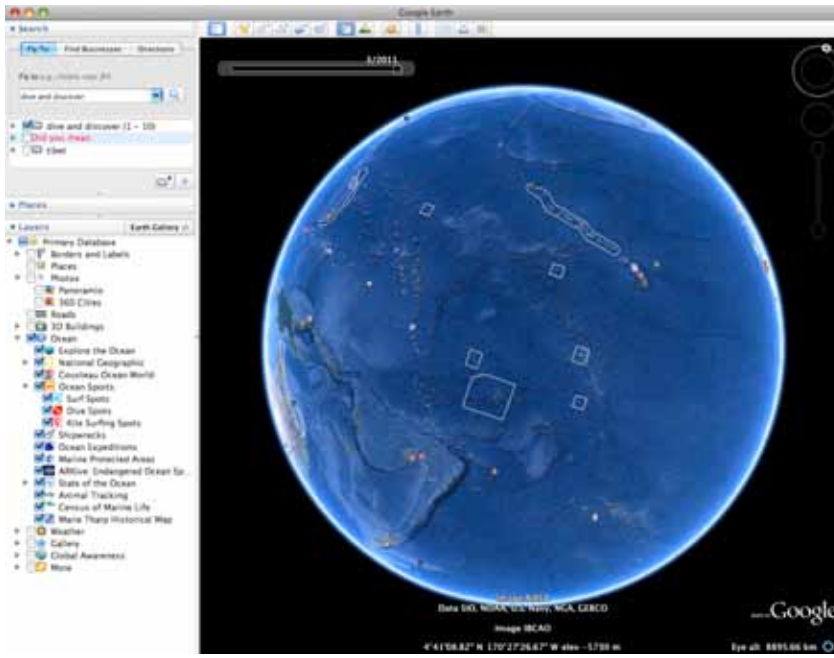

Figure 8: Google Ocean. © 2011 Google. Image NASA, DATA, SIO, NOAA, US Navy. GEBCO.

(*Oxford English Dictionary*)—or, better, a reverse rebus: a cryptic *and* transparent representation of a picture by words, symbols, arrangement of letters, etc. which suggest the picture.[4] This bevy of signs—straightforward and roundabout—in mind for Google Earth, what of Google Ocean? What sort of image of the sea is in the making in Google Ocean?

GOOGLE OCEAN

Google Ocean is a program that adds layers to Google Earth and itself features many sublayers (see figure 8). It permits users to look, for example, at outlines of Marine Protected Areas, data from the Census of Marine Life, icons representing locations of sunken ships, surf forecasts, and videos about creatures in peril (from the "ARKive: Endangered Ocean Species" website, itself part of Google Earth's "Global Awareness" layer). When Google Ocean was released, in 2009, polar explorer Pen Hadow wrote that "this is a watershed moment of shared global under-

standing of our oceans. Ocean in Google Earth will enable a global audience to follow the progress and findings of the Catlin Arctic Survey, an international scientific endeavour resolving the likely meltdown date of the Arctic Ocean's sea ice cover" (Khan 2009). The layers in Google Ocean are pointedly shaped by an ecological set of orientations; anxiety about global warming hums in the background of this platform.

But we must dig a little deeper to get a sense of what sort of representation of the ocean—or oceans—is in motion in Google Ocean. Unlike Google Earth, Google Ocean is not grounded in satellite photographs—or, for that matter, "street level" (or even sea level) photographs. Rather, Google Ocean is founded in topographical maps of the seafloor (these have negative elevations; sea level is Google's zero elevation). These maps appear through the thin veneer of a uniformly wavy water surface rendered in computer graphics. This is iconic, not indexical, water, and it has the same texture anywhere one goes (one can even make the water surface go away by clicking on a pull-down menu, realizing the oft-narrated literary dream of sucking away the sea). This "blank" water may be the 3D analog of the blank featureless sea represented on most world maps (see Steinberg 2000). "Flying in" permits the user to penetrate the water surface effortlessly, getting a closer look at the seafloor—though "effortlessly" may well be the wrong adverb here, since the "flying" movement requires a culturally tuned skill with a mouse or touchpad (I discovered that my own habitus was not fully up to the task of submarine navigation when I repeatedly overshot my target depth by several kilometers).

The seafloor at which one arrives after flying in is not so much a topographical map or picture as it is a *model*. A blue 2D image of a 3D lumpscape, the seafloor is compiled and built up from sonar tracings as well as satellite bathymetry (radar bounced off the surface of the sea to infer the topography below). As one writer on the Google Earth Community BBS puts it,

> [I]t is satellite radar geodesy (a coarse model of the seafloor based on radar measurements of sea height) corrected by

> actual single- or multi-beam sonar recorded by research vessels (much finer detail, much higher quality depth information). Neither of these two sources are "images" . . . ; they are both collections of mathematical data points ("Markopolo" 2005).

Though these models do manifest as images in the common sense use of that term, this writer is correct that they are a particular species of representation the specifics of which Google Ocean does little to reveal. These models are mash-ups of the iconic, indexical, and symbolic—none of which the interface makes clear, until one considers another element of the Peircian model of semiotics: that all signs must have an interpretant: an agentive, cognitive frame for reference. A simple way of thinking about this is to consider how data are captured for seafloor models, which is through an interpretative assemblage of ships, satellites, and computer programs. Artifacts in the data reveal some of the assumptions built into the human and machine intepretant ecology. Take the seafloor. One user on the Google Ocean BBS reports that several lines "radiating away from Cape Town are artifacts, errors in the model which correspond to ship tracks from the research vessels which left (or arrived at) Cape Town, recording sonar data as they traveled which is replicated in the GEO seafloor model" ("Markopolo" 2005). The image of the real, filtered through the model, indexes its social and institutional conditions of possibility, underscoring the way that systems of meaning can pre-shape what will count as a sign.

There is an odd sensory feature to Google Ocean's underwater world. Once beneath the virtual waves, the user sees, just above, a sea surface ceiling of generic ripples and, just below, a rumpled blue seafloor. Particularly odd is the fact that the water is absolutely transparent, with no indices of refraction, no attenuation of light.[5] This is not the dark deep, but a clear fishbowl—though with no fish; sea life does not swim in this space. It is also difficult to grasp scale here; understanding the size and location of the body one would have to inhabit to access these views is unclear (see figure 9). There is also no change in "medium" with our "travel" below the waves; the user still "flies,"

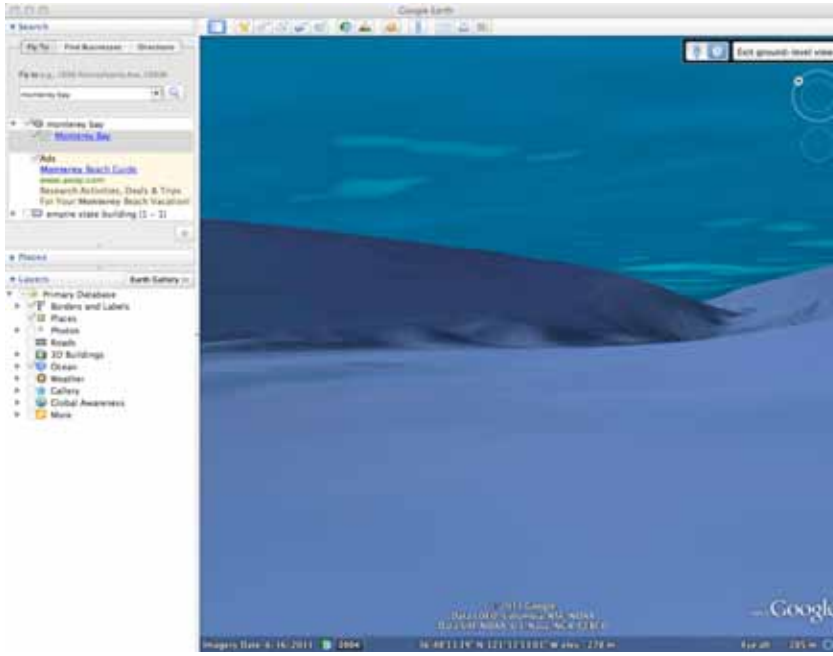

Figure 9: Monterey Bay, 285 meters below sea level. © 2011 Google. Data LDEO-Columbia, NSF, NOAA, DATA SIO, NOAA, U.S. Navy, NGA, GEBCO.

"floats," indicating something very strange about the place of "gravity" in this model, a point to which I will return.

I would put this image of the sea into the lineage of oceanographic apprehensions of the sea as follows: during the first oceanographic voyages, in the nineteenth century, ships such as Britain's HMS *Challenger* drew their knowledge of the abyss from dredging—bringing up objects from the bottom of the sea using buckets attached to piano wire. The deep was a mysterious zone of unknown depth, a dark and frightening realm of thick secrecy (in fact, in the early nineteenth century, naturalists thought the deep to be devoid of life because of a prevailing belief that sea water was *compressible*, that it got thicker as you went down). In the early twentieth century, sonar, or *so*und *na*vigation *r*anging, afforded a dimensional portrait of the deep that had been unavailable through the patchwork deployment of sounding lines. Sounding with sound, argues historian Sabine Höhler , marked an arc toward visual representations of the deep:

> Oceanographic research commencing in the mid-19th century could not rely on the direct observation of its object, but had to create its images of ocean depth through remote investigation. Depth became a matter of scientific definitions, systematic measurements, and graphic representations. In the course of a century, the opaque ocean of the 1850s was densely depicted in physical terms and transformed into a technically and scientifically *sound* oceanic volume (2002: 119).

The next move along the sensory trajectory was visualizing the deep with light. Jacques Cousteau's television specials and all their progeny, from *Blue Planet* to James Cameron's IMAX documentaries about hydrothermal vents, now afford optical access to bits of this oceanic volume. The sensory trajectory through which the deep sea has been scientifically apprehended has traveled from the tactile, to the auditory, to the visual. With Google Ocean, the ultimate fantasy of visualizing the deep—making it totally see-through—is materialized. Google is in many ways a post–Cold War ocean, an ecological ocean, an icon of a hoped for transparency of ecological auditing and governance. It is, in many ways, a dreamscape. I find helpful Michael Lynch's analysis of the coming together of diagrams and photos in the age of digital image processing: "Many diagrams take the form of 'conceptual' models. . . . [H]ybrid combinations of schematic, pictorial, and verbal constituents make up what Gilbert and Mulkay call 'working conceptual hallucinations'" (Lynch 1991: 209).

I remarked earlier on the politics inscribed into Google Earth. What might those be and how do they connect—or not—to the Google Ocean layer? Jason Farman, in his article "Mapping the Digital Empire: Google Earth and the Process of Postmodern Cartography" (2010), suggests that Google Earth necessarily inherits some of the imperial histories that gave rise to the practice of mapmaking. It may be difficult to see these, he suggests, because the platform is made of *photos*, suggesting that it is a simple one-to-one index of reality, an objective representation (Farman 2010: 875; cf. Daston and Galison 2007) (though see my

contention, above, that these are not photos, but rather *drawings*). More, since these pictures are sourced from satellites or anonymous photographers, they seem clean of authorial agency or agendas. Of course, the "view from nowhere" is a well-critiqued figure in science studies. Donna Haraway (1991) in "Situated Knowledge" famously named the "god trick" that so often comes with "overviews" that purport to be neutral—especially as they may be anchored in mapping practices dedicated to owning and controlling territory. The first-person character of Google Earth street views—or submarine models, as the case may be—does not exile that god trick, but rather obscures it by presenting a view supposedly analogous to be one that an "individual" can have (though, again, a weird individual, made of a virtual, roving eye, operated by a fleshy hand both present and absent to the user's consciousness. Gilbert and Mulkay's 1984 "working conceptual hallucination" is particularly apt here).

Just as with Google Earth, Google Ocean depends on representations that come from institutional addresses, which is no surprise given the very labor- and technology-intensive practice of mapping the sea. Ocean floor topographies are provided by the Scripps Institution of Oceanography, the National Oceanographic and Atmospheric Administration, the US Navy, the National Geospatial-Intelligence Agency, and scientists responsible for the General Bathymetric Chart of the Oceans (GEBCO). Many sublayers are from other organizations, and many of these are less "layers" in the sense of fully covering sheets of representation than they are skeins of factoids. A couple of these—such as the Cousteau Ocean World and National Geographic—simply geo-locate/tag stories or clips from television shows to particular spots on the Google globe. Shipwrecks and Ocean Sports layers direct wreck divers and surfers to points of interest.

Particular points of view are built into these layers. "State of the Ocean" layers—ocean observations, sea surface temperature, arctic sea ice, dead zones, Monterey Bay Aquarium: Seafood Watch—all these have environmental concerns at their heart. In 2005, Google provided documentation of the devastation of Hurricane Katrina. The Census of Marine Life has tags that key to pictures of sea life. The mélange

of government, university, and nonprofit sources of layers in Google Earth sketches out a diagram of contemporary ecological politics.

But human or cultural agency cannot fully explain the image of the sea in Google Ocean. Some of the artifacts that appear in Google Ocean result from "left on their own" algorithms dedicated to generic tasks. To a roughly tuned algorithm meant to map the seafloor, everything can look like the seafloor. Some users report that recent upgrades of seafloor models have erased entire islands. Thus, a user on the Google Ocean BBS:

> I'm going to report some of the islands which have gone missing, or partially missing after the update. . . . [H]ere are a few examples of problem areas:
>
> ▸ Maldives—some atolls and surrounding waters are now covered by the new ocean floor
>
> ▸ Island of St. Helena in south Atlantic half missing
>
> ▸ Several of the South Georgia islands near Antarctica are missing or partially missing. Examples: Montagu Island, Saunders Island, Cook Island, etc.
>
> ▸ Isles of Scilly off the SW of the UK are all missing.
>
> ▸ The shallow waters in the Bahamas are now all obscured.
>
> Please bring back the satellite imagery! (Taylor 2009)[6]

The commentary by users of Google Earth and Ocean points toward an intriguing feature of this image of the planet; it is one that permits, even invites, critique—and not only in the form of text. Users can add layers to Google Earth, which they can then share with other users. Jason Farman observes that the "Google Earth Community," a social network that assembles online to comment on and critique Google Earth, helps to foster cartographic debate, even undoing some of the imperial hauntings of the platform. Farman writes that "Google Earth uniquely engages its users, not as disembodied voyeurs, but as participants in global dialog, represented spatially on the digital map" (2010: 870). He writes further that "users can spatially debate the very

tool they are using while simultaneously augmenting the borders in Google Earth to offer a different map altogether" (873). Farman suggests that the Google Earth "overlay" feature—which permits users to overlay the map with alternative cartographies, which they can then email to other users—makes Google Earth a space of productive wandering, an electronic zone for what the situationist art movement called *derive* and *détournement.* As a kind of heterotopia—a mix of the real, the imagined, the possible, and the impossible—Google Earth may be a more unstable and promising representation than Spaceship Earth. Here, the map exceeds the territory.

Google Earth has become an authoritative platform for making maps and countermaps. Take, as one example, Stanford archeology doctoral student Adrian Myers's tracking of the growth of Guantánamo Bay prison construction using Google Earth (Myers 2010). While Myers's project, which visualizes what oceanic distance is meant to obscure, might be seen as a kind of citizen auditing of governmental doings, he points out that there are "ethical concerns inherent in the use of remotely sensed images, as Google Earth might be seen as a panoptic viewing technology that leaves no voice to those being viewed" (455). Any number of examples of this kind could be given—and it is also important to keep in view older questions of a "digital divide"; Google Ocean requires a high bandwidth that not all would-be maverick cartographers can access (which underlines a difference between the infrastructural realm Google takes for granted—a mid-twentieth century, publicly funded system of roads, cables, etc.—and today's increasingly privatized commons).

Google Ocean also hosts a fleet of maritime overlays (see, for example, <http://www.justmagic.com/GM-GE.html>): submarine cables, marine park wildlife surveys, fishing zone maps, navigational charts, world tides, sea surface temperature, rising sea level animations, sites of recent piracy, oil spills. The variety of concerns now writable into Google Earth and Google Ocean display a range of agendas, a range of mapping concerns, some of which may be informational, some of which may anchor maritime activism. They diagram an ocean imagined in multifarious registers. Google Ocean has also generated a series

Figure 10: Project Kaisei: Capturing the Plastic Vortex. Data SIO, NOAA, U.S. Navy, NGA, GEBCO. Image © 2011 DigitalGlobe, Image IBCAO, Image © 2011 TerraMetrics <http://kaisei.blipback.com/>.

of heterotopian social network interventions. Consider, for example, a recent voyage to the plastic vortex—a giant loop of floating plastic trash caught in the Northern Pacific gyre—that has lately been undertaken by ex-NASA employees who offer maps of their travel on their website, using Google Earth as their grounding map. The connected Ocean Voyages Institute, a California registered 501C3 nonprofit organization, organizes the plastic vortex expedition; their website features a Google Earth Globe, onto which they have overlaid the path of their voyages as well as links to videos of themselves poking at plastic gunk in the ocean (see figure 10). Or look at animations of the 2010 BP Gulf of Mexico oil spill that employ Google Earth as a backdrop (for example, <http://www.youtube.com/watch?v=2DS6smLuzBk>). Google Earth has become a passage point in what Kim Fortun (2004) has called "the infor-

mating of environmentalism," the making legible of environmental concerns using databases.

The Digital Ocean project, aimed at adding environmentalist overlays to Google Ocean, is part of this moment. Its logo, an image of a pixilated wave, plays with the tension between the quintessentially analog and wavy—the ocean—and the digital (see figure 11). One of the project advisors is Constance Penley, a critical theorist known for her analysis of science fiction fan remixes of popular TV shows, such as *Star Trek*, which in its "slash fiction" version has Kirk and Spock in a steamy love affair (1997). When, during a visit to Santa Barbara, I asked Penley how she imagined Digital Ocean, she said, "It's about slashing the ocean! It's about getting people to be *fans* of the ocean." Derridian boosterism, yes, but perhaps an index of possible geometries for new digital writing, reading, and thinking.[7] As a space of possible mappings—many of which are to do with ocean health, Digital Ocean and Google Ocean are like Spaceship Earth before them, tools for thinking about possible futures (see figure 12, an image made in Google Earth that offers, after McKibben, what Susan Kraemer calls "Google Eaarth").[8] That promise is packed into the medium of the representations themselves; both Spaceship Ocean and Google Ocean

Figure 11: The Digital Ocean logo.

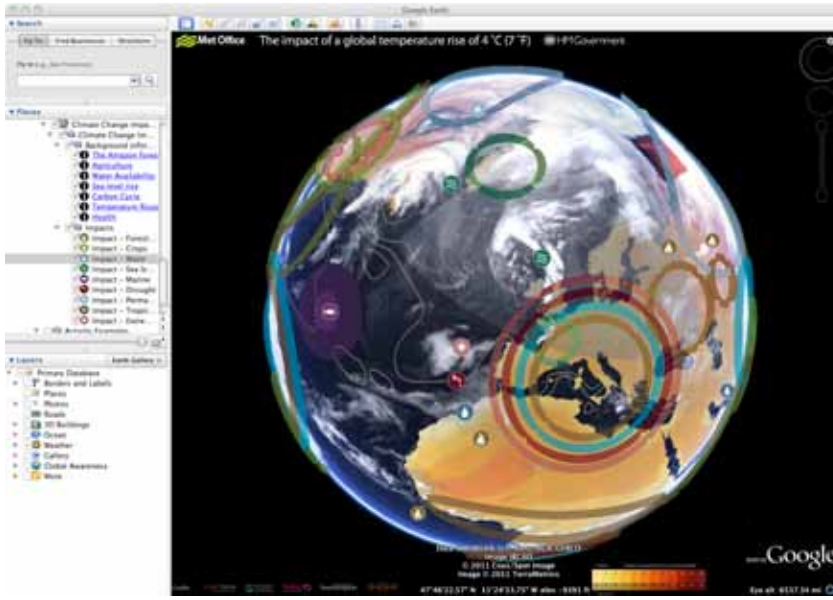

Figure 12: "Google Eaarth," as described by Susan Kraemer (2010). A layer in Google Earth that diagrams "the impact of a global temperature rise of 4 degrees C." Data SIO, NOAA, US Navy, NGA, GEBCO, Image IBCAO, ©2011 Cnes/Spot Image, Image © 2011 TerraMetrics.

arrive as high-tech images of the planet, images that have been rhetorically deployed to prompt thinking about planetary futures, using at-their-time futuristic modes of mechanical reproduction (cameras in space, computer graphics).

How, then, shall we understand the many signs swimming around in Google Ocean? Here I find it useful to pirate a concept from Peirce's work in logic, and think of Google Ocean as an "existential graph,"

> a logical graph governed by a system of representation founded upon the idea that the sheet upon which it is written, as well as every portion of that sheet, represents one recognized universe, real or fictive, and that every graph drawn on that sheet, and not cut off from the main body of it by an enclosure, represents some fact existing in that

> universe, and represents it independently of the representation of another such fact by any other graph written upon another part of the sheet, these graphs, however, forming one composite graph (Peirce 1931-1958 [1903]: 4.421).

Google Ocean as existential graph is a logical diagram that conjoins multiple representations, real and fictive, and multiple semiotic registers, iconic, indexical, symbolic, which can operate independently of one another (in different layers) while still forming part of a composite. So seeing Google Ocean points, I think, to the utopian heterotopia it enacts and promises—its existential politics—a world one and many, public and idiosyncratic, simultaneously.[9]

On the topic of utopian heterotopias, compare Buckminster Fuller's geodesic dome to Deleuze and Guattari's rhizome. Both the geodesic dome and the rhizome are constructed of lines. In the first case, the lines have a tensile strength that, properly harnessed, can hold a sphere together. In the second, the lines fly away from a center, away from coherence but not connection. Earth as double-dome unifies; Earth as rhizome multiplies (cf. Mol 2002). Google Earth Ocean does both. The rhizome may scribble over and into the dome, making a zone at once home and not home, a fusion and friction of Spaceship Earth, Gaia, Eaarth, and more.

THE GRAVITY OF THE GLOBE

Well before Spaceship Earth or Google Earth, the shape of the Earth was known by geodesy, the science of measuring the planet in three-dimensional space. In the late nineteenth century, Charles Sanders Peirce, when he was not working on logic and semiotics, held a job as a geodesist (see Lenzen 1972). From 1859 to 1891, Peirce worked for the US Coast and Geodetic Survey, seeking to determine the shape of the Earth from measurements of gravity made using swinging pendulums positioned at different locations on the planet. This was not a floating Earth, but a heavy one; as his aunt Charlotte Elizabeth put it in a letter she wrote home, "Charles Peirce & his wife are away off at Key West on

Coast Survey business—weighing the earth or something" (quoted in Brent 1998: 165).

Google Earth and Google Ocean have no weight. It is true that Google Earth's spheroid form uses geodesy from the World Geodetic System of 1984 to organize its coordinate system, and thereby implicitly records the effects of gravity on the shape of the Earth. But the program does not *model* gravity.[10] This may be especially difficult to remember when we go "underwater" in Google Ocean, in which the "experience" of floating may feel more "realistic" than it does on land (cf. Boellstorff 2008: 96 on how avatars in the online virtual world of "Second Life" can choose to do without "gravity," a sign of this world's status as fantasy). Even so, there are many watery materialities missing: pressure, currents, thermoclines, salinity, smells of beach rot—though one might worry that this critique is unfair since Google Ocean offers only a visual, rather than a sonic or tactile or echolocative interface, but in the optical domain, much too is askew: the refractive and attenuating effects on light of seawater are absent. This is an image of an ocean utterly light—weightless and transparent both.

This is an image that is *not*, in the Peircian sense, an image, a manifestation of qualities. Nowhere in the semiotics of Google Ocean can we find the quality of seawater as a medium in which light refracts, in which sound is transduced, and in which lively creatures spawn, swarm, respire, and expire. For all its heterotopian possibility, this is not the space of material and semiotic confusion that I have elsewhere named the "alien ocean" (cf. Helmreich 2009).[11] It is instead a diagram of the ways that many of us image now, layering icons, indexes, and symbols on top of a world of previous infrastructures, transparent and opaque, taken for granted, and found as well as forgotten.

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NOTES

1. In his 1956 book, *The Image*, Kenneth Boulding was interested in these older meanings of icon, writing of his analytic endeavor: "I will even venture to give the science a name—Eiconics—hoping thereby to endow it in the minds of my readers with some of the prestige of classical antiquity. I run some risk perhaps of having my new science confused with the study of icons. A little confusion, however, and the subtle overtones of half-remembered associations are all part of the magic of the name" (148). W. J. T, Mitchell, in *Iconology*, might give a more no-nonsense reading of the Whole Earth as an object of ideology, writing as he does that "the notion of ideology is rooted in the concept of imagery, and reenacts the ancient struggles of iconoclasm, idolatry, and fetishism" (1987: 4).
2. Insofar as this world floats in space as a kind of ocean, this "spaceship" might more properly be understood as a submarine, an entity whose distinction from its outside is a differential, not an absolute. Not Spaceship Earth, but Submersible Ocean. Earth is at once a ship and, as Carl Sagan put it, "the shore of the cosmic ocean" (1980: 2).
3. Google Earth, initially named Earth Viewer, was acquired by Google from a company called Keyhole, Inc. and rebranded in 2005 (see Farman 2010).
4. Cf. Maurer and Martin (2011) on the radical-rebus, another sometimes-paratactical mode of representation.
5. One reader of this paper suggested that this view might be appropriate for whales, who could use sound to gather just this sort of transparent kind of apprehension—in an auditory register. But I do not think that is right. On this model, Google Ocean for whales would still be missing the fact that sensing can only reach so far into the environment.
6. Note that Maldives is an island chain in actual danger of disappearing beneath the sea; see Helmreich (2011).
7. Also of a piece with the digital ocean is the National Science Foundation-funded Ocean Genome Legacy project—"dedicated to creating a global biobank housing the DNA blueprints (genomes) of

a broad cross-section of the endangered organisms of the sea." Here Earth is its own watery archive: "These materials have value as raw materials for research, as seeds for reconstitution of biological entities and functions, and as information sources and references for ecological and conservation studies." The Ocean Genome Legacy project treats the sea as an ark.

8. Google Earth also features a "historical imagery" slider, which permits going into the past and viewing old satellite photos. Google Ocean features one old topographical map of the seafloor, the Marie Tharp Historical Map. How about fleeting and temporary marine geographies? An overlay in a recent upgrade to Google Earth shows a false color model of the March 2011 Japan tsunami; the Tsunami Forecast Maximum Amplitude displays "computed tsunami amplitude in cm during 24 hours of wave propagation."
9. Anthropologist Bill Maurer points out that "Peirce was also writing in a world where the boundaries of the public were newly opened up by the end of the Civil War, yet where—Gilded Age—massive privatizations, railroads, and so forth were taking place" (pers. comm.).
10. Perhaps revisiting some of the thinking Peirce did during his day job as a geodesist can help us think about what is missing here. Peirce himself saw gravity as a *law*, not a *quality* (Pharies 1985: 12), a representation of a regularity, not a condition of possibility. But what if we inverted Peirce's logic and treated gravity as a quality, a kind of thickness that inhabits the material-semiotic world? This could amplify the place of materiality in the Peircian toolkit. Materiality already matters for thinking, for example, of the indexical, *impressed*, quality of a photograph—and it does so in a way that depends on a conception of materiality as composed of a physical structure—one that in turn depends for its sensibility on the meaning assigned to it (the materiality of photographic media only becomes important as indexical stuff if we believe that it captures "images"; the materiality of beach sand only becomes important as indexical stuff if we believe that footprints are good-enough signs of feet).
11. Reflecting on the contingency and alien character of being in the

world, Peirce once asked, "Why was I born in the nineteenth century on Earth rather than on Mars a thousand years ago?"

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