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# Introduction

> Today we are learning the language in which God created life. We are gaining ever more awe for the complexity, the beauty, the wonder of God's most divine and sacred gift. With this profound new knowledge, humankind is on the verge of gaining immense new power to heal.
>
> —President Bill Clinton[1]

Amidst the international excitement generated by the carefully staged joint announcement of 26 June 2000 that two competing teams of researchers had successfully completed a "working draft" of the human genome, both the popular and specialist press claimed that a new era had opened in the history and description of the human species.[2] Two years later, the Human Genome Project drew to a close with delivery of "the instruction set that carries each of us from the one-cell egg through adulthood to the grave."[3] Yet even this final rendering of the human genome is far from complete since sections of DNA near the center and at the ends of the chromosomes contain so much repetitive data that they cannot be positioned with accuracy. The language of life championed by President Clinton still contains many gaps: what kind of description of our human species has the genome project made possible?

Ever since the discovery of DNA, and the double-helix model of the chromosome, medical researchers have promised that mastering the genetic code of life—whether human, animal, or plant—would offer the possibility of a healthier, more productive world where one would be able to improve species, eradicate disease, and clone favorite pets.[4] Genetics has seemed to be on the verge of engineering the longevity that the Enlightenment thinker Condorcet could only imagine in 1795 when musing on the future of mankind: "will not the interval between the first breath that he draws and the time when in the natural course of events, without disease or accident, he expires, increase indefinitely?"[5] Condorcet assumed that the progress of knowledge would effect this benefit by gradually closing gaps in

our understanding of life. He probably never imagined that knowledge could be erected on gaps.

Condorcet dreamt a language of science that grew towards a perfection with no gaps or errors, "ever improving and broadening its scope" and "giving to every subject embraced by the human intelligence, a precision and a rigor that would make knowledge of the truth easy and error almost impossible."[6] By accepting a certain number of defined gaps, research on the human genome has undermined the persistent notion that the language of science is all-inclusive. It has also undermined the assumption that human beings are different in kind from animals. Researchers working with information from the genome project have arrived at some rather surprising estimates about the number of human genes. Backing away from original projections that the human genome might be comprised of more than 100,000 genes,[7] scientists began to extrapolate patterns from the genome project that predicted only about 30,000 human genes.[8] This number is uncomfortably close to the approximately 17,000 genes of *Drosophilia* fruit flies,[9] the completely tabulated 19,099 genes of the roundworm *Caenorhabditis elegans*,[10] or the estimated 15,000 genes of *Arabidopsis thaliana*, a plant related to mustard weed.[11] Current estimates are even lower—perhaps 24,500 or 23,299.[12]

Even such revised numbers assume that a mass of chromosome material in the human genome is "junk," the origin and purpose of which remains a mystery. Sydney Brenner, who coined the phrase, was quick to say "junk, and not garbage, because there is a difference that everybody knows: junk is kept, while garbage is thrown away."[13] Research on the Y chromosome has demonstrated Brenner's point.[14] The Y chromosome is unusual because it does not have a twin against which to check genetic integrity. Rather, it exchanges genes with two adjacent sequences—mirror images of one another—that otherwise carry no genetic information. In this way, seemingly useless material performs an essential backup function, allowing the Y chromosome to replicate with a minimum of error. One day, other seemingly useless material may figure in our accounts of the complexity of human life relative to that of flies and roundworms. It might turn out that proteins and enzymes peculiar to the junk material in the human genome determine much of who we are.

Many of the issues fueling publicity around the genome project strike us as germane to the problem of describing. The popular notion, echoed by President Clinton, is that sequencing the human genome brings us closer to understanding the essence of humanity. This might be true, although recent

studies have revealed that the chimpanzee's genome is 98.8% identical with that of humans, a startling discovery seeming to imply that variables like diet might, for instance, have affected the relatively recent genetic adaptation of humans to speech.[15]

The genome project has produced an extremely useful research tool, but it seems unreasonable to think that the essence of humanity has been captured in its strings of code. Its techniques were too limited to yield a definition of the human, whether physical or metaphysical. The project's computerized technology and algorithms of probability assume gaps in the sequence that do not threaten the usefulness of the resulting tool. High-speed sampling machines, designed to read "snippets" of stained chromosome material five-hundred thousand positions at a time (known as an "expressed sequence tag" or EST), converted the visual spectrum of each snippet into a sequence of four letters that became the "code" of each position. A somewhat controversial method to interpret this cornucopia of data, developed by J. Craig Venter's team at Celera Corporation, used a powerful computer algorithm to "splice" the snippets into a continuous thread: rather than working steadily from one end to the other, they scanned strips in a kind of "shotgun" approach and relied upon a battery of computers to produce the billions of comparisons and cross-checks to assemble the parts—very similar to how compact audio disks over sample the music to produce relatively error-free reproduction of complex sound waves.[16] The sequence of the genome was produced by a sorting operation guided by probabilities made possible by reducing the genetic material to a code of very few elements, and by accepting the inevitability of extensive gaps. Those gaps raise some general questions about our contemporary fascination with, and belief in, the power of digital bits to encode fully the material world.

What strikes us as worthy of comment in all of this is the unflagging belief that this sequencing technology has fully "mapped" the genome, even though an inordinate and surprising surplus of "junk" material remains. Some researchers believe this material might be chromosomes damaged by disease or altered by evolution throughout the long history of humankind, forming in a peculiar way a living archive of our species.[17] If this is so, our current understanding of the human genome relegates much of our genetic history to the scrap heap. But our point is slightly different. An explanatory shortfall is a problem only for those who fantasize the utopia of a completely defined code.[18] By contrast, if we define "description" rigorously—meaning to represent rather than to replicate an object materially—it be-

comes clear that digital technology of the sort used to sequence the human genome is also a form of representation and does not free us from the hermeneutic constraints of describing. What are some of those constraints?

The topic demands more than a cursory treatment, and the long meditation on description produced by the authors of the *Encyclopédie* (see Appendix) testifies to the historical and disciplinary complexity of the question. At least three conditions seem to govern descriptions. First, and perhaps foremost, is the simple fact that things do not describe themselves, meaning that descriptions are produced from particular perspectives or situations, and are based upon a finite and selective body of features—whether perceived by humans, measured by machines, or produced in the imagination. Leaving aside questions of use-value, we see no differences between descriptions of "real" things and those of imagined things. The corollary is that technical descriptions based on perceptions have no greater intrinsic claim to objectivity than the descriptions of a novelist or a painter. The second condition is that descriptions do not replicate objects, but rather employ different media to transmit the salient characteristics of those objects across time and space. To send a poem or a drawing of roses to one's lover will always be a different kind of present than an actual bouquet. The third condition is historical variability produced when the technology used to register descriptive features changes so dramatically that things previously invisible become newly visible. An uncanny example of this would be the earliest daguerreotype views of Paris that are mysteriously devoid of people—not because the streets had been cleared for the photographer, but because the medium was simply unable to register the presence of anything or anyone that moved.[19] Within a few years, thanks to the huge improvements in light sensitivity produced by exposing daguerreotype plates to bromide vapors, people began to repopulate those strangely empty streets.

The essays in the present volume sketch some of the historical circumstances tied to these three qualities as they were articulated in the late eighteenth century. Michel Foucault's groundbreaking work on this period, which clearly affects our own thinking, emphasized the rupture between disciplines of synthesis and analysis—a separation of deductive and formal sciences from empirical sciences that "detached the possibility of synthesis from the space of representation."[20] But the surprising aspect that emerges from these essays is the degree to which their archaeology of the "regime" of description does not reveal a rupture so much as three interlocking arenas, which we have used to divide and organize the volume. First, and

probably closest to Foucault's line of thought, is the section we have called "Description: Fantasies of General Knowledge." The recurring issue in this first group of essays concerns the utopian idea that knowledge is stable and generally impervious to the vicissitudes of time. Taken together, the essays counter this idea by demonstrating the historical nature of fact (Daston), the cultural, geographical, and gendered specificity of descriptions (Schiebinger), the emergence of a relational theory of language (Trabant), and the mutability of the border between quantitative and rhetorical disciplines that Foucault thought unbreachable (Poovey).

The essays gathered in "Describing: Imagination and Knowing" explore questions related to our assertion that descriptions of imagined things are technically indistinguishable from those of objects in the world. On one hand, realism in art—notably as a form of literature—is not isolated from the practices of science, but emerges historically where empirical modes of analysis are deployed in the construction of an imagined world (Klein). On the other hand, under highly specialized conditions in which the perceptual apparatus and imagination fall into perfect congruence, realism is forestalled by the emergence of an absolute mental reproduction (Scarry). Between these two extremes lie the physical encounters, recorded in various archives, which engender descriptions that might be both empirical and shaped by discursive constraints (Ernst), or sensual and driven by desire (Potts).

Attention to gaps and voids in the archive lead to our final section, "The Undescribed: Horizons of the Known." The three authors included under this rubric reconnoiter the historical breadth and reach of *Aufklärung* by drawing attention to the edges of our understanding. This includes revealing the emergence of a vitalist, organicist science that parallels both the mechanist, rationalist practices of empiricism, and the affective domain of *sentiment*, without intersecting either of them (Reill). In a like manner, the lucidly massed, geometric volumes of the architecture of Boullée and Ledoux, or the pervasive transparency of Foucault's Panopticon model, cannot be described without recourse to the voids that throw solids into relief, or the opacity that gives transparency its brilliance (Vidler). Finally, for those who believe that modernist immanence extends in an unbroken line from the Enlightenment, an archaeology of aesthetic description reveals a complex, unstable attention to both medium and message that Kant and Hegel cut short, but which has reemerged as the central concern of postmodernist theory (Wellbery).

Today, scientists regularly refer to the sequence of the human genome as a "map" of the human chromosome, and we believe that word is appropriate, though "description" would be more precise. Maps remain within the realm of classical description, which we have defined as intrinsically different from its object. Maps are representations that include many gaps and ellipses, yet one is still able to sail from Southampton to Rio using a map as an instruction set. This is how geneticists and drug companies are using the human genome—as a map to locate a relatively small number of genes amidst a vast sea of material where one hopes to find remedies for the diverse maladies that plague humankind. The promise of great commercial profit incites researchers to patent their genetic findings on speculation, even before knowing the eventual import. Nonetheless, sequencing of the entire human genome, including its lengthy runs of "junk" material, remains a long-term goal of some researchers, even though the genome project has been officially ended. The idea of an eventual success raises another kind of question: will the entirely sequenced human genome retain the approximation of a map, or will it actually approach the truth about life? Will it, in other words, remain within the realm of description? Recalling our three governing conditions, our answer would be yes. If a complete genome sequence is eventually achieved, it will be the product of a particular perspective determined by a given array of equipment and analytic procedures, it will employ a different medium than that of human cellular tissue, and—ultimately—it will be the result of a different technology of measurement and analysis than used at present. If today's incompleteness follows from limitations intrinsic to current technology, then closing those gaps will involve more than spending a lot of time on the problem: the technology itself will be forced to evolve. Finally, any added value derived from a fully sequenced human genome will emerge from its use as a tool in research or treatment, not from the mere fact of its completion.

Much has been made of the "digital revolution" and its potential to blur and to mix media, or to fabricate new realities—a nightmare envisioned in popular culture by the *Matrix* films. Yet we continue to believe that classical descriptive modes will not disappear, although they might very well be *absorbed*.[21] In saying this, we recall the troublesome "junk" material that eludes explanation and fills the gaps between genes along the extraordinary length of human chromosomes. One day those gaps will probably be filled with meaning—the way the streets of Paris eventually recovered their life and animation from those early daguerreotypes. Conceptual distinctions between representation and replication will surely remain viable in that

brave new world, but functional differences may collapse. In our most pessimistic moments, we can imagine that a cloned and re-engineered human species will find untidy analog descriptions to be merely pleasant diversions. But we also believe that the power to describe is one of the great achievements of human thought, and that an archaeology of description is order: the essays of this book are a beginning.