Threads

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14 November 2020 - 6 February 2021

Patterns in the Sand

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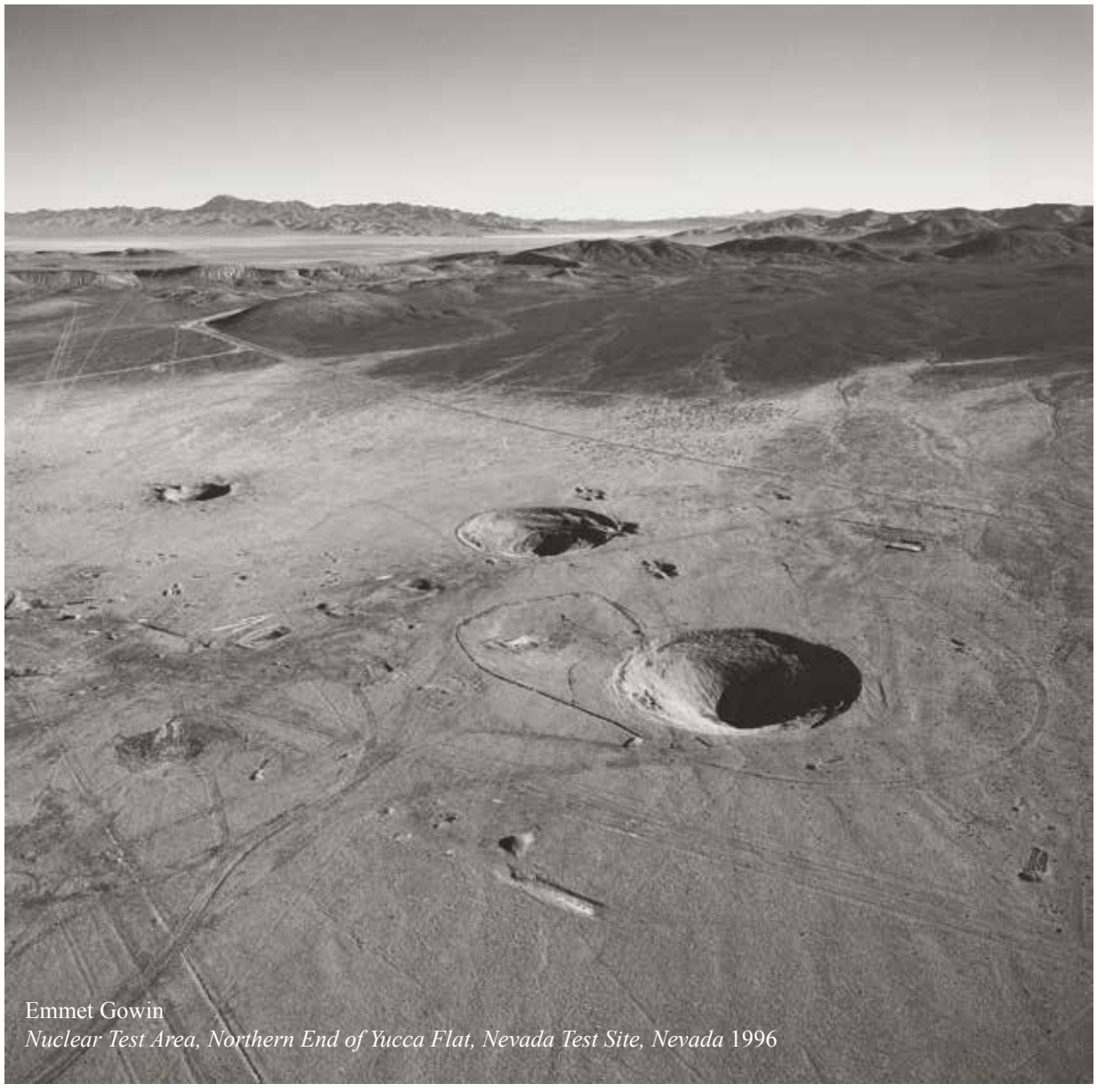
***When you see something that is technically sweet, you go ahead and do it and you argue about what to do about it only after you have had your technical success.* – J. Robert Oppenheimer**

Lately I have been staring at the photos of Emmet Gowin. An American photographer better known for images of his family, Gowin was given permission in the 1990s to photograph, from the air, the craters of the Nevada Test Site. This moon-like expanse in the desert is the most visible and lasting evidence of the legacy of what began, eight hundred miles east, at Los Alamos. In 1943, the Manhattan Project convened many of the brightest minds in American and European science in a hastily built prefab town on a remote, elevated site in New Mexico with few natural resources and very little connection to the outside world. These leading scientific figures had one goal: develop an atomic weapon before the Germans did. To their immense intellectual credit, they completed the job in less than two years.

Follow the Rio Grande river south from Los Alamos, down past Albuquerque, out into the flat blankness beyond Socorro, and there you'll find the Trinity Test Site. Here, almost exactly two years after the physicist leading the Manhattan Project, J. Robert Oppenheimer, was given his top-level security clearance, the first nuclear test was successfully carried out. Over four hundred people officially observed the first nuclear explosion, which took place at 5.29am, on the morning of July 16th, 1945. Victory in Europe had been achieved two months before, and the first and only use of an atomic weapon in war took place less than a month later in Hiroshima.



Emmet Gowin
Nuclear Test Area, Northern End of Yucca Flat, Nevada Test Site, Nevada 1996

Reflecting on the test in later years, Oppenheimer famously remarked that the explosion brought some lines from the Hindu holy book, the Bhagavad Gita, into his mind: "Now I am become death, destroyer of worlds." Oppenheimer, for all his wisdom and fine taste, was given to that kind of posturing. I have always preferred the more immediate reaction of Kenneth Bainbridge, Harvard physicist and director of the Trinity test, who was less poetic. "We're all sons of bitches now," he said.

I have begun to feel as if the present day is rhyming in some way with the past. That which we are experiencing now, in terms of social unrest, the rise of nationalism, and serious questions about the ethical implication of powerful and complex technology, is an echo of that experienced by previous generations. I have found myself reading across the Vienna and Frankfurt Schools, found myself reading into the scientific revolution of the 1920s, found myself most of all trying to understand the early days of the computer era – the foundations of the world we're living in today. I have been thinking that perhaps most of the public conversations we are having now have been had before, and typically at a much higher level of intellectual integrity and historical knowledge. This is not a positive thought, not least because, for all their rigour and insight, those previous generations did not exactly acquit themselves faultlessly when it came to the crunch.

Oppenheimer, perhaps the avatar of this earlier era in my mind, said: "It is a profound and necessary truth that the deep things in science are not found because they are useful; they are found because it was possible to find them." I have often wondered what exactly the 'deep things' are, and thought much about the conditions for their discovery. A related question follows naturally: what are the conditions for the loss of such knowledge? I think of the pre-Socratic Greeks, and their understanding of the cosmos; with the naked eye, they had a conception of how the universe worked that, once lost, was not again matched for accuracy until the Renaissance. As Arthur Koestler explains in *The Sleepwalkers,* the displacement of this knowledge led to thousands of years of labouring under false premises, millennia spent making more and more elaborate systems to explain that which was fundamentally unexplainable, because it was

fundamentally wrong. Because we had forgotten what we once knew. Because it was heresy. Such knowledge is not linear, not inevitable or even incremental; it is a coherence of forces, and brute luck is not the least of them.

Vannevar Bush, one of the most influential people in the early days of thinking about what would become the internet, was one of the four-hundred-odd observers of the Trinity Test. John von Neumann, whose influence on the earliest computer architecture lingers in almost every computer functioning today, was there too – it was largely his idea to pursue the particular implosion method used by the 'Fat Man' bomb that fell on Nagasaki. Many of the fundamental assumptions we have about how computers and networks function, about how information flows in a complex global society, can be traced back to this time in our history. And I wonder how those assumptions were shaped by the needs and the pressures of that particular age. Oppenheimer said: "Any man whose errors take ten years to correct is quite a man." What of the men whose errors – and their missteps, misjudgments, flaws, blind-spots, egos, politics – have seeped into the culture around us, so much so that they are invisible? How long will it take to notice any such error, and how long to correct? How long just to become aware of the assumptions in the first place?

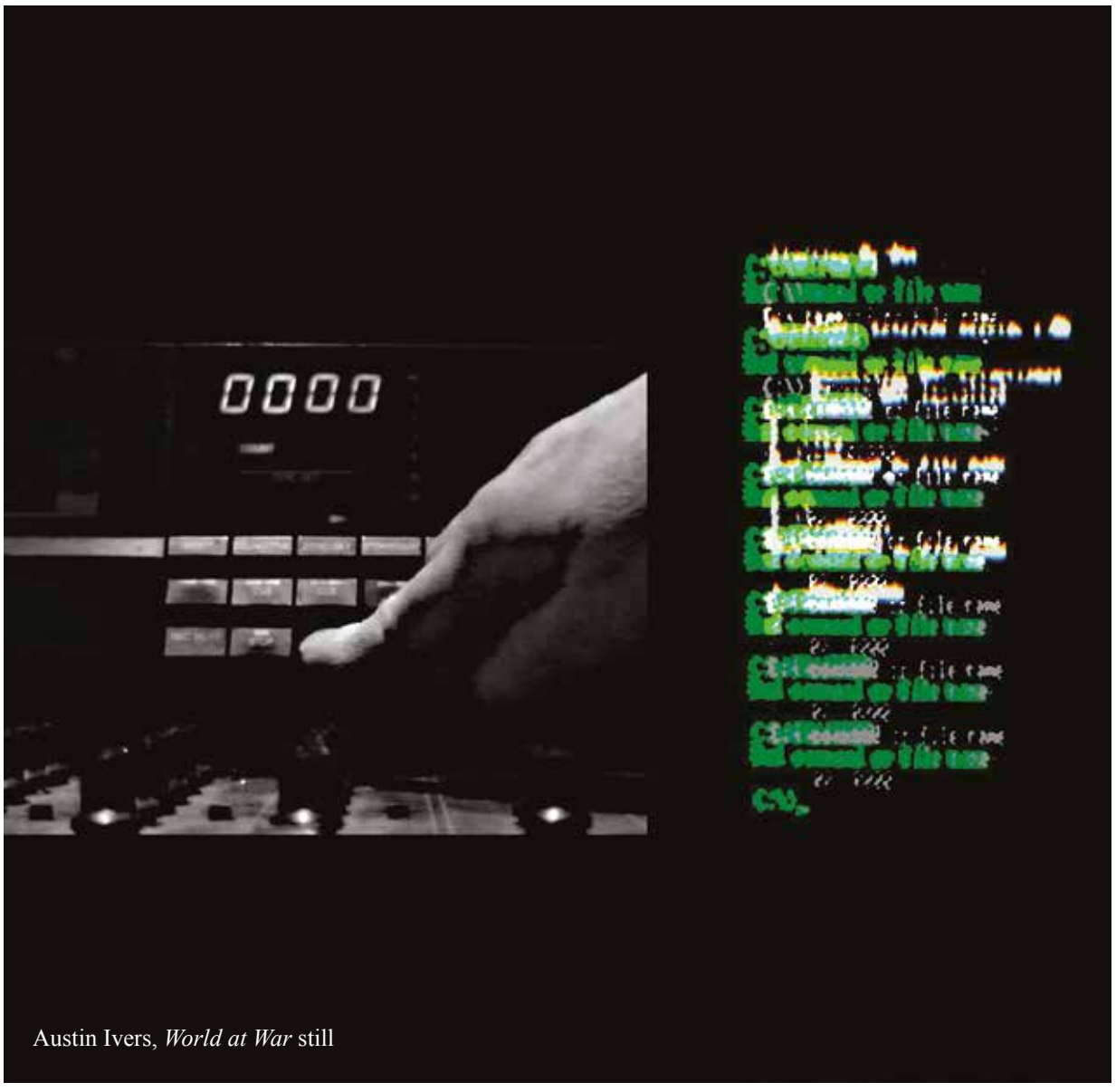
Alan Kay has called computer science a 'pop culture', because it has such disregard for the details of its own history, the ideas and the figures who have driven the innovations that everyone now working in the field – not to mention everyone who lives with the products of that field – can take for granted. As such, our computer era is a brittle one; it operates on a handful of foundational technologies which few understand and celebrates the visible but inconsequential sandcastles built upon them. Flowing through Kay's thought, as it flowed though Koestler's, is the idea the most stubborn obstacle to a better world is the world we currently have, and that what is necessary for real progress is the ability to see possibilities which are more than an iteration of the present. To connect with Oppenheimer's 'deep things', and to understand them anew. Instead, we live in a time of technological decadence, well-polished systems of smoke and mirrors obscuring a set of ideas and assumptions which have remained, with the force of truth, unchanged for decades. The mysteries are no longer apparent, nor the chinks in the armour.

An atomic bomb is a system for managing the release of energy in a concentrated manner: a cascade of feedback, pushing itself to greater and greater levels of intensity. The energy is forced in on itself repeatedly, into a tighter and tighter space, until it cannot go any further and an implosion becomes an explosion.

Feedback is the fundamental insight of systems theory, a way of thinking which found its feet in meeting the military demands of the Second World War. Systems theory is the idea that understanding how the aspects of a system feed into each other – what draws on what, what reinforces what, what limits what – is the key to understanding how that system works. It is not just the nodes, the points on the graph, which are important, but what flows between them. If you can follow the paths, follow the cascading waves of energy, capital, data, people, you can find ways to affect those relationships; to tip the scales, stem the tide, encourage one output and discourage another. Feedback is a part of every system, but in a system which is unbalanced, which is in some way corrupted, feedback meets no limitations, no barriers – it spirals out of control, and the system fails.

When the world ends, I imagine I will first notice that my laptop – the machine on which I'm typing this, the machine with which I spend the majority of my waking hours – has stopped working. The internet will be down. Phone signal will fizzle out. Electricity will drop out, and water will dry up. The systems which manage the flow of these vital services will be interrupted, corrupted, torn apart by some invisible attack. I don't expect a bright flash in the morning sky, a loud and hollow crack as the bomb hits; I expect a silent unpicking, a collapse that is slow and then very fast. It will come in the form of a virus, or a bug – not infecting human bodies, but infecting our methods of communication, the vast networks that steer billions of people and all their goods through the chaos of the everyday. Here, in the invisible threads of our lives, ever more managed and systematic, the damage will be done: the shipping containers will stay in the ports, the production lines will grind down, just-in-time supply chains scattered across the globe, unable to connect or cohere, will be broken and useless. I sound paranoid, like some conspiracy theorist, but I think simply that humans are human: some unknown actor, or some unforeseen element, will block an artery, cause a fuse to blow or a vessel to burst. A flipped bit, a sunspot, division by zero. Some thread will unspool, some knot come untied, and whipping around in the darkness, a trillion sparks of luminous potential will coalesce in a pattern we could not have predicted, not until it was too late.

The pattern we did not see will be our undoing.



Austin Ivers, *World at War* still