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Doreen Mende, Tom Holert

Editorial: “Navigation Beyond Vision, Issue One”

Today one may complain that life has been reduced to points in a matrix of relations—cities, territories, and historical narratives prematurely refined into categories of known and unknown, real and virtual, concrete and abstract space. And yet, when we need to locate a crucial resource (or ourselves, for that matter) who can afford not to search the grid for what everybody knows to be there?—the Italian restaurant, the emergency room, the ancestor, the terrorist. This is not simply about seeing; by definition, navigation organizes timescales and orders of magnitude that cannot be visualized simultaneously. Furthermore, in attempting to map and record various terrains and domains, contemporary navigators are themselves mapped and recorded at the same time. Super-modernity’s expansive enclosures of global infrastructure, time-zone logistics, and data behaviorism become external abstractions as much as computational and territorial facts.

“A computer animation is less a reproduction and more a production … or creation of a model world,” said Harun Farocki in a lecture only a few weeks prior to his untimely death in 2014. In this lecture, titled “Computer Animation Rules,” Farocki seemed to suggest that navigation poses a contemporary challenge to montage—the editing of distinct sections of film into a continuous sequence—as the dominant paradigm of techno-political visuality. Indeed, it is nearly impossible to underestimate the influence of cinema on the televisual imagination of twentieth-century spatial-political life. If montage is the core formal device for concatenating space and time into a continuous causal sequence, then for Farocki, the computer-animated, navigable images that constitute the twenty-first century’s “ruling class of images" call for new tools of analysis. Drawing on Alexander Galloway’s concept of “actionable objects” in gamespace, Farocki began to ask: How does the shift from montage to navigation alter the way images—and art—operate as models of political action and modes of political intervention?

If Google Maps seeks to map urban environments, and global finance seeks to map affective responses to possible events, Farocki appears to have employed the question of navigation to ask: What are the interfaces of navigation that transcend the realm of the purely technical, even as a form of visualization that paradoxically supersedes the spatial and temporal constraints of images completely? How do navigational paradigms in virtual and offline environments increasingly inform the politics of the image? If navigation puts ontological pressure on the static frame of a photographic or cinematic image, then how are our concepts of political action, visual literacy, and collective intervention also pressured to surpass or perform model worlds?

Rather than finding orientation by way of images in the real world, today images may mutate into a sort of interface—an operational tool reaching beyond

visual-cognitive persuasions, beyond representation, beyond "the image" itself, enabling seemingly boundless and borderless mobility between spaces, scales, temporalities. Navigation now begins where the map becomes invisible or indecipherable, operating on a plane of immanence in perpetual motion. Navigation, instead of framing or representing the world, continuously updates and adjusts multiple frames from viewpoints within the world. Navigation in the digital realm is the modeling and mapping of an elusive environment—in the service of orientation, play, immersion, control, and survival.

The ensuing existential condition or *technè* could be named "navigational." As a techno-ontological predicament, the navigational is operative in virtual and offline environments, as well as in the deep-layered relations of power and desire inherent to orientation and movement. Consider, for example, people who visit distant "home countries" based on DNA test results, just as many in those countries, moved by hope or violence, flee to foreign lands. Thus the "navigational" condition implicates metaphysical as well as political, economic, ecological, cultural, and legal mobilities. Freedom-of-movement rights, land and trespassing restrictions, immigration laws, GPS regulations, international trade protocols: they all codify and enforce (and constantly transform) the navigational condition, which in turn informs this emergent politics of the image.

If navigation puts ontological pressure on the static frame of a photographic or cinematic image, then how are inherited concepts of political action, visual literacy, and collective intervention also pressured to surpass or outperform model worlds? How does the operative and performative character of immersion in computational environments—navigating with and within images—impact the function and the status of the visual as such? Has navigation ever been a visual technology at all, or has it always compounded cosmological, mathematical, conceptual, and sensorial orders of magnitude into aggregate spatial orders that surpass the visual entirely?

Don't get us wrong—it is through navigation that we are also misled, often to terrifying degrees. The promise of pathfinding implied in the invocation of navigation may suddenly become a reality of catastrophic disorientation. Any knowledge that is operative in navigational measurement and movement is prone to be radically limited by culture, history, politics, and technology. The more a navigational attitude becomes structurally inevitable in digital oceania, the deeper a belief in mobility and progress will install itself, all the while dulling the ability to come to terms with the stasis and regression that accompanies it. Against the backdrop of platforms that swell into worlds, disorientation may have become much more than a structural liability or security threat. It may instead be an ethical resource that we are only beginning to explore.

In oscillating between technical, ontological, political, and metaphorical senses of "navigation," our shifting uses of the term could already be disorienting. Hopefully, this sense of obfuscation nevertheless originates in strategic theorization: from principle to paradigm, from description to definition, navigation is mobilized to serve different causes and ends in each contribution to this issue. Clarity of vision and reliability of data become delusional once navigation is rigorously dislocated by agents breaking away from secure pathways of movement and exploration. Perhaps stressing the insecurity and indeterminacy of navigation—particularly in a technological environment saturated with artificial intelligence—can provide alter-navigational practices and epistemologies to those otherwise vulnerable to navigational rule.

This issue represents the first continuation of the conference "Navigation Beyond Vision," organized by the Harun Farocki Institut (HaFI) and e-flux, and held at the Haus der Kulturen der Welt (HKW) in Berlin on April 5–6, 2019. Participants included Ramon Amaro, James Bridle, Kaye Cain-Nielsen, Maıté Chénière, Kodwo Eshun, Anselm Franke, Jennifer Gabrys, Charles Heller, Tom Holert, Inhabitants, Doreen Mende, Matteo Pasquinelli, Laura Lo Presti, Patricia Reed, Nikolay Smirnov, Hito Steyerl, Oraib Toukan, Ben Vickers, and Brian Kuan Wood. A second part of the issue is forthcoming.

—Tom Holert, Doreen Mende, and the Editors

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Doreen Mende is a curator and theorist who is currently Associate Professor of the curatorial/politics seminar of the CCC RP research-based Master at HEAD Genève/Switzerland. Since 2021 she has been the Director of the Cross-Collections Research Department of the Staatliche Kunstsammlungen Dresden (SKD), where she initiated the *Stannaki Forum* on diasporic knowledge, and conceptualizes the *Transcultural Academy "Futurities"* in 2023. Ongoing projects include the case-based academic research study *Decolonizing Socialism: Entangled Internationalism* (2019–24), funded by the Swiss National Science Foundation. Based on this research, a new series of exhibitions, called *sequences*, is coming up in 2024 featuring invited curators-researchers and artists at the Albertinium of SKD. In 2022, she realized *The Missed Seminar: After Eslanda Robeson in Conversation with Steve McQueen's End Credits* at Haus der Kulturen der Welt, Berlin. She has published with *e-flux journal*, MIT Press, Oxford University Press, *Jerusalem Quarterly*, spector books, archive books, IBRAAZ, and Sternberg Press. She is a cofounder of the Harun Farocki Institut in Berlin.

Tom Holert is a researcher, writer, and curator. He is the co-founder of the Harun Farocki Institut in Berlin. He's currently organising the research and exhibition project *Education Shock. Learning, Politics, and Architecture in the 1960s and 1970s*, at Haus der Kulturen der Welt, Berlin (forthcoming September 2020).

Jennifer Gabrys

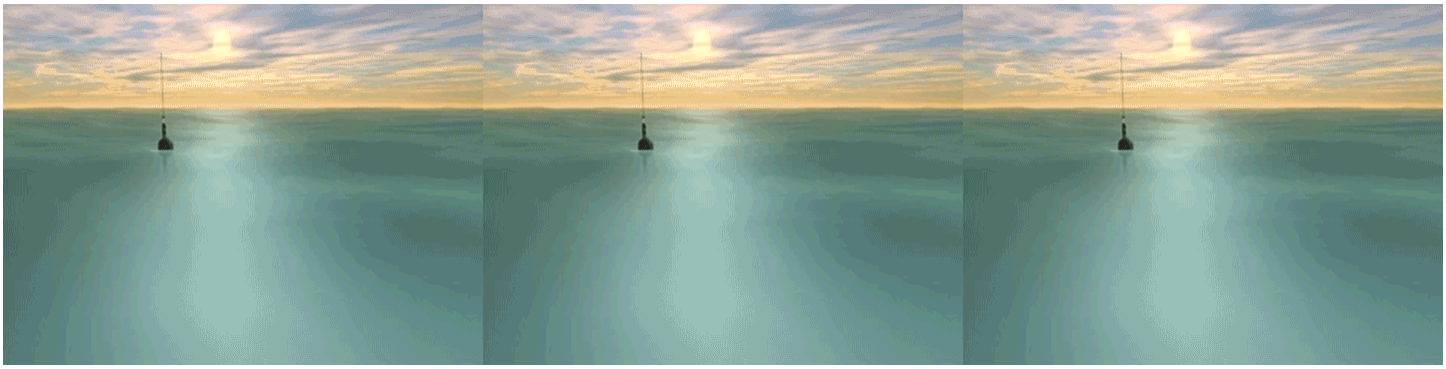
Ocean Sensing and Navigating the End of this World

Edges and ends of worlds are encountered frequently in the films of Harun Farocki. They form recurrent courses of navigation, tugging along ships and airplanes, riders and avatars, waves and clouds, memories and simulations. In one sequence in the eight-minute-long film *Parallel II*, a rider on horseback charges toward a horizon that at once recedes and refreshes. While the riding is swift and purposeful, it also folds back on itself, creating the conditions that would make or give sense to the journey. The rider and horse gallop along a dusty track as though in search of someone or something. Just as the purpose of the scene would sharpen into focus, the rider traverses into another refreshed landscape that presents an altered visual frame oriented toward a new pursuit. Rather than the rider following a self-defined objective, the computer world delineates the arc and aim of the journey, of which the rider is merely an expression or effect. In this scene from *Parallel II*, the narrator relates:

> Galloping swiftly out from the gate
> How far can the rider ride?
> Where does this world end?
> This world appears infinite
> A world generated by the gaze that falls upon it.

These are self-generating worlds. The contours of these worlds propel navigational practices that simultaneously unfold the narrative and structure of computer games. *Parallel II* is one film within the four-part film installation *Parallel I–IV* (2012–14), where Farocki explores computer vision and video games.[1] By probing at the logics of computer vision and navigation, Farocki tests the limits of worlds, both in terms of their mechanics and structure, as well as what they operationalize. By deliberately staging confrontations with these edge conditions, figures in *Parallel I–IV* traverse building edges and scramble along cliff faces to demonstrate how these worlds are constructed, and how they in turn organize ways of seeing, sensing, and feeling. Working in the context of computer games, Farocki draws attention to the shifting digital horizons that the gamer–player navigates in any particular game world. These digital technologies inform ongoing navigational practices, as well as ways of encountering and ending worlds—this one, or those to come.

World-ending is by now a pervasive topic. It is the default script written into the story of environmental change. Yet it is also a concept and event with a longer history. Worlds are projected to end in the face of climate breakdown, with people displaced and dispossessed from melting landscapes and submerged communities. Worlds have also continually been ending, with settler colonialism, environmental racism, and ecological exhaustion wreaking terminal destruction over the span of several centuries. The worlds and endings that are conjoining and collapsing are then many, with different consequences for



Argo Instrument Animations, NASA/Goddard Space Flight Center Conceptual Image Lab (2008).

the inhabitants and relations of those worlds. In the context of this issue of *e-flux journal* on navigation, I begin with Farocki's computer-game provocation to consider the question of where *this* world ends, especially through digital environmental sensing technologies tuned to detecting environmental change. How are worlds delineated, and their endings sensed, within a matrix of catastrophic environmental events and digital sensing technologies? Operating in a different register than computer games, environmental sensors nevertheless sense and make worlds that also express distinct edge and limit conditions.

The worlds I explore here are ocean worlds. They are less exclusively situated within the realm of the virtual, and are more distributed as particular ontogenetic formations that concretize through what I call the "becoming environmental of computation."[2] The becoming environmental of computation involves not merely the extension of sensor technologies across multiple different ecosystems, but also in-forms ways of encountering environments and environmental change. Sensors directly and indirectly detect the increasing pollution of oceans with plastics, rising temperatures, and accumulating carbon dioxide as it converts to carbonic acid. Oceans are spaces that are increasingly approaching limit conditions, from rising temperatures and acidification to saturation with plastic debris, sea-floor mining, habitat destruction, and the industrialization of ocean spaces.[3]

In this essay on ocean sensing and navigating the end of this world, I consider how Argo floats, remote-sensing satellites, wave buoys, and ship sensors assemble to form a world or worlds to be acted upon and navigated. By attending to these distinct forms of environmental sensing practices,[4] I examine the limit conditions and points of transformation that these sensing ensembles detect, especially in the form of oceans contaminated with plastic pollution and altered by climate change through rising temperatures and acidification. How do sensing and navigational strategies that unfold through digital ocean sensor systems tilt toward the end of this world by calculating and predicting the saturation of oceans with thermal pollution and plastics, as well as carbon dioxide and toxins?

These sensor systems monitor the accumulation of pollutants in ocean spaces, and as they navigate through ocean spaces with the aid of satellite and tracking systems, they also give rise to speculations about how to navigate the end of a world, or indeed how to move beyond a horizon for which there is no clear course of action. At the same time, the end of this world is a designation that is up for grabs, as many writers from Fred Moten to Déborah Danowski and Eduardo Viveiros de Castro have noted. Multiple worlds have already ended through environmental, racial, and economic violences that have razed possibilities for being otherwise. This provokes the question: Which world is *this* world that could be ending? How might these sensor systems or perceptive capacities then be extended to attend to worlds that have already ended, or that might be hastened along in their endings?

Harun Farocki (with Matthias Rajmann), Parallel II, 2014. HD video, 16:9, color, sound, 8:38 min (loop). Courtesy ofHarun Farocki GbR, Berlin.

Plastic Oceans

Located across the world's oceans are several sizeable concentrations of plastic debris that have variously earned

the title of "garbage patches." The Great Pacific Garbage Patch in particular has become an object of popular and scientific interest. It is an environmental anecdote to confirm our worst fears about overconsumption—and the dark side of the durable wonders of plastics that were promoted in so many postwar contexts. It is also an imagined indicator of what may even outlive us, given the lengths of time that plastics require to degrade. The garbage patch is in many ways an amorphous object, drifting through oceanic and media spaces as an ominous sign that focuses attention toward the ways in which oceans have become planetary-sized landfills. Yet it also signals a certain world-ending moment, arriving as the oceans become saturated with this synthetic and disposable material.

Popular imaginings of the Pacific Garbage Patch have included comparisons of its size to the state of Texas, or suggestions that it is an island that might be named an eighth continent, formed of anthropogenic debris. Upon hearing of the concentration of plastic wastes in the Pacific, many people search for visual evidence of this environmental contamination on Google Earth. Surely a human-induced geological formation of this magnitude must be visible even from a satellite or aerial view? However, because the plastic wastes are largely present as microplastics in the form of photo-degraded and weathered particles, the debris exists more as a suspended soup of microscopic particles that is mostly undetectable at the surface of the ocean.

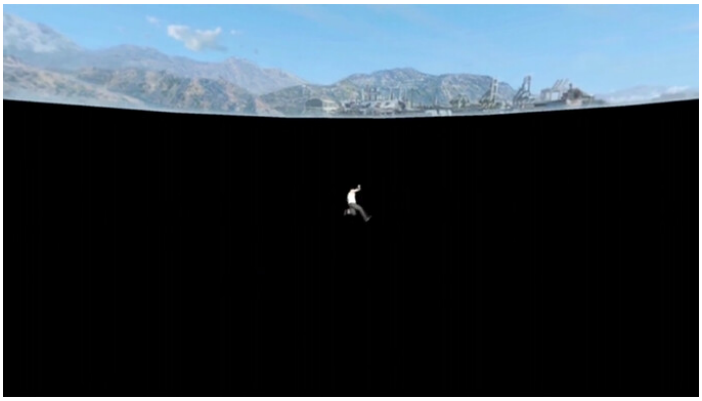
While Google Earth may be a platform for visualizing and locating ocean data,[5] this visualization technique presents a much different approach to "sensing" than seeing the patch as a photographic object. The inability to locate the garbage patches on Google Earth, a tool for scanning the seas through a conjunction of remote sensing, aerial photography, and online interfaces, even gives rise to popular controversy about how to locate the patch and whether the plastic conglomerations are actually present in the oceans, and if so, how to address the issue. The relative invisibility and inaccessibility of the patches render them as looming imaginative figures of environmental decline and yet relatively amorphous and unlocatable and so seemingly resistant to incentives toward environmental action. All of which raises the question: To what extent do environmental problems need to be visible in order to be actionable? Or do they instead become sense-able and navigable in different ways, less as images that raise concern, and more as shifting conditions that unevenly surface and require unfolding and expanded sensing practices and tactics? As Farocki's computer game investigations indicate, modes of navigation and sensing can also become ways of constructing these worlds, and their edge conditions.

If Google Earth or a satellite view of the garbage patch proves to be an impossible undertaking, it is because the plastics suspended in oceans are not a thick choking layer of identifiable objects but more a confetti-type array of suspended plastic bits. Locating the garbage patch is on one level bound up with determining what types of plastic objects collect within it and what effects they have. Yet on another level, locating the garbage patch involves monitoring its shifting distribution and extent in the ocean. The garbage patch is not a fixed or singular object, but a society of objects in process. The composition of the garbage patch consists of plastics interacting across organisms and environments. But it also moves and collects in distinct and changing ways due to ocean currents, which are influenced by weather and climate change, as well as the turning of the earth (in the form of the Coriolis effect) and the wind-influenced direction of waves (in the form of Ekman transport). As an oceanic gyre, the garbage patch moves as a sort of weather system, shifting during El Niño events, and changing with storms and other disturbances.[6] Ocean sensing then requires forms of monitoring that work within these fluid and changeable conditions.

The garbage patch as a figure does not directly come into view through ocean-sensing practices and technologies, but instead registers in a more indirect way, through proxy sensing. Environmental monitoring techniques often developed for purposes other than sensing plastics are subsequently tuned in to the drift of oceanic debris. Most sensors are set to detect salinity, temperature, and movement of ocean currents in order to bring patterns of climate change into view, a similarly elusive event that is not easily visualized. Rather than a *visual* fix on plastic pollution, sensing practices and technologies for monitoring environmental change instead indirectly register plastics within the mix of other environmental processes, geopolitical infrastructures, and digital devices.

Sensorized Oceans

Oceans have become highly instrumented sensor spaces. An extensive array of sensing nodes and drifting sensor points can be found on buoys and hulls of boats, underwater gliders, and Argo floats (instrument platforms for observing oceanic temperature, salinity, and currents). Ocean sensing also occurs via coastal webcams, remote



satellites, remotely operated vehicles (ROVs), autonomous underwater vehicles (AUVs), airborne sensors, unmanned aerial vehicles (UAVs), high-frequency radar, instrumented drilling platforms, and apps that citizens can use to document marine debris sightings.[7] Marine traffic tracking sites also document the movement of container ships and other large vessels; and some platforms and maps focus on capturing data from ocean-going objects that are part of the Internet of Things, revealing just how densely populated oceans and seas are with sensing devices.[8]

The importance of monitoring oceans has increased considerably, since oceans are the primary sink that absorbs both CO2 and heat, and the dynamics of these sink-based processes are less well understood in relation to climate change.[9] While many sensors are in place to take temperature observations, as well as feed into climate-change monitoring and modeling, other sensors are used to survey noise underwater in order to prevent damage to marine organisms' ability to navigate these spaces. On one hand, there has been a lack of monitoring in the oceans, which current practices are attempting to mitigate. On the other, the current spread of instrumentation is leading some researchers to propose remote access to the ocean from any number of sensor networks. As Stefan Helmreich writes in one instance about the proposed establishment of a "distributed ocean observatory," this project would involve "a network of remote sensing buoys that can provide continual Web access to data from the sea" and "would allow scientists to sit in their living rooms gathering oceanographic data."[10] One imagines scientists becoming avatars in an ocean-world computer game, searching out signals of environmental distress, while also asking, *where does this world end?*, as the ocean observatories generate more evidence of catastrophic environmental change.

The becoming environmental of computational sensors in oceanic spaces involves the instrumentation of oceans via extensive sensing networks as well as the reworking of the environments in which sensing takes place (from underwater to living rooms). Yet computational sensors become environmental in yet another way, where sensors themselves might be adapted to ocean environments and processes, with drifting buoys, Argo floats, and sensors on vessels circulating through oceans across surfaces, sub-surfaces, and at depths now down to six thousand meters.[11] And as sensors fill these spaces and provide monitoring data, they also generate other sensor tales, including observations about the likely drift of marine debris (especially in the form of plastic) through ocean currents, along with the increasing temperature of ocean spaces. Oceans might then be seen as an environmental medium with medial effects, guiding and informing the very sensing instruments that would navigate and make sense of oceanic spaces.

Ocean sensing and the detection of pollution, plastics, rising temperatures and carbon levels then involves numerous sensing instruments, including most pervasively Argo floats. Since 2000, thousands of Argo floats have been deployed to form a worldwide ocean-observing system. With nearly four thousand drifting Argo floats now in circulation (and over 2 million dive profiles contributing to global datasets), the Argo system captures temperature and salinity data that informs climate-change projections, while providing a map of ocean currents. Along with climate data, other ocean events such as plastic accumulation also surface as part of the tracking and tracing that Argo floats perform. The floats drift and dive down to one thousand and two thousand meters, and surface, providing data on conductivity and temperature, pressure, salinity, and location. As a communication system composed of Argo floats and the Jason satellite mission, this ocean sensing at once signals Greek mythologies of navigation, the accumulated histories of colonial shipping routes, as well as near-future trajectories for steering Spaceship Earth through the gathering storms of planetary collapse in the form of climate change and the collapse of ocean spaces.

Similar techniques for mapping the circulation of ocean debris include systems such as the Global Drifter Program, one ocean observation project among many that has deployed surface drifting (rather than diving) buoys equipped with sensors that communicate with satellites, and which are used to study the drift of plastics and other debris in the oceans. Using drifter tracing and sensor communications, the Global Drifter Program has deployed tracking buoys that communicate with satellites to establish circulation patterns in ocean currents. Along the way, the drifters have also become devices for establishing the likely movements of marine debris, since where the drifters collect is likely to indicate the same locations in which other flotsam collects.[12]

The Global Drifter Program consists of a platform of more than 1,250 drifting buoys that have been deployed over several decades spanning from initial development in 1979 to current annual mass deployments to monitor the oceans.[13] The buoys monitor the upper water column and provide information on ocean surface and atmospheric conditions, as well as fluxes between air and sea. Run through the Atlantic Oceanographic and Meteorological

Laboratory (AOML) in Miami, Florida, the drifters are deployed at study sites and then circulate across oceans. Detecting and sensing sea surface temperature, barometric pressure, wind velocity, ocean color, salinity, and subsurface temperatures, the buoys monitor ocean conditions primarily to determine weather and climate patterns. As they circulate, the buoys can also send one-hundred-and-forty-character messages on location and ocean conditions— what physical oceanographer Erik van Sabille has referred to as "Twitter from the ocean."[14] Part of the Global Earth Observation System of Systems (GEOSS) of monitoring technologies, the Global Drifter buoys also link up with earth models to provide forecasting data.

In addition to functioning as weather, climate, and circulation observation devices, the drifters have provided detailed and longer-term data on the likely movement of debris in oceans. A high proportion of drifters has gravitated toward the five gyres, and in this sense the drifters have provided further data for establishing where gyres are located and how long drifters or debris may converge in these areas.[15] Global Drifter data has led to the identification of a sixth Arctic gyre, as well as observations about the ways in which patches are "leaky" and circulate debris across regions, potentially over a time span of centuries.[16] The drifters are in many ways proxies for demonstrating how debris travels over time in oceans, how debris converges in gyres, and the length of time it may take debris to exit convergence zones (if at all) and wash up in coastal regions. The drifters were not originally developed as monitoring devices to study the accumulation of debris directly, since they focused on ocean circulation patterns. But the drifters became an imported technique for studying how debris circulates and settles in ocean spaces in relation to the study of ocean circulation. The drifters also eventually become debris, as they have a limited (five-year) battery life, and cease to function due to mechanical error, environmental stress, and more.[17]

The Global Drifter Program potentially not only validates or corrects prior and differing studies on ocean circulation but also provides a more real-time observation platform for understanding how gyres may shift—and debris concentrations along with them. In many ways, the ongoing deployments, shifting oceanic trajectories, and real-time communication of the drifters are practices that emerge in relation to and through a fidelity to the shifting techno-scientific objects under study. The sensing and satellite-linked drifters enable sensing practices that are able to more continually monitor these shifting conditions and processes. Sensing buoys concresce along with the circulation patterns and debris under study, thereby materializing a distinctly environmental and oceanic form of computational sensors. The shifting materialities of the garbage patch in-form the technologies that come to be used to monitor them. Littered oceanic spaces are co-constituted through the becoming environmental of these computational monitoring technologies. Environmental monitoring techniques "sense" an object such as the garbage patch that is relatively invisible and continually in process by navigating with and through ocean currents, in turn proxy-sensing the routes of plastics.

Oceans and objects are sites for sensing practices in the making. Drifters and sensors, together with studies of particle movement and ocean currents, are both abstract approaches to understanding the garbage patch, as well as concrete things that navigate as they generate worlds to be sensed.[18] Such techno-scientific observation techniques focused on marine debris in the gyres inevitably also mobilize responses for remediating and managing the issue of plastics in the seas. In this sense, the garbage patch in its intractable plasticity gives rise to techno-scientific practices not just to monitor but also to repair, control, or manage this object of study and concern.[19] Emerging systems for sensing oceans materialize as information infrastructures with embedded modes of governance. Yet these attempts to monitor the ocean might also arrive at the inability to arrive at a knowable or governable ocean.[20] Ocean-sensing practices reach a limit condition, where they observe and yet cannot fully predict the phase changes that the oceans will experience with plastics pollution and climate breakdown.

Such stress-testing of drifters and oceans resonates with the opening scene of Farocki's early film *Images of the World and the Inscription of War* (1989), where a wave machine in a laboratory creates waves that simulate, test, and observe the meeting zone between wave and land, as a technique that speculates toward the likely effects of waves on navigational abilities. Yet the wave machine cannot possibly capture the full array of waves likely to be encountered, or know the conditions that might cause these navigational challenges. The wave machine constructs conditions that imperfectly align with the stochastic wave worlds of multiple seas and oceans.

The material occasions of oceans are not only a remote object of digital study, but also an actual occasion in which we are now participating and through which we will continue to be affected. Here, new societies of objects emerge from the remains of techno-scientific pursuits and in turn give rise to new monitoring practices for studying these residual and yet generative objects with unknown and indeterminate effects. A key question arises from monitoring the oceans as generative techno-scientific and computational objects: What experimental forms of politics and environmental practices might materialize that are able to attend to these indeterminate and emergent effects, which also portend the end of a world, if not this world?

Sensing the End of this World

In a pluralistic ontological register, we could say that there is already more than one world in the present; and yet the world that is navigated via sensing technologies is presented as one that is at a saturation point and under crisis. By tracking the geo-spatial recordings of these ocean-sensing systems, it is then possible to ask, along with Farocki, *where does this world end?* Or in other words, how do sensing and navigational technologies chart the contours of a world that seems to be continually approaching an ending, while also suggesting strategies for sensing, mapping, navigating, and inventing worlds otherwise? Beyond navigating the end of this world through sensing devices, it could be possible to tune into other worlds that are typically not on the maps of drifts and floats. This is another way of suggesting that it could be possible to reassess the politics and "ontology of the navigational."[21]

These multiple worlds surface other sorts of "residence time," as Christina Sharpe has written about seafaring and oceanic spaces in the context of slavery and the "amount of time it takes for a substance to enter the ocean and then leave the ocean."[22] A concept from oceanography, residence time refers to the extended time frames within which materials, pollution, heat, and more circulate and transform within and through ocean spaces. Indeed, the plastics, heat, and carbon dioxide that are added to oceans can take many decades or centuries to circulate, with materials from the mid-twentieth century surfacing only now. Yet along with these chemical-material markers of extraction, there are also other entities churning through oceans that are less easily detectable through sensor technologies. Sharpe addresses the legacies of colonialism and slavery that have traversed oceanic spaces and left residues of bodies, violence, and inequality that continue to cycle through the depths, surfacing and recirculating further material histories of these events.[23] All that circulates through oceans also makes worlds, which can create violent and destructive spaces to navigate. They force the question: When will the residence time of *this* world come to an end, and how will the "end" be navigated?

Indeed, these endings might also indicate how the time of the present is "already dystopian," as Kyle Powys Whyte has suggested in relation to "indigenous perspectives on climate change." In other words, the rupture that marks endings in fact permeates present conditions, rather than being something that is yet to come.[24] Rather than search for strategies to sustain this world, such perspectives suggest other approaches and practices that might be tuned toward science fiction, in order to draw out the sedimented endings and forms of environmental and colonial violence that are undergirding this world, and to speculate toward other environmental inhabitations.

Or, as Fred Moten has suggested in the *Undercommons*, this world might not be suitable for repair and so should not be engaged with through recuperative logics and practices.[25] Rather than extend and maintain *this* world, its end should be hastened along in order to build something new. The question of what *this* world is within the context of a black radical tradition takes on another designation that suggests the limitations of what might be sensed and engaged with as self-evident. The sense of "common sense" is a social and political settlement that often elides the subjugating conditions that have enabled these forms of sense-making. Denise Ferreira da Silva picks up on the topic of the end of the world and suggests that by surpassing "the known and knowable World" it might also be possible to exceed universal subjects, racial subjugation, and "efficient causality." This is a way of "opening up the possibility for a radical departure from a certain kind of World."[26] The world that could be ending, that could be proposed to be ending, is always a particular construction that makes possible some inhabitations and not others. How such worlds are sensed, the ontologies that they operationalize, and the endings that are traversed, are conditions to be queried and even exceeded.

There are multiple worlds and multiple endings layered into these discussions,[27] as well as emerging through the sensing systems and sensing practices of environmental observatories and geopolitical infrastructures. Returning to Farocki's *Parallel* series, one can begin to consider the emergence of speculative practices and technologies for navigating at and beyond the end of this world. Toward the end of *Parallel II*, the narrator, having cycled through multiple game worlds, describes a program that is meant to prevent "the game figures from falling off the edge of the world." Yet in another game it is also possible to change the settings and cross over the edge of the game, making it "possible to break through the safety barrier and fall out into space" where one would free fall "like an astronaut catapulted from his spaceship." Where the limits of the game are made visible, and the end of this world is encountered, there is a distant urban conglomeration, a black cavernous space, and a subject in free fall.

By attending to the constructions of worlds, as well as the ends of worlds, it is possible to engage with how these ways of seeing, sensing, feeling, and navigating test the boundaries and conditions of worlds. The end of this world could occur on one level through the saturation, pollution, acidification, and defaunation of oceans as they alter through environmental change. Yet this ending and ways of sensing this ending also suggest that it could be necessary to attend to how these worlds are constructed, as environments of distributed computation, as digital worlds in the making, and as sedimented zones of colonial extraction and subjugation that continue to be plundered for labor, minerals, and resources. What does not show up at the edges of these worlds are the conditions whereby these worlds have been constructed—the *navigational meshes*, as Farocki has captured them. These navigational meshes are the parallel yet often hidden infrastructures

that support and enable worlds and their circumnavigation. When brought into view, they show up as the wireframe guides and coded protocols for operating within a particular zone. Navigational meshes could even constitute parallel worlds, a matrix of programs and programmability that could be rendered and reconstituted. By devising speculative instruments for tuning into these parallel worlds, it might be possible to sense the limit conditions of extractive ontologies, and to navigate beyond endings toward potentialities for otherwise inhabitations.

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This text includes portions of an abbreviated and revised reprint from chapter 5 of *Program Earth*, courtesy of the University of Minnesota Press.

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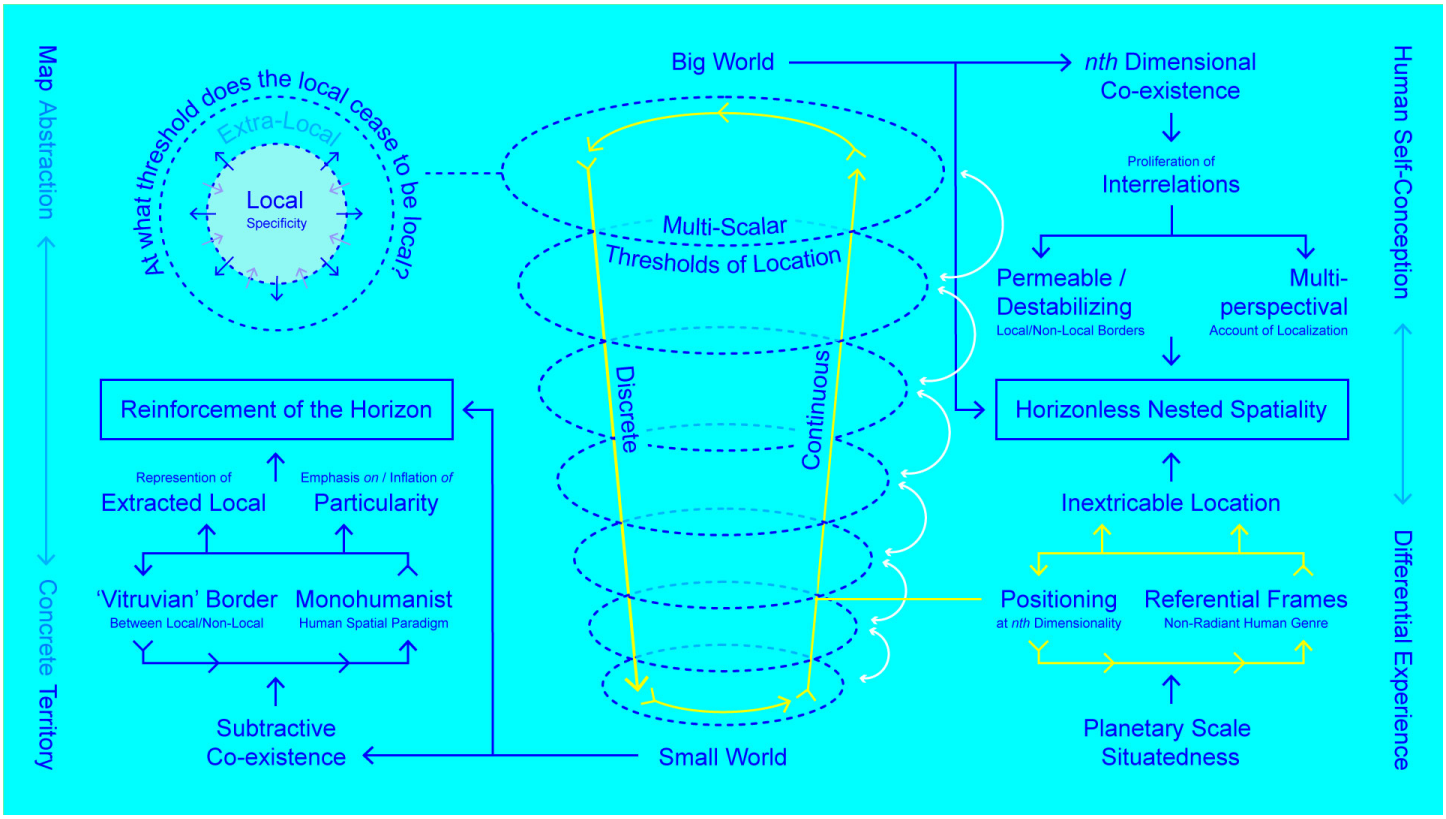
Patricia Reed

Orientation in a Big World: On the Necessity of Horizonless Perspectives

One of the most overplayed songs of all time was penned by Disney "Imagineers" just as increased communicative connectivity, commercial global travel, and transnational economic dependencies were (or were on the verge of) becoming commonplace. "It's a Small World" debuted in 1964 at the New York World's Fair. While it's easy to cynically shrug off the lyrical simplifications of this earworm, it's worth closer inspection: the lyrics capture some of the more insidious and inhibiting idealisms that persist in the present. The banal expression of the same name, recited nowadays as an automatism, typically describes a serendipitous moment of mutual reference in conditions otherwise uncertain or unknown; rarely is this expression uttered in a lamenting tone. There is nothing wrong with the pleasant quality of this "small world" encounter, per se, but it does raise more general questions as to why the sentiments captured by this expression seem desirable, and why they are understood as comforting. What does this expression divulge about an approach to navigating the world today?

There are two interwoven problems captured within those four, mundane words. First, the expression marks the enjoyment in confirming familiar frames of reference in order to tame an otherwise unknown or alien encounter—be it with a stranger, a perception, an idea, or a situation. As the driving fable of early domestic internet uptake, the framing of a "small world" amounts to the sales pitch of a simplified world readily amenable to human sensibility as it currently is, "promising" a minimization of the unwieldly global, into the cozy, intimate scale of a village. Second, the seemingly harmless expression obfuscates the ill-reasoned assumption that heightened interconnectivity yields proximity and closeness. While today there are more logistic, ecologic, economic, and communicative vectors that connect humans and nonhumans in deep chains of relation than ever existed before, structurally speaking, this condition points to something quite the opposite of a small world. It points, rather, to the increased *dimensionality* of coexistence produced by exponentially multiplied vectors of relation. More critically, the idealized myth of containable smallness constrains cognitive, ethical, and technological capacities to more adequately and justly navigate the world in its current *nth* dimensionality. The proliferation of interrelations and interdependencies has, for better or for worse, ushered in a very big world. This is a world that demands more adequate frames of reference (spatial, perceptual, and linguistic) to construct orientation within and for its extensive dimensionality.

The "planetary scale" serves as an initial, terminological index for this big-world condition of coexistential *nth* dimensionality. Particularly deployed in discourses on climate change and ubiquitous computation throughout the last decade, the planetary scale, in general, describes the consequential magnitude of (some) human techno-economic activity (such as fossil-fuel reliance and its derivative products/externalities) and the



"Hypothesizing Planetary Scaled Situatedness," diagram courtesy of the author.

amalgamation of their interacting effects that supersede the boundaries of earth (like mounting carbon dioxide concentrations in the atmosphere). Beyond its diagnostic significance, can the application of this term denoting "the scale of how things currently are" be put to use as a new frame of reference for social transformation? Could it serve as a pivotal concept through which the making of otherworlds can be practiced—a "making" that is always a remaking of the world already at hand?[1] Can this concept of "planetary scale" function as a basis for political invention and solidarity to lead us beyond the simplified comforts of a small-world framework? Today, those comforts and that framework combine to operate more as a threat than a promise as "global villages" mutate into fractured social bubbles steadfastly enclosed by confirmation-bias. If the planetary scale came into being as an aggregate result of nineteenth-century liberal incentives of private wealth accumulation, can the existing hyper-relationality and path dependence endemic to planetary coexistence be otherwise mobilized away from the ideals that underwrote the very materialization of this condition? Obviously, a linguistic marker on its own is not enough to answer such loaded questions. That said, such an utterance is not a trivial exercise either, provided that terms become consequential and not mere tokens of disciplinary jargon. When language is figured as a human-world interface for picturing and correlating with reality, it is useful to tease out how the term could transform given frames of reference—and in turn how these renewed frames could serve as a starting point for hypothesizing navigational ramifications both *at* and *for* this planetary scale.

Navigation as Synthesis

Before diving into navigation at a planetary scale specifically, it is worthwhile to lay out a brief outline of what navigation is. Navigation is, above all, a synthetic operation. First, it's the ongoing mediation of intentionality with the contingency of unknown or accidental events. Navigation is not destination, but it is not entirely divorced from destination either. It's a movement of inclination requiring markers of orientation. If navigation requires inclination to lend a functional or affective valence of direction to mobility, the politics of navigation are bound to claims on constructing these points of referential orientation, as well as making them sensible, intelligible, and shareable.

Second, navigation is reliant on extra-local, mental diagrams of space and time that are continually cross-referenced with situated localization. In this way navigation embodies the continuum between the conceptual and the material; and it is due to this weaving that navigators can continually revise and adapt their choreography and markers of orientation over time. As the saying goes, "the map is not the territory." However,

arresting this thought in its purely oppositional state undermines the crucial, synthetic dynamic wherein the map (understood as a conceptual artifact) partially shapes:

a) the perception and perceptibility of the territory or system,
b) how that territory or system is thought to exist beyond immediate sensory feedback (if it is sensible at all),
c) the possibility space of its imagined tractability, and
d) the understanding of causal interrelations, which contribute to pictures of agency.

The map, be it a story, a drawing, a diagram, a model, or a mathematical projection, may be distinct from the territory or system to which it refers, but it informs the way it is conceived, rendered accessible, and imagined as a navigable entity. Abuses of cartography occur when the abstraction of the map or mental schematics remain fixed and unresponsive to situational localization. The transplantation of European names to existing, inhabited, and locally named sites as a way to leverage cartographic projection for extraterritorial claims is just one such example where abuses of abstractions have been historically instrumentalized to abolish or disregard situational reality.[2]

Last, the activity of navigation presupposes the existence of a navigable thing. When it comes to the present, how navigable is the world today in its complex, *nth* dimensionality? In thinking through the politics of navigation, it's crucial to consider several related questions: For whom or what is navigability optimized? For whom or what is the very possibility of navigation foreclosed, and through what power dynamics are those affordances determined? Ready-at-hand navigability cannot be assumed as a given; the activity of navigation is inseparable from resetting and/or questioning frames of reference for rendering conditions navigable in the first instance. Since the planetary scale denotes an "object" so complex it surpasses the capacity for individual, heroic, human intellection, it can only be partially accessible at a collective or distributed level. In other words, planetary navigability can only be figured as an equally intricate, collective project. The necessary geometries, narrations, epistemologies, images, and interfaces (in both operational and linguistic form) to make this planetary scale tractable to navigation seem to be in a nascent state, if existing at all. This is not a dissuasion from the proportion of labor ahead, but a note of optimism infused with a realist bent.

Planetary Considerations

Several factors arise when speculating on transforming the "planetary scale" from its existing diagnostic state to one that may offer a valence for political orientation. The first and most obvious factor is the critical question of how to contend with scale as such. Historically, scalar ambitions have been equated with forms of domination, conformance, and homogenization. This correlation is evidenced by the current (yet dwindling) version of so-called globalization—a "unilateral globalization" built of, in the words of Yuk Hui, the "particular epistemologies [from a] regional worldview to a putatively global metaphysics"[3]—as well as the ongoing oppressions of colonial subjection, including its managerial derivatives. One of many examples of such managerial derivatives is the disputed and ongoing French treasury guarantorship of the Central and West African franc currency.

Another factor in figuring the possibility of an emancipatory planetary scale is to ask how this *nth* dimensional abstraction works back upon and transforms human self-understanding. The planetary scale isn't just an external condition, but also provides a conceptual opportunity to reframe where the human stands within this scale, a repositioning from which other pathways and logics for navigating the world cascade. What new perspectives are opened when human self-picturing is repositioned at and within this *nth* dimensionality? What other modes of relation unfold from the repositioning of self-picturing; and how can the consequences of this perspectival shift be narrated in both hypothetical and meaningful ways? If there is to be any just, political navigation *of* and *at* the planetary scale, these fundamental factors need to be accounted for both epistemologically and ethically. The aforementioned perspectives and modes can also be seen as interwoven precisely through the conceptual-material activity of navigating.

Preserving Specificity

To begin imagining navigation at the planetary scale without it becoming a mode of enforced uniformity, this structural condition of *nth* dimensionality needs to be approached with a commitment to the preservation of localized distinctions. What are the politics of location at the planetary scale? "A politics of location" emphasizes an accounting of (and accountability to) specificity in order to avoid the tyranny of diminishing the differentiation of the world into a rigid and *reductive picture* of totality. The question instigates a situated accounting for the localized geo-historical-material contexts from which one speaks, thinks, relates, learns, and acts—in other words, a conscious activity of positioning knowledge-makers. As Donna Haraway wrote, an insistence on "positioning" is not simply about revealing bias and scientific misuse. It also elaborates on a mode of objectivity understood to be productively partial; and since knowing (in both propositional and material forms) comes from this partial objectivity, it is informed by the perspectival contingencies of a specified place. Importantly, these partial, locatable knowledges are not instances of an anything-goes relativism that serves only as the "mirror twin" for an a-positional mode of objectivity (the god-eye trick), but are

rather to be understood as gateways for "webs of connections called solidarity in politics and shared conversations in epistemology."[4] The value of this "situational insistence" is that it preserves contextual particularity, and sees in this framework ways to build better, more robust accounts of reality. Where this situational insistence offers less methodological guidance, however, is in approaching the coherence of a generalized, better account—that is, how all those "conversations" or relays between epistemological localizations *cohere* in mutually influential, co-constitutive ways. How can situatedness be formulated in consideration of *nth* dimensional relationality, by relations both near and distant, by those which are immediately perceivable and those which are not? One of the central problems posed by the proposition of political orientation at the planetary scale is how to simultaneously uphold multiple scales of relationality. It's a mereological, part-to-whole, one-to-many-and-many-to-one problem, which is as old a problem as one gets in philosophy. However, the stakes for finding ways to *coexist in* this concept today turn it into an urgent question of social pragmatics.

The Discrete and the Continuous

There is a shared inclination in this regard, already present in Edouard Glissant's writing towards the end of the twentieth century on a "one-world" (*tout monde*). Glissant's *tout monde* was one composed of vastly different worlds, including representations of it, making it impossible to speak of the whole from a single position.[5] The negotiation of this multiplicity comes through the enactment of a what he proposed as a "world mentality" (a morphing of *mondialisation* to *mondialité*)[6]—a mentality in opposition the flattening forces of unilateral globalization (described by him as a driven by a non-site or non-positional mentality)—while simultaneously upholding a picture of a nonhomogeneous totality.[7] His focus on relationality qua specificity of location preserves particularity while also addressing the connected embeddedness of that site, insofar as any particular location is not extractable from the totality of its relations, despite its differential specificity. Glissant's is a multiplied and nested picture of specificity, not a subtractive one, constituting an important theoretical move that undercuts reductive claims linking specificity to atomized individualism.[8]

From another, rather distant field, leaps of invention around similar part-to-whole problems can be traced in the domain of mathematics. More precisely, the second half of the twentieth century saw a working through of what mathematician René Thom called the "founding aporia of mathematics": namely, the dialectic between the discrete (or the particular) and the continuous (or the global).[9] Alexander Grothendieck, the mathematician, climate activist, and vehement critic of scientism who notably cofounded the group Survivre et Vivre (Survive and Live), worked through this problem geometrically. He arrived at what is known as "Arithmetic Geometry"—where "arithmetic" signifies the discrete, and "geometry" signifies the continuous. In his lengthy semi-autobiography *Récoltes et Semailles* (Harvest and Sowing: The Life of a Mathematician, Reflections and Bearing Witness), Grothendieck details, in (somewhat) layperson terms, the scope of his geometrical innovation, historically on par with the innovations of Euclidean geometry (in its time), as well as the transformation of the general conception of space-time from Einstein's theory of relativity:

> As for Geometry, one can say that in the two thousand years in which it has existed as a science in the modern sense of the word, it has "straddled" these two kinds of structure, "discrete" and "continuous." One can say that the new geometry is a synthesis between these two worlds, which, though next-door neighbors and in close solidarity, were deemed separate.[10]

The point of this comparative detour via Glissant and Grothendieck is to highlight that for both thinkers, coming from disparate fields, there is no pitting of the discrete against the continuous. They each refuse this false choice, and put their efforts towards the articulation of a relational glue that upholds both discrete and continuous scales simultaneously.[11] Each approach delivers its own set of consequences and contexts of application to be sure, yet in thinking through both authors, we glean a mode of refiguring spatial relations, as well as relations *to* spatiality, that offer important insights for navigation at a planetary scale. Notably, this results in a picture of situatedness as discretely located, but also, crucially, as inextricable from the continuous or nonuniform totality.

Distributed Locatability

Through the synthetic lens of the discrete and the continuous, it can be said that locations or sites not only exist in and have relations to neighborhoods of broader contexts, but that this relationality feeds back into them. This means that sites or situations are co-constituted by extra-local relations. There exists an array of contextual conditions that co-produce any instance of localization. Today this isn't even a difficult idea; it's part of everyday life for those with internet connectivity, even if it doesn't lend itself to direct experience in many cases. Being online entails relations with both the locations that serve as sites of material extraction for our machines, and the specific laborers doing the work; additionally, the computational parsing of our requests instantiates chain reactions (columns) across variously geolocated jurisdictions and

entities at once, regardless of the happenstance, physical location of the user. In operational terms, this contemporary condition means that humans are multiply located—a distributed form of situatedness. This in no way erases the concretely differential experience of locational embodiment, but offers a more extensive, local/extra-local picture of "being situated" in view of the path dependencies that constitute the planetary scale. Location is partially defined by a specificity of experience, but it is irreducible to that which can be directly experienced. Although this may appear to be a useless academic framing of location, when evoking a concept like "systemic oppression" there is already a gesturing to both scales of location: the causal forces of distributed localizations that co-produce a concretely localized (embodied, lived, and known) experience of oppression.

To define location—or to define something as "local"—requires the implicit articulation of a geometric threshold. The term is usually taken as self-evident, yet it is one that implies specific (and contingent) spatial norms, scales, perspectives, and abstractions at work—ones that are rarely made explicit, drawing a border between a general terrain and a particular instance. Understanding the implied spatial abstractions in a term like "local" provokes a helpful moment to scrutinize certain assumptions. What is the border condition of location, and at what threshold does the local cease to be local? From which perspectival position are these thresholds drawn? The answers are many, since what these dilemmas of location signal is that location is, above all, a relative and not an absolute spatial concept.

How does this multi-scalar understanding of localization—as a continuum between the concrete and the abstract—affect the relative perspective from which situatedness is understood at a planetary scale? How are we to understand "positioning" within this framework, dependent as it is on consciously *locating* the knowledge-marker—a locatability now framed in a nested, non-extractable, and yet perspectivally differential dimensionality? There is a bidirectional answer: we can understand positioning from the location of *a* particular human self *in relation to* the general location of human, conceptual self-images. If the position of the human at the planetary scale is a decentered one, that is, one no longer conceivable as a heroic, monohumanist[12] human separate from and masterfully dominant *over* the world, how does this play into the navigational synthesis between the conceptual and the material, in the mutual influence between the abstract and the concrete? Put simply, how does the decentered human picture work back upon us as a form of diagrammatic agency, towards the way we come to account for situatedness in this *nth* dimensional frame of reference that is informed by, but irreducible to, the immediately concrete?

Struggle over the Human

There are those who champion, or who actively seek to amplify, the navigational turbulence produced by this decentered human position at the planetary scale, making for an urgent battle over claims on orientation. Such tendencies thrive among several techno-neoreactionaries, who, in denying absolutely any form of planetary navigability from a resituated human position, ultimately advocate for the stripping of humanity's cognitive-political agencies to transform given frames of reference. Paradoxically, what is often perceived as a form of techno-fetishist futurism is nothing but an unimaginative conservatism that celebrates the preservation of existing frames of reference. These existing frames are defended as if they are an immutable fact of nature, a world "naturally" oriented by nineteenth-century navigational frameworks, now augmented by twenty-first-century AI, smart cities, and iPhones. Implicit endorsements for dehumanization can be found in this destructive negation of these capacities. This is so, not because this endorsement traffics in images of machinic supremacy on the surface, as is often the point of critique, but because it amounts to a renunciation of the capacity to make claims on the *artificial nature* of humanity itself, a coexistential fictitious necessity for constructing markers of collective orientation. In the end, revelling in the chaotic perpetuation of navigational turbulences at the planetary scale is nothing more than an uninventive fossilization of status-quo fictions as given and permanent facts. At this juncture, it becomes evident that the struggle for orientation at *nth*-dimensionality coexistence demands intervention on this artificial plane, in order to dislodge naturalized conservatisms that are often disguised as blinking futurity.

Sylvia Wynter crucially theorized that no historical paradigm exists without a corresponding concept of the human to buttress its logics, modes of justifying certain actions/decisions, and frames of reference for "making sense." As the hybrid, bio/mythos creatures she frames us as (not unlike Haraway's "natureculture"), none of our social reality would be possible without the conceptual engineering of a certain "genre of being human." This genre-concept operates both as a template for idealized human adaption (setting borders of inclusion/exclusion in the process), as well as a vehicle through which to legitimize certain ways of organizing social life.[13] Paradigmatic epistemic and political change is tethered to how genres of being human are conceived, meaning that placing emphasis on the human does not necessarily lead to more anthropocentric narcissism, since the ramifications of human self-image transformation concern not only the human itself, provided that this non-radiant situatedness serves as a pivotal abstract location from which conceptual reconstruction can begin. In response to the totalizing effects of unilateral globalization, ushered in through the logic of an ontologized, monohumanist human, and the *homo economicus* template that it imposed far beyond the scope of its regional invention,

Wynter asserts the need to construct genres of being human "made to the measure of the planetary," as a way to justly contend with this now wholly inseparable, entangled totality.[14] How is this "measuring-up" of humanity to be imagined in a way that encompasses both an accounting for *nth*-dimensionality coexistence, and yet is also accountable to contingent, localized differentiation?

We can begin to answer this question in the negative, since there is no aspiration to continue the violent precedent of creating planetary-scale conditions from the absolutizing of a particular, regional-human perspective. Such a precedent captures instances of domination stemming from discrete conditions that get magnified to a continuous scale, forcing the plurality of the world into a reductive template. Such reduction provides no schematic for orientation commensurate with the planetary. Answering to this measure necessitates *nth*-dimensional approaches that can account for, and be accountable to, differentiation, complexity, and systems of human and nonhuman interdependence, without the malicious comforts of simplification and confirmation of the familiar. There exists no nonhomogenizing way of approaching this *nth*-dimensional, planetary condition with frames of reference applicable only to small-world scales.

A crucial distinction needs to be made at this step, between the aggrandizement of a locally situated concept to the scale of a big world on the one hand, and on the other the situating of concept-creation within a big-world perspective. A small-world perspective can be understood as a subtractive correlation to reality where the borders of positional location are "self-evidently" drawn in conformance with the accustomed proportions of ready-at-hand, immediate human experience—not unlike the proportionate borders of the Vitruvian Human diagram. A big-world perspective does not in any way disavow small-world localization; it's a necessary position of departure, but it insists on the insufficiency of such positioning in isolation to address (and be accountable to) the planetary scaled. Big-world positioning demands a nested account of situatedness, where "location" is no longer figured as self-evidently enclosed, despite its differential status, but is rather imagined as a synthesis between immediate/concrete surroundings and the dimensional vectors of relation that co-constitute it. A big-world perspective is not driven by a hubristic ambition towards an illusory "perfect" vision of totality. These perspectives, like any other, are always partial. The ambition is, rather, to introduce a better accounting for the transformation of spacial conception and dimensionality at this scale, in order to avoid the scalar pitfalls of conflating the part with the whole, and deploying that misgiving as a definitive navigational marker.

Horizonless Spatiality

Spatially and geometrically speaking, it's worth highlighting that the classical perspective coincided with the concept of the monohumanist human—the genre of human centrality where reality is conceived as optimizable in its own, familiar image, and "knowing" is often reduced to picturing the world as a resource for human projects.[15] Correspondingly, in this classical perspective, the re-enactment of human vision on a two-dimensional plane became mechanized, reproducing images wherein the extra-local vanishes at the threshold of a horizon, namely a subtractive mode of re-presentation. This works to reinforce a narrow depiction of what a location is, by extracting it from extra-local relations, and merely mimicking the limitations of human biosensory visual systems that have limited depths of vision and that tend to privilege proximate immediacy. Moreover, in both common and academic language, the "horizon" has (like the "small world" expression) become an automated term of choice, usually referring to a sense of expansiveness, or a way to loosely gesture to an unknown, becoming, futural phenomenon. At *nth*-dimensionality coexistence, the horizon is simply an inadequate correlation to reality; spatially, representationally, and linguistically, it has no existence in reality and can only reflect on small-world proportions. The horizon may be useful at the everyday, mechanical scale of the small world to be sure, but at the planetary scale, it stands in as a representational artefact for the monohumanist human world.

What is crucial, however, to glean from this historical example is the mutual influence between an emerging concept of a genre of being human (at the time) and a representational system for spatializing it, making this concept amenable to both sensation and thought. The planetary scale demands a similar picturing and spatializing approach for a new genre of being human commensurate with the planetary scale, in order to better account for this *nth* dimensionality. Without the comforts embodied by the relative nearness of the horizon of a discrete world remediated back to us in our own image, the big world demands perspectives from a position of distributed localization, composed of, but irreducible to, happenstance personal geophysical location. To hypothesize on seeing, hearing, moving, relating, and communicating from within this big world requires experimenting with techniques for accessing its unfamiliar, often opaque, and nested scales—for making its aggregate spatiality amenable to navigation at all. It is one thing to name the "decentred human" and its "planetary-scale" situatedness, but it is quite another to learn to *coexist* in the consequences of those concepts meaningfully, with material, epistemic, and social ramifications. Considered navigation at the planetary scale will be impossible with tools, language, concepts, and spatial figurations belonging only to the small world of the familiar and the discrete. If there is navigational optimism for this condition, a *realist optimism*, it will be vital to mobilize existing vectors of *nth*-dimensional relationality

otherwise in an effort to combat the exploitative incentives that instantiated their coming into being. That incentive is predicated on the most pernicious fiction of the monohumanist genre of being human, the myth of atomized personhood, whose idea of wealth belongs only to the smallest possible world. If existing relations are to be otherwise catalyzed against the inflation of small-world exploitation (the 1 percent meme captures this well), it's not just a world mentality that is required, but also big-world frames of reference, through which to hypothesize possibilities for non-radiant coexistence at this horizonless *nth* dimension.

X

The author would like to thank Kaye Cain-Nielsen for her editorial insights in transforming this text from its initial lecture form.

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Matteo Pasquinelli

Three Thousand Years of Algorithmic Rituals: The Emergence of AI from the Computation of Space

> With topographical memory, one could speak of generations of vision and even of visual heredity from one generation to the next. The advent of the logistics of perception and its renewed vectors for delocalizing geometrical optics, on the contrary, ushered in a eugenics of sight, a pre-emptive abortion of the diversity of mental images, of the swarm of image-beings doomed to remain unborn, no longer to see the light of day anywhere.
>
> —Paul Virilio, *The Vision Machine*[1]

1. Recomposing a Dismembered God

In a fascinating myth of cosmogenesis from the ancient Vedas, it is said that the god Prajapati was shattered into pieces by the act of creating the universe. After the birth of the world, the supreme god is found dismembered, undone. In the corresponding Agnicayana ritual, Hindu devotees symbolically recompose the fragmented body of the god by building a fire altar according to an elaborate geometric plan.[2] The fire altar is laid down by aligning thousands of bricks of precise shape and size to create the profile of a falcon. Each brick is numbered and placed while reciting its dedicated mantra, following step-by-step instructions. Each layer of the altar is built on top of the previous one, conforming to the same area and shape. Solving a logical riddle that is the key of the ritual, each layer must keep the same shape and area of the contiguous ones, but using a different configuration of bricks. Finally, the falcon altar must face east, a prelude to the symbolic flight of the reconstructed god towards the rising sun—an example of divine reincarnation by geometric means.

The Agnicayana ritual is described in the *Shulba Sutras*, composed around 800 BCE in India to record a much older oral tradition. The *Shulba Sutras* teach the construction of altars of specific geometric forms to secure gifts from the gods: for instance, they suggest that "those who wish to destroy existing and future enemies should construct a fire-altar in the form of a rhombus."[3] The complex falcon shape of the Agnicayana evolved gradually from a schematic composition of only seven squares. In the Vedic tradition, it is said that the Rishi vital spirits created seven square-shaped Purusha (cosmic entities, or persons) that together composed a single body, and it was from this form that Prajapati emerged once again. While art historian Wilhelm Worringer argued in 1907 that primordial art was born in the abstract line found in cave graffiti, one may assume that the artistic gesture also emerged through the composing of segments and fractions, introducing forms and geometric techniques of growing complexity. [4]In his studies of Vedic mathematics, Italian mathematician Paolo Zellini has

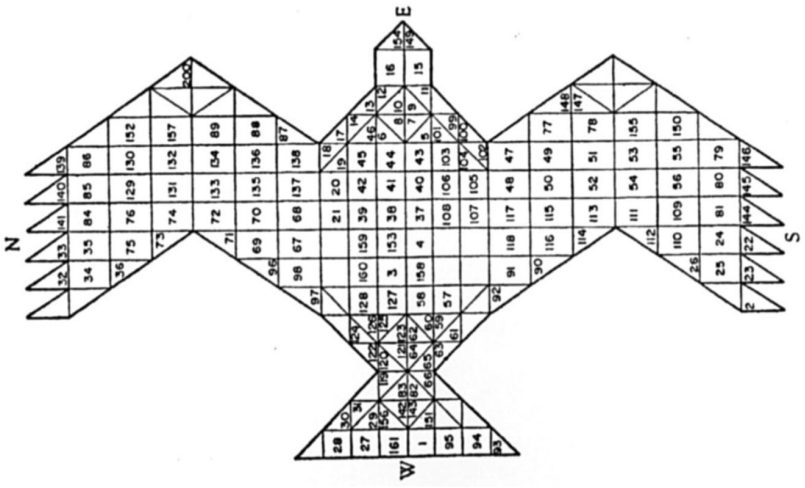

Illustration from Frits Staal, "Greek and Vedic geometry" Journal of Indian Philosophy 27.1 (1999): 105-127.

discovered that the Agnicayana ritual was used to transmit techniques of geometric approximation and incremental growth—in other words, algorithmic techniques—comparable to the modern calculus of Leibniz and Newton.[5] Agnicayana is among the most ancient documented rituals still practiced today in India, and a primordial example of algorithmic culture.

But how can we define a ritual as ancient as the Agnicayana as algorithmic? To many, it may appear an act of cultural appropriation to read ancient cultures through the paradigm of the latest technologies. Nevertheless, claiming that abstract techniques of knowledge and artificial metalanguages belong uniquely to the modern industrial West is not only historically inaccurate but also an act and one of implicit *epistemic colonialism* towards cultures of other places and other times.[6] The French mathematician Jean-Luc Chabert has noted that "algorithms have been around since the beginning of time and existed well before a special word had been coined to describe them. Algorithms are simply a set of step by step instructions, to be carried out quite mechanically, so as to achieve some desired result."[7] Today some may see algorithms as a recent technological innovation implementing abstract mathematical principles. On the contrary, algorithms are among the most ancient and material practices, predating many human tools and all modern machines:

> Algorithms are not confined to mathematics … The Babylonians used them for deciding points of law, Latin teachers used them to get the grammar right, and they have been used in all cultures for predicting the future, for deciding medical treatment, or for preparing food … We therefore speak of recipes, rules, techniques, processes, procedures, methods, etc., using the same word to apply to different situations. The Chinese, for example, use the word *shu* (meaning rule, process or stratagem) both for mathematics and in martial arts … In the end, the term algorithm has come to mean any process of systematic calculation, that is a process that could be carried out automatically. Today, principally because of the influence of computing, the idea of finiteness has entered into the meaning of algorithm as an essential element, distinguishing it from vaguer notions such as process, method or technique.[8]

Before the consolidation of mathematics and geometry, ancient civilizations were already big machines of social segmentation that marked human bodies and territories with abstractions that remained, and continue to remain, operative for millennia. Drawing also on the work of historian Lewis Mumford, Gilles Deleuze and Félix Guattari offered a list of such old techniques of abstraction and social segmentation: "tattooing, excising, incising, carving, scarifying, mutilating, encircling, and initiating."[9] Numbers were already components of the "primitive abstract machines" of social segmentation and territorialization that would make human culture emerge: the first recorded census, for instance, took place around

3800 BCE in Mesopotamia. Logical forms that were made out of social ones, numbers materially emerged through labor and rituals, discipline and power, marking and repetition.

In the 1970s, the field of "ethnomathematics" began to foster a break from the Platonic loops of elite mathematics, revealing the historical subjects behind computation.[10] The political question at the center of the current debate on computation and the politics of algorithms is ultimately very simple, as Diane Nelson has reminded us: Who counts?[11] Who computes? Algorithms and machines do not compute for themselves; they always compute for someone else, for institutions and markets, for industries and armies.

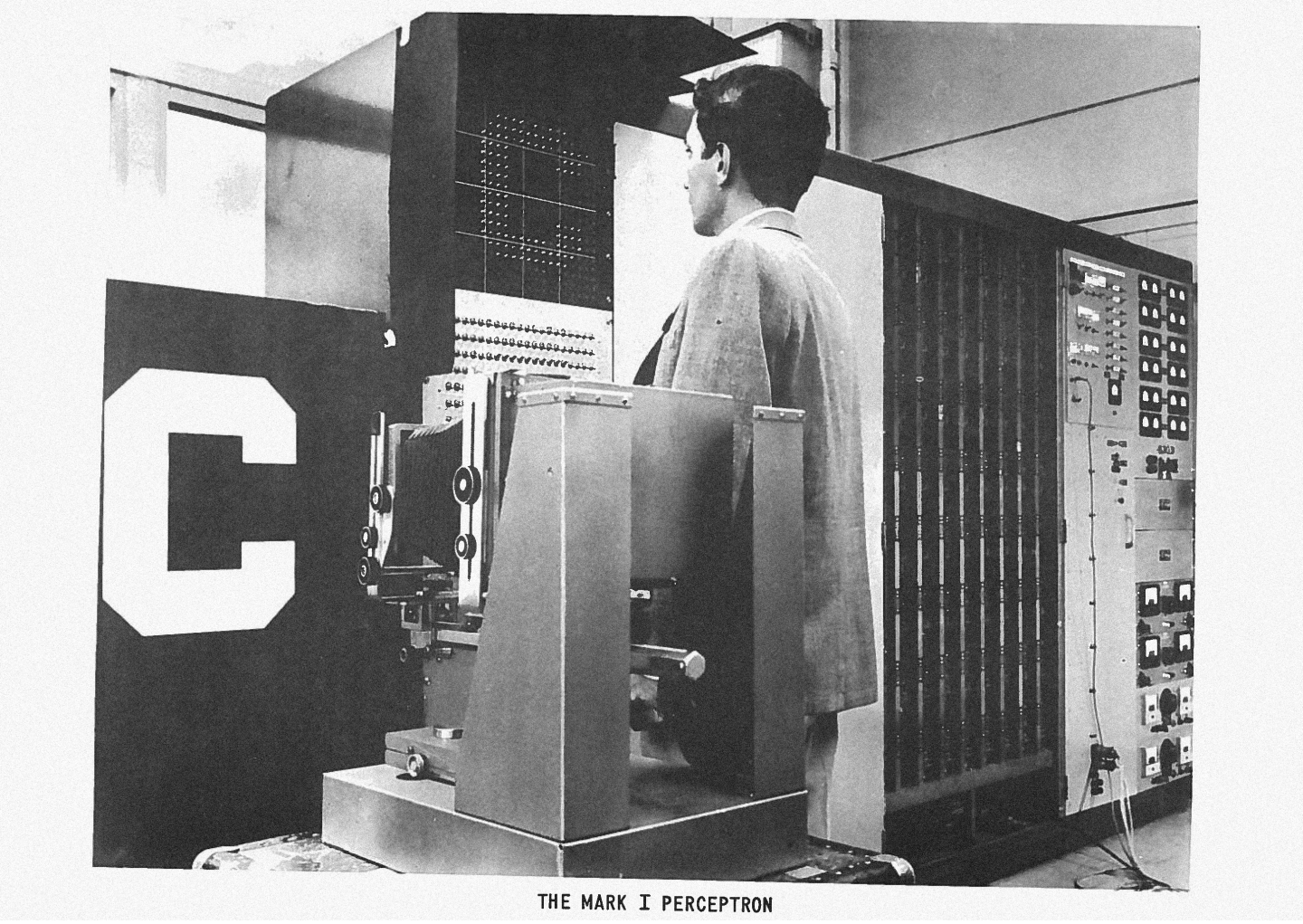

Illustration from Frank Rosenblatt, Principles of Neurodynamics: Perceptrons and the Theory of Brain Mechanisms, (Cornell Aeronautical Laboratory, Buffalo NY, 1961).

2. What Is an Algorithm?

The term "algorithm" comes from the Latinization of the name of the Persian scholar al-Khwarizmi. His tract *On the Calculation with Hindu Numerals,* written in Baghdad in the ninth century, is responsible for introducing Hindu numerals to the West, along with the corresponding new techniques for calculating them, namely algorithms. In fact, the medieval Latin word " *algorismus*" referred to the procedures and shortcuts for carrying out the four fundamental mathematical operations—addition, subtraction, multiplication, and division—with Hindu numerals. Later, the term "algorithm" would metaphorically denote any step-by-step logical procedure and become the core of computing logic. In general, we can distinguish three stages in the history of the algorithm: in ancient times, the algorithm can be recognized in procedures and codified rituals to achieve a specific goal and transmit rules; in the Middle Ages, the algorithm was the name of a procedure to help mathematical operations; in modern times, the algorithm qua logical procedure becomes fully mechanized and automated by machines and then digital computers.

Looking at ancient practices such as the Agnicayana ritual and the Hindu rules for calculation, we can sketch a basic definition of "algorithm" that is compatible with modern computer science: (1) an algorithm is an abstract diagram that emerges from the repetition of a process, an organization of time, space, labor, and operations: it is not a rule that is invented from above but emerges from below; (2) an algorithm is the division of this process into finite steps in order to perform and control it efficiently; (3) an algorithm is a solution to a problem, an invention that bootstraps beyond the constrains of the situation: any algorithm is a *trick*; (4) most importantly, an algorithm is an economic process, as it must employ the least amount of resources in terms of space, time, and energy, adapting to the limits of the situation.

Today, amidst the expanding capacities of AI, there is a tendency to perceive algorithms as an application or imposition of abstract mathematical ideas upon concrete data. On the contrary, the genealogy of the algorithm shows that its form has emerged from material practices, from a mundane division of space, time, labor, and social relations. Ritual procedures, social routines, and the organization of space and time are the source of algorithms, and in this sense they existed even before the rise of complex cultural systems such as mythology, religion, and especially language. In terms of anthropogenesis, it could be said that algorithmic processes encoded into social practices and rituals were what made numbers and numerical technologies emerge, and not the other way around. Modern computation, just looking at its industrial genealogy in the workshops studied by both Charles Babbage and Karl Marx, evolved gradually from concrete towards increasingly abstract forms.

3. The Rise of Machine Learning as Computational Space

In 1957, at the Cornell Aeronautical Laboratory in Buffalo, New York, the cognitive scientist Frank Rosenblatt invented and constructed the Perceptron, the first operative artificial neural network—grandmother of all the matrices of machine learning, which at the time was a classified military secret.[12] The first prototype of the Perceptron was an analogue computer composed of an input device of 20 × 20 photocells (called the "retina") connected through wires to a layer of artificial neurons that resolved into one single output (a light bulb turning on or off, to signify 0 or 1). The "retina" of the Perceptron recorded simple shapes such as letters and triangles and passed electric signals to a multitude of neurons that would compute a result according to a threshold logic. The Perceptron was a sort of photo camera that could be taught to recognize a specific shape, i.e., to make a decision with a margin of error (making it an "intelligent" machine). The Perceptron was the first machine-learning algorithm, a basic "binary classifier" that could determine whether a pattern fell within a specific class or not (whether the input image was a triangle or not, a square or not, etc.). To achieve this, the Perceptron progressively adjusted the values of its nodes in order to resolve a large numerical input (a spatial matrix of four hundred numbers) into a simple binary output (0 or 1). The Perceptron gave the result 1 if the input image was recognized within a specific class (a triangle, for instance); otherwise it gave the result 0. Initially, a human operator was necessary to train the Perceptron to learn the correct answers (manually switching the output node to 0 or 1), hoping that the machine, on the basis of these supervised associations, would correctly recognize similar shapes in the future. The Perceptron was designed not to memorize a specific pattern but to *learn* how to recognize potentially any pattern.

The matrix of 20 × 20 photoreceptors in the first Perceptron was the beginning of a silent revolution in computation (which would become a hegemonic paradigm in the early twenty-first century with the advent of "deep learning," a machine-learning technique). Although inspired by biological neurons, from a strictly logical point of view the Perceptron marked not a biomorphic turn in computation but a *topological* one; it signified the rise of the paradigm of "computational space" or "self-computing space." This turn introduced a second spatial dimension into a paradigm of computation that until then had only a linear dimension (see the Turing machine that reads and writes 0 and 1 along a linear memory tape). This topological turn, which is the core of what people perceive today as "AI," can be described more modestly as the passage from a paradigm of passive information to one of active information. Rather than having a visual matrix processed by a top-down algorithm (like any image edited by a graphics software program today), in the Perceptron the pixels of the visual matrix are computed in a bottom-up fashion according to their spatial disposition. The spatial relations of the visual data shape the operation of the algorithm that computes them.

Because of its spatial logic, the branch of computer science originally dedicated to neural networks was called "computational geometry." The paradigm of computational space or self-computing space shares common roots with the studies of the principles of self-organization that were at the center of post-WWII cybernetics, such as John von Neumann's cellular automata (1948) and Konrad Zuse's *Rechnender Raum* by (1967).[13] Von Neumann's cellular automata are cluster of pixels, perceived as small cells on a grid, that change status and move according to their neighboring cells, composing geometric figures that resemble evolving forms of life. Cellular automata have been used to simulate evolution and to study complexity in biological systems, but they remain finite-state algorithms confined to a rather limited universe. Konrad Zuse (who built the first programmable computer in Berlin in 1938) attempted to extend the logic of cellular automata to physics and to the

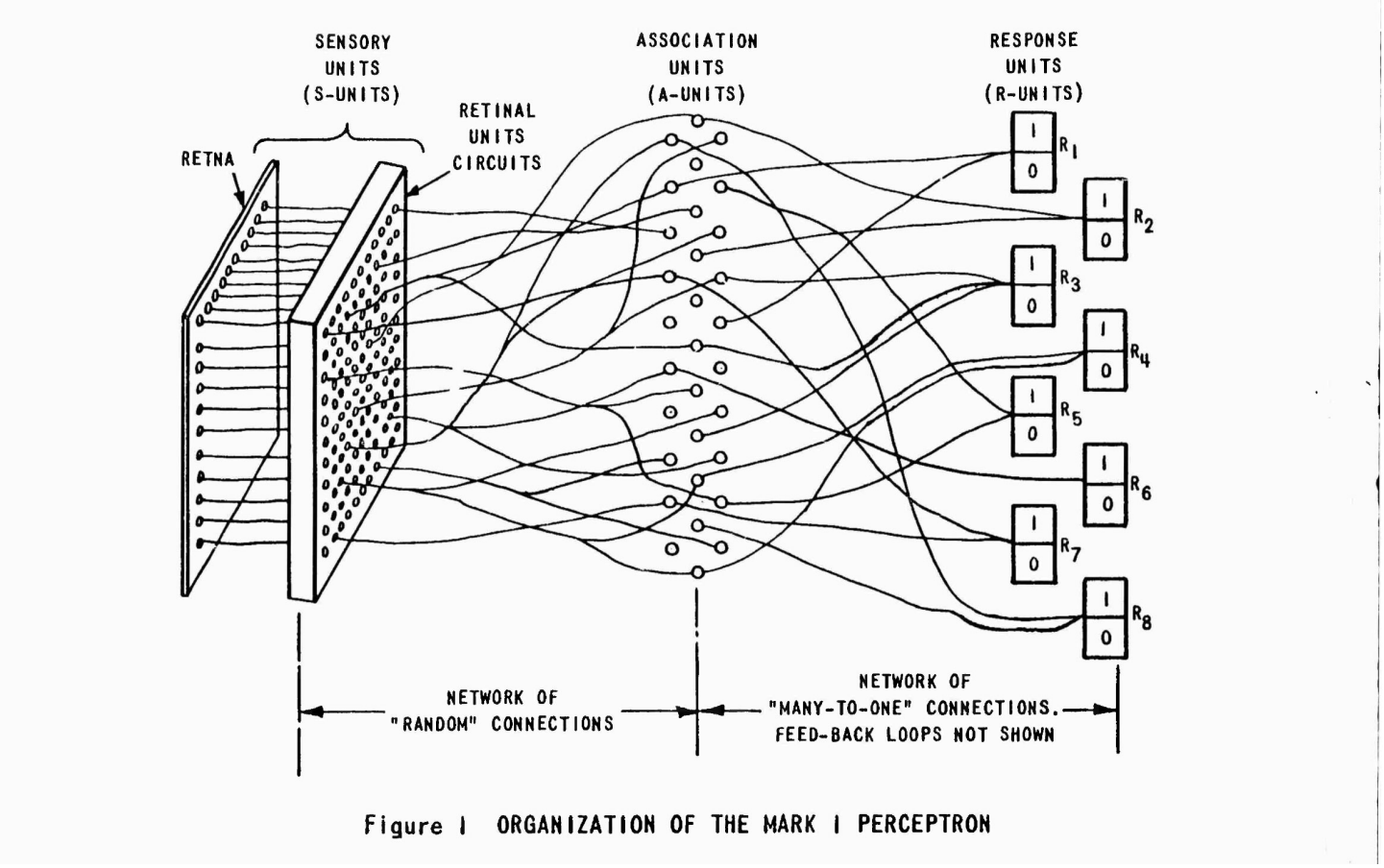

Illustration from Frank Rosenblatt, Principles of Neurodynamics: Perceptrons and the Theory of Brain Mechanisms, (Cornell Aeronautical Laboratory, Buffalo NY, 1961).

whole universe. His idea of " *rechnender Raum*," or calculating space, is a universe that is composed of discrete units that behave according to the behavior of neighboring units. Alan Turing's last essay, "The Chemical Basis of Morphogenesis" (published in 1952, two years before his death), also belongs to the tradition of self-computing structures.[14] Turing considered molecules in biological systems as self-computing actors capable of explaining complex bottom-up structures, such as tentacle patterns in hydra, whorl arrangement in plants, gastrulation in embryos, dappling in animal skin, and phyllotaxis in flowers.[15]

Von Neumann's cellular automata and Zuse's computational space are intuitively easy to understand as spatial models, while Rosenblatt's neural network displays a more complex topology that requires more attention. Indeed, neural networks employ an extremely complex combinatorial structure, which is probably what makes them the most efficient algorithms for machine learning. Neural networks are said to "solve any problem," meaning they can approximate the function of any pattern according to the Universal Approximation theorem (given enough layers of neurons and computing resources). All systems of machine learning, including support-vector machines, Markov chains, Hopfield networks, Boltzmann machines, and convolutional neural networks, to name just a few, started as models of computational geometry. In this sense they are part of the ancient tradition of *ars combinatoria*.[16]

4. The Automation of Visual Labor

Even at the end of the twentieth century, no one would have ever thought to call a truck driver a "cognitive worker," an intellectual. At the beginning of the twenty-first century, the use of machine learning in the development of self-driving vehicles has led to a new understanding of manual skills such as driving, revealing how the most valuable component of work, generally speaking, has never been merely manual, but also social and cognitive (as well as perceptual, an aspect of labor still waiting to be located somewhere between the manual and the cognitive). What kind of work do drivers perform? Which human task will AI come to record with its sensors, imitate with its statistical models, and replace with

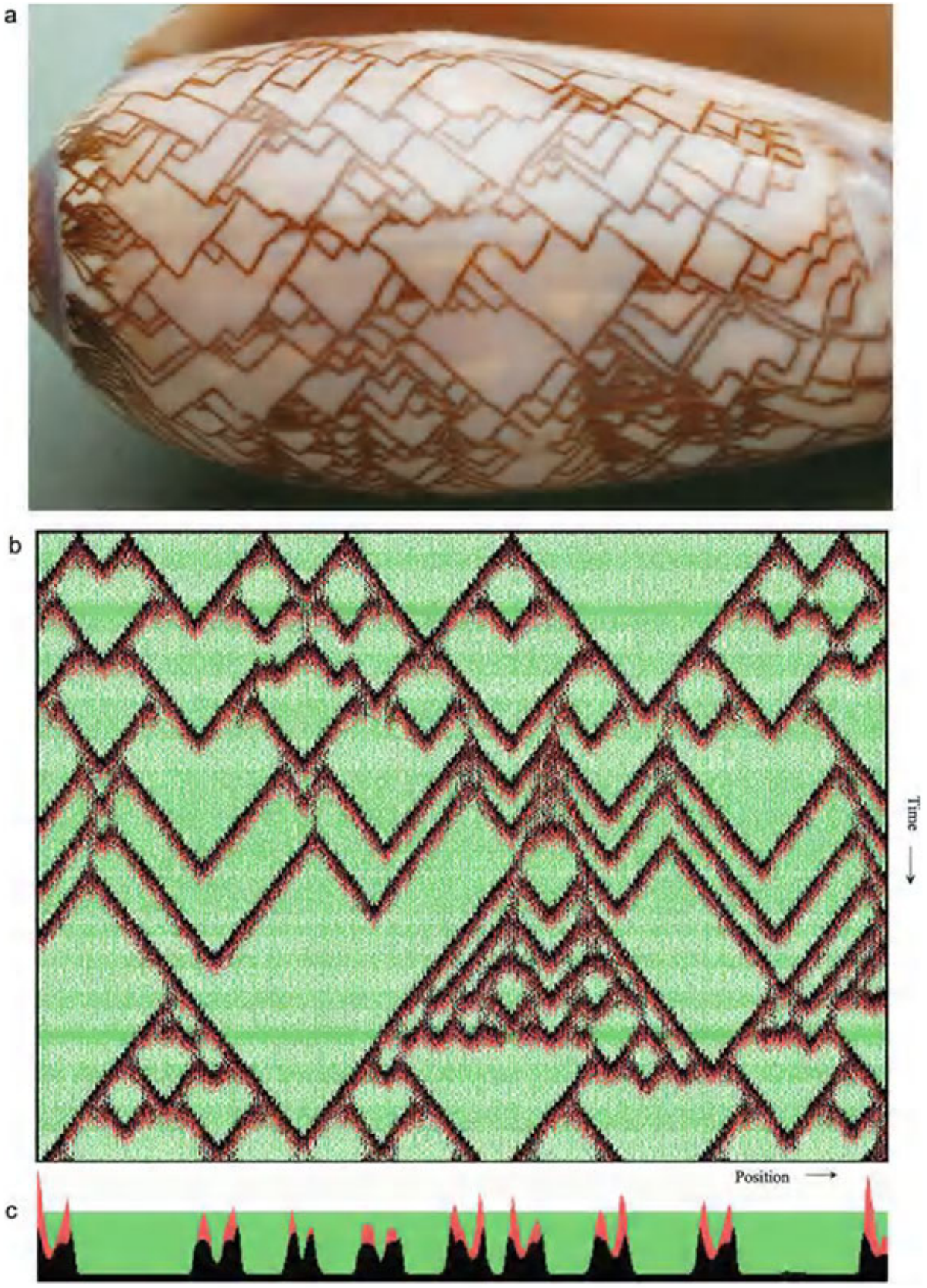

Image from Hans Meinhardt, The Algorithmic Beauty of Sea Shells (Springer Science & Business Media, 2009).

automation? The best way to answer this question is to look at what technology has successfully automated, as well as what it hasn't.

The industrial project to automate driving has made clear (more so than a thousand books on political economy) that the labor of driving is a conscious activity following codified rules and spontaneous social conventions. However, if the skill of driving can be translated into an algorithm, it will be because driving has a logical and inferential structure. Driving is a logical activity just as *labor is a logical activity* more generally. This postulate helps to resolve the trite dispute about the separation between manual labor and intellectual labor.[17] It is a political paradox that the corporate development of AI algorithms for automation has made possible to recognize in labor a cognitive component that had long been neglected by critical theory. What is the relation between labor and logic? This becomes a crucial philosophical question for the age of AI.

A self-driving vehicle automates all the micro-decisions that a driver must make on a busy road. Its artificial neural networks learn, that is *imitate* and *copy*, the human correlations between the visual perception of the road space and the mechanical actions of vehicle control (steering, accelerating, stopping) as ethical decisions taken in a matter of milliseconds when dangers arise (for the safety of persons inside and outside the vehicle). It becomes clear that the job of driving requires high cognitive skills that cannot be left to improvisation and instinct, but also that quick decision-making and problem-solving are possible thanks to habits and training that are not completely conscious. Driving remains essentially also a *social activity*, which follows both codified rules (with legal constraints) and spontaneous ones, including a tacit "cultural code" that any driver must subscribe to. Driving in Mumbai—it has been said many times—is not the same as driving in Oslo.

Obviously, driving summons an intense *labor of perception*. Much labor, in fact, appears mostly perceptive in nature, through continuous acts of decision and cognition that take place in the blink of an eye.[18] Cognition cannot be completely disentangled from a spatial logic, and often follows a spatial logic in its more abstract constructions. Both observations—that perception is logical and that cognition is spatial—are empirically proven without fanfare by autonomous driving AI algorithms that construct models to statistically infer visual space (encoded as digital video of a 3-D road scenario). Moreover, the driver that AI replaces in self-driving cars and drones is not an individual driver but a collective worker, a social brain that navigates the city and the world.[19] Just looking at the corporate project of self-driving vehicles, it is clear that AI is built on collective data that encode a collective production of space, time, labor, and social relations. AI imitates, replaces, and emerges from an *organized division of social space* (according first to a material algorithm and not the application of mathematical formulas or analysis in the abstract).

5. The Memory and Intelligence of Space

Paul Virilio, the French philosopher of speed or "dromology," was also a theorist of space and *topology,* for he knew that technology accelerates the perception of space as much as it morphs the perception of time. Interestingly, the title of Virilio's book *The Vision Machine* was inspired by Rosenblatt's Perceptron. With the classical erudition of a twentieth-century thinker, Virilio drew a sharp line between ancient techniques of memorization based on spatialization, such as the Method of Loci, and modern computer memory as a spatial matrix:

> Cicero and the ancient memory-theorists believed you could consolidate natural memory with the right training. They invented a *topographical system*, the Method of Loci, an imagery-mnemonics which consisted of selecting a sequence of places, locations, that could easily be ordered in time and space. For example, you might imagine wandering through the house, choosing as loci various tables, a chair seen through a doorway, a windowsill, a mark on a wall. Next, the material to be remembered is coded into discreet images and each of the images is inserted in the appropriate order into the various loci. To memorize a speech, you transform the main points into concrete images and mentally "place" each of the points in order at each successive locus. When it is time to deliver the speech, all you have to do is recall the parts of the house in order.

The transformation of space, of topological coordinates and geometric proportions, into a technique of memory should be considered equal to the more recent transformation of collective space into a source of machine intelligence. At the end of the book, Virilio reflects on the status of the image in the age of "vision machines" such as the Perceptron, sounding a warning about the impending age of artificial intelligence as the "industrialisation of vision":

> "Now objects perceive me," the painter Paul Klee wrote in his *Notebooks*. This rather startling assertion has recently become objective fact, the truth. After all, aren't they talking about producing a "vision machine" in the near future, a machine that would be capable not only of recognizing the contours of shapes, but also of completely interpreting the visual field … ? Aren't they also talking about the new technology of visionics: the possibility of achieving *sightless vision* whereby the video camera would

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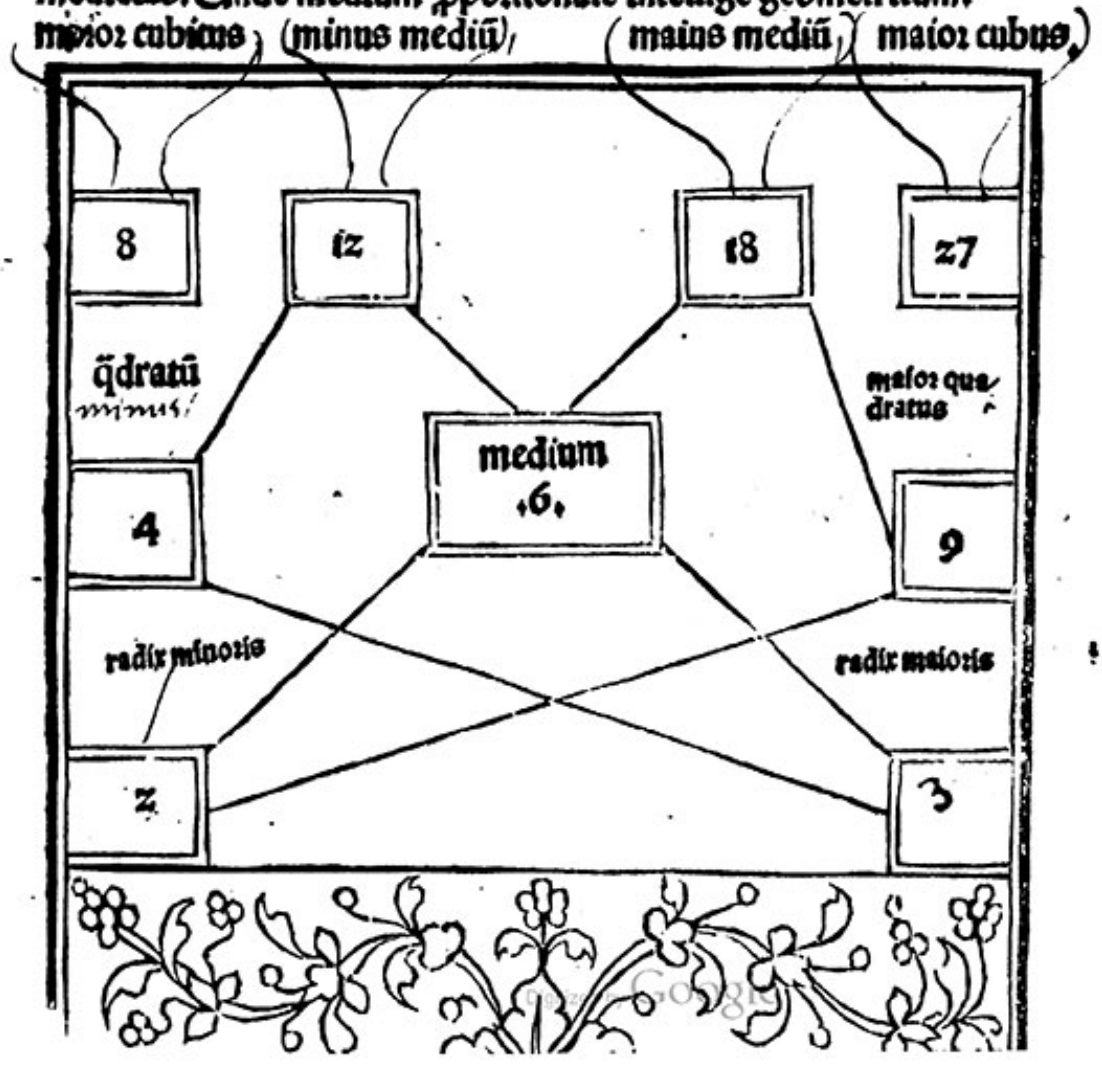
Notādū qō tres sunt medietates famose.s.Arismetrica:Geometria ꝛ Musica.Arismetrica ꝓsiderat idēptitatē excessus ꝛ nō idēptitatem ꝓportiōis vt .i.z.3. Geometria ē q̄ ꝓsiderat idēptitatē ꝓportiōis ꝛ nō excessus vt.z.4.8.Musica est q̄ ꝓsiderat nec hoc nec illud sz q̄ est pro portio extremoꝝ eadē est ꝛ differētiaꝝ vt.6.3.z. Geometrica proprie medietas.Unde medium ꝓportionale intellige geometricum.



Ioannis de Sacro Busco, Algorismus Domini, c. 1501. National Central Library of Rome. Photo: Public Domain/Internet Archive.

> be controlled by a computer? … Such technology would be used in industrial production and stock control; in military robotics, too, perhaps.
>
> Now that they are preparing the way for the automation of perception, for the innovation of artificial vision, delegating the analysis of objective reality to a machine, it might be appropriate to have another look at the nature of the virtual image … Today it is impossible to talk about the development of the audiovisual … without pointing to the new industrialization of vision, to the growth of a veritable market in synthetic perception and all the ethical questions this entails … Don't forget that the whole idea behind the Perceptron would be to encourage the emergence of fifth-generation "expert systems," in other words an artificial intelligence that could be further enriched only by acquiring organs of perception.[20]

6. Conclusion

If we consider the ancient geometry of the Agnicayana ritual, the computational matrix of the first neural network Perceptron, and the complex navigational system of self-driving vehicles, perhaps these different spatial logics together can clarify the algorithm as an *emergent form* rather than a technological a priori. The Agnicayana ritual is an example of an emergent algorithm as it encodes the organization of a social and ritual space. The symbolic function of the ritual is the reconstruction of the god through mundane means; this practice of reconstruction also symbolizes the expression of the many within the One (or the "computation" of the One through the many). The social function of the ritual is to teach basic geometry skills and to construct solid buildings.[21] The Agnicayana ritual is a form of algorithmic thinking that follows the logic of a primordial and straightforward computational geometry.

The Perceptron is also an emergent algorithm that encodes according to a division of space, specifically a spatial matrix of visual data. The Perceptron's matrix of photoreceptors defines a closed field and processes an algorithm that computes data according to their spatial relation. Here too the algorithm appears as an emergent process—the codification and crystallization of a procedure, a pattern, after its repetition. All machine-learning algorithms are emergent processes, in which the repetition of similar patterns "teach" the machine and cause the pattern to emerge as a statistical distribution.[22]

Self-driving vehicles are an example of complex emergent algorithms since they grow from a sophisticated construction of space, namely, the road environment as social institution of traffic codes and spontaneous rules. The algorithms of self-driving vehicles, after registering these spontaneous rules and the traffic codes of a given locale, try to predict unexpected events that may happen on a busy road. In the case of self-driving vehicles, the corporate utopia of automation makes the human driver evaporate, expecting that the visual space of the road scenario alone will dictate how the map will be navigated.

The Agnicayana ritual, the Perceptron, and the AI systems of self-driving vehicles are all, in different ways, forms of self-computing space and emergent algorithms (and probably, all of the them, forms of the invisibilization of labor).

The idea of computational space or self-computing space stresses, in particular, that the algorithms of machine learning and AI are emergent systems that are based on a mundane and material division of space, time, labor, and social relations. Machine learning emerges from grids that continue ancient abstractions and rituals concerned with marking territories and bodies, counting people and goods; in this way, machine learning essentially emerges from an extended division of social labor. Despite the way it is often framed and critiqued, artificial intelligence is not really "artificial" or "alien": in the usual mystification process of ideology, it appears to be a deus ex machina that descends to the world like in ancient theater. But this hides the fact that it actually emerges from the intelligence of this world.

What people call "AI" is actually a long historical process of crystallizing collective behavior, personal data, and individual labor into privatized algorithms that are used for the automation of complex tasks: from driving to translation, from object recognition to music composition. Just as much as the machines of the industrial age grew out of experimentation, know-how, and the labor of skilled workers, engineers, and craftsmen, the statistical models of AI grow out of the data produced by collective intelligence. Which is to say that AI emerges as an enormous *imitation engine* of collective intelligence. What is the relation between artificial intelligence and human intelligence? It is the social division of labor

X

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1
Paul Virilio, *La Machine de vision: essai sur les nouvelles techniques de representation* (Galilée, 1988). Translated as *The Vision Machine* , trans. Julie Rose (Indiana University Press, 1994), 12.

2
The Dutch Indologist and philosopher of language Frits Staal documented the Agnicayana ritual during an expedition in Kerala, India, in 1975. See Frits Staal, *AGNI: The Vedic Ritual of the Fire Altar,* vol. 1–2 (Asian Humanities Press, 1983).

3
Kim Plofker, "Mathematics in India," in *The Mathematics of Egypt, Mesopotamia, China, India, and Islam* , ed. Victor J. Katz (Princeton University Press, 2007).

4
See Wilhelm Worringer, *Abstraction and Empathy: A Contribution to the Psychology of Style* (Ivan R. Dee, 1997). (*Abstraktion und Einfühlung,* 1907).

5
For an account of the mathematical implications of the Agnicayana ritual, see Paolo Zellini, *La matematica degli dèi e gli algoritmi degli uomini* (Adelphi, 2016). Translated as *The Mathematics of the Gods and the Algorithms of Men* (Penguin, forthcoming 2019).

6
See Frits Staal, "Artificial Languages Across Sciences and Civilizations," *Journal of Indian Philosophy* 34, no. 1–2 (2006).

7
Jean-Luc Chabert, "Introduction," in *A History of Algorithms: From the Pebble to the Microchip* , ed. J ean-Luc Chabert (Springer, 1999), 1.

8
Jean-Luc Chabert, "Introduction," 1–2.

9
Gilles Deleuze and Félix Guattari, *Anti-Oedipus: Capitalism and Schizophrenia* , trans. Robert Hurley (Viking, 1977), 145.

10
See Ubiratàn D'Ambrosio, "Ethno Mathematics: Challenging Eurocentrism," in *Mathematics Education* , eds. Arthur B. Powell and Marilyn Frankenstein (State University of New York Press, 1997).

11
Diane M. Nelson, *Who Counts?: The Mathematics of Death and Life After Genocide* (Duke University Press, 2015).

12
Frank Rosenblatt, "The Perceptron: A Perceiving and Recognizing Automaton," Technical Report 85-460-1, Cornell Aeronautical Laboratory, 1957.

13
John von Neumann and Arthur W. Burks, *Theory of Self-Reproducing Automata* (University of Illinois Press, 1966). Konrad Zuse, "Rechnender Raum," *Elektronische Datenverarbeitung* , vol. 8 (1967). As book: *Rechnender Raum* (Friedrich Vieweg & Sohn, 1969). Translated as *Calculating Space* (MIT Technical Translation, 1970).

14
Alan Turing, "The Chemical Basis of Morphogenesis," *Philosophical Transactions of the Royal Society of London B* 237, no. 641 (1952).

15
It must be noted that Marvin Minsky and Seymour Papert's 1969 book *Perceptrons* (which su perficially attacked the idea of neural networks and nevertheless caused the so-called first "winter of AI" by stopping all research funding into neural networks) claimed to provide "an introduction to computational geometry." Marvin Minsky and Seymour Papert, *Perceptrons: An Introduction to Computational Geometry* (MIT Press, 1969).

16
See the work of twelfth-century Catalan monk Ramon Llull and his rotating wheels. In the *ars combin atoria* , an element of computation follows a logical instruction according to its relation with other elements and not according to instructions from outside the system. See also *DIA-LOGOS: Ramon Llull's Method of Thought and Artistic Practice* , eds. Amador Vega, Peter Weibel, and Siegfried Zielinski (University of Minnesota Press, 2018).

17
Specifically, a logical or inferential activity does not necessarily need to be conscious or cognitive to be effective (this is a crucial point in the project of computation as the mechanization of "mental labor"). See the work of Simon Schaffer and Lorraine Daston on this point. More recently, Katherine Hayles has stressed the domain of extended nonconscious cognition in which we are all implicated. Simon Schaffer, "Babbage's Intelligence: Calculating Engines and the Factory System," *Critical inquiry* 21, no. 1 (1994). Lorraine Daston, "Calculation and the Division of Labor, 1750–1950," *Bulletin of the German Historical Institute* , no. 62 (Spring 2018). Katherine Hayles, *Unthought: The Power of the Cognitive Nonconscious* (University of Chicago Press, 2017).

18
According to both Gestalt theory and the semiotician Charles Sanders Peirce, vision always entails cognition; even a small act of perception is inferential—i.e., it has the form of an hypothesis.

19
School bus drivers will never achieve the same academic glamor of airplane or drone pilots with their adventurous "cognition in the wild." Nonetheless, we should acknowledge that their labor provides crucial insights into the ontology of AI.

20
Virilio, *The Vision Machine*, 76.

21
As Stall and Zellini have noted, among others, these skills also include the so-called Pythagorean theorem, which is helpful in the design and construction of buildings, demonstrating that it was known in ancient India (having been most likely transmitted via Mesopotamian civilizations).

22
In fact, more than machine "learning," it is data and their spatial relations "teaching."

Nikolay Smirnov

Meta-geography and the Navigation of Space

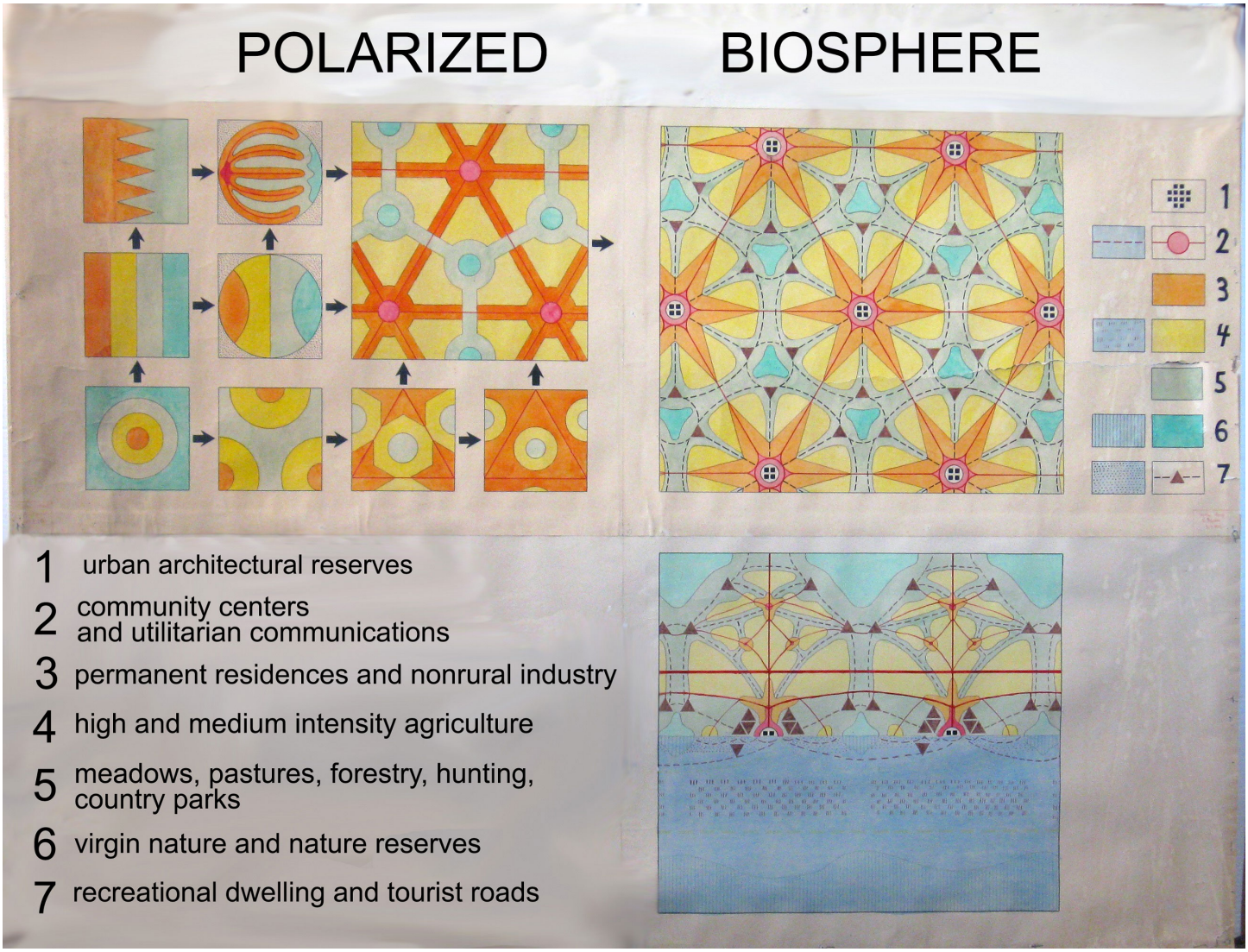
Human beings perceive space through its reflection in their own consciousness and corporeal perception; space, spatial images, and their representations determine and define one another. The foundational principle of the practice of meta-geography is the understanding that changing space or its image/imago, or the representations of the latter, means changing life—and vice versa.[1] A shift in one of the three components will inevitably trigger a shift in the others. Meta-geography offers a new perspective on geography that champions the interdependence of any given space, its images/imagoes, and its representations. In other words, geographical constructs do not only depend on the spaces they represent; those spaces themselves are formed in accordance with our representations of them.

According to Russian geographer Dmitry Zamyatin, meta-geography can be understood as "images of space and [the] space of images."[2] The word "image" here literally designates the Russian word , which signifies not only visual representation, but also cognitive, linguistic, aural, or bodily forms of representation. It is closer to the understanding of the image in the practice of Russian icon painting, or the depiction of the creative work of imagination in the writings of Henry Corbin or Gilbert Durand.[3] In this sense, the image is indissolubly connected to thought and space. Spatial imagination is intimately linked to the human mind and its projective activity.

The twentieth century initiated a process of "shattering" the nation-state space, and of imagining the creation of "other" spaces. Many spatial practices that emerged in Russia starting in the 1960s—such as those of Soviet geographer Boris Rodoman, discussed below—aimed at destroying the invisible walls established by streams of "power." Moreover, these activities sought to create spaces of alternative experience.

In a meta-geographical interpretation of the world, the phenomenological becomes ontological precisely via imagination. In other words, meta-geography focuses on phenomenological and ontological aspects of the "space of images." This approach asserts that it is a fundamentally impossible to cognize the world outside of human perception and imagination, which means that all geographical knowledge takes the form of images.[4]

Meta-geography is a specific branch of critical geography developed in Soviet and post-Soviet Russia. Taken together, the various phases of meta-geography that have evolved since the 1960s constitute a framework encompassing both a critical reflection on mapping—from the state and geopolitical level right down to the deepest personal level—as well as a counter-mapping practice that actively involves both thinking and corporality.



Boris Rodoman, "Polarized Biosphere," c. 1970-1. Paper, mixed media, 132 × 168 cm. Translated by Nikolay Smirnov. Copyright: Boris Rodoman, Museum of Russian Geographical Society.

The related practices of diagrammatics, cognitive mapping, and counter-mapping lead us to the core of the concept of meta-geography, which connects landscape, mind, and body in a single research assemblage. The knowledge and practices developed by successive generations of Soviet thinkers and scientists allow us today to understand meta-geography as a tool for navigation by way of "rewriting" and constructing spaces.

I. The Birth of Meta-geography: The Soviet Period and Boris Rodoman

In the Soviet Union, meta-geographical concepts were originally explored by proponents of mathematical modeling in geography. The term "meta-geography" was probably first proposed by geographer Yulian Saushkin in the late 1960s, amidst a general interest in metascience, or "science about science," and following the example of "meta-cartography" in particular.[5] In 1967, Soviet geographers Veniamin Gokhman, Boris Gurevich, and Yulian Saushkin presented a paper on the basic principles of meta-geography at the seventh congress of the Regional Science Association International at The Hague.[6] In their view, meta-geography was a theoretical discipline that tries to identify patterns according to which geographical knowledge is formed. The meta-science "explores the potential and the possibilities of geographical science by bringing out its fundamental nature," and describes basic geographical notions such as "space."[7]

Meta-geography was quickly assimilated into theoretical geography—that is, the area of knowledge that studies and constructs theoretical models such as models of the evolution of metropolitan areas. With varying degrees of accuracy, such models can visually and mathematically

express a process that takes place in the geosphere.

In the 1960s, geographer Boris Rodoman, a young colleague of Saushkin, first conceived of "geo-cartoids." According to Rodoman, "Geographical cartoids (or geo-cartoids) are diagrams depicting a real or imaginary territory more simply, without necessarily complying with the rules of classical cartography—for instance, without projection or scaling, and with exaggeratedly straightened lines and coarse outlines."[8] By way of example, Rodoman proposed that the cartographic drawings made by prehistoric hunters, warriors, shepherds, and treasure hunters could all be considered cartoids, and that certain medieval world maps, along with cartographic drawings on contemporary posters, flags, badges, labels, and book covers, fit into the same category.

Because they are more generalized than maps, cartoids are very useful for depicting typical, imaginative, and ideal territorial models. That's why Rodoman considered cartoids to be the building blocks of the language of theoretical geography. He traced their function as representations of abstract geographical models in science back to the nineteenth century—for example, in the graphical representation of Johann Heinrich von Thünen's "Model of Land Use" (1826). But it is only in the second half of 1960s that cartoids were implemented as the main method of theoretical geography. Rodoman claims that they actually generated, rather than served, the discipline.[9]

In Rodoman's map-like diagrams we are confronted not only with the features of the objects being mapped (a landscape, the author's experience, or his interests), but also with the mapping procedure itself as a fundamentally important and basic feature of the human mind. The common link between a cartoid that depicts a model of a landscape and a cartoid that schematizes the interests of its author reveals the very procedure of mapping as primarily a cognitive process. Moreover, by charting and mapping himself and his own interests, the researcher makes visible the processes of constructing the subject. In other words, through his geo-cartoids, Rodoman reveals the action of forces and flows of power that construct the subject in many respects as a random assemblage.

The best known of the several dozen cartoids that Rodoman created is "Polarized Biosphere," also known a "A Networked Polarized Landscape." Rodoman argued that it

> shows the desired combination of natural landscape and built environment, with conflicts reduced to a minimum. The city and wildlife are considered as two poles of the biosphere that man equally needs. They are divided by intermediary zones, with the degree of urbanization, intensity of economic activity, and population density increasing from the natural pole to the urban one.[10]

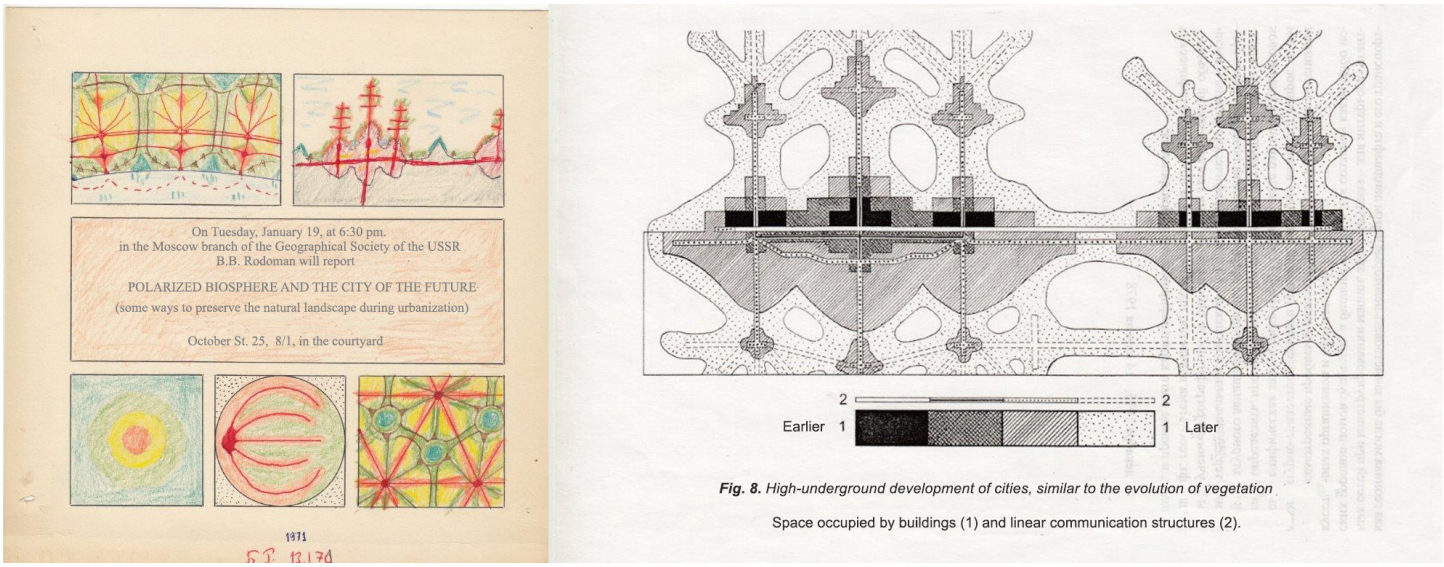
In Rodoman's depiction, the various functional zones of this "polarized landscape" are located on an infinite plain, with no water. All cities on this cartoid appear to be the same size, making it a very abstract model. The forms of this basic cartoid could be transformed during the process of accounting for the real physical conditions of different geographical terrains. Accordingly, Rodoman explains that the lower part of the cartoid

> shows the result of the first of the possible transformations of a basic cartoid—some water is introduced (a sea or lake), and this radically changes the entire configuration. It will change even more if we introduce rivers, mountains, etc. This is how we can move from an imaginary terrain to a real one.[11]

On the one hand, this cartoid/model is "idealized," meaning that it "expresses a desired condition of the biosphere (the harmonic symbiosis of urban life and the natural environment)."[12] On the other, Rodoman claims that his cartoids "reflect the specificity of our Russian space … of our cultural landscape … about which my disciple Vladimir Kagansky said the following: 'The Russian landscape is the product of the interaction not between nature and society, but between nature and the state.'"[13]

According to Rodoman, the main features of the Russian landscape are: 1) its hyper-centralization, which reflects Russia's bureaucratic hierarchy; 2) its radial spatial links, which are much more developed than its tangential links, so that the link between two neighboring cities is often weaker than their individual links to the administrative center (either the regional center or Moscow); and 3) this leads to a phenomenon called "the inner periphery," where territories on the borders between administrative zones (areas that are the farthest from administrative centers) are the most undeveloped. That's why these administrative dead ends so easily accommodate natural reserves. Observing this pattern, Rodoman formulated the "principle of the polarized landscape" and proposed to use this principle to realize a harmonious symbiosis between human and nature, as depicted in "Polarized Biosphere."

During his life, Rodoman produced many different variants of this specific cartoid. For a 1971 public address entitled "Polarized Biosphere and the City of the Future: Some Ways to Preserve the Natural Landscape during Urbanization" (delivered at the Moscow branch of the Geographical Society of the USSR), he drew cities as huge ships sailing in the lithosphere, the outermost layer of the earth's crust. In this drawing, urban elements appear



Boris Rodoman, "Geo-bionics: City's Ships and City's Trees," 1971. Left: Rodoman's report announcement. Top right: underground development of cities, similar to the evolution of vegetation cover (bottom right). Translated by Nikolay Smirnov. Copyright: Boris Rodoman.

biological and organ-like. For example, telecommunication lines, designated in red, are not completely straight, instead resembling dendrites, which grow from a neuron core (in this metaphor: the urban center). In general, the space depicted in this model looks like a kind of kaleidoscopic tissue formed by repeating cell-like elements. Two nets are intertwined, evoking the symbiosis of two living system.

In a later 1978 version of "Polarized Biosphere," the cities look like gigantic trees. In the same year, in his essay "Landscape-Geographical Bionics," Rodoman wrote that urbanization develops as a vegetative cover. In his view, "all constructions can be considered artificial (technogenic) analogs of vegetation. Buildings and settlements initially isolated and situated on the surface ... grow upward and downward ... and connect into a solid global building/city, as if floating in the earth's crust." Continuing this logic, Rodoman deems urban development the "city-building-vessel-forest."[14]

Here, we observe two very important qualities of Rodoman's models of the polarized biosphere. First, the "body" is understood both as the body of the landscape and that of the mapper, which constitutes the main research tool.[15] From the very beginning, Rodoman conceived of anthropogenic landscapes as quasi-organic objects. He merged urban and organic models through bionics, arriving at what he called "geo-bionics." Bionics can be understood as an application of the principles of the organization, qualities, functions, and structures of living nature to the investigation and construction of artificial objects. According to Rodoman's definition, geo-bionics is the "investigation and construction of territorial systems which, in their spatial organization, are somehow analogous to living organisms and their communities."[16] All of Rodoman's cartoids are produced according to the principles of geo-bionics: cities as trees, neighborhoods as leaves, communication lines as dendrites, nets of urban and natural fabric as symbiotic living systems.

The second important quality of Rodoman's models of the polarized biosphere is that they depict nature as *constructive* and *transformative*. As mentioned above, this model/cartoid expresses a desired harmonic symbiosis between the human city and nature. Given his belief in the possibility and necessity of the rational regulation of all nature by humankind, Rodoman looked to the philosophy of Russian cosmism for inspiration—namely the writings of Vladimir Vernadsky and Nikolai Fedorov. Vernadsky and Fedorov argued for the need to regulate life on earth and in space, a task which humanity must undertake as its final purpose. It is interesting to note that in the mid-1960s, Rodoman proposed a project for the electronic real-time command and control of the earth's biosphere. This automated global geo-informational system "would continually portray changes in the mapped object," for example, differences in weather patterns between regions.[17] Later, the American researcher Robert Brook Cathcart variously dubbed this project "Rodoman's electronic geography proposal" and "Rodoman's theory of space-age geography."[18]

In another cartoid, "Ski Routes around Moscow," drawn from memory in 1990, Rodoman depicts the skiing routes he liked to take around the city between the 1950s and the 1980s. During this period, almost everyone in the USSR used public transportation, especially the well-developed network of radial railroads stemming from Moscow (the rail lines formed a star-shaped figure because of the

hyper-centralization of the Moscow region). Designated ski routes began and ended at certain railway stations that were near forests, so that people could get off the train and immediately begin skiing. In "Ski Routes around Moscow," Rodoman charts the skiing paths between railway stations, revealing the structure of the Moscow region's landscape. He explains:

> I call these routes "traverses" because they seem to be cut between the platforms of suburban electric trains and cross uncrowded woodland (usually at the border of administrative districts). Geographers offered to preserve and develop the Moscow region's unique and informally created infrastructure of mass suburban recreation, but our state chose to destroy public space and divide the land into private property. Urbanization, motorization, and cottage building destroyed most of these wonderful routes, but something remained.[19]

So, "Ski Routes around Moscow" is not only a document of a specific Soviet subculture (amateur skiers); it also forms an implicit portrait of a landscape that has been dramatically transformed since the period represented from its author's memory.

In "Ski Routes around Moscow," we see that Rodoman was mapping not only a landscape, but also his own experience. This kind of mapping is heightened in his cartoid "Interests of B. B. Rodoman" which he calls a "para-geographical cartoid." In this map there are no boundaries between profession and hobby.

When mapping refers to the researcher himself, it becomes an implicit critical practice through the process of *diagrammatization*. We established that Rodoman's geo-cartoids contain an implicit critique of the Russian landscape and the powers that constitute it (hyper-centralization, the influence of administrative divisions, and so on). His para-geographical cartoids do the same kind of work concerning the construction of subjectivity in modern society.

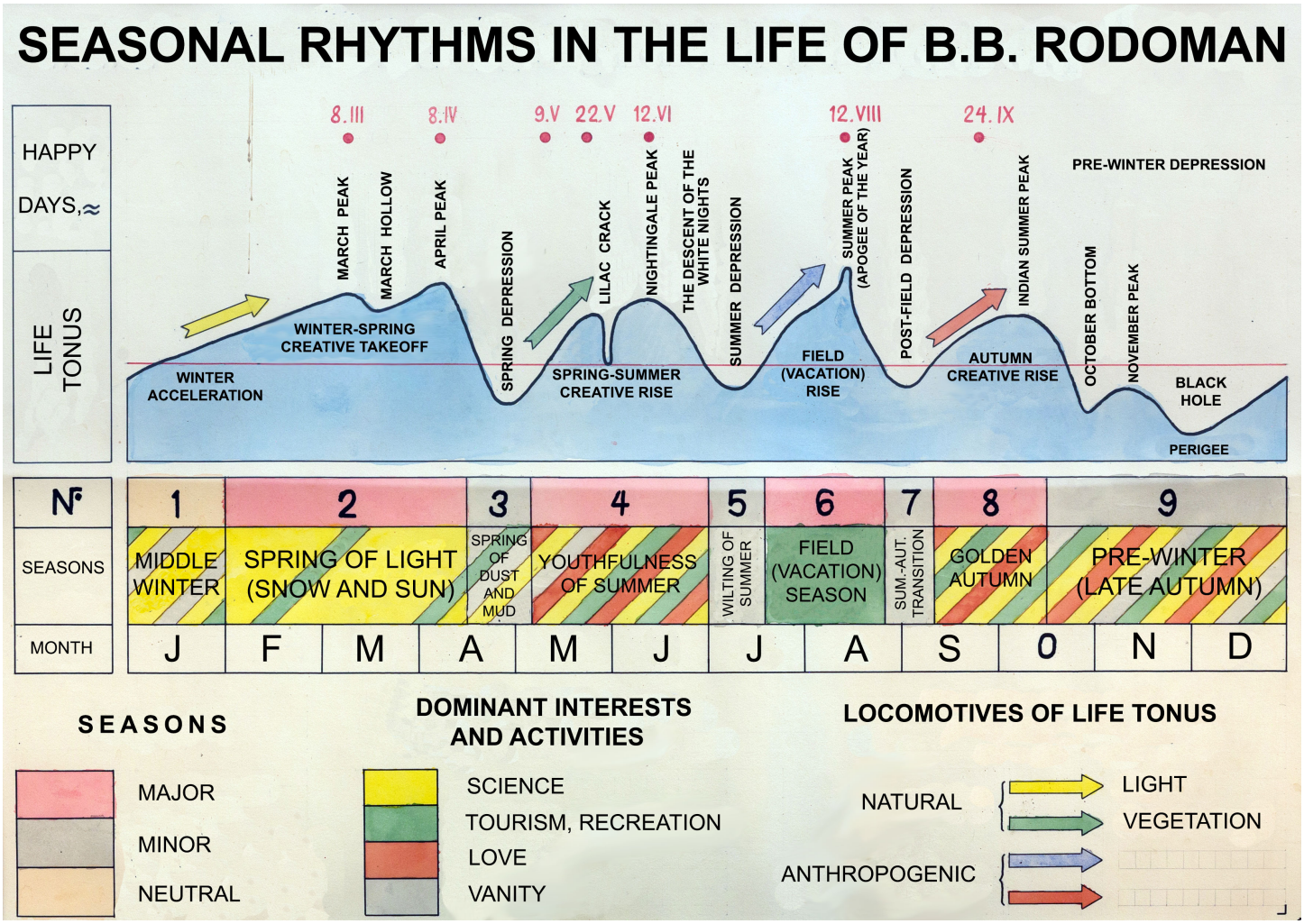
There is a grey, unlabeled circle located in the center of "Interests of B. B. Rodoman." This grey circle seems to represent the author's subjectivity, not as an essence, but rather as the functional *place of subjectivity* that is revealed in the process of mapping/diagrammatization. In other words, this grey circle makes visible the mechanics of constructing subjectivity: it does not exist a priori, but is constituted through the influence of external objects such as science, tourism, sexography, and so on. The most demonstrative feature in this regard is the fact that arrows on the cartoid point towards the subject, not out of it.

Another example of self-mapping is found in Rodoman's "Seasonal Rhythms in the Life of B. B. Rodoman." This cartoid looks like a landscape profile of some unknown terrain, with hills and flatlands, ridges, and gorges over which Rodoman has mapped out seasonal rhythms in his emotional life. This schema was based on long-term self-observation. According to "Seasonal Rhythms in the Life of B. B. Rodoman," the life activity of the author depends on both natural factors (e.g., vegetation) and anthropogenic factors (for which Rodoman wasn't able to synthesize proper, short titles). He describes one of the latter as "thirst for exotic lands far away, geographic romanticism, and a desire to break free from the burden of everyday life," and another as "the desire to return home to Moscow, return to myself and to my main occupation (writing)—calming."[20]

The most important features of Rodoman's models are their diagrammatic power and their implicit critical stance.[21] Their stance is "critical" because the cartoids reveal the peculiarities and limits of the objects they depict, and make visible the processes of object formation, whether in the context of the Russian landscape or the subjectivity of the author. This critical stance is "implicit" because criticizing the existing state of affairs was not Rodoman's stated goal.

Rodoman considers his most serious and "pure" scientific work to be the paper "Methods of Individual and Typological Regionalization/Zoning and their Depiction on the Map," published in 1956. He developed this theme until the end of the 1960s. He characterizes all of his subsequent writing as "a gradual loss of originality and dissolution in the peripheral, Russian areas of global science." According to Rodoman, in his early works he dealt with the most abstract, universal laws of geographic space and the process of the regionalization/discretization of space. After the late 1960s, his theoretical universal models "began to fill up with socio-economic specifics" thus becoming the bearer of implicit critical knowledge in relation to the Russian landscape.[22]

In his early works on forms of regionalization, Rodoman aimed to formulate a theory of logical forms of regionalization/zoning and complex classifications in geography. As part of this effort, in 1979 he created a three-part cartoid entitled "1. Multidimensional Classifications and Forms of Regionalization; 2. Taxon Types by their Position in Taxonomic Pyramids and Ladders; 3. Branching and Locking of Taxonomic Ladders." This triptych can be regarded as an attempt to create a system of "geo-grammatics," or a set of diagrammatic principles for all geographical processes. In Rodoman's geo-grammatics, geographical processes are regarded as something that happens in between landscape, mind, and body. When *any* kind of territory is charted, mapped, and imagined, mental geographical models—i.e., images/imagoes—are formed as a result. These models depict not just physical territories, but also



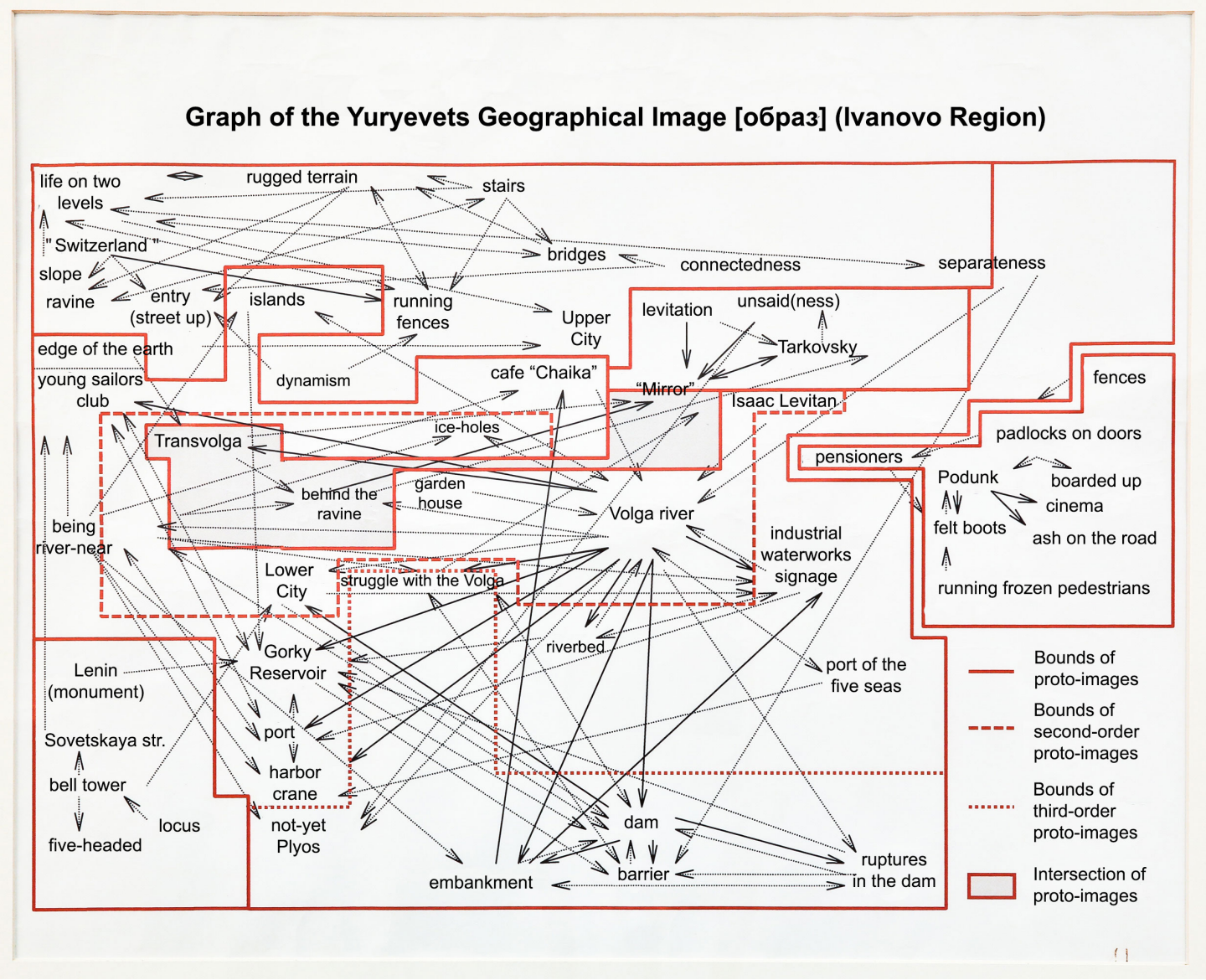
Boris Rodoman, "Seasonal Rhythms in the Life of B. B. Rodoman,"1984. Paper, mixed media, 65 × 89 cm. Translated by Nikolay Smirnov. Copyright: Boris Rodoman, Museum of Russian Geographical Society, Evgeny Alekseev, Tretyakov Gallery.

territories in a Deleuzian and post-Deleuzian sense as well. Today we comprehend and represent many objects as territories; various cognitive and semantic spaces, experiences and activities, and complex objects are portrayed via spatial models. Meta-geography is concerned with studying the specific nature of the process of mapping, modelling, and creating the images/imagoes of spaces, whether physical or abstract. In this sense, meta-geography critically reflects on the very process of *geographyzing* not just geo-space, but anything that can be presented through spatial models.

II. Postmodern Meta-geography: The Cultural Landscape and the Space of Images

Meta-geography continued to develop in the post-Soviet period. Geographer Vladimir Kagansky, an informal student and "only disciple" of Rodoman, continued to develop the grammatic branch of meta-geography. In the late Soviet period, he published such texts as "On the Specifics of the Language of Cartoids" (1979) and "Classification as Knowledge and Knowledge about Classification" (1991). Kagansky expanded his inquiry to include the theory and methodology of the regionalization of semantic spaces. On this basis, Kagansky developed a hermeneutics of the Russian cultural landscape. In order to summarize his methodological developments in theoretical geography, Kagansky proposed the original conception of "reading society through an inquiry into the cultural landscape." His works on the Russian/Soviet cultural landscape became the point of intersection between 1) theoretical/meta-geographical research into the rules and logical forms of geo-grammatics; and 2) structuralist analysis of the forms and meanings of the Russian/Soviet landscape.[23]

But the real humanistic and postmodernist turn in meta-geography was made by the geographer and poet Dmitry Zamyatin. Zamyatin worked out his own conception



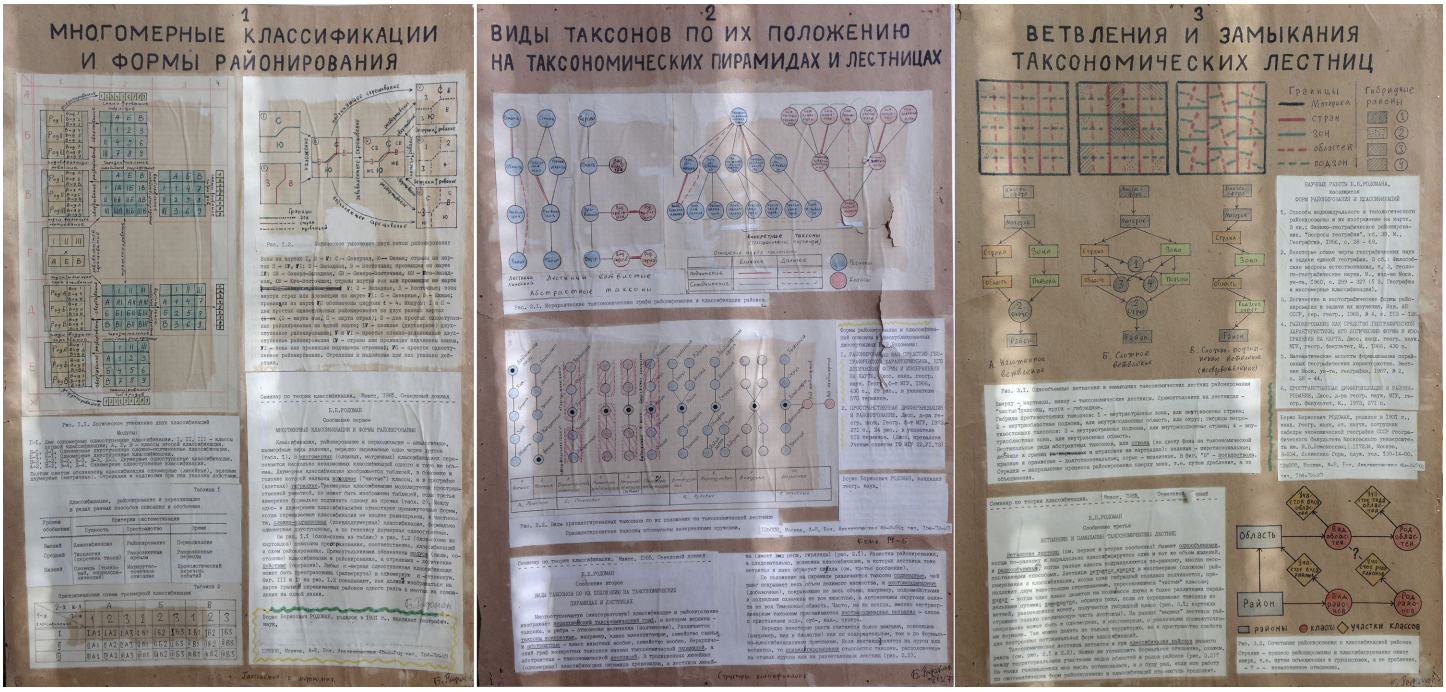
Tatiana Voronets, Evgenia Shvets, Victor Saxon, Vladimir Yasenovsky, and Alexei Yamoldin (under the direction of Dmitry & Nadezhda Zamyatin), "Graph of the Yuryevets Geographical Image [образ] (Ivanovo Region)," 1999. Paper, printer, 63 × 46 cm. Translated by Nikolay Smirnov. Copyright: Dmitry Zamyatin, Evgeny Alekseev, Tretyakov Gallery.

of meta-geography:

> Meta-geography is an interdisciplinary area of knowledge, which resides at the conjunction of science, philosophy, and art, and studies possibilities, conditions, methods, and discourses of geographical thinking and imagination … Meta-geography deals with the problematics of patterns and specifics of mental distancing from specific experiences of perceiving and imagining space.[24]

These experiences in "mental distancing" produce images/imagoes of space that are not only visual but that also work through the imagination and enact bodily experience.

In the 1990s, Zamyatin produced "conceptual maps" representing images/imagoes of places. Here the mental image becomes the main object of study. For example, the conceptual map "Graph of the Yuryevets Geographical Image [образ] (Ivanovo Region)," which Zamyatin produced collectively with others, tries to reveal the more or less "objective" images/imagoes associated with the Russian town of Yuryevets: those that exist persistently in the mass consciousness and which are stable and repetitive in the process of interacting with the geographical object.



Boris Rodoman, “Geo-grammatics Tryptich,” 1979. Left: “Multidimensional Classifications and Forms of Regionalization.” Middle: “Taxon Types by their Position in Taxonomic Pyramids and Ladders.” Right: “Branching and Locking of Taxonomic Ladders.” Mixed media, each 60 × 42 cm. Copyright: Boris Rodoman, Museum of Russian Geographical Society.

Nadezhda Zamyatina, Zamyatin’s wife and colleague, subsequently continued these attempts to develop a methodology for an “objective” study of the geographical image/imago. Zamyatina used population surveys and statistical and mathematical methods to account for the various components of the geographical image/imago. With this approach it was possible to explore the geographical images/imagoes that exist in different social strata at the psychological and abstract level, and which are represented in various communication channels and media. In general, this approach is close to certain Western studies of geographical representations, such as Kevin Lynch’s famous 1960 book *Image of the City*.

Dmitry Zamyatin, in turn, increasingly departed from the scientific and rational methodologies for working with image/imagoes. The imagination has occupied an increasing role in his practice. Paradoxically, essay writing has become his main method for creating geographical images/imagoes. Zamyatin clarifies this practice: “In general meta-geography mixes various textual traditions: artistic, philosophical, and scientific; the genre of the essay has become very important as it allows for stating and interpreting meta-geographical problems in the freest possible manner.”[25]

Following this logic, Zamyatin’s work has increasingly focused on the conflicts between and hybridization of different systems of representing space, as well as direct study of the space of imagination. Imagination is at the center of “spaciography,” a practice in which Zamyatin creates confrontations between the Western cartographic system and Eastern gestural-calligraphic experiences of space. In this series, Zamyatin takes maps of Russian cities made in the typical style of the modern period—which for him is associated with the Cartesian, Western, “rational” method of charting space—and scrawls a black pseudo-calligraphic form that almost appears to deface the original image. The radical appearance of the form represents a kind of struggle for identity. Thus, he contrasts and merges two systems of imagining space, asserting the hybrid West–East, or Eurasian, identity of Russian spaces.

This interpretation of meta-geography is postmodernist in nature and has apparent postcolonial connotations because it declares the fundamental multiplicity of all possible spaces, and champions “alternative” spaces—the kind that could be characterized as “other.” Zamyatin explains the connection between representations of reality, mental diagrams, and sociology as follows: “Meta-geography suggests that mental diagrams, maps, and images of ‘parallel’ spaces exist and coexist with representations of reality that sociologically dominate during a certain epoch.”[26]

On the one hand, this postmodernist understanding of meta-geography leads to the “classic” postmodernist, deconstructive, and progressive conclusion about geography: all geographical space is “invented” and constructed. And it is evident now that geographical images/imagoes and representations have always

impacted the adoption of concrete spatial solutions—not only artistically speaking, but also politically and socially.

But it is also important to remember that these constructivist, postcolonial efforts can bring not only emancipation and the discursive "birth" of other spaces, but also dangerous consequences of excessive and noncritical strategic essentialization. The danger in such cases is that essentialism can become "sacred" in and of itself. Discursive emancipation can then slide into a real confrontation among different geo-cultures.

III. Meta-geography as a Tool of Navigation

From a critical deconstructive point of view, meta-geography is a specific conceptual framework that illuminates our perceptual "packaging" and understanding of space. This framework is shaped by culture and history, so we should speak of not one but many meta-geographies, of a map of meta-geographies, of dominant meta-geographies, and so forth. In this sense, meta-geography has the potential to become a tool for power in its effort to manage space: controlling both meta-geography and physical space is key to commanding political power. However, the work of Rodoman and Zamyatin analyzed here provides a basis for establishing meta-geography as a discursive, rather than a managerial or control-based, tool.[27]

Soviet and post-Soviet traditions of meta-geography have today given way to new understandings of meta-geography. These can be found most vividly in books like *The Myth of Continents: A Critique of Metageography* by American geographers and historians Martin W. Lewis and Kären Wigen, and *Deny Anarchic Spaces and Places: An Anarchist Critique of Mosaic-Statist Metageography* by Xavier Oliveras Gonzáles, a geographer from Barcelona.[28]

When it has become clear that any space is a construct, a product of the imagination, we can speak of different kinds of spaces, write their histories and anthropologies, learn to navigate them. In this context, meta-geography can act as a tool for navigation through existing representations of space. Indeed, the political significance of navigation today is hard to overestimate. Most people take the space where they live for granted, failing to realize its nature or origin; they do not have the tools to navigate—or more importantly, to change—their spatial and mental environment. In the process of mapping, a key question arises: What kinds of subjects, and which "truths," are produced by specific spaces and images? Navigation here means orienting oneself within these different spaces and semantic structures, increasing one's knowledge of their constructed—and changeable—nature.

Today, the map precedes the territory; geographical images produce spaces, places, and social processes, influencing techniques of governance. Images have become not only representations of various meta-geographies, but their very field. That is, the image field has itself become, in a material sense, the space within which it is possible and necessary to navigate.

X

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1
We can differentiate between the image as an inner, cognitive reality, and the image as an external, reified representation. The first is closer to the notion of "idea" or even "archetype." Let's call it: image/imago. The second can be one of the possible reifications/externalizations of the first. In short, the image/imago is available only to its creator/carrier/visionary/medium, until they represent it somehow to others. The notion of the image/imago has roots in Neoplatonism and in Orthodox iconography and Hesychasm, which is a mystical tradition of contemplative prayer.

2
Dmitry Zamyatin, *Meta-geography: Space of Images and Images of Space* (Agraf, 2004), 512.

3
Henry Corbin and Gilbert Duran were post-Jungian theoreticians and participants in Eranos, an intellectual society dedicated to humanism.

4
With this in mind, we can recall the theory of reflection that Lenin developed in his 1909 *Materialism and Empirio-criticism* , according to which "the mastery of nature manifested in human practice is a result of an objectively correct reflection within the human head of the phenomena and processes of nature, and is proof of the fact that this reflection (within the limits of what is revealed by practice) is objective, absolute, eternal truth." Vladimir Ilyich Lenin, *Collected Works* (Lawrence & Wishart, 1962), 190.

5
American geographer William Bunge coined the latter term in his book *Theoretical Geography*, which was translated into Russian at 1967.

6
Veniamin Gokhman, Boris Gurevich, and Yulian Saushkin, "Some Basic Problems of Meta-geography," *Report to the 7th Congress of the Regional Science Association International* , The Hague, 1967.

7
V. Gokhman, B. Gurevich, and Y. Saushkin, "Problemy metageografii" (Problems of Meta-geography), in *Matematika v ekonomicheskoi geografii* (Mathematics in Economic Geography), vol. 77 (1968): 3. Here and below, all translations from Russian-language sources are by the author.

8
Boris Rodoman, *My Geographical Cartoids* (2016), 61. Saushkin declared Rodoman to also be one of the founders of theoretical geography in the USSR, pointing to the latter's pioneering early work of the 1950s, especially "Methods of Individual and Typological Regionalization/Zoning and their Depiction on the Map" (1956). According to Rodoman, "Explaining what theoretical geography is means setting out the contents of meta-geography. And taking a detached view of meta-geography means talking about meta-meta-geography." Boris Rodoman, *Meta-geography* (Oikumena Publishers, 2007), 97.

9
Rodoman, *My Geographical Cartoids* , 57.

10
Rodoman, *My Geographical Cartoids* , 57. While "Polarized Biosphere" is the title by which this cartoid is most commonly known, Rodoman gave it a second title—"A Networked Polarized Landscape"—to provide a more precise scientific description of the diagram.

11
Rodoman, *My Geographical Cartoids* , 57.

12
Boris Rodoman, *Polarized Biosphere* (OECUMENE, 2002), 12.

13
See →.

14
Rodoman, "Landscape-Geographical Bionics," in *Collected Articles* (OECUMENE, 2002), 63–64.

15
Consider Rodoman's remarks on the crucial role of personal, empirical, bodily interaction with the landscape: "Travels were the main source of my theoretical models." Rodoman, "My Line in Geography," in *Areas and Networks: Essays of Theoretical Geography* (OECUMENE, 1999), 249.

16
Rodoman, "My Line in Geography," 63.

17
Boris Rodoman, "Logical and Cartographic Forms of Regionalization and their Study Objectives," *Soviet Geography*, no. 6 (November, 1965): 3–20.

18
Richard Brook Cathcart, "Improving the Status of Rodoman's Electronic Geography Proposal," *Speculations in Science and Technology* 9, no. 1 (April, 1986); Cathcart, "Seeing is Believing: Planetographic Data Display on a Spherical TV," *Journal of the British Interplanetary Society* , vol. 50 (1997). Cathcart notes that the "electronic geography of Rodoman" has been partially implemented by NASA.

19
Rodoman's explanation of "Ski Routes around Moscow," in preparation for the exhibition "Meta-geography: Space – Image – Action," New Tretyakov Gallery, Moscow, 2015–16.

20
Boris Rodoman, *Seasonal Rhythms in my Life: Problems of Theoretical and Humanitarian Geography* (Russian Research Institute of Cultural and Natural Heritage, 2013), 24.

21
At the April 2019 conference "Navigation Beyond Vision," held at HKW in Berlin and organized by e-flux, HKW, and the Harun Farocki Institute (which gave rise to this issue of *e-flux journal*), Kod wo Eshun shrewdly pointed out this peculiarity of Rodoman's cartoids. He also compared them to diagrams created by W. E. B. Du Bois for a 1900 exhibition in Paris—diagrams that depicted the social position of African Americans. Compared to photography, which shows its object as a "natural fact," the diagram portrays the flows of power that construct the subject. The theorist Alexander G. Weheliye recently wrote about this in his "Diagrammatics as Physiognomy: W. E. B. Du Bois's Graphic Modernities," *CR: The New Centennial Review* 15, no. 2 (Fall 2015): 23–58.

22
Rodoman, "My Line in Geography," 243.

23
See Vladimir Kagansky, *Cultural Landscape and Soviet Habitable Space* (New Literary Review, 2001).

24
Dmitry Zamyatin, "Meta-geography: On the Way to Co-emplacement," in *Meta-geography: Space – Image – Action* , exh. cat. (New Tretyakov Gallery, 2015).

25
Zamyatin, "Meta-geography," 21. The activity of the Center for Humanitarian Studies, formed and headed by Zamyatin at the Russian Research Institute of Cultural and Natural Heritage, was important in this process between 2004 and 2013, as were several meta-geographical research expeditions carried out by Zamyatin jointly with the Vasiliy Golovanov, Andrey Baldin, and Rustam Rakhmatullin. It can be argued that in the 1990s and 2000s, it was this circle that developed the postmodernist understanding of meta-geography as an "images of space and the space of images."

26
Zamyatin, "Meta-geography," 27.

27
In 2015–16, Kirill Svetlyakov, Dmitry Zamyatin, and myself mounted the exhibition "Meta-geography" at the New Tretyakov Gallery in Moscow. This exhibition understood meta-geography as an interdisciplinary tool for navigating representations of space in art, science, and everyday life.

28
Martin W. Lewis and Kären Wigen, *The Myth of Continents: A Critique of Metageography* (University of California Press, 1997); Xavier Oliveras Gonzáles, *Deny Anarchic Spaces and Places: An Anarchist Critique of Mosaic-Statist Metageography* (The Anarchist Library, 2010) https://theanarchistlibrary.org/library/xavier-oliveras-gonzalez-deny-anarchic-spaces-and-places-an-anarchist-critique-of-mosaic-statis.lt.pdf .

Oraib Toukan

Toward a More Navigable Field

Palestinian self-representations seemed to recognize the power and speed of the reproduction of images from very early on. This is evident in the photographs by Sulafah Jadallah and Hani Jawharieh of Palestinian refugees-turned-resistance-fighters in the 1960s; in Mustafah Abu Ali, Khadijeh Habashneh, and the Palestine Cinema Institute's transnational network of films in the 1970s; in Sliman Mansour and Ismail Shammout's paintings reproduced into posters, calendars, and book covers across the Arab World in the 1980s; and among many others.[1] The years of the Palestinian revolution (1968–82) not only represent the heyday of international and student activism for and within Palestine,[2] inter-revolutionary friendship films, and politico-aesthetic battles between Marxist-Leninist movements.[3] They were also an overall moment of total faith in the power of the silver halide compound to name a struggle.

Every new image of Palestine may begin to appear "something-like," though not quite, but rather "similar-to" the last addition to an inventory—now a pile—of "Palestinian Images."[4] And for every image that's been created, a chain of image-fragments can potentially be found in many bits, on many hard drives all over the world.[5] "It's a very crowded place," wrote Edward Said in 1986, regarding the space of representations of Palestine, "almost too crowded for what it is asked to bear by way of history or interpretation of history."[6] In fact, Said impeccably referred to Palestinians as "the image that will not go away":

> To the Israelis, whose incomparable military and political power dominates us, we are the periphery, the image that will not go away. Every assertion of our non-existence, every attempt to spirit us away, every new effort to prove that we were never really there, simply raises the question of why so much denial of, and such energy expended on, what was not there?[7]

This "pile" of "Palestinian Images," that was propelled by collective Palestinian consciousness to devictimize the image of the refugee, was eventually replenished by cruel images dehumanizing the Palestinian into someone who is "telegenically dead."[8] In an essay on the 2014 war on Gaza, Sherene Seikaly proposed that Palestine is itself as *archive*: an archive and "the archiving of moments of destruction and uprising, death and life, of loss and accumulation."[9] Seikaly's writing conjures a flow of repeating and continually reappearing images of colonization and decolonization in the Palestinian time-space since the 1930s. These are images that Ariella Azoulay has also instrumentally slowed down in order to advocate for the individual civil claims that these photographs actually contain.[10] A civil language of photography itself, one that begins to more valuably find the perpetrator that photographs of suffering so often

Oraib Toukan, When Things Occur, 2016. Film still, single-channel video, 28'00"

conceal.

But rather than crying out, pictures that emanate from Palestine increasingly point to a question: "What exactly can't you see in what I am seeing?" (or, put another way: *What the fuck can't you see in this?*).The Palestinian story is as much a story of decolonization, civil strife, and massive injustice as it is about how best to show an injustice that feels like it cannot be seen. And so here lies a quandary: a disjunction between what feels like overrepresentation of the Palestinian subject, and a genuine frustration with an inability to *see* that subject. A dark, nondescript woman keeps reappearing on our screens. She is holding her chest in pain over some extreme loss, and is somewhere under siege in Gaza, occupied in the West Bank, obscured inside Israel, or exiled in a refugee camp in Lebanon, Syria, or Jordan.[11] The original Sontagian claim that "too many" images of suffering anesthetize viewership can help explain this paradox of being represented while also not being seen, but this assertion has been exhausted, and is in any case a theoretical dead end. The problem persists, no matter how many cruel images[12] have been scrolled over: Palestinians have remained a people in struggle no matter how many systems of separations have been created to dissolve that struggle.

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The two quotations from Edward Said above come from *After the Last Sky*, a 1986 book comprised of text by Said and photographs by Jean Mohr (John Berger's long-time collaborator). The book borrows its title from a line in a 1983 poem by Mahmoud Darwish: "Where should we go after the last frontiers / Where should birds fly after the last sky / Where should plants sleep after the last breath of air?"[13] Both Darwish's poem and Said's book resonate with an image of sheer exhaustion that comes from not having been able to find an appropriate aperture opening, one that will need to find still more depth beyond the last sky. "The road forward is blocked," Said writes, "the instruments of the present are insufficient, we can't get to the past."[14]

In photography, depth of field is the spatial distance between the nearest and farthest subjects that are perceived to be in acceptable focus. This image of sheer exhaustion, from not being able to find an appropriate aperture opening, that Said and Darwish engage and stir up, seems like a depth of field stuck between the nearest and farthest points of its subject: the erased past and blocked future. In 2017, the Palestinian collective Subversive Films translated, interpreted, and published instructional notes by the Palestinian revolutionary cinematographer Hani Jawharieh, handed over to them by Hani's wife, Janet Jawharieh.[15] Hani Jawharieh was a member of the Palestine Film Unit, a collective of image makers that originally operated out of a

kitchen-turned-darkroom in Amman, Jordan in 1967. Yasser Arafat was said to have once hid in this darkroom, and Sulafah Jadallah, one of the collectives' key photographers—who is otherwise a little-known and almost obscured Palestinian photographer—was said to have paid its rent.[16] Eventually the collective was instituted into the network of the Palestine Liberation Organisation in Beirut, and Jawharieh died for its mission in 1976 while filming combat in Ain Toura, Lebanon.[17] Looking through Jawharieh's manuscript, one is reminded of how important focus and clarity are to the process of decolonization. Images of resistance strive for clarity in all its forms: clarity of status, clarity of message, clarity of focus. The aim of images of resistance *is* to be as evidentiary and as clear as one can possibly be with a sign. This remains the case even when the circumstances of filming (quick decision making, unpredictable movement, night filming, etc.) provide for anything but precision, along with more modest technical capabilities that work against the grain of focus.[18]

Jawharieh coherently lays out the standard simple formula for increasing the clarity of an image when he writes: "Increasing the depth of field will increase the clarity of elements."[19] But more importantly, he specifies and warns: "subjects that are nearer or further from the point we wish to focus on will appear entirely out of focus."[20] The precaution signals that anything outside of the nearest and farthest subject in view will fall into the circle of confusion—into a complete blur. However, it is exactly *in* this circle of confusion that awareness can happen. It is in the indecipherable, in the point of total abstraction of a figuration, where one can transcend representation all together, *into* a sphere of political consciousness. And in turn, it is in *navigating* across the various planes of a micro, hyper-visual field at the level of the pixel-grain, in an almost haptic quality (when it *feels* like it can be touched and in tu----rn becomes touching), where one can begin to fathom injustice.[21] Grasp it, by finally understanding it as violent. It is only after I retroactively alter an image's resolution and zoom in, that I can truly grasp just how organised and rigid its resolution is, and how harsh that grid can be. That is the point at which I begin to comprehend just how co-optable the picture of suffering can be, and how it can seamlessly turn into an efficient instrument of fear by the perpetrator—into a one-for-all deterrent—like a cruel trophy of war.

In a beautiful homage by the late painter and physicist Vladimir Tamari written from Tokyo some forty years after Jawharieh's passing, Tamari mentions that Jawharieh once worked in an optical shop in Jerusalem, where they both grew up. He describes that the shop had a white plaster bust of Mahatma Gandhi wearing glasses in its window, and how it's owner, Elia Adranly, shared long-winded theories to them on the effect of the Earth's rotation on winds.[22] This is not far from the way in which Jordanian vocalist Yazan Al Rousan once recounted a theory in passing to me on the sound of the spin of the earth, which can only be heard the second the earth stops spinning. It is much like the groan of a refrigerator that can only be heard once the fan stops spinning. This is not to say that cruel images can only be approached through analogy, but rather that navigating *outside* of the optical sphere, into the grain of a pixel, might be the beginning of filling in for a sight that we have yet to see, much like a sound we have yet to hear.[23] It's an intentional distortion of a visual field that outdoes representation altogether by moving the optical into the navigable, in order to reach what is beyond or after Said and Darwish's "Last Sky."

What's more, the loss of figuration to the point of abstraction liberates cruel images from their impulse to be understood via resemblance and the colonial gaze. That is, the inclination of relating the image of a dead person of color to the white male body of Christian European art history—the outcry that results from pictures of naked, tortured detainees that get accompanied by "a shock of recognition" with the male body of a Hellenistic Sculpture as initially described by Eisenman in *The Abu Ghraib Effect* (or in Viennese Actionism as discussed by Boris Groys).[24] Or, the shock of resemblance of a protestor raising the Palestinian flag at a certain angle at a border protest to escape Gaza's "open-air-prison"[25] to Liberty herself holding the flag in Delacroix's painting of 1830.[26] (This is not unexpected, as resemblance or likeness are part and parcel of the definition of an image, but are, arguably, irrelevant).

The problem with this navigational field is that it can be limited to "pure-thought." This is much like the way Daniel Buren explains color, in that the extent of its abstraction is not utterable.[27] (Let alone illustrated herewith via two-dimensional pictures). Consider color reproduction systems like the Pantone monopoly in categorizing what *should* be seen in any particular color as opposed to "actually" seeing, for example, Pantone 18-4334: Mediterranean Blue. But seeing from *within* that extreme proximity to an image, when colors begin to mesh into webbed hues, can propel a viewer into a field of knowing—via *seeing* a totality. This kind of seeing constitutes a visual literacy, a self-emancipatory type of knowing, that begins with grasping images by understanding them past their representational signs. This is not a call to abstract the image of violence incurred on a people—much like Facebook's arbitrary and sometimes ridiculous warning blurs of videos with violent content[28] —but rather to understand cruel images by diving even deeper into their vertical extreme, and moving across them as grids. This is different to what Etienne Balibar calls "an extreme visibility of violence" in a global topography of cruelty.[29] Or the performed, high-res, networked dimension of violence in Donatella Della Ratta's Syria in *Shooting a Revolution* (2018). It is also different to Forensic Architecture's practice of excavating images to tune into *criminal* evidence emanating from their "stratigraphic layers."[30]

So, what is a knowing through seeing that which is indecipherable? In Kayfa ta's *How to Mend: Motherhood and its Ghosts* (2018), Eman Mersal considers the picture of motherhood from all its angles. She takes the hidden fetus in an ultrasound image as one such angle: "something like a butterfly, like a worm, a tiny beast" in a sea of oceanic waves, declared to be the womb.[31] But what comes after viewing a "lone fetus" or "dark hole" is a knowledge by way of revelation—and a knowledge that comes without doubt. She notes that the mediator, the transducer in the ultrasound device is known in Arabic as the *misbar* (): "the *sounder*, because 'It sounds out, reveals, and makes plane.'"[32] Mersal considers why exactly it is that we cannot "find" mothers on the flip-side of this image, in portraits of them, in evidence of them. Put differently, and in a perspective that presupposes my original question on the Palestinian quandary, why is it that we cannot *see* a subject in an image of that subject? For Mersal, knowledge is a sheet, a curtain, or a drape: a veil of something that we often cannot see, don't want to see, are unable to see (or care to see?). "Isn't knowledge—as per the dictum of early medieval Arab mystic al-Niffari—a veil?" she argues.[33]

Kashf in Sufism unveils knowledge in order to reach a consciousness (not unlike the English word *dis-* cover) . But what ensues is subjective certainty: a seeing of that which was actually, probably known prior to viewing.[34] Though writing from an entirely different analytical space, James Bridle critiques, but also privileges, abstraction as key for thinking through computational opacity and complexity, in claiming:

> We don't and cannot understand everything, but we are capable of thinking it. The ability to think without claiming, or even seeking to fully understand is key to survival in a new dark age because, as we shall see, it is often impossible to understand.[35]

As of yet, there is no built-in function in consumer screen devices that allows a user/layperson/amateur to truly navigate an image. One must save it, and reopen it in order to vertically dive into the tender cracks and fissures of a cruel image—of any image for that matter—to look into its resolution. It almost feels like an ethical imperative that such a functionality should exist. But the excesses of capitalism and its reciprocal relation from the onset to image-making has worked to override the details of cruel images.[36] Precisely because it's in the details that a revelation can happen. The scrolling function on phones, laptops, and tablets has perfectly propelled capitalism forward, and so stopping to try to navigate the close details of injustices from 1 meter or 1000 kilometers away nominally ruptures the flow of cruel images that are otherwise scrolled over, viewed in haste, or shared in despair.[37] In and of itself, navigation changes the pace and manner at which single images are being viewed; think of it as an occupational break in thumb soreness from continually scrolling through content—a slight remedy for "texting thumb," or what used to be called "Nintendo thumb."

Departing from Harun Farocki's remark before his passing in 2014 that "computer-animated, navigable images constitute the twenty-first century's 'ruling-class of images,'" and therefore demand a different kind of analysis,"[38] Doreen Mende formulates a crucial theoretical question. She asks: "What *could* be a political image-practice of the 21st century for questioning the principle of navigation that updates, calculates, and incorporates the frame excessively and continuously into the image-making process?"[39] Navigation as paradigm acknowledges the collapse of a viewing and of an experience into one, but its theoretical appeal lies in the pressure navigation puts on the singular, static, representational frame.[40] This is because navigation seemingly strides over the boundary of the single image, surpasses it. And so even when it undeniably feels like images—and the central place in the complex worlds we live in that Farocki vitally revealed—have seemingly walked out of themselves to map and model us in one,[41] we cannot say goodbye to the representational frame until we step out of aspect-ratio. Until then, the sealed and shielded, self-enclosed boundary of a single image will always be governed by the meeting of two-lines. The single pixel, the smallest viewable element of a digitized image epitomizes this, if not turning into the archetype of the sovereignty, almost devouring character, of the frame and the world it contains.[42] And so, no matter how many image frames will be rendered to make up ever more complex systems of the model-worlds we have come to inhabit—that James Bridle draws out—a perpetually supressed consciousness will always lie in that rim and in the world that it represents. As do the lips of history, and history as it has already been represented. Clarity of status, or clarity and its lack thereof, *lies* in that frame.

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In 1917, the American photographer and educator Paul L. Anderson (who wrote and set a precedent for several books on the techniques of photography) criticized photographers that strive too much for clarity, concluding:

> They have convinced themselves that they actually do see objects as sharply as does the anastigmat, though in point of fact this is a physical impossibility ... many of this school, in their passion for extreme sharpness, stop down to F/45 or F/64—even, in some cases, to such absurd stops F/128 or F/256 believing that by so doing they are improving definition . But in this instance, as in the former, they are deceiving themselves, for it should be noted that stopping down to improve definition cannot be continued indefinitely.[43]

Anderson dwells at length on camera mechanics, interweaving his opinions on the size of a camera's F-stop (aperture, as a measurement of the size of the lens opening in relation to focal length) or focal length itself (the distance between the lens and the subject in focus on a film or image sensor). He notes: "if a lens is of too great a focal length it will often be found difficult, by reason of the size of the studio or the configuration of the landscape*, , to get far enough away to include all that is wanted*."[44]

In April 2018, Yasser Murtaja was targeted and killed by Israeli forces while filming historic protests in Gaza not far from Israeli perimeters.[45] Murtaja was a known drone enthusiast, who along with his childhood friend Rushdi Sarraj, formed a film collective in 2014 called *Ain Media*, which pioneered top-down photography and videography over the Gaza strip. When a lens is perpendicular to the plane of the subject it is filming, it is called "God's-eye-view" in English, as if the ensuing recording is all-encompassing and devoid of a point-of-view. The word *ain* in *Ain Media* means eye in Arabic and resonates with this point-of-view, or "bird's-eye-view," but is also a play on the ever-present, surveilling "eye" over Gaza.[46] (The region's residents reportedly live with the constant humming sound of Israeli military drone surveillance over what amounts to a 40 km long strip of land). The collective's first drone was a hand-me-down from a visiting, "left-leaning" Canadian digital media film crew, who left a Phantom 3 behind for the collective in 2014.[47] Two weeks before Murtaja's death, he posted an aerial shot that the collective took of Gaza city and wrote: "I crave the day I can take this shot from the air and not from the ground...I am 30 years old. I live in Gaza, and I've never traveled!" Following his death, moving condolences addressed him in the second person, making clear that he traveled, and traveled the farthest skies.

X

Image courtesy of the author.

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1
See Nadia Yaqub, *Palestinian Cinema in the Days of Revolution* (University of Texas Press, 2018), and Dan Walsh's personal collection, digital archive, and life-long interest in Palestine Poster Project http://www.palestineposterproject.org/ .

2
See Rasha Salti and Kristine Khoury's remarkable research, project, and publication *Past Disquiet: Artists, International Solidarity, and Museums in Exile* that departed from the 1978 International Art Exhibition for Palestine in Beirut.

3
For now, notwithstanding the spectacular televised hijacking of five aircrafts to a small landing strip in Jordan in 1970, aka "Dawson's Field."

4
The title of a 1976 publication by the Palestine Cinema Institution of Hani Jawharieh's works of Palestinian Fedayeen following his death; similarly, the book title subheading *Palestinian Lives* of E dward Said's photo-book *After the Last Sky;* or, simply, a 2019 Google Image search of the same search words: "Palestinian Images."

5
This paragraph revisits a forward I wrote in the catalog for the exhibition "Palestinian Political Posters" from the collection of George Michael Al Ama and Saleh Abd Al Jawad, curated by Inass Yassin, December 2013: *Political Posters* , exh. cat. (Birzeit University 2014).

6
Edward W. Said, *After The Last Sky* (Faber and Faber, 1986), 4.

7
Said, *After The Last* Sky, 42.

8
From Benjamin Netanyahu's infamous wording to CNN during the 2014 war on Gaza: "They want to pile up as many civilian dead as they can. They use telegenically dead Palestinians for their cause. They want the more dead, the better" https://theintercept.com/2014/07/21/netanyahus-telegenically-dead-comment-original/ . See also Ozge Ersoy and Bikem Ekberzade with Thomas Keenan, *tel·e·gen·ic* (PRODUCE 2, 2014) https://issuu.com/oersoy/docs/spot_produce_telejenik_eng_son .

9
Sherene Seikaly, "Gaza as Archive," in *Gaza as Metaphor*, eds. Helga Tawil-Souri and Dina Matar (Hurst and Company, 2016), 228.

10
If not actively contributed to finally writing the Palestinian struggle as a *civil* rights movement. See Ariella Azoulay, *The Civil Contract of Photography* (Zone Books, 2008).

11
Iman Mersal has positively analyzed that same mother (the oft-discussed "Palestinian women" in the region), calling her the "instrumental" mother but one who turns into a "standardized mother" precisely because she keeps reappearing in images. This is the point at which she argues that "all Palestinian mothers become a single Palestinian mother," in Iman Mersal, *How to Mend: Motherhood and Its Ghosts* (Kayfa Ta and Sternberg Press, 2018), 66.

12
See my "Cruel Images," *e-flux journal* , no. 96 (January 2019) https://www.e-flux.com/journal/96/245037/cruel-images/ .

13
Cited in *After the Last Sky*, 2. The poem is "The Earth Is Closing In on Us," and was published in Darwish's magazine *Alkarmel* in November 1984.

14
As quoted in the Palestine Poster Project archive https://www.palestineposterproject.org/poster/after-the-last-sky-a-festival .

15
Subversive Films, *The Syllabus* (2017), 2. An art project in the form of printed matter that was commissioned by Tirdad Zolghadr for the 5th Riwaq Biennale, and later co-commissioned and expanded by Lara Khalidi. Jawharieh's notes were most likely written sometime in the 1970s. Subversive Films writes that though the manuscript is seemingly devoid of "revolutionary context," its fascination lies in its use as a teaching tool-set.

16
Interview with Salah Abu Hanud in Amman Jordan by artist Ala Younis, January 2012, when we found the earliest works of this group among discarded and newly categorized reels that belonged to a former Soviet cultural center in Amman.

17
Supplement to Subversive Films, *The Syllabus* .

18
Subversive Films and the Egyptian collective Mosireen cowrite and expand on such circumstances in a printed compendium of their respective syllabi.

19
Subversive Films, *The Syllabus*, 10.

20
Subversive Films, *The Syllabus*, 33.

21
Impelled by Laura U. Marks thesis of the haptic in *The Skin of the Film: Intercultural Cinema, Embodiment and the Senses* (Duke University Press, 2000).

22
Vladimir Tamari, "Remembering My Friend, Hani Jawhariyyeh," *Jerusalem Quarterly* , no. 67 (Autumn 2016): 19–27.

23
Or, like the exact moment the stage curtain falls and crashes on the ground in René Pollesch's recent play *Cry Baby*. Here, a long white bedroom drape forms the background of the entire play until it crashes and falls, and one realizes the copious depth still left to the Deutsche theatre. The farthest visible point to us as spectators is now a black sheen drape hung in folded layers with ever more dimensionality.

24
Eisenman sets out to inquire why exactly this is so, why his anger at Abu Ghraib's image of torture and suffering was "accompanied by a shock of recognition" with "treasured sculpture's and paintings from a distant past," in Stephen F. Eisenmann, *The Abu Ghraib Effect* (Reaktion Books, 2007), 11.

25
Ilana Feldman, "Gaza: Isolation," in Helga Tawil-Souri and Dina Matar (eds.), *Gaza as Metaphor*, Hurst and Company, 2016), 95-101.

26
As picked up by many on social media, news media agencies then chose to screen grab Laleh Khalili's twitter post: '"Holy shit what an image: '13th attempt to break the Gaza Blockade by sea.' Photo by Mustafa Hassouna (Andalou Agency for Getty)," https://twitter.com/lalehkhalili/status/1054833479937126400 .

27
Buren states: "For me, colour is pure thought, and therefore completely inexpressible, *every bit as abstract as a mathematical formula or a philosophical concept* ," (italics my own), quoted in Anna McNay, "Daniel Buren: Comme Un Jeu d'Enfant / Like Child's Play, Work In Situ," *Studio International* , September 2014, http://www.studiointernational.com/index.php/daniel-buren-like-childs-play-work-in-situ-review-musee-d-art-moderne-strasbourg .

28
Which would be to depoliticise them, or to kill them as images, and as per social media's arbitrary offshore decision making on what it deems as imagery too violent to be viewed. See Norman Finkelstein and his battle with *youtube* removing a tribute to Yaser Murtaja as inciting violence in https://mondoweiss.net/2018/04/youtube-sensational-incitement/ .

29
In Etienne, Balibar, "Outlines of a Topography of Cruelty: Citizenship and Civility in the Era of Global Violence, " in *We, the People of Europe? Reflections on Transnational Citizenship* (Princeton University Press, 2004).

30
From Gilles Deleuze's analysis of Foucault's *Archaeology of the present (1969)* which forms a crucial understanding for their work and which runs across Forensic Architecture's work, as practice.

31
Iman Mersal, *How to Mend: Motherhood and Its Ghosts* (Kayfa Ta and Sternberg press, 2018), 82.

32
Mersal, 80.

33
Mersal, 88.

34
Or "that which is *implicitly* known," as put by Oztürk, Ridade in "Sufism in Cinema: The Case of *Bab'Aziz: The Prince Who*

Contemplated His Soul ," *Film-Philosophy* vol. 23, issue 1 (2019): 55-71. Thank you also to Haytham El-Wardany for an email conversation with me on *Kashf*.

35
James Bridle, *New Dark Age: Technology and the End of the Future* (Verso Books, 2019), 6.

36
From the earliest assertions in Walter Benjamin's writing, to Ariella Azoulay and Hito Steryl among others.

37
See also Doreen Mende's decisive analysis on the slowing down of images via navigation in her lecture: "The Navigation Principle: Slow Image," https://www.e-flux.com/video/176025/e-flux-lectures-doreen-mende-the-navigation-principle-slow-image/ .

38
e-flux, Harun Farocki Institute, and Haus der Kulturen der Welt, " *e-flux journal* and Harun Farocki Institut present: 'Art After Culture: Navigation Beyond Vision' at Haus der Kulturen der Welt," https://www.e-flux.com/program/255383/e-flux-journal-and-harun-farocki-institut-present-art-after-culture-navigation-beyond-vision-at-haus-der-kulturen-der-welt/ .

39
Doreen Mende, introduction to the conference "Navigation Beyond Vision," HKW, Berlin, April 2019.

40
" *e-flux journal* and Harun Farocki Institut present: 'Art After Culture: Navigation Beyond Vision' at Haus der Kulturen der Welt."

41
As argued by Bridle in *New Dark Age* .

42
In other words, it's actually that singular image frame that is hosting *us* in its womb.

43
Paul L. Anderson *Pictorial Photography: Its Principles and Practice* (first published https://archive.org/search.php?query=date:1939), the quotes are taken from: Paul L. Anderson, *The Technique of Pictorial Photography* (J.B. Lippincott Company, 1939).

44
Anderson, *Pictorial Photography*, my italics.

45
The protests were dubbed "The Great March of Return," leading up to Nakbah Day in May, which marks the year of Palestinian expulsion. See https://www.theguardian.com/global-development/2018/apr/09/yasser-murtajas-last-video-footage-protests-soldiers-black-smoke .

46
As told to me by Rushdi Sarraj in conversation; see also: Atef Abu Saif's diary, *The Drone Eats With Me* (Beacon Press, 2016).

47
As told to me by Rushdi Sarraj.

Tom Holert

Ships in Doubt and the Totality of Possible Events

The Planetary Sensorium

Elicited by an elliptical remark from the late Harun Farocki about the relation between filmic montage and the visual economy of computer games,[1] a particular question has began to loom ever larger to myself and a few others: To what extent and to which consequences is the visual culture of the present, and thus, arguably, the present itself, caught in the paradigm of navigation?

With this question in mind, I am repeatedly stopped in my tracks in front of pictures that circumstantially unveil themselves to me in different ways than before. Take the so-called *Madonna of the Rose* (1529/30), a painting by Parmigianino.

The Dresden *Madonna* is a perfumed, sticky, and disorienting scene of sexual innuendo set in an environment of turbulent fabric.[2] The mother–child relationship depicted here is one of reciprocal arousal in the knowledge of a viewer's presence, with a built-in sense of oedipal inevitability. Arguably more Venus and Amor than Madonna and Jesus, the young woman doesn't seem to know where to place her hands. Meanwhile the boy, naked, with his genitalia ostentatiously exposed, somehow—by threading his hand between the woman's breast and upper arm—produces the *rosa mystica* of Christian iconography. The Madonna's eyes are painted almost closed, in an intriguing mix of piety and ecstasy.

The flower's scent, more than its visual splendor, seems to catch Maria's/Venus's sleepy attention. Sight and smell are ambitious artistic tasks to represent as coexisting in one pictorial space. Both sensorial registers contribute to the respective individual's sense of being situated in (or indeed *navigating*) a specific environment. As this environment happens to be a painting's fictional realm, the issues of anthropological affordance and visual representation become endlessly intertwined. How does a painting place what it shows in space?

In the case of Parmigianino's *Madonna of the Rose* it is hard to tell where the viewer is supposed to direct her gaze, as everyone in the picture seems somewhat distracted and out of role. While Maria/Venus appears to be guided by her olfactory sense, Jesus/Amor, awkwardly languishing across the picture's lower parts, is busy multitasking. Not only is he planting the rose in the composition's golden section and thus, tacitly, showing off his geometric savvy, he is also—with big eyes and blond curls—flirting with the viewer.

What first caught my navigational attention on this visit to the Old Masters Picture Gallery in Dresden was the boy's indulgent engagement with the planetary in the lower-right corner of the painting. Parmigianino, always fond of spheres (as in his well-known 1523/4 *Self-Portrait in a Convex Mirror*, which he painted on a vaulted piece of

detail of Parmigianino, Madonna of the Rose (Madonna della Rosa), 1529/30, oil on canvas, 109 × 88.5 cm, Old Masters Picture Gallery/Gemäldegalerie Alte Meister, Staatliche Kunstsammlungen Dresden, photo: Wikimedia Commons/Public Domain.

poplar wood), placed a cartographic globe in this painting both as the masturbatory toy of a (precocious) child and a symbol of power and geographic knowledge. Without even looking at what his left hand is doing, the boy caresses the globe's renditions of the oceans, continents, and coastlines of Europe, Africa, and Asia. Seen and touched in this way, the toy globe appears as an erogenous zone entirely, an object sensitive to sexual stimulation.

Is it ready to be penetrated by the sun, as Georges Bataille suggests in "Solar Anus," his 1927/1931 mythopoeic-cosmogonic copulation fantasy on planet earth's untold sex life?: "From the movement of the sea, uniform coitus of the earth with the moon, comes the polymorphous and organic coitus of the earth with the sun. The terrestrial globe is covered with volcanoes, which serve as its anus."[3]

Of course, Bataille's geo-porn resonates strongly with ecological debates that preceded and followed it, and which have been relayed through feminist and queer concerns until today.[4] The initial reason to write "Solar Anus" was, among other things, Bataille's interest in parodying Descartes, Hegel, romanticism, and surrealism in their different attempts to fuse Ego and the (cosmic, transcendental) whole.[5] The text thus aims at a radical heterogeneity against what Bataille had learned, with Nietzsche, to despise as a tendency towards celebrating union and identification in Western thought. The scenes of orgasmic convulsion, copulation, digesting, and vomiting in "Solar Anus" function as anti-anthropomorphist envisionings of an exuberant heterogeneity featuring nonhuman protagonists and their relationships. The earth's surface is perceived as a living organ with its particular affordances for those who want to move across it and enter its orifices. The peculiar ecological, seismological, and geological concerns of Bataille's text could inform a kind of navigational imaginary which takes

Parmigianino, Madonna of the Rose (Madonna della Rosa), 1529/30, oil on canvas, 109 × 88.5 cm, Old Masters Picture Gallery/Gemäldegalerie Alte Meister, Staatliche Kunstsammlungen Dresden, photo: Wikimedia Commons/Public Domain.

seriously the specific sensitivity and sexuality of the planet and its astronomical surroundings.

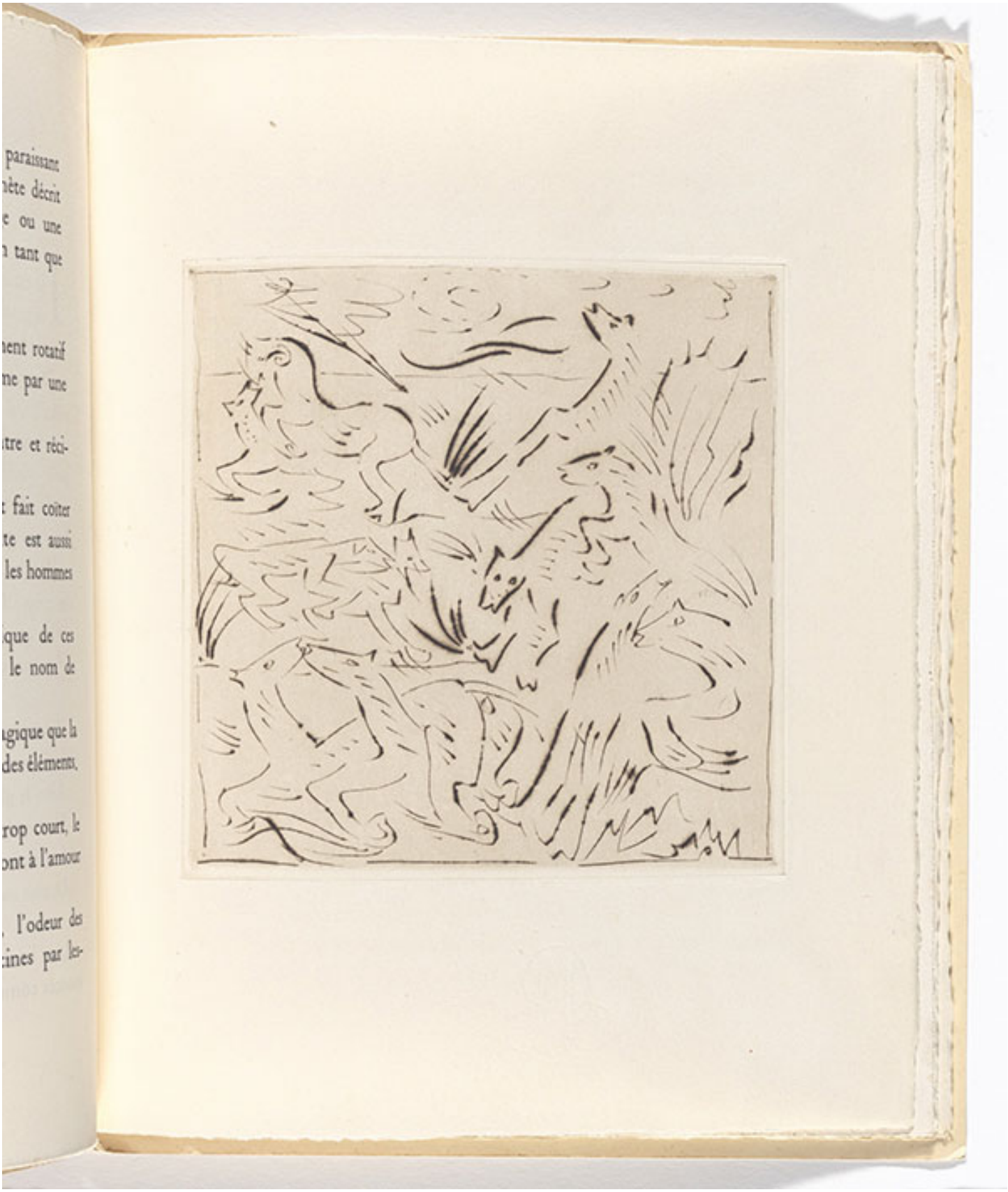
Gesticulating in a System of Mutually Relative Positions

In a similar, yet certainly also very different way, Parmigianino's painting suggests that finding orientation should be conceived as a fundamentally tactile, sensuous, nonvisual matter (and, considering the pedophilic gaze impelled by the picture, a rather disconcerting one too). The boy's hand, more than his vision, is the navigational device par excellence. It also serves as a precedent for another infamous hand of a boy with "a passion for maps" some four centuries later. Charlie Marlow, the narrator of Joseph Conrad's 1899 *Heart of Darkness*, recalls his childhood dreams of "blank spaces on the earth." "And when I saw one that was particularly inviting on a map," Marlow muses, "I would put my finger on it and say, 'When I grow up I will go there.'"[6] Both hands, first in the sixteenth-century painting and then in the turn-of-the-twentieth-century novel, point to an evolving set of protocolonial, colonial, and neocolonial gestures that continue to inform geopolitical visual cultures. The hand is used as a scaling device, allowing one to literally touch the cartographic representations of often vast geographical areas, thereby making available an individual bodily experience of exploration, travel, and possession. In the mind deformed by colonialism, the touching of the map anticipates the grabbing of the land.

Interestingly, Immanuel Kant made a compelling argument for the significance of the particular role that hands and dexterity, rather than cognition and calculation, play in spatial coordination and orientation in his early, 1768 treatise "Von dem ersten Grunde des Unterschiedes der Gegenden im Raum" (a title that has been translated either as "On the First Ground of the Distinction of Regions in Space" or as "Concerning the Ultimate Ground of the Differentiation of Directions in Space"):

> No matter how well I may know the order of the compass points [Die Ordnung der Abtheilungen des Horizonts], I can only determine regions [Gegenden] according to that order only in so far as I know towards which hand this order proceeds; and the most complete map of the heavens, however perfectly I might carry the plan in my mind, would not teach me, from a known region, North say, on which side to look for sunrise, unless, in addition to the positions of the stars in relation to one another, this region were also determined through the position of the plan relatively to my hands. Similarly, our geographical knowledge, and even our commonest knowledge of the position of places, would be of no aid to us if we could not, by reference to the sides of our body, assign to regions the things so ordered and the whole system of mutually relative positions.[7]

With Kant's "whole system of mutually relative positions" in mind, Parmigianino's ballet of dislocated hands in the *Madonna of the Rose*, as with many of his other paintings, could be reconsidered as a multivectorial, multidirectional space—a space that is constantly transforming and being transformed by numerous corporeal extremities moving, gesticulating, touching, caressing in a multiplicity of directions and with varying degrees of intensity. Moreover, the relationality of bodies and "regions" that Kant suggests propels his text into the realm of certain contemporary arguments around embodiment and situatedness in feminist, queer, black, postcolonial, indigenous, and other intersectional studies and activism. Guided by thinkers such as Donna Haraway, Denise Ferreira da Silva, Linda Tuhiwai Smith, Kim TallBear, and Zoe Todd, the onto-epistemological stakes of a politics of knowledge that critically opposes Cartesian-Kantian dualist notions of subjectivity and cognition inevitably involve the critique of violence with regard to space and geography. Attending to



André Masson, Plate (folio 5) from Georges Bataille, L'Anus solaire, Paris: Editions de la Galerie Simon (Daniel-Henry Kahnweiler), 1931.

the place-based extinctions of First Nation peoples, the urban geographies of race and segregation, or the public-private spatialities of sexual and anti-black violence, all of which are very much part of the present political debate, it is evident to what extent bodies, geographies, and knowledges are bound up in assemblages of violence and force. Hence, Kant's "reference to the sides of our body" and to the "whole system of mutually relative positions" should be read in the knowledge of what Denise Ferreira da Silva has called the philosophical (Cartesian, Kantian) elevation of "the formal (as the pure or transcendental) to that moment that is before and beyond what is accessible to the senses," because it is only in this moment that "the mind [is] comfortable dealing with the sort of objects—numbers and geometrical forms—which it can handle without reference to space-time."[8] As Ferreira da Silva's formulation suggests, the epistemic violence of abstraction inherent in Western rationalist philosophy is also always to be considered as a physical "handling" of numbers and forms. And it is here, at this junction of form(alism) and force, that a critical notion of navigation gains traction.

Hodological Escapes

In the past two decades of the twenty-first century, the role of haptics and the body in relation to the orientation and movement within (and by way of) images has been discussed at great length in another area of expertise: the corresponding realms of academic game studies and commercial game development. Harun Farocki became interested in these theories of increasingly immersive, interactive, and algorithmized image technologies through his last realized project, *Parallel I–IV* (2012–14). Especially influenced by a reading of Alexander Galloway's 2006 *Gaming: Essays on Algorithmic Culture*, the project made him think about the navigability and actionability of continuous gamespace in relation to more traditional filmic narration by way of montage.[9]

Without attempting to summarize ongoing debates since the turn of the century around embodiment, navigation, and gamespace,[10] I would like to point to a particular moment in these theorizations, namely the recent revisitation of the work of Kurt Lewin (1890–1947). In the 1920s and '30s, this social and child psychologist's dynamic field theory of "psychobiological" vectorizations and orientations proposed a post-Euclidian and post–Gestalt Theory approach to analytically spatialize individual and group dynamics. Lewin's notion of "topological psychology," synthesized in a monograph on its "principles" published in 1936,[11] three years after he had sought exile in the States, proved to be of particular interest to those game studies people who were looking for ways to understand the particular ludic engagement and involvement that games demand from (and offer to) their users/players.[12]

Thinking of the above quote by Kant, it is interesting how the notions of "region" (*Gegend*) and "field" coalesce in Lewin's writings and in the numerous diagrams he inserted on the printed page. They participate in an algebraization of psychological geometry, a shift "from objects to processes, from states to changes of state,"[13] that is conceived as one towards "topology."

Following Lewin, the topological operates both inside and outside the psychobiological entity, be it a person or a group. The forces, drives, desires, interests, ambitions, pains, and pleasures of an individual constitute a constantly transforming, hypermobile, and relational process-architecture made of said regions and the changing positions occupied by the person within and towards them. Change in a person (or in a group) is always also a change in the tectonics of its spatiality, a test of the endurability or accessibility of its "barriers" and "boundaries," a redirecting of its "locomotions" and "forces," and thus a rescaling of the topological environment as a whole. This all occurs on top of the background of "a totality of possible events" that Lewin calls "life space."[14] Space as such becomes expanded and potentialized, since

> from the point of view of mathematics there is no reason to limit the number of dimensions to three. The progression to spaces of *n* dimensions is possible without difficulty. Mathematics deals also with spaces whose number of dimensions is different at different points. It might seem enticing to psychology to make free use of the possibilities which the introduction of a more complicated space or of a space of many dimensions would offer.[15]

On a different plane, in another dimension altogether, Lewin's concept of topology is also ready to take into account the restrictive dimensions of lives organized and policed by social and economic forces that contribute to the reaching of the plenitude of the "life space." Thus Lewin was interested, for example, in studying the topology of punitive confinement, such as prisons, as well as pondering the effects of prohibitions caused by class affiliation and geopolitical position:

> There is a difference in freedom of movement between different classes and conditions even where they are legally equal. The rich man generally has much greater freedom of movement because of his means. He can take a special train or an airplane in order to reach his destination quickly. The poor man may have legally exactly the same rights as the wealthy one, but what is much more important for him is the fact that his social dependence and the task of supplying himself with the immediate necessities of life, such as his daily food, narrow down his freedom

logische Richtung R_{ab} bestimmt als Anfangsdifferential des Weges $a\,b$, obschon die *Euklid*ische Richtung R_{ab} nahezu die entgegengesetzte ist. In einem Labyrinth von der in der Abb. 22 wiedergegebenen Form entspricht der Richtung R_{ab} der Pfeil in a. Die Richtung im hodologischen Raume stimmt in diesen Fällen also sehr gut mit jener Richtung zusammen, die psychologisch tatsächlich für eine Person besteht, die das Labyrinth hinreichend gut kennt.

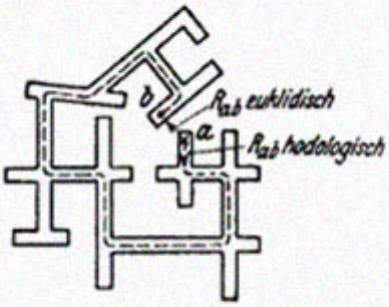


Abb. 21.

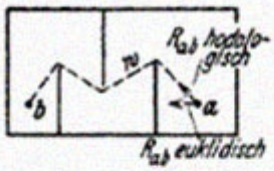


Abb. 22.

Euklidische und hodologische Richtungen.

Für eine genauere Betrachtung der Eigentümlichkeiten des hodologischen Raumes gehen wir zunächst auf den einfachsten Fall ein: Das

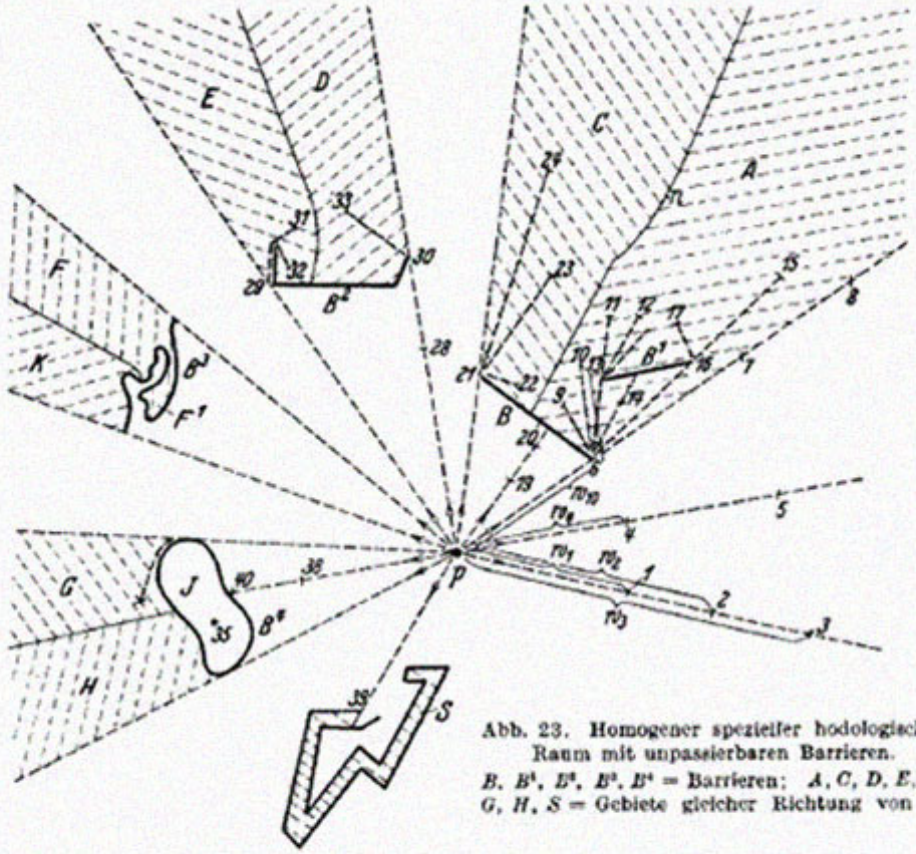


Abb. 23. Homogener spezieller hodologischer Raum mit unpassierbaren Barrieren.
B, B^1, B^2, B^3, B^4 = Barrieren; A, C, D, E, F, G, H, S = Gebiete gleicher Richtung von p.

Feld mag in bezug auf die in Frage kommende Wegart funktionell *homogen* sein. Das heißt: sofern das Feld überhaupt passierbar ist, soll die betreffende Lokomotion in jeder Richtung und in jedem Punkte

A page from Kurt Lewin's "Der Richtungsbegriff in der Psychologie: Der spezielle und allgemeine Hodologische Raum," Psychologische Forschung 19, no. 3–4 (1934).

> of movement to a much greater extent … One of the most important goals of domestic and foreign politics is to change the space of movement of a single person or of a group. At the same time it is one of the essential means of reaching a political goal. Political struggles as well as struggles between individuals are nearly always struggles over the boundary of the space of free movement.[16]

Reading movement in close regard to political economy, class politics, and the politics of migration may have been as topical in the global 1930s as it is today; however, Lewin's crucial contribution to the conceptualization of a politics of mobility and pathfinding lies in the grounding of his theory of topology in a notion of the "hodological space." The term "hodology" derives from the Greek *hodos*, meaning "path," and continues to be used in fields as diverse as geography, neuroscience, psychology, and philosophy.[17] In a 1934 article on the "concept of direction in psychology," Lewin asks what qualities a space would have "in which the direction *Dab* is defined as initial differential of the distinguished path [ausgezeichneter Weg] from *a* to *b*." He would label such a non-Euclidian space "hodological."[18] Without going into any detail here, it might suffice to say that for Lewin the hodological space is the space of the "distinguished path," a path that is mathematically overdetermined by what is happening in the regions that are being traversed and by what is changing for the individual due to the inner and outer states she's passing through. Lewin repeatedly returns to the case of the escaping prisoner to exemplify the specificities of the hodological. In this choice, he emphasizes that the path/direction is guided by a sense of and longing for freedom, and thus by a *political* desire.

Cinematic Path-Finding

Never directly drawing on the terminology of navigation, which became more common in behaviorist studies only a decade or so later (largely elicited by Norbert Wiener's introduction of the nautical concept-metaphor of cybernetics in the 1940s), Lewin nonetheless partakes in an early instance of what might be called a navigational turn. This turn, in turn, expands across a wide field of concerns, experiences, and knowledges—from psychology to mathematics, politics, and notably, film (and which was so strikingly palpable in the conference that *e-flux journal* and the Harun Farocki Institut organized in Berlin in April 2019). Lewin's relationship to cinema took many directions in addition to his use of a film camera in the 1920s to record children's behavior for research and demonstration purposes. Like his colleague Wolfgang Köhler,[19] Lewin was also read by Sergei Eisenstein, collaborated with Russian psychologist Alexander Luria, and met the polymath-director when the latter visited Berlin in 1929.[20] Eisenstein was particularly eager to learn more about Gestalt psychology and to find material for his theory of cinematic expression and the immersive involvement of the spectator by means of filmic montage. There are several connections to be found between Eisenstein's project of a cinematic method of involvement and mobilization and Lewin's field theory and vectorial psychology,[21] but only a few direct traces.

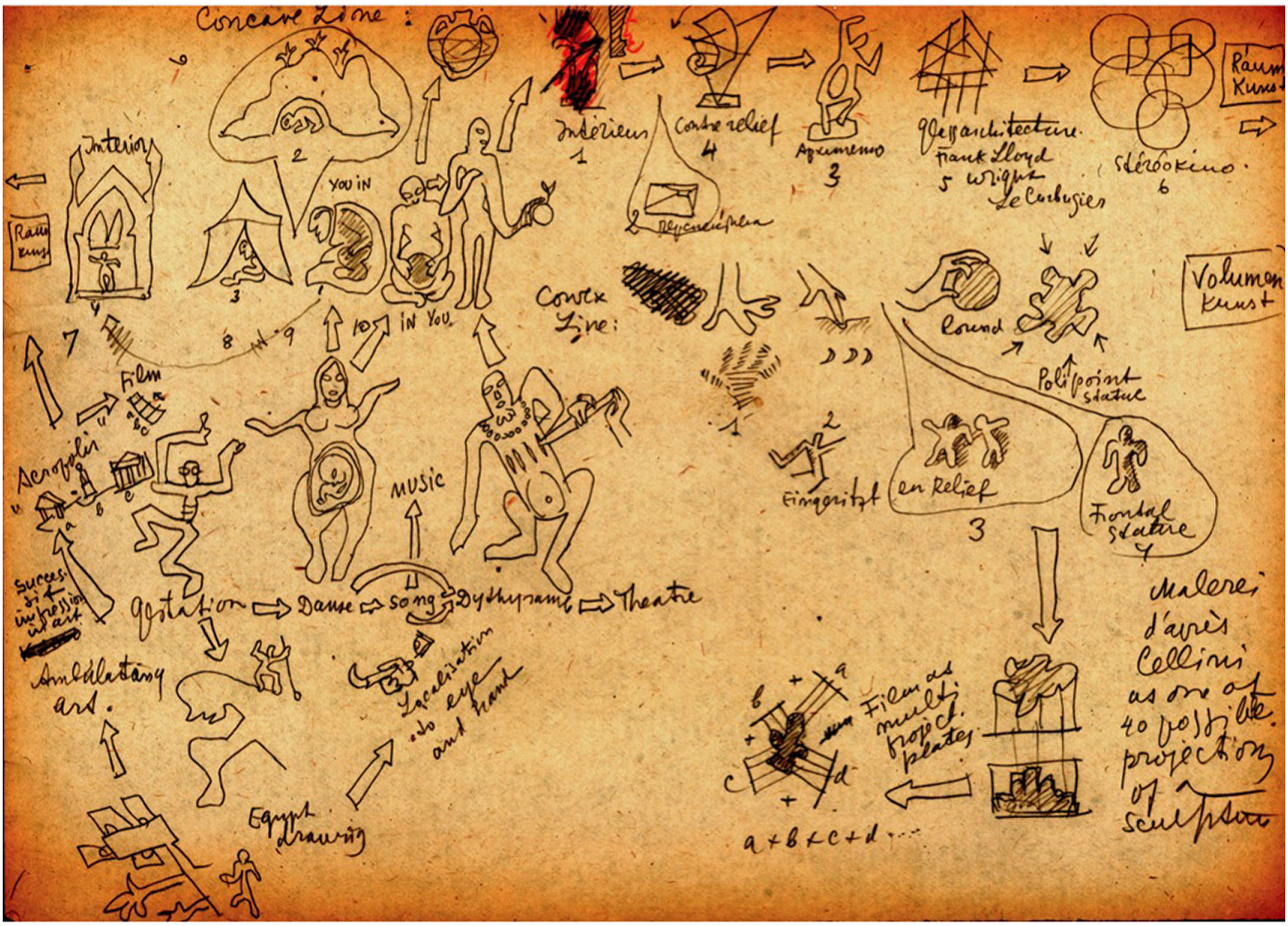
A somewhat unexpected introduction of the hodological dimension ("the word path") can be tracked in a singular drawing from Eisenstein's huge compendium *Notes for a General History of Cinema* from the mid-1940s.[22] With this tableau, Eisenstein tried to picture what he considered the entirety of cinematic practices, covering a vast geographic and historical area of pictorial and ritual activity. As suggests media scholar Antonio Somaini,

> what emerges from this drawing is once more the conviction, shared by Eisenstein and Warburg, that the history of images and artistic forms should be approached through montage. Montage here becomes an instrument of orientation, like a map, within a history of artistic forms that would otherwise remain an intricate labyrinth.[23]

In the lower-left corner of the drawing, Eisenstein represents an instance of what he denotes, writing in English, as "ambulatory art," that is, an art of or by walking. The drawing refers to visual and artistic practices in which bodily motion through space, drawing, and mapping interlace and interact, for instance in the art of Japanese artists such as Hokusai, who performed "the 'running around' an object … with the hand," as Eisenstein writes in his *Notes*, amid reflections on drawing and haptics in the history of art.[24]

Tellingly, considering the notion of "ambulatory" art, the term "path" had accrued a particular meaning in Eisenstein's film theory writings of the later 1930s. In a paragraph from a text on "Montage and Architecture" from around 1938, without making explicit reference to Lewin's "hodological space," Eisenstein nevertheless seems to make use of the concept:

> [When talking about cinema], the word path is not used by chance. Nowadays it is the imaginary path followed by the eye and the varying perceptions of an object that depend on how it appears to the eye. Nowadays it may also be the path followed by the mind across a multiplicity of phenomena, far apart in time and space, gathered in a certain sequence into a single meaningful concept; and these diverse impressions pass in front of an immobile spectator.[25]



Sergei M. Eisenstein, from his book Notes for a General History of Cinema, 1945–46. Russian State Archive of Literature and Art (RGALI), Moscow.

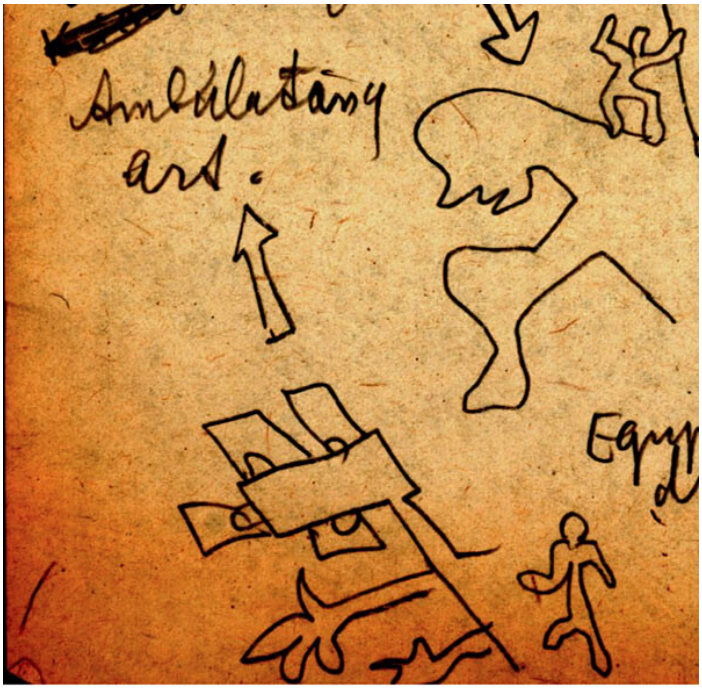
Eisenstein's canny articulation of cinema and path, that is of image and orientation, of the visual and the kinetics of following a path, is one road to follow in the project of identifying points of mutation, of paradigmatic shifts towards the navigational condition of the present. Emphasizing motion and searching for Eisenstein was key in reconsidering the interlaced spatialities of built and filmed environments, with the ultimate aim of arriving at an expanded notion of the viewer's attention and involvement. On the other hand, Eisenstein still posits an "immobile spectator" for whom a "single meaningful concept" has to be produced. More forward-looking may be his thought of "a path followed by the mind across a multiplicity of phenomena, far apart in time and space."

Here, Eisenstein anticipated the mobilization of cognition and perception that has long since become an important asset of cognitive capitalism's mode of valorization. Pathfinding and searching, like modeling and mapping, are crucial activities of involvement and survival in an age that is characterized by constant localization and orientation, by being tracked and mined. This age could be dubbed, if it weren't so corny, the age of the navigational self. This self, this subject-type, may be "immobile" like Eisenstein's spectator, but it is most definitely impelled 24/7 to leave a trace and produce itself as a moving target to be navigated.

Ariadne's Thread and the Dionysian Mindfuck

Moving back and forward simultaneously from gamespace to paths through cinema and montage, I, figuring as another of those navigational selves, discovered Parmigianino's *Madonna of the Rose* painting anew when I came to Dresden for a conference on Friday, May 24 of this year. This date fell just a couple of days before the 2019 European Parliament elections—the prospect of which provoked a massive "#FridayForFuture" demonstration, part of the movement against climate catastrophe organized since 2018 by students throughout Europe.

Elections and protests, environmentalism, future-thinking



Detail of Sergei M. Eisenstein's drawing connected to the Notes for a General History of Cinema (1945-46), Russian State Archive of Literature and Art (RGALI), Moscow.

on different scales (Europe, the planet), the legacies of colonialism, the presence of new strands of decolonial thought, how all of these could be seen as interlaced with the navigational condition—these thoughts were constitutive of the mood in which I encountered the painting. Any framing of the dexterity of Parmigianino's Jesus/Amor in terms of colonialism, or rereading it from a needed feminist navigational perspective, could be rejected as utterly far-fetched in its anachronism. However, the painting's brushstrokes intimate that navigation equals the caressing and potential penetrating of terrestrial topography and geology. This particular framing of the terrestrial condition is, following Bataille, orgasmic, eruptive, and ejaculative:

> The terrestrial globe is covered with volcanoes, which serve as its anus. Although this globe eats nothing, it often violently ejects the contents of its entrails ... The earth sometimes jerks off in a frenzy, and everything collapses on its surface. The Jesuve is thus the image of an erotic movement that burglarizes the ideas contained in the mind, giving them the force a scandalous eruption.[26]

Fittingly, in sight of the disturbingly sexualized representation of a navigator/Jesus provided by Parmigianino's painting, Bataille, without any connection to the *Madonna of the Rose*, uses the name "Jesuve" (or "Jésuve" in French). The term is a portmanteau of his invention that contracts Jésus and Vésuve, but also Vénus, the Cartesian " *je suis*," and the " *sève*," the sap of Dionysos.[27]

Bataille's Jésuve is also an (anti-)epistemological concept, the "image" of a terminally sexualized and violated rationality. It is, quite bluntly, the philosophical figure of a mindfuck. Under the tutelage of Jésuve, orientation is deemed to be in an eternal crisis. Rather than finding one's way out of the labyrinth of human existence and non-knowledge, the Jésuvian mindfuck is supposed to keep the subject firmly, if ecstatically, inside the primordial maze of ancient mythology extended into the present of Bataille's battle with enlightened rationality. The Dionysian, a-cognitive dimension of the mindfuck, tangible also in Parmigianino's painting's epistemological reflection on sight and touch, sensuousness and topography, (dis)orientation and desire, tends to subvert any pathfinding effort.

On the other hand (and, considering all that has been said above, the trope of the hand is chosen here with caution), let's consider the role of Ariadne in the Dionysian narrative. The quintessential mythological pathfinder, the daughter of king Minos from Crete, provided a man, Theseus, a warrior from Athens, the means to escape her father's labyrinth (which was built by the enslaved engineer-architects Daedalus and Icarus) after Theseus had killed her half-brother, the Minotaur. Having helped Theseus find his way out of the Minoan labyrinth, Ariadne finds herself in a diasporic, exilic state, abandoned both by her family and her alleged lover—on a beach. In Evelyn De Morgan's 1877 painting *Ariadne in Naxos*, Parmigianino's *Madonna of the Rose*, and particularly her abundant, featherlight draperies, appear to have been teleported into a Pre-Raphaelite environment. Here, lavishly posing on pre-touristic sands, Ariadne contemplates the futile deployment of a thread to guide the object of her desire (Theseus) out of what they both perceived as the carceral architecture of the Cretan ruler and his monster. Although the operation was successful, Ariadne seemed to have lost everything; in her attempt to outwit the labyrinth, she fooled herself. Despite her best efforts at tactile navigation, providing Theseus with a thread made most likely by a woman's hand, the labyrinth persisted—if in unexpected ways.

Meeting (and falling for) Dionysos and his entourage in despair might have made Ariadne reevaluate the situation. For in a Dionysian perspective, a labyrinthic existence[28] becomes desirable in itself. In fact, the maze proves to be the actual paradoxical place to be in order to escape the determinating placedness of one's existence—to escape what Gilles Deleuze in his 1962 *Nietzsche and Philosophy* called "method": "Method in general is a means by which we avoid going to a particular place, or by which we maintain the option of escaping from it (the thread of the labyrinth). 'And we, we beg you earnestly, hang yourselves

Evelyn de Morgan, Ariadne in Naxos, 1877, oil on canvas, 90.8 × 132.8 cm, The De Morgan Foundation and the De Morgan Collection, Watts Gallery Estate, Guildford, Surrey, United Kingdom, photo: The De Morgan Foundation.

with this thread!'"[29]

By disqualifying method and by privileging disorientation against the enlightened desire for accountability and placement, Deleuze thus points to the fundamental pointlessness of navigation, as the aim should be *to never reach a destination*. He also draws on Nietzsche's sexist assumption about the deadliness of Ariadne's thread (only good to commit suicide with). Instead of navigating, Deleuze recommends voyaging to a rigorously non-navigational landscape. Deleuze's epistemological advice amounts to a thinking against orientation and into the labyrinth as well as other "extreme" places and times. In *Nietzsche and Philosophy*, Deleuze implores his post-existentialist, neo-Nietzschean, and future post-structuralist readership to reach

> the height of summits and caves, the labyrinths; midday-midnight; the halcyon aerial element and also the element of the subterranean. It is up to us to go to extreme places, to extreme times, where the highest and the deepest truths live and rise up. The places of thought are the tropical zones frequented by the tropical man, not temperate zones or the moral, methodical or moderate man.[30]

Notwithstanding the voluntaristic Ubermensch disposition operative in such lines, the navigational doesn't simply vanish at Nietzsche's or Deleuze's will, as much as they are both frantically working at refuting a goal-directed understanding of navigation. Casting a Dionysian spell might not suffice here. For one, how does one reach the "extreme places" if not by navigational means? Ariadne certainly arrived at one of those extreme places when landing on Naxos, where Dionysos pursued her, frighteningly, with his chariot pulled by tigresses. But this experience didn't leave her in disorientation and distress, much to the contrary. As Ovid and others report, after he had persuaded her to marry him, Dionysos made Ariadne the ultimate navigational wedding present if there was ever was such a thing: "Have the sky for your gift: there you'll be gazed at as a star; / you'll often guide ships in doubt, as the Cretan Crown."[31]

By attaching Ariadne to the sky and thus elevating her from the material terrestrial ground, Dionysos also devaluates the crucially embodied nature of her navigational knowledge. The myth of Ariadne, a mainstay of feminist literature and theory,[32] is an example of how men successfully appropriate women's contribution to

salvage and social cohesion in order to support their own interests and careers. Disembodiment has proven to be one of the successful strategies resulting in gendered power asymmetries, yet with regard to navigational knowledge and skills, a (changing) set of phenomenological theorizations of embodied orientation and sensorially diverse modes of pathfinding, mapping, and modeling has remained comparably strong.

This gesture also could be read as an acknowledgment of Ariadne's achievement as a mediator of navigational technology and methodology. Amid all the Dionysian turmoil and the god's penchant for deterritorialization, equipping the bride with the features of a stellar body that guides "ships in doubt" is paying tribute to the epistemological and existential need for orientation, to the entanglement of knowing and surviving.[33]

X

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1
See the editorial of this issue and, for one example, my "Meshed Space: On Navigating the Virtual," in *Myths of the Marble*, exh. cat. eds. Milena Hoegsberg and Alex Klein (Sternberg Press, 2017), 95–112.

2
The *Madonna of the Rose* is a later work by an artist who was called "the little one from Parma" and whose actual name was Girolamo Francesco Maria Mazzola. Parmigianino died young, in 1540, at thirty-seven. But he lived long enough to build a reputation as a pioneer of eccentric Mannerist painting and draftsmanship. Famous for his courtly, flattering portraits of noblewomen and noblemen, but even more so for his anatomically daring *figurae serpentinatae* in rel igious paintings such as the notorious 1534/35 *Madonna with the Long Neck* , Parmigianino was also an accomplished eroticist.

3
Georges Bataille, "Solar Anus," in *Visions of Excess: Selected Writings, 1927–1939* , ed. and intro. Allan Stoekl, trans. A. Stoekl with Carl R. Lovitt and Donald M. Leslie, Jr. (University of Minnesota, 1985), 7.

4
See, for example, Eric Robertson, "Volcanoes, Guts and Cosmic Collisions: The Queer Sublime in *Frankenstein* and *Melancholia*," *Green Letters* , 18, no. 1 (2014): 63–77; Patrick Ffrench, "Bataille's Nature: On (Not) Having One's Feet on the Ground," in *Georges Bataille and Contemporary Thought* , ed. Will Stronge (Bloomsbury, 2017), 33–49; Nigel Clark and Kathryn Yusoff, "Queer Fire: Ecology, Combustion and Pyrosexual Desire," *Feminist Review* 118, no. 1 (2018): 7–24.

5
See, for example, Leslie Anne Boldt-Irons, "Bataille's 'The Solar Anus' or the Parody of Parodies," *Studies in 20th Century Literature* 25, no. 2 (2001): 354–74.

6
Joseph Conrad, *Heart of Darkness* (1899) (Dover Publications, 1990), 5–6.

7
Immanuel Kant, "Von dem ersten Grunde des Unterschiedes der Gegenden im Raum" (1763), quoted from Peter Woelert, "Kant's Hands, Spatial Orientation, and the Copernican Turn," *Continental Philosophy Review* 40 (2007): 139–50, 142.

8
Denise Ferreira da Silva, "1 (life) ÷ 0 (blackness) = ∞ – ∞ or ∞ / ∞: On Matter Beyond the Equation of Value," *e-flux journal* 79 (February 2017) https://www.e-flux.com/journal/79/94686/1-life-0-blackness-or-on-matter-beyond-the-equation-of-value/ .

9
See Harun Farocki, "Computer Animation Rules," lecture IKKM Weimar, July 7, 2014 https://ikkm-weimar.de/publikationen/video-audio/ikkm-lectures/computer-animation-rules/ .

10
Which would also mean retelling an epic battle between the "narratologists" and the "ludologists" launched by game scholars Gonzalo Frasca, Jesper Juul, and others. See, e.g., Gonzalo Frasca, "Simulation versus Narrative: Introduction to Ludology," in *The Video Game Theory Reader* , eds. Mark J. P. Wolf and Bernard Perron (Routledge 2003), 221–35; Jesper Juul, *A Clash between Game and Narrative: A Thesis on Computer Games and Interactive Fiction* , 1999 http://www.jesperjuul.net/thesis/AClashBetweenGameAndNarrative.pdf ; Jesper Juul, "Games Telling Stories? A Brief Note on Games and Narratives," *Game Studies* 1, no. 1 (July 2001) http://gamestudies.org/0101/juul-gts/ .

11
Kurt Lewin, *Principles of Topological Psychology* , trans. Fritz and Grace M. Heider (McGraw-Hill, 1936).

12
See, e.g., Stephan Günzel, "Die Realität des Simulationsbildes: Raum im Computerspiel," in *Die R ealität der Imagination: Architektur und das digitale Bild* , ed. Jörg H. Gleiter (Bauhaus-Universität, 2008), 127–36 (also https://doi.org/10.25643/bauhaus-universitaet.1317); Steffen P. Walz, *Toward a Ludic Architecture: The Space of Play and Games* (ETC Press, 2010).

13
Lewin, *Principles of Topological Psychology* , 16.

14
Lewin, *Principles of Topological Psychology* , 16.

15
Lewin, *Principles of Topological Psychology* , 194.

16
Lewin, *Principles of Topological Psychology* , 46–47.

17
See, e.g., David Turnbull, "Maps Narratives and Trails: Performativity, Hodology and Distributed Knowledges in Complex Adaptive Systems—an Approach to Emergent Mapping," *Geographical Research* 45, no. 2 (June 2007): 140–49; and Dominic H. ffytche and Marco Catani, "Beyond Localization: From Hodology to Function," *Philosophical Transactions of the Royal Society B* , no. 360 (2005): 767–79. (No mention of Lewin in either text though.)

18
Kurt Lewin, "Der Richtungsbegriff in der Psychologie: Der spezielle und allgemeine Hodologische Raum," *Psychologische Forschung* 19, no. 3–4 (1934): 249–99, 265.

19
See, e.g., Katja Rothe, "Mimesis als Sozialtechnik: Kurt Lewin, der Film und die Nachahmung," *Archiv für Mediengeschichte* 12 (2012): 127–36.

20
See Oksana Bulgakowa, "Sergej Eisenstein und die deutschen Psychologen," in *Herausforderung Eisenstein* , ed. Oksana Bulgakowa (Akademie der Künste der DDR, 1989), 80–9.

21
See, e.g., Pia Tikka, *Enactive Cinema: Simulatorium Eisensteinens* (University of Art and Design Helsinki, 2008), 127–28 https://core.ac.uk/download/pdf/80710802.pdf .

22
I owe the knowledge of this drawing to Elena Vogman and Antonio Somaini.

23
Antonio Somaini, "Cinema as 'Dynamic Mummification,' History as Montage: Eisenstein's Media Archaeology," in Sergei M. Eisenstein, *Notes for a General History of Cinema* , eds. Naum Kleiman and Antonio Somaini, trans. from Russian by Margo Shohl Rosen, Brinton Tench Coxe, and Natalie Ryabchikova (Amsterdam University Press, 2016), 94.

24
Eisenstein, *Notes for a General History of Cinema* , 200.

25
Sergei Eisenstein, "Montage and Architecture" (c. 1938), intro. Yve-Alain Bois, *Assemblage* 10 (D ecember 1989): 110–31, 116.

26
Bataille, "Solar Anus," 8.

27
For a Lacanian reading of Bataille's neologism, see Albert Nguyên, "Bataille 'Le Jésuve,'" *L'en-je lacanien* 10 (2008): 47–79.

28
Arguably anticipating the "labyrinthcity" of a "neo-baroque" present, see Angela Ndalianis, *Neo-Baroque Aesthetics and Contemporary Entertainment* (MIT Press, 2004).

29
Gilles Deleuze, *Nietzsche and Philosophy* (1962), trans. Hugh Tomlinson (Alhlone Press, 1983), 110.

30
Deleuze, *Nietzsche and Philosophy* , 110.

31
Ovid's Heroides*: A New Translation and Critical Essays* , eds. Paul Murgatroyd, Bridget Reeves, and Sarah Parker (Routledge, 2017), 119.

32
For an excellent application of the Ariadne myth to contemporary academia, see Briony Lipton, "Writing through the Labyrinth: Using *l'écriture feminine* in Leade rship Studies," *Leadership* 13, no. 1 (2017): 64–80.

33
The navigational relationship between stellar constellation and orientation (on sea level or on land) in the Mediterranean has been reemphasized recently by artist Bouchra Khalili, in a time when the visual offers of the sky have already been replaced by satellite-based GPS technology. Her 2011 *Constellations* series of diagrams graph the trajectories of illegalized immigration to Europe while strongly and deliberately resembling astronomical constellations. Khalili's series is reminiscent of the fact, in Eric de Bruyn's formulation, "that star patterns have another cultural significance, one that predates their use as a navigational tool: namely, to commemorate the dead." Eric C. H. de Bruyn,

"Beyond the Line, or a Political Geometry of Contemporary Art," *Grey Room* 57 (Fall 2014): 24–49, 45.

James Bridle

Failing to Distinguish between a Tractor Trailer and the Bright White Sky

New York City, 1925. An empty touring car stands against the curb on Broadway. A man steps onto the running board and raises a hand. Without further intervention, the car starts its engine, shifts into gear, and lurches away from the sidewalk into thick traffic. It heads down Broadway, followed by police motorcycles, meandering uncertainly from side to side, narrowly missing a milk wagon, and then a fire engine.

Somewhere on Fifth Avenue, the car makes a wild swing, and the man on the running board lunges for the steering wheel. He's too late, and they plough into another car. This one is full of photographers and movie men desperately trying to capture an image of the driverless vehicle. "The invention of the ship," as Paul Virilio wrote, "was also the invention of the shipwreck."

The car was called the American Wonder, and it was the invention of the man on the running board: an ex-Army engineer called Francis P. Houdina. The appearance of autonomy was produced by radio waves, broadcast from a car behind. In July of the same year, the illusionist Harry Houdini broke into the offices of Houdina Radio Control and smashed the furniture, accusing the company of using his name unlawfully and stealing his mail.

Francis Houdina protested in turn that use of the magician's name would imply that his invention was a trick, rather than a genuine, working machine, but the network of associations is present from the very beginning: the car, the illusion, the image, and the crash.

This timeline of the self-driving car begins and ends—for now—with a crash. The second, unlike the first, is fatal. In May of 2016, a man called Joshua Brown was driving—or rather, being driven—along a highway in Florida when his Tesla Model S crashed into the side of a large truck.

The Model S was the first production car to offer something like full automation. It has a feature called "Autopilot" which offers limited autonomy. Using a combination of radar, sonar, video cameras, and machine intelligence, the car can drive itself for hours at a time under many different conditions. Drivers are required to keep their hands on the wheel at all times, and receive audio and visual warnings if they do not.

Joshua Brown was using Autopilot at the time of the crash. In a blog post a few days after his death, Tesla stated that a truck had turned to cross the highway in front of Mr. Brown's car, and the car's sensors had failed to register it. "Neither Autopilot nor the driver," they wrote, "noticed the white side of the tractor trailer against a brightly lit sky, so the brake was not applied."

Mr. Brown was a huge Tesla fan, and had posted a number of videos on YouTube showing off the features of his car. He posted his last video one month before his death, showing his car, under Autopilot control, swerving to avoid

James Bridle, Gradient Ascent, 2017. Single-channel digital video, 12'00''. The film Gradient Ascent follows a drive by a self-driving car up Mount Parnassus in Greece: the classical home of the Muses and thus art and knowledge. The journey is accompanied by a narrative on mythology and technological progress inspired by René Daumal's surrealist novel Mount Analogue (1952).

a tow truck that had drifted into his lane. The video is called "Autopilot Saves Model S," and you can still watch it online, and hear the Malcolm Gladwell audiobook Brown is listening to, and his exclamation of "Holy shit!" as the car suddenly jerks to one side. Elon Musk retweeted the video, and Brown told a neighbor that "for something to catch Elon Musk's eye, I can die and go to heaven now."

Before the crash, investigators revealed, Brown had been driving for thirty-six minutes without his hands on the wheel, and had ignored seven separate warnings. While the truck should have been visible to the driver for a full seven seconds leading up to the crash, a portable DVD player was found in the wreckage, and the truck driver testified that Brown had been watching a Harry Potter movie when his car went under the truck. It was still playing in the wreckage.

In 1971, in an essay for the Automobile Association's magazine *Drive*, J. G. Ballard wrote:

> If I were asked to condense the whole of the present century into one mental picture I would pick a familiar everyday sight: a man in a motor car, driving along a concrete highway to some unknown destination … I think that the 20th century reaches almost its purest expression on the highway. Here we see, all too clearly, the speed and violence of our age, its strange love affair with the machine and, conceivably, with its own death and destruction.[1]

It's important to note that the self-driving car is not, in itself, dangerous. As Tesla noted, there is on average one fatality for every 60 million Autopilot miles driven worldwide. Mr. Brown was the first known fatality in over 130 million miles where Autopilot was in charge. But then, the danger posed by the self-driving car is not merely one of road death. It is one of lack of understanding, and lack of control.

As Ballard noted in his essay, the appeal of older cars is that they are comprehensible. They are "rooted in the 19th Century—a visible and easily grasped technology of pistons, flywheels and steaming valves— … a far cry from the new technologies of the late 20th century—a silent and mysterious realm of invisible circuitry." This tendency has only accelerated in our own time, from black-box devices to remote and inscrutable cloud platforms.

Recent news reports in the United States described how the owners of John Deere tractors are paying Ukrainian

James Bridle, Gradient Ascent, 2017. Single-channel digital video, 12'00''.

hackers to fix their tractors, because the machines are now driven primarily by computers, and the manufacturers have designed them in such a way as to prevent their owners from mending them themselves.

This aesthetic and technological obscurity breeds political unease, and corporate contempt. An example of this is the behavior of Uber, the ridesharing company which has become a byword for corporate greed and social irresponsibility. Beyond its well-documented sexism and disregard for local tax laws, employment rights, and the reporting of sexual assaults, Uber wields technological ambiguity as a weapon.

This ambiguity starts in the user interface, in which the system sometimes creates what are known as "ghost cars"—fake rides in the user's vicinity, that are generated to convince the user that the service is more active than it really is. Rides are tracked, without the user's knowledge, and this God's-eye view is used to stalk high-profile clients. A program called Greyball has been used to deny rides to government employees investigating the company's numerous transgressions.

But perhaps Uber's greatest perceived sin—and the one that takes us back to the self-driving car—is the social atomization it produces. Taxi drivers are no longer employees but precarious contractors. Riders are alienated individuals, contributing to the offshoring of tax revenues, the decline of public transport services, and the class divisions and congestion of city streets. The ultimate goal of Uber's business, whether that's driving cars or delivering takeout, is to replace its human workers entirely with machines. It's own self-driving car program is well advanced, and its retention of human employees is ultimately a matter of cost.

Unruly humans, despite their lingering desire for the freedoms of city life, are, for the moment, marginally cheaper than pliable machines. But this situation will not last much longer, and the self-driving car is a herald of all kinds of automation, which will deprive millions of work in the coming decades.

All of this was forecast by Ballard in that 1971 essay. Nationwide traffic reports, satellite navigation, direct-debit toll roads, and the remote electronic control of the vehicle are all predicted. "Sooner or later," he wrote, "it will become illegal to drive a car with a steering wheel. The private car will remain, but one by one its brake pedal, accelerator and control systems, like the atrophying organs of our own bodies, will be removed." With those control systems goes the freedom that the twentieth century idea of the automobile entailed. It is the death drive, virtualized.

While Ballard's forecast was accurate, it didn't and doesn't have to be inevitable. The deployment of self-driving cars

and full automation to engender loss of control, alienation, and immiseration is hardly surprising, but not inescapable. Just because a technology—whether it's autonomous vehicles, satellite communications, or the internet—has been captured by capital and turned against the populace, doesn't mean it does not retain a seed of utopian possibility.

The self-driving car is in fact a fantastic example of this tendency. It is, properly regarded, the opposite of autonomous. Whereas the twentieth-century automobile, equipped with a paper map and a couple of jerry cans of fossil fuel, could light out for parts unknown under the sole control of the rugged individualist, the self-driving car is enmeshed in an infrastructure of renewable energy, electrical power, satellite signals, slippy maps, over-the-air updates, and messy human desires. It must continually reexamine and revise its view of the world, adapting to and learning from its environment and the experiences of other vehicles. Its perceived intelligence is always and utterly a networked intelligence.

Far from being a vehicle for individualism and selfish freedoms, the self-driving car necessitates a return to the communal and the social. The moral and regulatory obstacles faced by today's exploitative, extractive corporate technologies—from Facebook, to Uber, to Google—exist not because of some residual technophobia or conservatism, but because those technologies are against nature—a nature that encompasses our own desires and our own creations. The role of the artist and the activist in such a system is thus to explore other possibilities for these technologies: not against them, but by working with and subverting them.

To give an example of transforming such a system from my own work, at the beginning of 2017 I spent several weeks driving around the mountains of central Greece in a car I had fitted out with several cheap webcams, and a homemade accelerometer fixed to the steering wheel. As I drove, a laptop on the passenger seat recorded my location, speed, steering angle, and the view from the windshield.

This information was subsequently fed into an open-source machine learning system similar to the one used by Google, Tesla, Uber, and others to train their self-driving cars. By watching my driving, the software learned to drive itself—and not on the freeways of Southern California, or the test tracks of Bavaria, but among the towns and villages of Greece, a place with a very different material, economic, and mythological history and present.

In this development process, I also emphasized certain different behaviors. My car was designed to get lost. Rather than entering a desired destination and sitting back, surrendering decisions over routing to the machine, in return for a guaranteed arrival my self-driving car plots a random course, taking every available exit, off-ramp, and side road in order to prioritize the journey over the destination. The end of the journey cannot be predicted, nor can the sights encountered along the way. The cognitive effects of such a journey are produced in collaboration between human and machine imaginations.

While sympathetic to histories of the flâneur and the dérive, this strategy is ultimately derived from technological approaches to complex problems, and particularly the "random walk"—a stochastic, algorithmic exploration of the problem space, which acknowledges the possibilities of multiple, contested, and potentially infinite answers to any particular problem.

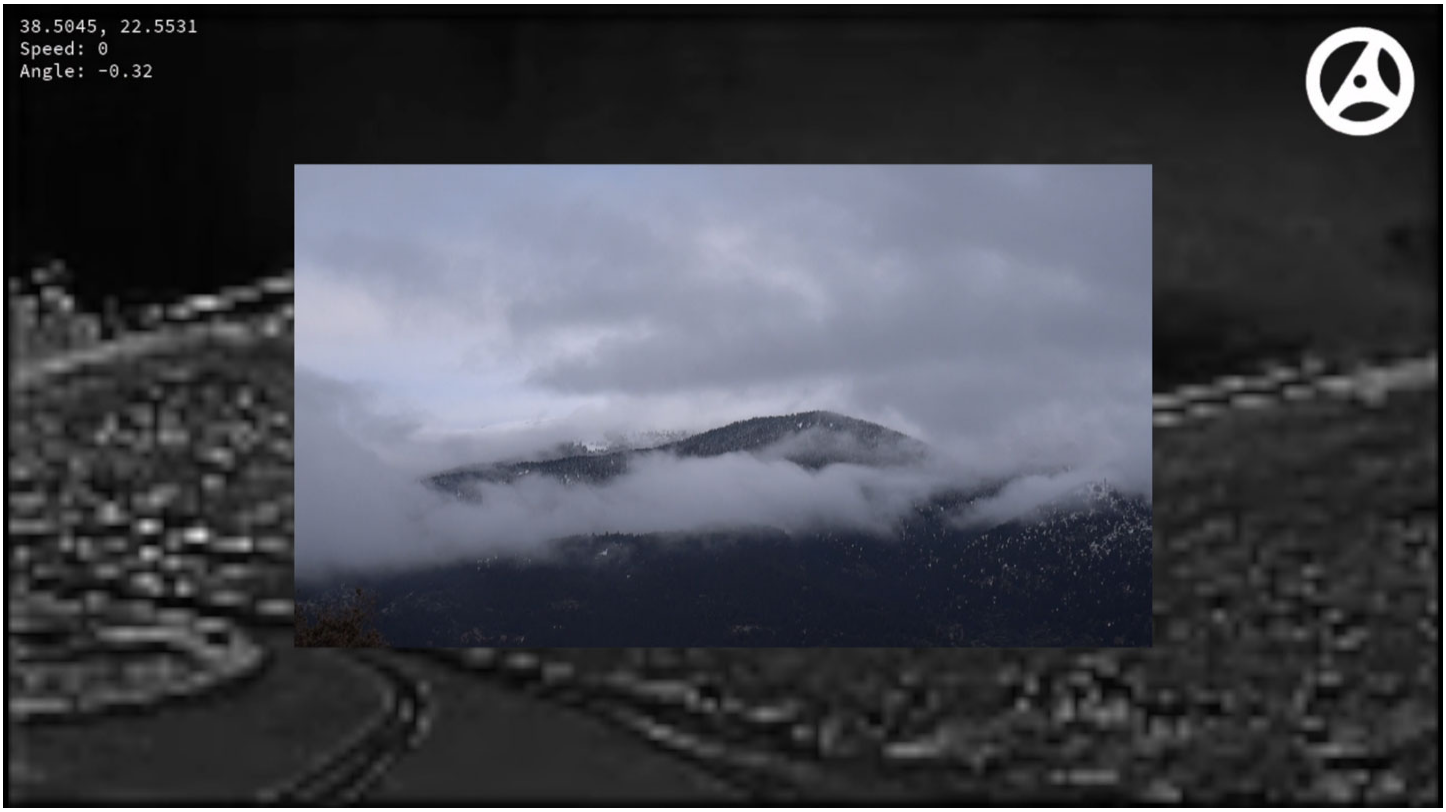
On the other hand, resistance and refusal must remain as possible responses to the technologically augmented assault directed at individual autonomy today—the off switch must still be within reach. In my research into autonomous vehicles and machine vision, I have tried to develop several strategies for human-scale opposition to exploitative automation, such as the Autonomous Trap. This trap is constructed by drawing a pair of nested circles—one solid, one dashed—on the roadway. From the outside, the pattern denotes a right of way. From the inside, it means no entry. Thus any car, programmed to obey the rules of the road, may enter, but cannot leave, like a demon trapped within a magic circle.

The trap, an unquestionably aggressive action, has the potentially emancipatory benefit of being legible to both the human and the machine—and thus it opens up a shared space of mutual communication, not buried within obscure lines of code and proprietary software, but painted directly on the street, for all to see. For its material, it uses both the physical stuff of the world, and the networked, noumenal, meta-stuff of digital video and signal processing.

The Autonomous Trap was inspired in part by my favorite story about networked automotive systems—and resistance. In October 1978, the Italian premier Giulio Andreotti was scheduled to visit Bologna to give a speech, and the city's Autonomists were discussing how to protest. A comrade named Pino arrived at the assembly and silenced the other speakers with a shout. "We must use technology to defeat capitalism!" he cried, and opened his long coat to reveal various tools and keys hung within.

One of these keys was for the city's traffic lights. It was copied and distributed, and on the day of Andreotti's speech the Autonomists used the keys to turn every light red, causing instant gridlock. Andreotti never left the airport. Such is the effect of an embedded, networked, and technologically literate resistance.

It must be hoped, however, that our future admits for greater collaboration with our technologies, instead of obstruction. Such an approach will require a radical



James Bridle, Gradient Ascent, 2017. Single-channel digital video, 12'00''.

rethinking of our cities and communities that is more, not less, in the image of our technologies—if we can free those technologies from the grasp of large corporations and opaque politics. Just as the internet itself is an unconsciously generated product of our unconsciously networked desires, so the most quotidian technological products reveal aspects of other, loving futures. This possibility exists even within the steel, glass, and gas of the self-driving car.

If we choose not to imagine and engage with such possibilities, we too are in danger of failing to distinguish between the tractor trailer and the bright white sky—trapped in the automobile, hands off the wheel, being taken, in the most comfortable and efficient manner, straight into the side of the truck.

X

James Bridle is an artist and writer working across technologies and disciplines. His artworks have been commissioned by galleries and institutions and exhibited worldwide and on the internet. *New Dark Age*, his book about technology, knowledge, and the end of the future, was published by Verso in 2018, and he wrote and presented "New Ways of Seeing" for BBC Radio 4 in 2019.

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See https://www.jgballard.ca/deep_ends/drive_mag_article.html .