SURPRISE

107 Variations on the Unexpected

Dedication and Prelude

To Raine Daston

In his essay "Of Travel," Francis Bacon recommends that diaries be used to register the things "to be seen and observed." Upon returning home, the traveler should not entirely leave the visited countries, but maintain a correspondence with those she met, and let her experience appear in discourse rather than in "apparel or gesture." Your itineraries through a vast expanse of the globe of knowledge seem to illustrate Bacon's recommendations, and have inspired many to embark on the exploration of other regions—some adjacent, some distant from the ones you began to clear. Yet not all have journeyed as well equipped as you with notebooks, nor assembled them into a trove apt to become, as Bacon put it, "a good key" to inquiry. As you begin new travels, you may add the present collection to yours, and adopt the individual booklets as amicable companions on the plane or the U-Bahn. Upon wishing you, on behalf of all its contributors, *Gute Reise!* and *Bon voyage!*, let us tell you something about its genesis and intention.

Science depends on the unexpected. Yet surprise and its role in the process of scientific knowledge-making has hitherto received little attention, let alone systematic investigation. If such a study existed, it would no doubt have been produced in your Department at the Max Planck Institute for the History of Science. The topic is a seamless match with your interest in examining ideals and practices of scientific and cultural rationality—ideals and practices often so fundamental that they appear to transcend history or are overlooked altogether. It is also an endeavor too broad and diverse for a single scholar to pursue, and you would undoubtedly have approached it by joining forces with others. Guided by a vision of collective empiricism and nurtured by the joy of collaborating, you have both researched and practiced forms of intellectual cooperation. Working groups and their edited books have become a hallmark of the Department's achievements. We have all experienced the recipe: bring together the right mixture of people and themes, in constantly fresh combinations, add a few audacious questions, and set in motion a series of unforeseen and highly productive encounters that generate unexpected findings, long-standing friendships, and a vast interdisciplinary network of like-minded scholars.

It is this network of varied sensibilities that we mobilized for a collective work on surprise and the history of knowledge, drawing on the Department's characteristic outlook and the creativity of those who have supported and shaped it over the past twenty-five years. It was impossible for us to include each and every scholar in residence during the Department's existence. In order to keep the project manageable, we had to restrict ourselves to inviting those who had been its members or guests for at least two years, or had been centrally involved in one of its working groups.

The response to our call was enthusiastic. As the papers came streaming in, we became increasingly excited. We realized that the synergies created by this project testify to the gratefulness that lives on within a vibrant scholarly community, and convey something of the intellectual and affective dispositions that sustained the life of your Department.

We envisaged a cornucopia of short texts crossing epochal and disciplinary boundaries. The contributors were asked to engage with *surprise* as a basic component of seeking, constructing, and experiencing knowledge of the world. The 107 pieces in this volume look at surprise as a historical category, as a staged performance or spontaneous reaction, or as part of a personal experience during scholarly endeavors. They mobilize different genres—from the erudite to the autobiographical, from the essayistic to the poetic and pictorial. Taken together, they engage with and build upon your work, foregrounding an epistemic category closely related to wonder.

Wonder, however, involves a paradox: it is the beginning of inquiry, but that very inquiry puts an end to it. Wonder is thus "a barometer of ignorance." The present collection of texts nuances, perhaps even contradicts, the observation that "The more we know, the less we wonder." For all those acquainted with you can attest to your permanent sense of wonder, your capacity to be surprised, and your ability to turn that emotion into productive accomplishments for the dignity and advancement of learning. Never *blasée*, you have shared the curiosity of junior and senior scholars alike, encouraging them to pursue the paths this dubious passion opens toward its apparent end. Such an attitude embodies a manner of being in the world, a

spontaneous yet reflexive confidence that the pursuit and growth of knowledge does not lead to melancholy world-weariness, but to ever-new and pleasurable sources of *admiratio*.

The result of our collective endeavor is presented here in alphabetical order by authors' last name, the texts themselves ranging, randomly, from "A Family Conversation" to "Zufallsfunde." As in the *Encyclopédie*, the arbitrariness of that order is meant to suggest the impermanence of systems and the frailty of methodical arrangements, while evoking unforeseen depths, unusual convergences, unexpected companions, and the indefinite and surprising ramifications of the ways of human understanding. The occasion seemed to lend itself less to purely erudite disquisitions than to a self-conscious epistemic and emotional exercise in friendship and gratitude. It is offered in that spirit, as a readable work to be dipped into for spells of browsing, and as a handy edition fitting in any pocket, tailored to your specific needs and practices of being on the go. May this collection be an enduring source of enjoyable surprise!

Barcelona, Berlin, London, November 2018

Mechthild Fend, Anke te Heesen, Christine von Oertzen,
Fernando Vidal

Christa Donner, *The Two-Handed Question*, 2018, collage. Based on sketches drawn during Deptartment II's colloquium in fall 2015. Courtesy of the artist.

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Erratum

John Carson's essay was inadvertently omitted in the printed version of this book.
It was added without page numbers to this pdf. We sincerely apologize to the author.

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Hooks, Nets, and Links

Gadi Algazi

Within three days in February 1953, some 6,000 new immigrants were evicted from a transit camp near Israel's eastern border. Inhabitants of the camp, most of them Iraqi Jews who had arrived in Israel since 1951, had been involved in collective protests against unbearable living conditions, discrimination, and political control by the bigwigs of the neighboring town, Kfar-Saba. The sudden dismantlement of the camp and their dispersal into seven different transit camps, where conditions were even worse, was mainly intended to put an end to those protests. The eviction was carried out by military and police forces in a secret operation that took three days. Officially, nothing had happened. News reports were withheld by military censorship and most of the relevant dossiers have not yet been declassified. In the following years, however, references to the event gradually made it into the press. I turned to the newspapers.

How should one go about seeking clues to a non-event? Digitized newspapers invite you to search for single terms or combinations, but it is almost impossible to take in a whole page at a glance and skim for relevant headlines. What should I be looking for? Times, places, and personal names turn out to be the most useful hooks for sifting through unstructured, heterogeneous material. Once you catch sight of a person, a significant date, a promising site, you follow them. What else was that person doing? With whom or what was she or he associated? If a name works like a fishing-hook, temporal and spatial proximity are a net thrown into the sea of digitized texts: What else was happening there and then?

What emerges is a provisional map of possible links, their nature initially obscure. This low form of historical inquiry assumes that social, temporal, and spatial proximity matter and works mainly through contiguity, but seems to eschew schemes of interpretation. Once you have a hunch about underlying relations, chains of causality, or supra-local links, you might stretch your field of inquiry backward and forward in time or broaden it to other places or institutions. But first you cast your net as wide as possible. This does not even amount to following the actors, because at this stage, you don't know who they are. In some respects, it is not so different from

working in archives, only that the page or the newspaper edition is a relatively random bundle of information brought together as newsworthy.

Following every newspaper item mentioning Kfar-Saba in the year after the eviction, I come across a report about a former camp resident, Ephraim Shemesh, who tried to take up residence in the town nine months later. He was prevented from doing so by the mayor: The camp dismantled, he wanted no more communist troublemakers. This throws precious light on the reasons behind the secret operation, turning an outlier into a limit case for a more common pattern of political screening. I take that back to the archive. There, the mayor mentions one of the main protest ringleaders, a "most dangerous instigator," who is now trying to move back into town.[1] Could it be Shemesh? Now I find a report about Shemesh opening a public meeting just three weeks before the eviction.[2] I follow the thread of his name and find him two years later, residing in a settlement next to Kfar-Saba. It is reported that he was fired after publicly confronting a speaker for the ruling party. He started a sit-in at the labor exchange office to get his job back. This yields a clear sense of his political affiliation and local notoriety. Three years later, I find him filing a petition to the Supreme Court. By now, he is resident in Kfar-Saba and successfully challenges the local water utility company. The identity of his lawyer suggests that Shemesh may have moved to the moderate left.

The transit camp and the town prove good hooks to start with. To follow the evicted immigrants, I then look for every news item about the places they were sent. Are the nameless immigrants who protested against unemployment in one such camp the same as the ones evicted in 1953? If so, dispersal did not completely suppress their rebelliousness.

In state archives, such camps often vanish from view upon their "suppression," which often meant nothing more than the replacement of tent compounds under government care with wooden

1 Kfar-Saba Labor Council, March 9, 1953: Lavon Archive, iv-250-38-70.

2 *Kol ha-'Am,* January 4, 1953 [Hebrew].

shacks attached to local councils—the seeds for a number of future poor neighborhoods on the outskirts of Israeli towns. Newspapers prove more rewarding. Their reports often preserve the informal, popular designation of an officially abolished camp, allowing me to locate it with some precision. On the other hand, they hardly mention women activists. People's names are also in flux. In the Hebrew press, immigrants' names—and Arab names more generally—are constantly misspelled, shifting from one report to the next and occasionally making it impossible to locate people. Jewish immigrants assumed newfangled "Israeli" names or kept switching between different ones.[3] All this has to do with the combined effects of immigration and colonization. Typographic conventions fluctuate, too: in the 1950s, Hebrew newspapers used three different sorts of hyphens and at least two styles of quotations marks. This type of search is difficult in the absence of uniform designations, stable linguistic and typographic codes, a bounded and stable social landscape.

Times are no less tricky. How far into the past should you cast your net? What kind of temporal proximity is likely to generate relevant clues? Most of the immigrants evicted had arrived no more than three years earlier; this stakes out a rough and ready limit. But how far back should you go to inquire about the local elites that presided over the operation, their politics and alliances? Does the definition of proximity depend on the shape and dimensions of "what happened?" It's difficult to delimit temporal proximity in advance, without formulating hypotheses.

With digitized collections, however, you are tempted to throw a tried-and-tested hook beyond reasonable limits, just to see what happens—something unthinkable when systematically skimming through newspaper issues one by one. Mine was a simple hook, the name of one of the transit camps where the evicted found themselves. The name reappears eleven years later. In 1964, a twenty-six-year-old radical journalist covering labor and social affairs meets people living in shacks under threat of imminent eviction at the pe-

3 Shemesh himself used the Arabic form of his name, Shammash, in a letter to the editor of an Arabic newspaper: *Al-Ittihad,* March 6, 1953 {Arabic}.

riphery of a town. They bear the scars of a previous eviction, and tell him that back in 1952—they get the year wrong—they were evicted under a false pretext from a transit camp near Kfar-Saba. This is the most vivid piece of written evidence about the event, reported by its victims eleven years after the fact. The journalist signed with his pen name, but I immediately recognize him.[4] I ask him for more details. He reads the clipping with moderate interest: No, there were so many stories he covered; he does not remember it. "How have you come across this one?" he asks me, "Is this something you're now working on?"

4 Joseph Galili [Algazy], "A Camp as a Permanent Dwelling," *Kol ha-'Am,* July 2, 1964 [Hebrew].

Things Made Strange

Elena Aronova

The Second International Congress of the History of Science and Technology, held in London in July 1931, is remembered for the surprise appearance of a delegation from the Soviet Union. More unexpected still was the depiction of the relationship of science and history that one of the Soviet delegates, physicist-historian Boris Hessen, articulated in his paper. Hessen ventured to "present a radically different view of Newton and his work," contrasting a familiar image of Newton as a lonely genius "divorced from life" to the one in which Newton "in the fullest sense of the word was in the center of the physical and technical problems and interests of his time."[1] Some of Hessen's readers were taken aback—disconcerted, bewildered, or bemused—while others found his ideas eye-opening and groundbreaking. Hessen's paper has had a lasting impact on the history of social constructivist thought in science studies and the history of science. His intervention and its context have been comprehensively analyzed, yet little reflection has been given to the heuristic device of surprise—making familiar things strange and unfamiliar—that Hessen used to great effect. Whatever Hessen's own methodological premises were, he expressed quite consistently a methodological stance that had gained ascendancy in the first decades of the twentieth century within Russian-Soviet human sciences. The complex genealogy of surprise as a heuristic device might itself be surprising for historians of science today.

The motley crew of literary scholars, artists, and linguists known as the Russian Formalists had labeled their method *estrangement* or *defamiliarisation* ("ostranenie" in Russian, derivative of "strannyi"—meaning "strange"). Estrangement snatches ordinary things from the context of their familiar associations and makes them look unfamiliar and "strange," as if seen for the first time. Most ambitiously, they sought to use art to surprise and shock us into confronting an often senseless reality, redefining our relations with the everyday world. As Viktor Shklovsky famously put it, "the device of art is to make objects 'unfamiliar,'" to describe or represent the world in an unusual or

1 Boris Hessen, "The Social and Economic Roots of Newton's 'Principia'," in *The Social and Economic Roots of the Scientific Revolution: Texts by Boris Hessen and Henryk Grossmann,* ed. Gideon Freudenthal and Peter McLaughlin (Heidelberg: 2009), 41–101.

surprising way, and thus to "make it strange." He takes examples from Lev Tolstoy's novels to illustrate the device of *estrangement*. Tolstoy, Shklovsky wrote, "makes the familiar seem strange by not naming the familiar object. He describes an object as if he were seeing it for the first time, an event as if it were happening for the first time." For example, in *War and Peace*, Tolstoy describes an opera as "painted cardboard and oddly dressed men and women who moved, spoke, and sang strangely in a patch of blazing light." Or, in "The Resurrection," Tolstoy substitutes prosaic expressions for religious terms and words common to the dogmas and rituals of the church. As a result, Tolstoy "presented as strange and monstrous what {people of his time} accepted as sacred." Tolstoy, Shklovsky argued, "uses this technique of 'defamiliarization' constantly."[2] The parallels between this philological discussion and Hessen's discussion of Newton are unmistakable, in spite of all the differences in their position in Soviet society and the apparent absence of direct contact.

The Russian Formalists' technique of *ostranenie* is remarkably resonant with the ontology developed by science studies scholars and post-Kuhnian historians of science. Inaugurating the whole new genre of laboratory studies, Bruno Latour and Steve Woolgar approached scientists in the contemporary laboratory setting of the Salk Institute in La Jolla, California, as members of "a strange tribe who spend the greatest part of their day coding, marking, altering, correcting, reading, and writing" and whose strange practices could only be understood "without recourse to the explanatory concepts of the inhabitants themselves."[3] Latour and Woolgar labeled their methodological stance an "anthropological strangeness." Steven Shapin and Simon Schaffer have put this ontology to work in historiographic practice. The authors of *Leviathan and the Air-Pump* approached the experimental culture of seventeenth-century England as an anthropologist would approach a foreign culture, trying to understand it

2 Viktor Borisovich Shklovsky, "Iskusstvo kak priem," in *O teorii prozy* (Moscow: 1925), 7–20; English translation: Shklovsky, "Art as Technique," in *Literary Theory: An Anthology*, ed. Julie Rivkin and Michael Ryan (Malden, MA: 1998), 15–21.

3 Bruno Latour and Steve Woolgar, *Laboratory Life: The Construction of Scientific Facts* (Princeton, NJ: 1986), 40–41.

from the so-called native's point of view. Just as an anthropologist first comes to a foreign culture as a stranger, they pretended to be strangers to experimental culture. "Playing the stranger" was the heuristic device they endorsed in order to de-familiarize an activity the participants take for granted, to "query its taken-for-granted framework" and "to move away from self-evidence."[4]

In searching for allies in their project of questioning the "self-evident," scholars usually point to Anglo-American cultural studies. Indeed, the lessons of cultural anthropologists such as Clifford Geertz, who described the scholar's "encounter with his object of study" as "the journey into another world, a magical realm full of surprises,"[5] were not lost on historians of science in the wake of Kuhn. The anthropological focus on the localness of knowledge practices, rather than on the "universality" of knowledge, resonated with the post-Kuhnian turn in the history of science to local practices and the cultures of science. Be it a study of witchcraft among the Azande or the cultural history of objectivity and rationality, this "journey into another world" revealed the meanings of things within the context in which they were produced. The results of defamiliarizing the obvious and self-evident were often surprising to the historians themselves. Once defamiliarized and placed in historical context, the seemingly timeless and ahistorical objectivity "came to seem at once stranger—more specific, less obvious, more recently historical—and deeper … than we had ever suspected."[6]

"Estrangement"—making the familiar unfamiliar and strange—has become a central methodological strategy in science studies and the cultural history of science. As a heuristic device, "estrangement" has a strange genealogy indeed. If nothing else, it links together Boris Hessen, the Russian Formalists, Clifford Geertz, the authors of *The Leviathan and the Air-Pump*, and the authors of *Objectivity* in an improbable, yet not entirely surprising, genealogy.

4 Steve Shapin and Simon Schaffer, *Leviathan and the Air-Pump*: *Hobbes, Boyle, and the Experimental Life* (Princeton, NJ: 1985), 6.

5 Clifford Geertz, *The Interpretation of Cultures: Selected Essays* (New York: 1973), 347.

6 Lorraine Daston and Peter Galison, *Objectivity* (Cambridge, MA: 2007), 10.

A Matter of Skill

Maria Avxentevskaya

Ha. *interject.* {*ha,* Latin.}: An expression of wonder, surprise, sudden question, or sudden exertion.[1]

The historical typologies of surprise include Aristotelian and Platonic interpretations, the casting of surprise as an emotional response and as a sense-making process. Considering it in the spirit of Plato's ἐξαίφνης, a sudden flash of cognitive illumination displaying things in a new light, we will zoom in on the vocabulary of amazement in the early modern British history of knowledge. This discursive lens can help us to observe how speaking about the marvelous invoked nuanced responses to epistemic anomalies.

In the early seventeenth century, "surprise" in common usage indicated an ambiguous action. The etymology of the verb, ultimately from Latin *superprehendere,* meaning "seize, catch," contributed to its mixed connotations: most often it implied "to interrupt an activity"—something not necessarily pleasing for those surprised. Whereas "surprise" resembled a lightning strike of new awareness, "wonder" referred to a more continuous encounter with the new, one also linked with a state of being baffled or taking a naive delight in magic tricks. Didactic arguments often cited "wonder" as part of the withering negation, "no wonder that."

The epistemic role of amazement can be described in terms of *stasis*—a rhetorical technique best understood through analogy with physical movement. *Stasis* is the cessation of a motion due to a sudden noticing of conflicting stimuli to move in different directions. In rhetoric, this means pausing the discourse to ruminate on the possible unfolding of argumentative paths because one's attention has been arrested by a new object. The procedure of *stasis* departs from a surprise and continues with wondering—asking questions about new phenomena to appropriate them into a tentative narrative, which is a logically neutral way to explore novel grounds without disturbing established beliefs.[2]

1 Samuel Johnson, *A Dictionary of the English Language* (London: 1755), 954.

2 Quintilian, *Institutio oratoria,* trans. Harold Edgeworth Butler (Cambridge, MA: 1922), Book III, 5:80–81.

Early modern natural philosophy conceptualized wonderment by amalgamating its colloquial connotations with the legacy of classical rhetoric. Bacon's *Advancement of Learning* (1605) famously characterized wonder as both "broken knowledge" and "the seed of knowledge."[3] The ostensible discrepancy between breaking and planting is resolved in Bacon's explanation of how "aphorisms, representing a knowledge broken, do invite me to inquire further."[4] This insight is exemplified in his *Novum Organum* (1620), where the "broken knowledge" articulated in aphorisms induces a *stasis*-like disposition to pause the argument and examine the emerging discursive paths. Experimental philosophy redefined surprise as a noble state of mind and a precursor to making sense of puzzling phenomena.

But how should attention be attuned to the right cues for surprise? Which seeds will sprout into illuminating new ontologies? How could the mind, wrestling with the dialectics of case and series in the practices of collecting, adopt a nuanced treatment of irregularities in observation, thought, and action?

Early discourses of the mind deemed some surprises to be more surprising than others because they signaled anomalies that were harder to explain. Robert Burton's *The Anatomy of Melancholy* (1621), which privileged "it is a wonder" statements, discerned such perplexing deviations from regular oddities. For example, although madness is a mysterious malady in itself, what is "more to be wondered at" is that "it takes every other, and sometimes every third in a lineal descent."[5] The pseudo-Aristotelian *Mechanical Problems* (3rd c. BCE–6th c. AD) already discriminated between the degrees of learned wonderment: one could equally marvel at natural causes and human τέχνη appeared to contravene the laws of nature, but the most wondrous were things that paradoxically embraced opposites.[6]

John Wilkins's *Mathematical Magick* (1648) followed the reception of the Aristotelian corpus in cultivating a sense of surprise.

3 Francis Bacon, *Advancement of Learning* (London: 1605), Book I, I, 3.

4 Bacon, *Advancement of Learning*, Book II, XVII, 7.

5 Robert Burton, *The Anatomy of Melancholy* (Oxford: 1628), Books I, II, VI.

6 Aristotle, *Minor Works,* ed. W. S. Hett (Cambridge, MA: 1936), 330–331, 333.

Although his early writings reiterated surprise's contemporary connotation of equivocality, Wilkin's vernacular treatise on popular mechanics makes even more noticeable the semantic twist of emancipating and objectifying wonder. He brings the practical art of mixed mathematics into the pantheon of the liberal arts, which also liberates the artificial wonders that are crafted without magic. Most of the marvels he mentions are fabled mechanical contrivances involving kinetic extremes: exceptionally swift, slow, and powerful motion, extraordinary imitations of living bodies or natural sounds, and movement with no apparent cause. However, artificial wonders excel due to their "compendious" configuration: the most wondrous inventions of mechanical art are useful for a "multitude and variety of services" but at the same time are "regular, simple, and perspicuous, like the apprehensions of a distinct and thoroughly informed judgement."[7] Wilkins's recipe for the right wonderment involves compounds of paradoxical opposites—the principle of composition endorsed by all the liberal arts.

In spite of enthusiastic disclaimers, early modern natural philosophy benefited from rhetorical *ornamentum* in the sense of both "apparatus" and "embellishment." In Wilkins's view, what equated mechanics with other liberal arts was their shared capacity to adorn by ingeniously implanting coherence into the copious mass of parts and details. All liberal arts refine the skill of pausing in surprise to regard things in their various congruities. Long before Kant's *Critique of Judgement*, classical rhetoric shaped the aesthetics of wonder in pushing the limits of the possible for human knowledge and craftsmanship. In early modern England, this agenda was promoted by the recently established Royal Society of London. Its first apologist, Thomas Sprat, working under Wilkins's close supervision, claimed to foresee the "wonderful model" of future science, which he was determined to convey, even though, at times, it would inevitably be disfigured by unskilful hands.[8]

7 John Wilkins, *Mathematical Magick, or the Wonders that May Be Performed by Mechanical Geometry* (London: 1648), 169; also: 9–10, as quoted below.

8 Thomas Sprat, *The History of the Royal Society* (London, UK: 1667), 60–61.

How I Found the Dogs

Monika Baár

Berlin, April 2008.
10 p.m., Tegel Airport. I board the night flight of the (now defunct) Hungarian Airlines, traveling from Berlin to Budapest. The journey isn't long, under two hours. Some passengers are sleeping; others are staring at their phones. I have more than enough reading material for even a transatlantic journey: *New York Review of Books, Der Spiegel*, two novels. Somehow, tonight, none of these appear as attractive as they do on other occasions. Perhaps I should try to sleep? It doesn't work. Spontaneously, I reach for the in-flight magazine. It's something I rarely do: I have little interest in advertisements; I have heard the safety instructions many times. Leafing through, I stumble on a short piece, just two paragraphs: "This month we are celebrating the international day of guide dogs for the blind." Guide dogs have been used since ancient times, explains the text, but their professional training started in Germany after the First World War to support the many young, blind veterans who wanted to be able to return to work and live independently. Little do I know that this in-flight magazine story will become my next research topic.

Groningen, late night, 2009.
Haphazard googling leads me to the work of Rudolphina Menzel (1891–1973), outstanding canine scientist. Among other contributions, she was the author of groundbreaking research on the developmental phases of puppies. I become interested in her life. Born into a liberal Jewish family in Austria, she studied at Vienna University and then researched, bred, and trained dogs. A Zionist, she gave her dogs Hebrew names and taught them to respond to Hebrew commands. Following the Anschluss, at the very last minute, she managed to leave Austria with her husband. This unlikely escape was thanks to a local SS member who warned them about the imminent danger and helped them to leave. There was a reason for his kindness. Earlier, he had received the gift of a dog from Rudolphina, a striking manifestation of solidarity across the deepest divides. The Menzels then settled in Palestine and Rudolphina created an infrastructure for the training of working dogs in Israel: guide dogs for the blind, mine detection dogs, security dogs. But she encountered a problem which she solved;

the "imported" European dogs couldn't cope with the climate and the local parasites, and so she located a semi-feral type of dog used by the Bedouins and domesticated it. Indeed, the new breed turned out to be much better suited to the local environment. She called it the Canaan dog, and it became the "national breed" of Israel. To this day, Canaan dogs are often photographed with the Israeli flag in the background.

Central Zionist Archives, Jerusalem, April 2010.
"Could you please write your name in the registration book?" asks a friendly old lady as I enter the premises of the Central Zionist Archives. A rather strange situation, the likes of which I have not experienced since my childhood. Then there was no shame in not being able to write my name. But in my late thirties it is an entirely different feeling. Later that day, I ask a friend to teach me to write my name with Hebrew characters, and I suddenly realize how convenient it is to be left-handed in this new situation. The archivists are not particularly friendly; one of them is smoking in the little room behind the counter. This is a first: Smoking in the archives! Where all the unique and irreplaceable documents of many of the "founding fathers" of the country are being held! I wait at the counter and finally the requested dossiers are handed over to me. Some contain only a single sheet; others are very bulky. All are rather dusty, and I get the impression that no one has looked at them since they were delivered to the archives after Menzel's death. The material is a miscellany: assessment sheets testing the capabilities of dogs for various working functions, manuscripts of articles, press clippings showing American youth visiting the guide dog training premises in the context of a bar mitzvah project, postcards sent to friends, a draft of a film script. Most of these items are crowded into one big paper box, and as I am trying to sort them out, a handwritten letter falls out of the box onto the floor. Picking it up, I notice that it is written in German. The author of the letter thanks the Menzels for the invitation to visit them in Israel, which he regretfully cannot accept because of his old age and failing health. He would, however, very gladly welcome the Menzels in St. Petersburg if they were interested in visiting

him. The letter continues with a technical discussion in which he accepts some of the criticism leveled by Rudolphina at this theory of dog conditioning. And then, the letter falls again onto the floor, this time from my hands. I pick it up, put it back into the dossier, and silently ask Rudolphina, and Ivan Pavlov for forgiveness for having been handling their correspondence so clumsily.

Zadig et la sarigue de Cuvier

Bruno Belhoste

La reine de Babylone a perdu sa chienne.

– Jeune homme, n'avez-vous point vu le chien de la reine ?

– C'est une chienne et non un chien, répond Zadig, une épagneule très petite. Elle a mis depuis peu à bas, elle boîte d'un pied et elle a des oreilles très longues.

– Vous l'avez vue ?

– Non, et je n'ai jamais su que la reine avait une chienne.

Zadig est condamné. Mais voilà que la chienne est retrouvée et il doit s'expliquer:

– J'ai vu sur le sable les traces d'un animal, et j'ai jugé que c'étaient celles d'un petit chien. Des sillons m'ont fait connaître que c'était une chienne dont les mamelles pendaient, et qu'ainsi elle avait des petits. D'autres traces m'ont appris qu'elle avait les oreilles très longues ; et, comme le sable était moins creusé par une patte que par les trois autres, j'ai compris que la chienne était un peu boiteuse.

La méthode de Zadig racontée par Voltaire est celle des traces. Cuvier prétendra la remplacer par une autre, qu'il élève au rang d'un principe : celui de la corrélation des formes. Pour illustrer son principe, Voltaire a écrit un conte. Pour démontrer le sien, Cuvier nous offrira une surprise : le récit de la sarigue.

Les ouvriers des carrières de Montmartre ont apporté au savant un bloc de gypse fendu en deux morceaux, laissant apparaître, quand on les sépare, la double trace d'un petit animal: sur la partie supérieure la tête, tournée du côté gauche, le corps et la queue ; sur la partie inférieure, ébréchée, seulement quelques os. Il s'agit d'identifier l'espèce.

Cuvier commence par examiner les mâchoires et la dentition. L'empreinte de la partie gauche de la mandibule montre qu'il s'agit d'un carnassier. Creusant dans la pierre pour dégager la partie droite, Cuvier trouve quatre molaires en bas et quatre en haut, ainsi qu'une canine. Cette partie lui rappelle celle d'un animal fossile décrit par Delamétherie, qui y a vu une chauve-souris, mais cette fois le squelette est bien celui d'un quadrupède. La position du condyle, note-t-il, est plutôt celle d'un insectivore. Il pense d'abord à un hérisson. Soudain, en creusant plus profond, apparaît l'élément décisif : la largeur

de l'apophyse coronoïde, caractéristique des didelphes. Un dernier détail vient confirmer l'hypothèse: le pli intérieur de la branche montante, invisible sur la partie gauche, ressemble exactement à celui d'un didelphe du genre sarigue. L'examen des molaires, avec leurs trois petites pointes, renforce une conviction déjà faite: l'animal est une sarigue.

La sarigue est un petit marsupial d'Amérique. Que vient-elle faire à Paris? Le géologue Faujas de Saint-Fond a déjà attaqué Cuvier pour avoir identifié dans un fossile les restes d'un tapir. Puisque la faune du Nouveau Monde et celle de l'Ancien sont entièrement distinctes, comme l'a montré Buffon, il ne peut y avoir de tapirs en France, qu'ils soient fossiles ou vivants. D'ailleurs, soutient Faujas, tout chez Cuvier est faux: le tapir, mais aussi les prétendus animaux disparus qui se sont multipliés sous sa plume: le mammouth, le mastodonte, le mégathérium, le paléothérium, etc. Ces reconstitutions ne sont que le fruit d'une imagination fertile.

La sarigue de Montmartre est pour Cuvier une aubaine. Avec elle, il entend bien répondre à Faujas et le terrasser définitivement : oui, des animaux d'Amérique ont vécu dans le passé à Paris ; oui, certaines espèces d'animaux sont aujourd'hui éteintes; oui, le scénario des *Epoques de la Nature* de Buffon n'est qu'un roman; oui, la méthode de reconstitution des fossiles fondée sur l'anatomie comparée, et plus particulièrement sur le principe de la corrélation des formes, est certaine, contrairement aux «édifices fantastiques» des théories de la Terre, que Cuvier méprise et dont Faujas est le champion attardé.

« Le vrai cachet d'une théorie est sans contredit la faculté qu'elle donne de prévoir les phénomènes ». Pour cela, Cuvier réunit quelques confrères qui seront ses spectateurs. Il grattera devant eux le morceau inférieur, à hauteur du bassin de l'animal. Vous y verrez deux os spéciaux qui soutiennent la poche marsupiale, annonce-t-il, preuve irréfutable que cet animal fossile est semblable aux animaux du Nouveau monde. Cuvier dégage délicatement la pierre et voilà qu'il triomphe: les deux os apparaissent, comme il l'avait prévu. Mais, s'il s'agit d'un marsupial, est-il d'Amérique ou d'Australie? Cuvier, grattant encore la pierre, trouve la réponse définitive. Sur le membre

inférieur, le pouce est plus long que les autres doigts : c'est bel et bien une sarigue !

Le récit de la sarigue est entré dans la légende de la paléontologie. C'est le principe de corrélation des formes mis à la portée des enfants. Comme Cuvier l'écrit lui-même,

> aujourd'hui quelqu'un qui voit seulement la piste d'un pied fourchu peut en conclure que l'animal qui a laissé cette empreinte ruminait ; et cette conclusion est tout aussi certaine qu'aucune autre en physique ou en morale. Cette seule piste donne donc à celui qui l'observe et la forme des dents, et la forme des mâchoires, et la forme des vertèbres, et la forme de tous les os des jambes, des cuisses, des épaules et du bassin de l'animal qui vient de passer. C'est une marque plus sûre que toutes celles de Zadig.

Pourtant, en 1880, dans un article ironique, Thomas Huxley est revenu sur ce principe. Il note que Cuvier n'a rien fait d'autre, en identifiant la sarigue, que n'avait fait Zadig avec la chienne. Son raisonnement est purement inductif et analogique : nul principe nécessaire, nul « science presque géométrique », ainsi que Cuvier l'affirme en conclusion de son article, mais seulement des traces et des indices. D'ailleurs, cette fameuse expérience réalisée publiquement a-t-elle vraiment eu lieu ? Sans doute. Pourtant, il reste un fait surprenant : en dehors du récit de Cuvier lui-même, nous n'en avons ni indication, ni témoignage. Cuvier est un très grand naturaliste. C'est aussi, il faut l'avouer, un grand illusionniste !

The Wolf Around the Bend

Etienne S. Benson

The wolf tracks appeared after a mid-May snowfall, running along a gravel bar in the river just in front of Adolph Murie's cabin in Mount McKinley National Park. Upstream, Murie knew, there was no prey to attract a wolf's attention at this season, so the most likely explanation was a den with pups. He followed the tracks for about a mile until they led away from the river and up a bluff. There, he later recalled, "I surprised myself and a black wolf, a male."[1] The wolf fled to a nearby ravine, where Murie could hear him howling and barking as he searched for the den.

Murie's 1961 account of his years of field research in McKinley, *A Naturalist in Alaska*, is full of such unexpected encounters. Murie is surprised by wolves, wolves are surprised by Murie, squirrels are surprised by foxes, bears are surprised by other bears. Predators and prey alike are wary and alert, but surprises are nonetheless frequent, and occasionally fatal. Sometimes one party has the jump on the other, but often the surprise is mutual. Two animals, one of whom may be human, share a moment of shock, wondering what happens next.

Murie first arrived in McKinley—since renamed Denali—in the summer of 1939, on assignment from the National Park Service to determine whether wolves threatened the survival of the park's population of Dall sheep. His study and the recommendations he drew from it loom large in the history of the US park system, helping as they did to bring a long-standing policy of predator eradication to an end.[2] Over the following two decades, Murie continued to revisit Alaska, steadily widening the scope of his observations to encompass the park's moose, caribou, bears, foxes, squirrels, voles, ravens, ptarmigans, cranes, gulls, weasels, and wolverines.

When necessary, Murie was capable of characterizing wildlife in the quantitative terms of population ecology, but his favored form of evidence was the telling anecdote. It was his stories more than his statistics that convinced conservationists that wolves helped to maintain nature's balance by eliminating the weak, the old, and the

1 Adolph Murie, *A Naturalist in Alaska* (New York: 1961), 199.

2 Richard West Sellars, *Preserving Nature in the National Parks: A History* (New Haven, CT: 2009), 158–160.

diseased. This storytelling approach was atypical for field biologists of Murie's generation, and even more so for the generation that followed him, who instead sought to solidify their status as scientific experts by adopting self-consciously "objective" methods—that is, methods that were quantitative, instrument-based, and avoided all talk of intentions or emotions.[3] Murie's methods, in contrast, harked back to Ernest Thompson Seton and other early-twentieth-century tellers of anthropomorphic animal stories.[4]

Some of Murie's favorite animal stories concerned moments of surprise. Punctuating his accounts of animal behavior and ecology, they distilled long hours of mostly uneventful observation into exciting instants of discovery. These tales also gave him an opportunity to communicate some of his most deeply held values. For Murie, explaining the behavior of wild animals was not enough; he wanted to understand them, which he believed could only be done by treating them as sentient individuals rather than as unfeeling automata or aggregate populations.[5] As his older brother Olaus Murie noted, "true basic research" for Adolph meant "establishing an intimate relationship with the creatures that reveals their motivation in all they do."[6] Surprising encounters, in this context, were signs of intimacy and steps toward understanding.

If surprise arises from a violated expectation, then the expectation that is violated most often in the pages of *A Naturalist in Alaska* is that of solitude. The particularities of animal behavior sometimes elicit Murie's astonishment, but it is often merely the unexpected presence of an animal that catches him off guard. The same holds true for the animals he observes. A ground squirrel might suspect that there are foxes nearby, but the sight of a particular fox peering into the mouth of her burrow at this very moment still provides a

3 Gregg Mitman, "When Nature *Is* the Zoo: Vision and Power in the Art and Science of Natural History," *Science in the Field,* special issue, *Osiris* 11 (1996): 117–143.

4 Ralph H. Lutts, *The Nature Fakers: Wildlife, Science and Sentiment* (Charlottesville, VA: 2001); Lorraine Daston and Gregg Mitman, eds., *Thinking with Animals: New Perspectives on Anthropomorphism* (New York: 2005).

5 Eileen Crist, "Naturalists' Portrayals of Animal Life: Engaging the Verstehen Approach," *Social Studies of Science* 26, no. 4 (1996): 799–838.

6 Olaus J. Murie, "Foreword," in Murie, *Naturalist in Alaska,* xi–xii, on xii.

jolt. The expectation of solitude required for this kind of surprise is, in Murie's view, something that can be found only in the wilderness. In the city or on the farm, cross-species encounters are either absent or too predictable to generate the surprises that will deepen understanding.

If Murie believed that the value of wilderness came largely from the opportunities it provided for solitude and surprise, then it is clear why he was opposed to the electronic surveillance techniques that were being introduced to the parks around the time he was writing *A Naturalist in Alaska*. The problem with radiocollars and similar devices was not simply the intrusion of technology into what Murie saw as the last remaining enclaves of pristine North American wilderness, but also their impact on the equal-opportunity economy of surprise, in which a fox in hot pursuit of a ground squirrel could be startled by a ptarmigan bursting out of the underbrush, or a scientist could stumble into the path of a wolf hurrying home.[7] From Murie's perspective, radiotracking looked like a means of monopolizing surprise, and as such it undermined one of the values that made wilderness worth preserving in the first place.

There is nothing innocuous about surprise; to find out that the world is other than expected is often to discover that it holds unforeseen hazards. While wolves posed little threat to Murie, bears could do serious damage, and they were a source of real and constant anxiety. Murie, too, was hardly harmless to all the creatures he met. On that late-spring day in 1940, after chasing away the black wolf's mate, Murie crept into the den and used a willow branch to drag out three of the whimpering pups, one of whom he took back to camp "for closer observation and acquaintance."[8] Stealing the pup left Murie with a lingering sense of guilt, but that, too, was part and parcel of the wilderness economy of surprise. His aim was not innocence but rather openness to other lives and other minds beyond the human —minds that were, like his own, sometimes surprised, sometimes surprising, and sometimes both at once.

7 Murie, *Naturalist in Alaska*, 156.

8 Murie, *Naturalist in Alaska*, 200.

Random Numbers For and Before Computers

Dan Bouk

Demographers in the early 1940s studying the "social and psychological factors affecting fertility" among white, native-born American couples completed a series of extensive interviews and punched the responses onto paper tabulating cards. Their worries about the peculiarities of small samples led them to interview disproportionate numbers in some classes of respondents, such as those who said they "planned" their families and yet still had many children. But that fix created a different problem: their final paper cards underrepresented more typical classes.[1] A solution lay between the pale-blue, heavy-paper covers of a small booklet—not in its few pages of text, but rather in its 26 pages, each covered top to bottom by nonsensical strings of printed digits numbering 41,600 in all.[2]

The booklet promised a surprise on every page—no, a surprise with every digit. Its author, L. H. C. Tippett, worked in Karl Pearson's Department of Applied Statistics at University College, London, where he had been employing a traditional technique for coming up with random numbers to test some statistical theories. He filled a bag with paper "tickets," each bearing a different number. Then he drew tickets from the bag. Other researchers at the time drew balls from urns or picked from shuffled cards. They had adopted the techniques of gamblers and priests to serve science. Balls, lots, tickets, or cards that had once been plucked by those seeking the thrill of uncertainty or some hint of the will of God became for statisticians machines for manufacturing statistically reliable surprises. Mathematical statisticians wanted a string of numbers that could not be explained by any logic or structure. They wanted to be sure that no one could predict what the next number in each string would be.

Tippett's research demanded thousands of numbers, and he could not manage the process with his paper tickets. (One imagines the paper cuts.) Karl Pearson suggested he abandon the tickets, noting in a preface, "In short, ticket and cards, balls and beads fail in large scale

1 P. K. Whelpton and Clyde V. Kiser, "Social and Psychological Factors Affecting Fertility: V. The Sampling Plan, Selection, and the Representativeness of Couples in the Inflated Sample," *Milbank Memorial Fund Quarterly* 24, no. 1 (January 1946): 49–93.

2 L. H. C. Tippett, "Random Sampling Numbers," *Tracts for Computers* 15 (1927).

random sampling tests; it is as difficult to get artificially true random samples as it is to sample effectively a cargo of coal or of barley."[3] Tippett visited the library of the Statistics Department instead.

Flipping through volumes of U.K. census data, he judged that the areas of each parish presented random patterns of digits. Years later he turned census figures into random numbers: "In order to avoid possible biases due to such factors as rounding, I discarded the first two and last two digits of each area, and copied down all the remaining digits, more or less in the order in which they appeared in the returns."[4] Future users could read the digits left to right, or in reverse, or by columns, or along diagonals to generate the greatest number of random strings possible.

Today the production of random numbers begins with an algorithm and relies on the power of the computer to generate surprise, to simulate with code the absence of logic and purpose. Tippett's story refigures randomness as a quality to be sought among the debris left behind by the "avalanche of printed numbers."[5] It reminds us that statistics was, quite often, a science of the archives.[6] And the computers in this case were not the generators of these numbers but their audience.

Pearson's Department of Applied Statistics began publishing *Tracts for Computers* after it "carried out a great deal of computing work of one kind or another bearing on special war problems of a physical character" during WWI.[7] The tracts offered the growing ranks of human computers a de facto textbook and brought into wider circulation the sort of tables that were essential to speeding calculations for complex problems: tables that included Tippett's random sampling numbers. Audiences appear to have been greedy

3 Tippett, "Random Sampling Numbers," iii.

4 Tippett, "Letters to the Editor: The Genesis of Random Numbers," *American Statistician* 19, no. 1 (February 1965): 16.

5 Ian Hacking, "Biopower and the Avalanche of Printed Numbers," *Humanities in Society* 5, nos. 3 & 4 (1982): 279–295.

6 Lorraine Daston, "The Sciences of the Archive," *Osiris* 27, no. 1 (2012): 156–187.

7 Prefatory note to Eleanor Pairman, "Tables of the Digamma and Trigamma Functions," *Tracts for Computers* 1 (1919).

for these new resources: in the New York Public Library's copy of Tippett's numbers, the tables have been cut out, as were those in a similar, later tract.

Following Tippett's library discovery, other researchers tied to Pearson's lab through the global networks traced by its journal *Biometrika* began using his tables to test theories or design experiments. Over the next two decades, Tippett's tables spawned new tables of statistical derivates in Kolkata and Uppsala. Those who used them also frequently took the opportunity to test the numbers for randomness and found them suitable for drawing small samples and generally devoid of any "systemization," as a researcher at the Mayo Clinic concluded after making extensive tabulations from cards punched with the numbers—cards he used to randomize treatments in a study. Only the scale of the series presented a lasting problem: researchers needed more random numbers for larger-scale research.[8]

Back in Indianapolis, the researchers also punched Tippett's numbers into paper cards. They used the numbers to select 44 cases of "fecund childless couples" to duplicate and 161 cases of "fecund couples with one live birth" to duplicate plus 21 to copy two times over. By these duplications, the researchers applied the appropriate weightings to each group for the final statistical analysis. Which cards should be duplicated? Thanks to Tippett's summer in the library, the answer came as a surprise.

8 K. Raghavan Nair, "On Tippetts 'Random Sampling Numbers,'" *Sankhyā: The Indian Journal of Statistics* 4, no. 1 (1938): 65–72; Herman Wold, "Random Normal Deviates: 25,000 Items Compiled from Tract No. XXIV (M. G. Kendall and B. Babington Smith's Tables of Random Sampling Numbers)," *Tracts for Computers* 25 (1948): iv–vi; Robert Gage, "Contents of Tippett's 'Random Sampling Numbers,'" *Journal of the American Statistical Association* 38, no. 222 (1943): 223–227.

« Ce sentiment vif de plaisir … »

Marie-Noëlle Bourguet

À l'automne 1796, lors d'une course minéralogique dans le massif du Fichtelgebirge, Alexander von Humboldt voit sa boussole s'affoler soudain à l'approche d'un amas de serpentine verte, très pure : la roche semble dotée d'une polarité magnétique si puissante qu'elle a, à plusieurs mètres de distance, « détourn{é} l'aiguille aimantée de sa position naturelle ». Le voyageur raconte avoir éprouvé devant ce phénomène intempestif un vif sentiment de plaisir : le trouble déclenché par « la vue d'un phénomène nouveau » est pour lui un appel à ouvrir l'enquête. Dès ce moment, bientôt encouragé par le physicien et navigateur Jean-Charles de Borda qui lui conseille d'emporter au Nouveau Monde une boussole d'inclinaison, Humboldt fait de l'étude du géomagnétisme, phénomène dont la nature est alors mal identifiée, un objet de tous ses voyages : « Observons ; recueillons des faits indubitables ; c'est seulement ainsi que les théories physiques s'établiront sur des bases solides[1]. »

S'inscrivant dans la longue tradition qui, depuis Platon et Aristote, fait de la capacité humaine à admirer et à s'étonner le principe même de la connaissance, Humboldt reconnaît ainsi une portée heuristique à l'émotion que suscite la vue d'un phénomène inhabituel, extraordinaire. Symptôme d'un décalage, sinon d'une rupture, entre le savoir acquis, qui fonde l'attente, et l'observation d'un fait inattendu, insolite, la surprise est loin d'être une sensation passive, imposée de l'extérieur : elle excite chez le voyageur curiosité, questionnement, attention. À ce titre, au travers d'expressions qui disent l'étonnement, la surprise, l'émerveillement même – en allemand, *Erstaunen,* Überraschung, *Verwunderung* –, cette notion occupe dans l'écriture narrative de Humboldt une place cruciale, essentielle à l'évocation de l'activité de connaissance.

Cependant, la réaction face à l'imprévu ou à l'inconnu est loin d'être un sentiment univoque : à preuve, la variété des situations qui provoquent l'étonnement du voyageur au moment de son arrivée au Nouveau Monde en juillet 1799, et qui correspondent à des configurations cognitives très diverses. Le voici, alors qu'il vient de mettre le

1 Alexandre de Humboldt, "Sur les polarités magnétiques d'une montagne de serpentine," *Bibliothèque britannique* 5 (1797): 376–388.

pied sur le continent, près de Cumaná. Confronté à la nouveauté radicale de la faune et de la flore américaines, il tente de décrire à son frère Wilhelm l'expérience esthétique qu'a provoquée cette rencontre, la soudaine perte de repères, l'intense plaisir ressenti : « Nous nous promenons jusqu'à présent comme des fous {…}. On rejette toujours un objet pour en saisir un autre. Bonpland assure qu'il perdra la si les merveilles ne cessent pas bientôt[2]. » Submergés par l'émotion face à l'exubérance de la nature tropicale, les deux compagnons se trouvent dans un état d'égarement et de sidération, incapables d'aucune opération de connaissance. L'émerveillement et la désorientation restent une source d'excitation, de jubilation même ; mais ces sensations, cantonnées dans le registre émotionnel et esthétique, échappent sur le moment à toute analyse rationnelle.

Peu après, dans les mêmes lieux, c'est une impression en complet contraste que suscite chez Humboldt la vue, non de la végétation cette fois, mais des masses rocheuses qui apparaissent à nu près de la côte. Ici, la nature et l'orientation des strates lui paraissent d'emblée familières, éveillant obscurément la réminiscence de choses déjà vues par-delà l'océan. La sensation reste celle de l'étonnement, mais le mécanisme épistémique qui la sous-tend n'est pas celui d'une rupture. Il est au contraire de l'ordre de la reconnaissance, qui permet d'établir des liens, de comparer, d'élaborer :

> Lorsqu'à la fin d'une longue navigation, après avoir passé d'un océan à l'autre, l'habitant du nord aborde à une côte lointaine, il est surpris de trouver, au milieu d'une foule de productions inconnues, ces strates d'ardoise, de schiste micacé et de porphyre trapéen, qui forment les côtes arides de l'ancien continent {…}. Partout il reconnaît, et non sans une certaine émotion, au milieu d'un nouveau monde, les roches de son pays natal[3].

Là où l'étrangeté du monde végétal et animal laisse le voyageur d'abord stupéfié, parce qu'elle paraît excéder toute possibilité de rap-

2 Alexandre de Humboldt, *Lettres américaines d'Alexandre de Humboldt*, ed. E. T. Hamy (Paris: 1905), 27.

3 Alexandre de Humboldt, *Vues des Cordillères et monumens des peuples indigènes de l'Amérique* (Paris: {1810}–1813), 1:122.

prochement, le sol américain le surprend agréablement en offrant d'emblée des points de repère, des indices qui éveillent le souvenir, permettent le raisonnement, conduisent à la généralisation savante : au regard du géognoste, ces rochers attestent l'unité des phénomènes géologiques et l'universalité des lois qui, d'une rive à l'autre de l'océan, régissent la physique du globe terrestre.

Entre ces deux extrêmes – expérience du choc émotionnel face à la nouveauté de la nature américaine, sentiment de familiarité devant la structure de la terre –, tous les registres possibles de la surprise ont accompagné Humboldt au long de son voyage, forgeant le ressort psychologique et la dynamique de sa quête. Un demi-siècle plus tard, faisant retour sur son expérience, le vieil homme devait s'inquiéter à l'idée que puisse un jour s'épuiser, sous l'effet des avancées de la science mesureuse et quantificatrice dont il s'était fait l'apôtre, le « charme de la nouveauté et de la surprise » dont son voyage avait été empreint.

> Notre siècle, plus investigateur et maître d'un plus riche fonds d'idées, a trouvé une compensation à la perte des jouissances que faisait éprouver autrefois aux spectateurs surpris la masse imposante des phénomènes de la nature. {…} Cette conquête des temps modernes a pour garant l'observation de plus en plus pénétrante qui s'applique au jeu régulier des forces de la nature[4].

Son inquiétude est bientôt levée, cependant, par la seule énumération des champs d'exploration nouveaux ouverts à la science de son temps : électromagnétisme, polarisation de la lumière, physiologie des organismes vivants, etc. Face au « vaste ensemble de merveilles qui se déroulent à nos regards comme un monde nouveau dont nous touchons à peine le seuil », l'enchantement et la surprise n'étaient pas près de disparaître de l'expérience des savants.

4 Alexandre de Humboldt, *Cosmos. Essai d'une description physique du monde*, trans. Charles Galusky (Paris: 1855–1859), 2:328–329.

Fiat Lux

Martin Brody

As the orchestra evaporates into silence, a bassoon farts, loud and low. The music glides along serenely while the performers execute a slow-motion exodus. A recapitulation proudly appears in the wrong key, sowing confusion. A fortissimo chord crashes into a pianissimo cadence. The violins stop dead in the middle of a peppy fanfare to fix their sour lowest string. They appear to be protesting a newfangled technology, the wire-wound, gut G string.

Franz Joseph Haydn's symphonic pranks weigh heavily in the history of European concert music. As many have noted, the master's penchant for comic surprises augured the ascendance of a newly efficient apparatus, the orchestra, performing in a new environment, the public concert. Rendered by a large ensemble populated by seasoned performers, the slapstick effect of a loud sound in a soft passage could have the semiotic density of an omen—as Emily Dolan has put it, "an aural promise of the orchestra's potential … signal{ing} to the listener that the entire movement plays with the *idea* of the orchestra."[1] Haydn's idea, however, was more than sonic. Whether subtle or slapstick, collective or individual, orchestral mischief was an expression of the will, and it seemed to emanate from the instruments themselves. Orchestral mischief thus could mirror an unruly audience, spoofing its flatulence, loud noises, and unpredictable fits.

No misdeed, however, was left unassimilated in the musical order. Haydn's maverick pranks also created a compact between composer and listener, who, as Scott Burnham proposes, is "in effect both straight man and insider, progressing from someone who is joshed to someone who gets the joke." The musical joke enfranchised a distractible audience, enforcing keen attentiveness to a relentless argument of organized sounds that subsume all anomalies. As Burnham suggests, Haydn's surprises spark a "shock of recognition {that} is no vertiginous glimpse into a solipsistic abyss but rather a surging confirmation of the self-transcending dimension of self-consciousness. {B}ecause Haydn always eventually fulfills the underlying protocols of his musical language … his style can be playful without being

1 Emily Dolan, "The Work of the Orchestra in Haydn's Creation," *19th Century Music* 34, no. 1 (summer 2010): 3–38, on 11.

iconoclastic, witty without being subversive. Haydn's playful disruptions ultimately confirm the sovereignty of Reason."[2]

Miming a rowdy audience with sonic jokes while taming it with a wordless affirmation of Reason is the hallmark of surprise in Haydn's last 12 symphonies. The jokes come fast and furious in these "London" Symphonies, but they are fully sublimated, absorbed into the form. No one theatrically walks offstage mid-movement or makes a game of retuning an instrument. Surprise, when intricately woven into the warp and woof of a maximally dynamic structure, is apotheosized as the source of invention and the touchstone of contingent forms that appear and evaporate in real time.

Haydn's most stunning musical surprise, the "fiat" chord that occurs when God calls forth light in *The Creation,* was, however, no joke, and it reminds us that the composer was never altogether modern. In a program note on *The Creation,* music critic Donald Frances Tovey called the question by insinuating the story of Haydn's visit to the astronomers William and Caroline Herschel into the lore of the oratorio. The composer traveled to Slough to see the Herschels and their telescope on June 15, 1792, shortly after the completion of the triumphant performances of the first six London Symphonies. The occasion inspired Tovey to consider Haydn's interest in rendering the music of the cosmos as a scientific affair. "The chaos {Haydn} intends to represent," Tovey wrote, "is no mere state of disorder and confusion. He has a remarkably consistent notion of it, which harmonizes well enough with the Biblical account of the Creation; not less well with the classical notions of Chaos, whether in Hesiod or Ovid; but most closely with the Nebular Hypothesis of Kant and Laplace, which almost certainly attracted Haydn's attention."[3]

As usual, Tovey's comments provoke close listening, here by raising the question of a composer's interest in cosmogony. "Being an artist," he wryly proposed, "Haydn represents Chaos in a thinkable aspect." In elaborating, however, he suggested that *The Creation's*

2 Scott Burnham, "Haydn and Humor," in *The Cambridge Companion to Haydn*, ed. Caryl Clark (Cambridge, New York: 2005), 59–76, on 75.

3 Donald Frances Tovey, *Essays in Musical Analysis* (Oxford: 1937), 5:114–46, on 114–115.

Antonio Tempesta, "The End of Chaos." Etching from the series *Ovid's Metamorphoses*, 1606. The Elisha Whittelsey Collection and Fund, 1951. The Metropolitan Museum of Art, New York.

mighty opening downbeat evokes something beyond human thought. "Here is your infinite empty space." The first thinkable event in this universe is a resounding measuring stick that subdivides a silent universe into zones defined by 2:1 frequency ratios. The ensuing motives, modulations, and chromatic harmony that compose the nebulae in this not-quite-empty space are made of pitches that subdivide octaves into 12 equal half steps, with the relationship between two proximate notes defined by a complex frequency ratio $\sqrt[12]{2} \approx 1.059463{:}1$. Equal temperament, facilitated by modern instrument design, migrated on many fronts from theory to practice during Haydn's career. It reigns in glorious imperfection in his representation of chaos. The sustained dissonances and chromatic motives that coalesce in the latter phases of the formation of the universe, before God's fiat, uncannily anticipate the music of the future: the leitmotivs and chromatic harmony of Wagner and even the atonality of Schoenberg and Webern, in which interval patterns uninformed by the possibility of ideal consonance govern musical order.

God, it seems, wanted something more: just intonation, transcendent consonance. As William Gardiner aptly described it in 1911, "At the fiat, 'Let there be light!', the instruments are unmuted, and the audience is lost in the refulgence of harmony."[4] God's surprise is no more or less than a loud, long, C major triad. Pure consonance is unburdened for a few precious seconds from thinkable musical principles: norms of harmony and counterpoint and the musical jokes that affirm them. In representing the primordial chaos on the far side of divine light, Haydn anticipated negative dialectics. For the pious composer, however, the possibility of divine perfection appeared in the guise of a stunning shock of *Admiratio*, the precondition and sine qua non of Enlightenment liberalism's surprising jokes.

4 William Gardiner, "Defence of Modern Music," *Monthly Magazine* (March 1811): 134.

Aristotle, Unflappable Philosopher

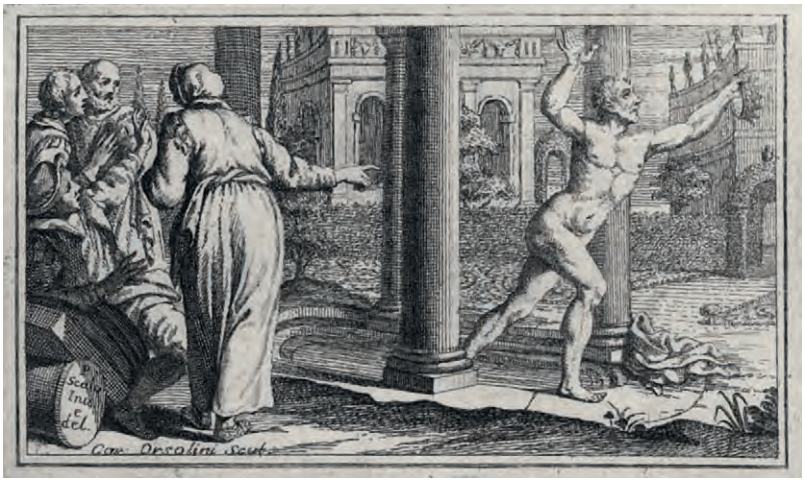
Joan Cadden

An informal survey of nonspecialists reveals that the most obvious point of intersection between "surprise" and "ancient science" is the "Eureka!" of Archimedes, or rather the exclamation point integral to his utterance. But, setting aside the lack of such punctuation in ancient Greek, the association fails. According to Vitruvius (*De architectura*, IX, Preface, 10), from whom we have received the apocryphal story, what the ancient mathematician was expressing when he devised a way to evaluate the purity of a golden crown was not surprise but joy (*gaudio*), however absent that emotion may be in this eighteenth-century image.

Furthermore, whatever his subjective experience, Archimedes both was and presented himself as a master of complex methods, in whose hands the subject matter of mathematics is familiar territory.

Aristotle's confident control of natural philosophy was similar, and it derived from his dual view of his subject matter. In the context of his teleological perspective, the coherence of the natural world was axiomatic. Only if napping through his lectures on the heavens would one have found oneself taken aback by the philosopher's conclusions. In contrast, the phenomena of the sublunary world he described in *Meteorology* or the works on animals, not to speak of the collection of unanswered questions contained in the *Problemata*, might seem to offer many opportunities for surprise. Yet precisely because they were, by their very status, subject to necessity, accident, and chance, Aristotle had no commitment to their regularity, much less predictability. He was unsurprised by phenomena and the ways in which they could be understood, because he viewed the natural world as ordered and purposeful at one level, prolific and unfettered at another. The former might elicit admiration; the latter, low expectations. Neither was disconcerting.

Where, if anywhere, did surprise fit in Aristotle's thinking? Answering entails philological choices, in order to avoid terms such as θαυμάξω, whose meanings center around "wonder," a distinct domain into which only angels fear not to tread, and the history of which could fill a volume, were anyone willing to undertake such a daunting task. Verbs with the root "strike" (πλήσσω), notably ἐκπλήσσω and καταπλήσσω, sometimes tinged with alarm, are at least quantita-



Gian-Maria Mazzuchelli Bresciano (1705–1765), *Notizie istoriche e critiche intorno alla vita, alle inventioni, ed agli scritti di Archimede siracusano* (Brescia: 1737), title page. Bayerische Staatsbibliothek München, 1054717 4 A.gr.b. 149, title page, urn:nbn:de:bvb:12-bsb10215513-6.

tively distinguished from wonder. Aristotle himself reports that people often regard "amazement" or "stupefaction" (ἔκπληξιν) as "excessive wonder" (ὑπερβολὴν θαυμασιότητος) (*Top.* IV.5, 126b14-25). Indeed, he persistently associates surprise with both weakness and excess, that is, deviation from an ideal mean.

As a mental or emotional state, surprise interested Aristotle in moral and rhetorical contexts. People who were easily rattled lacked moderation. Any emotion, he explained in the *Nicomachean Ethics*, admits of excesses that keep people from achieving an appropriate equilibrium. Thus, neither those who are shocked by nothing nor those who are shocked by everything are capable of an appropriate modesty and sense of shame (*EN* II.7, 1108a34; see also: *EE* II.3, 1221a1 and III.7, 1233b28). If the habitus of being unduly struck by things bars one from fulfilling moral and social ideals, it also—indeed consequently—makes one a mediocre audience for serious art. The catharsis that a tragedy should produce requires the spectator to experience fear or pity, but, as Aristotle observes in the *Rhetoric*, those who jump every time someone says "boo" (ἐκπεπληγμένοι) are too

focused on their own situations to be susceptible to pity, while the overly brave or reckless are taken aback by nothing. (*Rhet.* II.6, 1385b29-34).

Surprise can have a positive function, but even when it does, its causes and effects reveal why Aristotle excludes it from the experience of the philosopher. In tragedy the mechanisms of catharsis may be served by the shock of recognition at an unwitting act. Sophocles's *Oedipus* provides his example of a discovery that astounds the audience (*Poet.* XIV, 1454a4: ἡ ἀναγνώρισις ἐκπληκτικόν). In order to advance the goal of producing wonder, it is permissible for art to make a work more astonishing (ἐκπληκτικώτερον) by deviating from the truth, something that is not permissible in politics (*Poet.* XXV, 1460b13-25). In such cases, the author, by the use of rhetorical devices, may produce surprise in the audience, in whom it gives rise to emotional and ethical effects. Sometimes these are negative, as when an orator gives the false impression of speaking the truth, stupefying (καταπλήττουσι) listeners with empty sounds (*Rhet.* III.7, 1408a20-25). But even if they are positive, the cause is not the truth and the effect is not knowledge. Surprise is thus dissociated from science.

In fact, surprise may be a reaction that separates the sheep from the goats, the connoisseur of nature from its mere audience. In that spirit, the first-century BCE Aristotelian *De mundo* expresses pity for small-minded people who are overawed (ἐκπεπληγμένους) by ordinary things like a cave or a mountain (*DM* I, 391a24). Aristotle himself seems to have been amused by those who failed to appreciate the abundance of variety in the natural world. *Historia animalium* mentions the enormous range in the size of internal organs within a species, apparent in sacrificial victims. He cites the island of Naxos, where "nearly all quadrupeds {have} such a large {gallbladder} that foreigners are shocked {ἐκπλήττεσθαι} when offering a sacrifice, supposing it is their own personal omen, but it is its nature" (*HA* I.17, 496b26-29).

Archimedes may have aimed to create a sense of surprise in his readers by the use of elaborate stylistic strategies.[1] Aristotle had no such aim, although—indeed because—he recognized the rhetorical and psychological mechanisms involved. Neither admitted to having been caught off guard himself. Over the years, nature continued to deliver her surprises to nonscientists—consider the courtly recipients of electrical shocks. But the romance of the astonished scientist became hard to resist. By the time of the engraving, 1737, being caught off guard had changed valence and function. Both the philosopher and his audience look surprised, if for different reasons, and one could substitute Galvani with his frog for Archimedes with his crown. Bonnet was taken aback, even shocked, to discover that the *puceron* he had been observing was a *pucerone*. In addition, however, the emotion that disciplined attentiveness produced in Bonnet was, by his own account, delight—perhaps akin to the joy that disciplined reasoning had produced in Archimedes.[2]

1 Reviel Netz, *Ludic Proof: Greek Mathematics and the Alexandrian Aesthetic* (Cambridge, UK: 2009), 66–114.

2 Lorraine Daston, "Attention and the Values of Nature in the Enlightenment," in *The Moral Authority of Nature,* ed. Lorraine Daston and Fernando Vidal (Chicago: 2004), 110–111; Lorraine Daston, *Eine kurze Geschichte der wissenschaftlichen Aufmerksamkeit* (Munich: 2000), 34–35.

Locating Dreams

Mary Baine Campbell

Robert Plot, L. L. D., F. R. S., first curator of the Ashmolean, secretary of the Royal Society, Oxford professor of Chymistry, antiquarian, naturalist, and writer, grew up in Kent, where he heard a strange story that had been going around for generations: the story of a dream dreamed in 1586 by Sir Henry Wotton's father Thomas, an estate manager in Boughton Malherbe, Kent, while Henry was a student at Oxford.

Plot owed the genre he is sometimes credited with inventing, the "natural history" of British places, to William Lambard, author of the *Perambulation of Kent* (1576)—dedicated to the Kentish dreamer Thomas Wotton! Plot's contributions, natural histories of Oxfordshire (1677) and Staffordshire (1686), aimed to initiate a series describing in its natural entirety each county of England and Wales. In 1674 he had published a template for inquiries, inviting "the Ingenious of each County in my Travels" to contribute "informations"—preferably "strange"—in writing.

Enquiries was revised in 1679 and 1693, but queries for the category "men and women" barely changed. In 1679, in a world without anthropology, sociology, or psychology, it asked, in sum,

> Know you of any *strange accidents* that have befallen *Men* or *Women*? Of any *prodigious births, numerous Off-springs, Hermophrodites {sic}*? Men or Women *extreamly alike*? of *prodigious memories?* Of *extraordinary stature*, either in *excess* or *defect*? of any that have strange *antipathies* to *meat, drinks, animals,* &c? of unusual *fastings, sleep, dreams* that have strangely come to pass? of Men of *extream age*, of *sudden deaths?* or of any reputed *dead* that have strangely come to *life* again? Know you of anything remarkable that attends a *Family* in their *lives,* or *death*? Are there any ancient *Sepulchers* hereabout of Men of *Gigantick stature, Roman Generals*, or *others* of ancient times? Has there ever been any certain *apparitions* hereabout? Know you of any strange *customs* now in use in this place? or any strange *confusions* in *consanguinity* or *affinity?*

After 1674 he deleted "Know you of any Monstrous creatures to be seen in this Countreye?" Subsequent travels may have disappointed him (or he had not encountered the legless skink of Hampshire).

The Natural History of Oxford-shire, following an account of a maddened squad of Poltergeister attacking Puritan Commissioners who set up a canteen in the former "King's Bedchamber" at Woodstock's manor house, relates a dream of Wotton's that solved a crime.

> Thomas Wotton, a little before his death dreamed, that the University treasury was robbed by Towns-men and poor Scholars, and that the number was five. And being that day to write to his Son Henry … at Oxford, he thought it worth so much pains, as by a Postscript in his Letter, to make a slight enquiry of it. The Letter (which was writ out of Kent, and dated three days before) came to his Sons hands the very morning after the night in which the robbery was committed; and when the University and City were both in a perplext Inquest of the Thieves, then did Mr. Wotton show his Fathers Letter, by which such light was given of this work of darkness, that the five guilty persons were presently discovered, and apprehended.[1]

Although police still "solve" crimes by means of dreams and ESP, that is because the police are not interested in reason: their value is effectiveness. Are they surprised when dreams locate bodies?

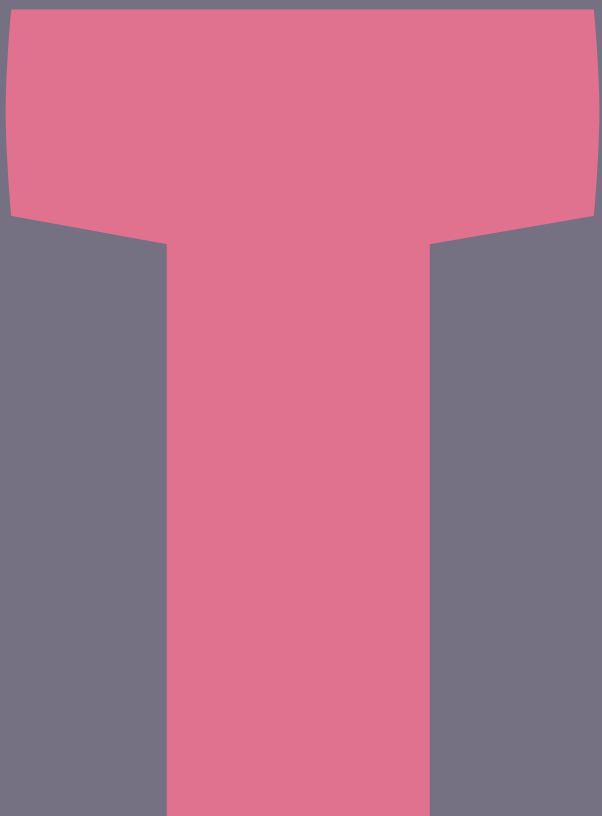
A still stranger surprise lurks in the writing. Plot introduces the dream (itself a "work of darkness") as "a remarkable *Dream* of Thomas Wotton Esq; … whose dreams did usually prove true. The *dream,* 'tis true, of which I am now writing, was had at *Bocton* in *Kent*, but the most important concern of it relating to *Oxford*, I thought fit rather of the *two* to place it here". This conundrum—the proper bibliographical location, among Plot's Baconian histories, of a Kentish dream with consequences for the Oxford constabulary and "five guilty persons"—shocked me into a series of questions I have pursued ever since (starting at MPI's Abteilung II). What is a prophetic dream, that a Professor of Chemistry and Secretary of the Royal Society could see it as part of the "natural history" of anywhere,

1 Robert Plott, *The Natural History of Oxford-shire: Being an Essay Toward the Natural History of England* (1676), 210-211. The following quotation is taken from the same source.

"with rocks, and stones, and trees"? What is natural history, that this dream belongs to it? What is a place, that it could be hard to say whether its presence in a dream or the location of the dreamer's body determines it? Is a place in a book, is *Oxford-shire* a book? What is thought, if a dream can do its work so easily? What is sight, if a dream can do its work in the dark? What is inquiry, if a dream can do it in our sleep? What are facts, when a dream knows them and the police do not? What is distance (whatever place is!) if a dream can cross it instantaneously? What is a County, if the categorical identity of a dream depends upon it? How is it different from a Book about one? Why does this dream "fit" better in *Oxford-shire* than in *Kent*?

I have no room to answer these questions. The work of many is necessary to arrive at a moment of structural understanding or familiarity that comprehends the phenomena together, in a flash of insight. But we share many of these questions with Plot himself. If wonder is, as Plot's hero Bacon claimed, "broken knowledge," then for all our nanotechnology, neuroscience, and driverless cars, we are broken still. In fact, scientists like it that way. Without the shocking pleasure of surprise (shared with travelers and aficionados of professional magic), it's just another useful job. The alchemist Plot has discovered the collective nature of his work but does not mean to give up its private aesthetic thrill.

> *All people are desired, to whom these* Articles of Enquiry shall come*, maturely to deliberat {sic} each particular, and to answer as many of them as they can, … and to have their Answers written in a Paper apart, to lie ready against the* Undertaker of this Design *shall call for them, in case they should then be absent from home; for which all persons shall receive due acknowledgements …*; and if they shall communicat *{sic}* any secret, shall be gratified with the suitable return of another.



Mutating Ocean Currents

Lino Camprubí

"Admirose un portugués
de ver que en su tierna infancia
todos los niños en Francia
sabían hablar francés.
"Arte diabólica es",
dijo, torciendo el mostacho,
"que para hablar en gabacho
un fidalgo en Portugal
llega a viejo y lo habla mal;
y aquí, lo parla un muchacho."

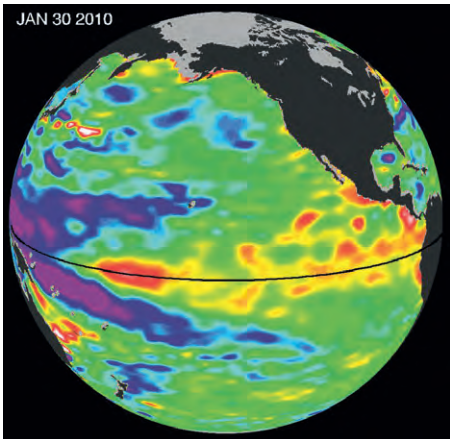
Moratín, "Saber sin estudiar" (ca. 1870).

This satirical epigram by Nicolás Fernández de Moratín (1737–1780) tells the story of a Portuguese gentleman who, traveling to France, admires the "diabolic trick" by which even children speak better French than he can after years of intense study. Here, surprise is an amusing measure of ignorance: the joke is on the one who is surprised. The term *surprise*, likely of military provenance, compares a knowing subject to an ignorant one and gives the former strategic advantage; to be *taken* by surprise is etymologically coincident with the Latin *prehendere*. This version of surprise has also been implied by standard ways of writing the history of scientific error.

This is true for popularizers of science. Take for instance Benito Jerónimo Feijoo (1676–1764), who tells the same story as Moratín in the context of a series of pedagogical tales.[1] He conceived these tales as tools against ignorance and false wit, from which came "so many miracles, apparitions of death, ghosts and elves, so many portents of magic and so many wonders of nature. Hoping to become admirable, people invent prodigious things, and vulgar people believe the most extraordinary things to be ordinary."[2] Feijoo's program was one of disenchantment, and this required ridiculing vulgar surprise and awe through reasonable explanation.

1 A story he attributed to Antoine Le Métel d'Ouville, etc.

2 "Chistes de N," *Teatro crítico universal* 6 (1734).



This image depicting the current El Niño condition in the Pacific Ocean was created with data collected by the U.S./European Ocean Surface Topography Mission on the Jason-2 satellite during a 10-day period around January 30, 2010. Courtesy NASA/JPL-Caltech, Ocean Surface Topography Team.

And it was also true for early philosophers. According to both Plato and Aristotle, astonishment and wonder were nothing less than the source of all philosophical investigation. But the intended outcome of those investigations was precisely the erasure of wonder: a satisfied curiosity might be *wise*, but it is no longer curious. For St. Augustine and St. Thomas Aquinas, on the other hand, the gulf between ignorance and wisdom was the unbridgeable distance between our knowledge and God's. Wonder inhabited that gap. Such understandings of wonder would make the history of knowledge into the history of the elimination of surprise, gauging the ignorance of previous generations by recounting how former marvels became explained and normalized through the discovery of hitherto hidden causes.

Is that all there is to wonder? On the contrary, historians of science have worked hard to reenchant the past. Discussing *Wonder*, a book in which Philip Fisher challenges Descartes's unsurprising program, Raine Daston asks incredulously, "[Does] one man's wonder become another man's raised eyebrow?" As she has shown in other places, the more phenomena were explained by the sciences and the more wonders were normalized, the more exceptions appeared calling for an explanation. Tighter rules lead to the proliferation of exceptions.

What does all this have to do with mutating oceans? Well, scientists, including oceanographers, have also used surprising surprises

to legitimize their new approaches. In 1992, oceanographer Carl Wunsch suggested shifting paradigms: "Why does the oceanographic literature have so many papers expressing surprise when some element of the circulation appears to be changing. … {E}xpressions of surprise ought to be reserved for a determination that something has not changed over some time interval." Wunsch's paper, "Decade-to-Century Changes in the Ocean Circulation," appeared in *Oceanography* as a manifesto for increasing the scale of physical oceanography. Zooming out from giving attention to local fluctuations to a global and longue durée–oriented perspective, Wunsch argued, would reveal that ocean currents and circulation were constantly changing in response to climatic changes and other factors.

The stakes of scale were simultaneously epistemological and ontological. Because of difficulties in observing the oceans and the scarcity of data, physical oceanographers had "resorted to treating data taken over many years and decades as though it were simultaneous," losing "sight of the fact that a steady-state ocean had been assumed and not demonstrated." Throughout the twentieth century, observers of ocean dynamics had mathematized the relationships between oceanic physical quantities (such as temperature and salinity). Scientists from Albert Defant (1884–1974) to Henry Stommel (1920–1992) sought to develop laws and theories of circulation that would help them in mapping and explaining the movement of water masses and in differentiating local contingent flows from fixed systems and patterns.

But the natural sciences seem to be becoming increasingly historical. As Norton Wise and others have argued, they aim at explaining no longer through laws but rather by narrating change. Similarly, a historical ocean requires not observation and deduction but *monitoring* and *tracking*. Wunsch was one of the main scientists in charge of designing the World Ocean Circulation Experiment (WOCE). The WOCE was a huge transnational project that deployed instruments from thermometers to satellites to measure variables like temperature and salinity across the world throughout an entire year. Given the necessary investments, it was unthinkable to sustain research for longer, but Wunsch hoped similar efforts could be carried out in

the mid-term future—he hoped by 2041. The possibility of comparison would then allow for historicity. WOCE developed an "observational strategy" to produce data usable by future ocean scientists: the historical sciences are necessarily archival.

How to interpret, then, the surprising surprises that populate the history of science? In Kuhnian terms, they could be the product of shifting gestalts, a symptom of the incommensurability that separates two different worldviews. In this circumstance, Feijoo and Moratín chose laughter, the easy way out. And yet, the turn to a mutable ocean was not a history of paradigm incommensurability. WOCE explicitly aimed at rendering global and local scales commensurable and gave new meaning to local variations. Rather than a history of incommunicable images or of ever-increasing scales and globalization, presenting the amazement of one's predecessors as indicative of their ignorance implies a history of epistemology full of oscillations and complex integrations. The discovery of the cycle of water seemed to throw Heraclitus and his view of change overboard—by enabling us to swim twice in the same ever-returning river. However, it turns out now that we imagine ourselves swimming in an ever-changing ocean. Parmenides and his unchanging eternity are the losers. And who knows what comes next?

A Psychologist is Amazed

John Carson

The modern scientific article is not notorious for its displays of affect. The format of such articles is designed to eliminate the subjective and personal: methods, procedures, results, conclusions, all presented in a form of scientific plain-speak. Indeed, as Lorraine Daston and Peter Galison, among others, have demonstrated, by the nineteenth century most western scientists were embracing a form of objectivity that idealized the mechanical production of data, with scientists positioned as modest witnesses, reporting without embellishing or distorting.[1]

I highlight the affectlessness of the modern scientific paper in order to underscore an unusual feature of the way in which psychologist Henry H. Goddard discussed his "discovery" and adoption of the 1908 Binet-Simon Intelligence scale.[2] In 1906, Goddard was appointed psychologist at the New Jersey Training School for Feebleminded Girls and Boys in Vineland and tasked with conducting research on feeblemindedness, particularly its accurate diagnosis. Alerted in 1908 to Alfred Binet and Théodore Simon's 1905 publication of a new way to assess intellectual ability, their intelligence scale, Goddard soon thereafter began experimenting with it. However, he found the scale of only limited value and responded skeptically to the 1908 revision, reporting later, in 1916: "It seemed impossible to grade intelligence in that way. It was too easy, too simple."[3] Goddard put the revision aside and only some weeks later "decided to give it a fair trial."

There is no contemporaneous account of Goddard's reaction to his experience with the scale. What we do have is a series of retrospective remarks starting in 1910 and continuing until at least 1923. In each, Goddard portrays himself as having been "amazed" by the 1908 scale and what it could accomplish. "No one can use the tests on any fair number of children," he explained in a 1910 article, "without

1 Lorraine Daston and Peter Galison, *Objectivity* (New York: 2007).

2 On Goddard, see Leila Zenderland, *Measuring Minds: Henry Herbert Goddard and the Origins of American Intelligence Testing* (Cambridge: 2001).

3 Henry H. Goddard, "Editor's Introduction," in Alfred Binet and Théodore Simon, *The Development of Intelligence in School Children,* trans. Elizabeth S. Kite (Baltimore: 1916), 5–6.

becoming convinced that … the tests do come amazingly near what we feel to be the truth in regard to the mental status of any child tested."[4] A year later Goddard lauded the tests for "their amazing accuracy," and in a 1916 account described himself as "surprised."[5] Finally, in a 1923 letter to Kimball Young Goddard explained: "When I read Binet's 'Measuring Scale,' I rejected it as too formal and exact. I thought 'mind' could not be measured in that way. … {However} the more I used it the more amazed I was at its accuracy."[6]

Whatever Goddard's initial reaction may have been, what did it mean to invoke the language of amazement in these various reports recounting his first experiences with the scale? Typically, when Goddard remarked on his astonishment, he did so in the context of the close correspondence he discovered between the test results and the assessments arrived at by the staff at Vineland. A critical challenge facing the first generation of mental testing practitioners was demonstrating that their tests "worked."[7] This was no easy task, as there was no agreed upon alternative system for scientifically assessing intelligence. The fallback was to rely on human judgment, gained on the basis of extensive experience with the individuals at issue, and to match that to the performance of the instrument. Goddard claimed just such a correlation between the Binet results and "Institution experience." While he could have simply presented this match between the two forms of assessment without further comment, Goddard instead included allusions to his affective response. I would like to suggest they served at least two functions.

First, "amazement" helped Goddard make an epistemic claim that something new and of consequence had occurred. The instrument in Goddard's hands allowed scientists to do something heretofore not possible: assess intelligence directly and accurately. This was, for

4 Henry H. Goddard, "Four Hundred Feeble-Minded Children Classified by the Binet Method," *Pedagogical Seminary* 17 (1910): 387–397, on 389.

5 Henry H. Goddard, *The Binet-Simon Measuring Scale for Intelligence* (Vineland: 1911); and Goddard, "Editor's Introduction," 5.

6 Kimball Young, "History of Mental Testing," *Pedagogical Seminary* 31 (1923): 1–48, on 35.

7 See John Carson, *The Measure of Merit: Talents, Intelligence, and Inequality in the French and American Republics,* 1750–1940 (Princeton: 2007), 177–183.

Goddard, unexpected—a deviation from the way in which human mentality had been understood ("I thought 'mind' could not be measured in that way"). He tried the scale out only because he hoped it would be of some pragmatic value in classifying Vineland residents. "Amazement" helped to mark the novelty of what the scale was actually able to accomplish; moreover, it may also have suggested that there was an element of the uncanny. How could a psychological instrument do what had before required long experience and expert judgment? The mechanical amazed at the same time as it threatened the very expertise that had given it birth, a doubleness that may have haunted many of those who embraced mechanical forms of objectivity.

Second, "amazement" was also a moral claim, in this case about Goddard himself. Goddard the scientist had to appear sober and upright, immune to the temptation to announce something extraordinary in order to enhance his reputation. Representing himself as astonished allowed Goddard to underscore his modesty, that he was simply revealing and reporting what was really there and was as surprised as anyone else. This may have been particularly important for the Binet scale results where, as Goddard makes clear, the experience of administering the tests constituted a critical part of the process of becoming convinced by them. "The more I used it," Goddard wrote Young, "the more amazed I was at its accuracy."[8] Experience is not something easily transferred; trusting someone else's experience requires trusting that they were the right sort of person to have the experience and report it faithfully. Thus, Goddard's oft-repeated self-report that he was amazed may have helped bring attention not only to what he found, but also to his own persona as someone with the right demeanor to find it.

I do not want to hang too much on Goddard's reports of amazement. Doubtless psychologists would have found his results of interest whether or not he reported his surprise at what the new instrument could accomplish. But I do think his desire to include such remarks illuminates something important about the role of affect in

8 Young, "History of Mental Testing," 35.

scientific practice. Here, amazement and surprise help remind us of the deep entanglements of the moral and natural orders in the doing, if not the reporting, of modern science.

Vertige interprétatif

Karine Chemla

1984 marqua un tournant dans l'histoire de la documentation avec laquelle nous étudions les mathématiques en Chine ancienne. Auparavant, l'ouverture de tombes scellées dans les derniers siècles avant notre ère avait exhumé de véritables « bibliothèques ». Cet hiver-là, les archéologues découvrirent, dans l'ensemble de manuscrits que recelait la tombe 247 à Zhangjiashan, probablement fermée vers 186 avant notre ère, un texte mathématique. Les plus vieux manuscrits mathématiques connus jusqu'alors provenaient de la cache de Dunhuang, murée vers l'an 1000, tandis que les livres les plus anciens au texte desquels nous pouvions remonter par des arguments indirects dataient, eux, au mieux, du Ier siècle avant notre ère. La découverte d'*Écrits sur les procédures mathématiques* représentait donc un événement majeur, qui éclairait des siècles sur lesquels nous ne savions rien.

Comme d'autres manuscrits funéraires, son texte était consigné sur 190 lattes de bambou. Il avait un titre et comportait de sections clairement identifiables, débutant chacune par un en-tête. Bref, tout conférait à l'objet les traits d'un ouvrage. C'est à ce titre qu'on l'édita et le commenta. Puisque c'était un livre, présumait-on, l'objet avait donc été copié sur un autre manuscrit. L'hypothèse s'imposait d'autant plus facilement que certaines marges inférieures comportaient des signatures, précisant parfois que les signataires avaient « déjà vérifié le texte ». Les premiers travaux philologiques prirent donc les erreurs comme de fautes de copistes. Les historiens des mathématiques virent, eux, dans le manuscrit, l'un des ouvrages sur la base desquels le canon *Les Neuf Chapitres sur les procédures mathématiques* avait été compilé au premier siècle. Ils concentrèrent donc leurs efforts sur la relation entre ces deux écrits.

Les hasards des séminaires firent qu'un jour Daniel Morgan me posa une question ô combien pertinente : pourquoi trouve-t-on des erreurs dans des sections d'*Écrits* portant la signature de correcteurs anciens ? Clairement, un texte mathématique donne prise à l'identification des erreurs de façon spécifique et leur analyse constitue un puissant moyen pour étudier les modalités de production d'un écrit. C'est dans cette perspective que Daniel et moi, conjuguant les compétences de l'étude des manuscrits et de l'histoire des mathématiques,

décidâmes d'examiner systématiquement les erreurs que contenu comme phrasé d'*Écrits* permettaient de déceler. Il fallait, pour cela, reprendre au début le déchiffrement du manuscrit, pour éviter d'attribuer nos erreurs de lecture aux scribes anciens.

Un matin, Daniel me confia sa perplexité. Son réexamen montrait que le document avait été écrit par deux mains différentes. Dans certaines sections comme « Réduire la largeur », qui occupait les lattes 164 à 181, ces deux mains alternaient même l'une l'autre y compris au milieu d'une phrase. Sur l'écran qui figurait une dizaine de lattes, Daniel traça la ligne invisible où la première main s'effaçait au profit la seconde. « Vois-tu où tu mets le doigt ? », m'exclamai-je. La section « Réduire la largeur » se composait de paragraphes de longueurs différentes, mais à la structure répétitive. Il me sauta donc aux yeux que si le tracé de la ligne invisible paraissait aléatoire, le passage de relais se produisait toujours au même endroit de la procédure mathématique, répétée, dans les divers paragraphes, sur des valeurs numériques différentes.

Le dessin des caractères invitait à distinguer formellement, dans chaque paragraphe, deux zones de texte, qui, d'un paragraphe à l'autre, s'avéraient être les mêmes au regard du sens mathématique. Progressivement, d'autres différences se manifestèrent entre les deux parties ainsi distinguées. En effet, *Écrits* comporte des tables numériques, systématiquement consignées sous la forme de listes de clauses séparées les unes des autres par des signes de ponctuation. En gros, dans chaque paragraphe de « Réduire la largeur », la première main n'écrivait que la partie tabulaire du texte, tandis que la seconde n'inscrivait que du texte continu relatif aux calculs effectués. La première main rédigeait de façon complète tandis que la seconde abrégeait toujours. L'opposition formelle entre les deux zones coïncidait donc avec des différences de contenu aussi bien que d'expression mathématiques, que, dans le même temps, elle exhaussait.

L'ensemble des traits matériels de ces lattes imposait de revoir notre interprétation du sens et de la nature du document : contrairement à ce que les exégètes y avaient lu, nous n'avions pas affaire à un *exposé* mathématique, mais à des *notes* produites dans un contexte d'apprentissage, où la première main paraissait guider la seconde.

Les calculs que cette seconde main rapportait de façon abrégée n'étaient pas *copiés* d'un autre document, mais reportaient les résultats d'opérations qui venaient d'être effectuées à titre d'exercice. Au lieu d'omissions de copistes, nous lisions désormais des notes produites en apprenant. Bref, la forme des caractères nous avait mis sur la voie d'une nouvelle interprétation du sens du texte et des modalités de sa production.

Le document trahissait donc des interactions entre divers acteurs. C'est également la conclusion que nous dûmes tirer, pour de tout autres raisons, de l'examen conjoint de la section « Inscrire de façon erronée sur un certificat ». M'appuyant sur des règles philologiques classiques, j'avais cru pouvoir conclure, de la répétition erronée de trente caractères, à une erreur de copie. Mais les traces matérielles imposèrent là aussi une réinterprétation radicale du scénario qui avait produit ces lattes. En demandant : « que font ces points ici ? », Daniel décilla mes yeux sur le point que comportait la marge inférieure de la première latte – où figuraient les caractères répétés sur la deuxième latte. Qui plus est, un autre point était apposé, à l'endroit où la copie avait omis un caractère essentiel. Les éditions signalaient ces marques, sans y chercher un sens. De fait, un autre caractère, moins essentiel, avait été sauté en amont. Or, si la deuxième latte répétait le texte erroné, cette seconde copie, pratiquée à partir du caractère placé immédiatement avant la première omission, restituait les deux caractères manquants.

Dans les deux cas, les points signalaient des erreurs, tout juste celles que j'avais décelées. Une présence les avait apposés, et, par réaction, le scribe avait répété la copie pour la corriger. La corrélation des marques et de la répétition montrait que la reprise des caractères illustrait un mode de correction d'erreurs, dans un espace où scribe en cours d'apprentissage et auteur de points interagissaient. Or c'était, dans ce cas, la première main, et non pas la deuxième, qui avait formé les caractères d'« Inscrire de façon erronée sur un certificat ». Marques et écritures trahissaient donc un monde de plus en plus peuplé d'individus, dont il nous fallait lire les identités dans les traces. Leurs interactions avaient façonné tant le texte que l'apparence d'*Écrits*.

De plus, si c'était apparemment par *copie* qu'« Inscrire de façon erronée sur un certificat » avait été produite avant d'être insérée dans *Écrits,* l'acte textuel qui avait présidé à la réalisation écrite de « Réduire la largeur » semblait différent. Au total, les diverses sections paraissaient donc avoir été le fruit d'opérations scripturales variées. L'hypothèse qu'*Écrits* était un ouvrage composé de sections semblables succombait sous les témoignages de ces traces. Il fallait interpréter plus localement, en lisant tout à la fois les mots et la matière. Deux mains. Deux points. Et l'interprétation bascule.

Les écrits anciens se lisent le plus souvent dans des éditions modernes, qui ont gommé traces de mains et autres marques. Que reste-t-il du sens des textes ?

Priestley, Providence, and Prophecy

John R. R. Christie

"I hardly know of any experiment that is more likely to amaze and surprise than this is," wrote Priestley, concerning the counterintuitive diminution of volume occurrent on mixing nitrous and atmospheric air, his foundational eudiometric experiment.[1] He characterized the earlier, famous Leyden vial experiment in comparable terms, "to this day, justly viewed with astonishment by the most profound electricians."[2] His paradigm of such unexpected events was the resurrection of Christ, whose unquestionable death and resurrection were in addition "peculiarly favourable to the design of providence."[3] Priestley's epistemic grasp of such events was indeed providentialist, an aspect of his attempt to detect God's "different footsteps," not the legible forms of divine creation in the space of nature, rather the less discernible traces of the deity's action in the temporality of human history.[4]

Varying degrees of providentialism were not unusual in eighteenth-century historiography. Less usual was Priestley's insistence upon the actions of particular providence, not merely the general or ordinary providence of divine administration but the purposive providential attention to particular events, their historical sequence, and their consequence. Within these, recent scientific development received specific emphasis, the "amazing improvements in natural knowledge which have been made within the last century … {by which} there appears to me a very particular providence in the concurrence of those circumstances which have produced so great a change." Primary examples were "the most unexpected revolutions … as in the history of electricity, and now in the discoveries relating to air," the results, that is, of both his own and his friend Benjamin Franklin's scientific research.

These, then, were signs of the times, but to describe such times as Priestley understood them requires further elucidation. More re-

1 Joseph Priestley, *Experiments and Observations on Different Kinds of Air* (London: 1775), 355.

2 Joseph Priestley, *The History and Present State of Electricity* (London: 1767), 85.

3 Joseph Priestley, *A General History of the Christian Church, to the Fall of the Western Empire* (Birmingham, UK: 1790), 24–25.

4 Joseph Priestley, *Lectures on History, and General Policy* (Birmingham, UK: 1787), 452–453.

markable than his distinctive providentialism was Priestley's pervasive hermeneutic devotion to biblical prophecy and its significance with respect to a rapidly approaching millennium. These preoccupations appear both early and late in his publications and correspondence, from his teaching at Warrington's Dissenting Academy, later published as the *Institutes of Natural and Revealed Religion*, through his major work *Corruptions of Christianity,* and on to his Hackney Fast-Day Sermons and Hackney Farewell Address of the 1790s, as well as in many other works, including those of a specifically scientific nature. Current progress in knowledge "will put an end to all undue and usurped authority in the business of religion, as well as of science," the final ruin of "corrupt establishments" will be complete and glorious, "And the English hierarchy … has equal reason to tremble even at an air pump, or an electrical machine."[5] The trembling hierarch in question was not the unnerved Court aristocrat but rather the mitred bishop of the politically established Anglican Church.

Such writings did not hesitate in striking an authentically apocalyptic tone, first of all technically, to do with biblical prophecy and its interpretation in the context of contemporary history: "the gradual diffusion of intellectual light … is a promise of … the fulfilment of prophecies which announce a state of great and permanent felicity of the latter days of the world."[6] They were also apocalyptic in the term's further conventional connotation, of the violent and calamitous nature of the oncoming change of the world. "We may say that the plan of this divine drama is opening more and more, the grand catastrophe growing nearer and nearer."[7] He anticipated "the fall of civil powers," a "calamitous time" before the inauguration of the millennium: "May the kingdom of God, and of Christ … truly and fully come, though all the kingdoms of the world be removed, in order to make way for it."[8]

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5 Priestley, *Experiments*, xxiii, xxv, xxiii.

6 Joseph Priestley, *A General History of the Christian Church, from the Fall of the Western Empire to the Present Time* (Northumberland, PA: 1802), xvii.

7 Priestley, *Lectures*, 452.

8 Joseph Priestley, *An History of the Corruptions of Christianity* (Birmingham, UK: 1782), 483–484.

The accelerated pace of scientific progress, typified by unexpected, fundamental discoveries whose historical significance was specified by Priestley's profoundly religious epistemics of amazement, was thus not simply a providential matter. These signs were portents, designating the contemporary period as a providentially designed path to the prophesied catastrophes that would precede Christ's return and a general resurrection, followed by a millennium devoted to true religion and the further pursuit of the truths of natural knowledge, a pursuit, Priestley believed, in which his resurrected being would participate.

Now, Priestley and his fellow Rational Dissenters are with some regularity assimilated into the historiography of the Enlightenment in Britain, although such work can tend either to marginalize or ignore the numerous apocalyptic and millennial expressions of his thought.[9] He was undoubtedly a progressivist and a perfectibilist and thought himself an active participant in an enlightened age. Yet this light, this scientific progress, and its telos in a millennially perfected human nature was no bland expression of religiosity, for it was scripturally founded and prophetically motivated. As such, it is very far from the irreligious Enlightenment of Voltaire or Diderot, of Hume or Gibbon, the latter even suggesting the attention of the civil magistracy to Priestley's writings. These might indeed be said to contain elements of the religious enthusiasm, superstition, and fanaticism the irreligious strove to extirpate. It may then be the case that Priestley's amazement is, or ought to be, accompanied by this surprise to the historiography of the Enlightenment. There would be a disconcertingly steep historiographical admission price to pay, were conventional interpretive practice to include Priestley's apocalyptic Enlightenment within its analysis.

9 See, e. g., Roy Porter, *Enlightenment: Britain and the Creation of the Modern World* (London: 2000); Knud Haakonsen, ed., *Enlightenment and Religion: Rational Dissent in Eighteenth-Century Britain* (Cambridge: 1996).

"I am an Axolotl"

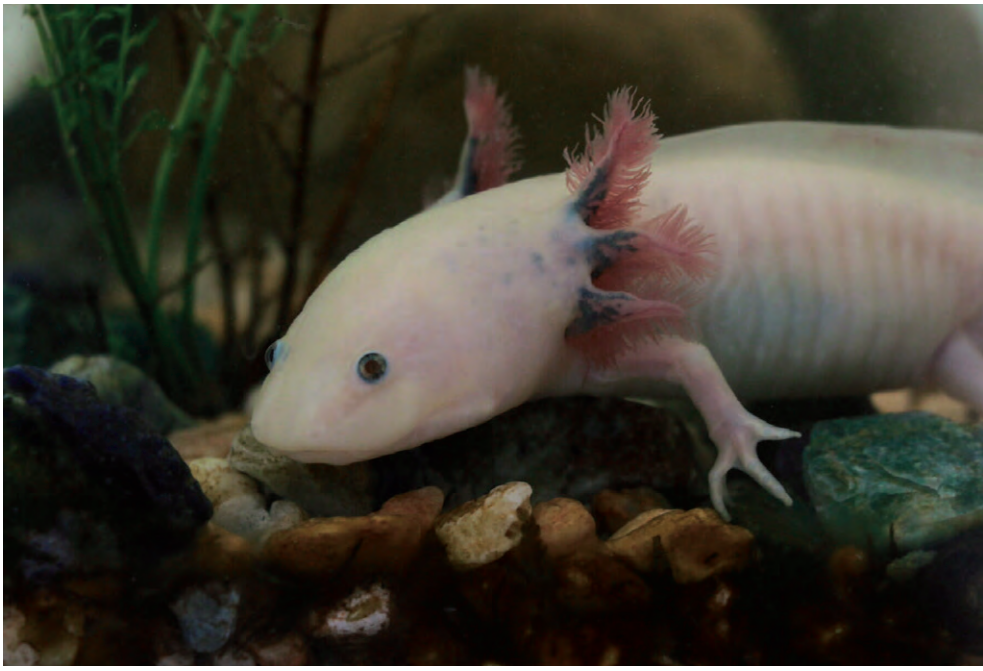
Angela N. H. Creager

I rarely read something strange, even startling, in twentieth-century biology. But a 1924 passage by Herbert Spencer Jennings, on the metamorphosis of a Mexican salamander, left me incredulous.[1] These aquatic salamanders, he claimed, reproduced true to form in captivity and could do so indefinitely. Their traits were even inherited in Mendelian fashion. However, when placed in drier conditions, the salamanders changed dramatically. Their bodies became smaller and less flat, the gills disappeared, and the animals moved onto land where they breathed air. They reproduced in captivity, but their tadpoles grew up to leave the water, maturing to live on land. The terrestrial variant also exhibited patterns of Mendelian inheritance. As Jennings observed, "Here we have two extremely different sets of inherited characters; which one shall appear is determined by the environmental character under which the organism develops. Both sets are hereditary characters; both sets are environmental characters." So perfectly Lamarckian the giraffe might be jealous.

I teach Jennings's "Heredity and Environment" in my history of biology class. It is a valuable statement by a geneticist in response to the misleading simplifications of popular eugenics. He famously asserts, "Nothing can be more certain than that hundreds of genes are required to make a mind—even a feeble mind." One year a student asked me about the Mexican salamander. I tracked it down, expecting to turn up Jennings's erroneous source. Instead, I discovered his description to be accurate and its transformation widely documented. Not only that. The axolotl (as it is called) is a popular pet and an important model organism—studied by biologists since the late nineteenth century because of its phenomenal ability to regenerate body parts as well as transform type. The salamander graces the cover of Stephen Jay Gould's *Ontogeny and Phylogeny*, an exemplar of neoteny, the persistence of juvenile traits in adult form.[2] Verging on extinction in the wild due to pollution and invasive species in its

1 H. S. Jennings, "Heredity and Environment," *Scientific Monthly* 19 (1924): 225–238, all following quotations from 229–234.

2 Stephen Jay Gould, *Ontogeny and Phylogeny* (Cambridge, MA: 1977).



A captive axolotl with leucistic coloring. The normal color of axolotls in the wild is dark. Axolotls bred in captivity come in four colors, but this pink-skinned coloring is especially popular (at least based on photographs), perhaps due to the humanoid appearance.

two native lakes, the axolotl survives in captivity.[3] In the last two decades, its artificial existence as a species has become a cautionary tale about environmental degradation.

Ambystoma mexicanum, as the species is now known, was part of the diet of Mexican Indians for thousands of years. The animal was called axolotl for the Aztec god Xolotl, perhaps contributing to the mythology of this shape-shifting deity. Europeans learned of the axolotl after Cortés's troops reached Mexico City, in codices by Spanish friars, and a 1615 natural history by Francisco Ximénez.[4] Alexander von Humboldt sketched the axolotl on his South American travels at the turn of the nineteenth century, publishing his description and drawings in 1806.[5] Georges Cuvier obtained preserved axolotls (and other Mexican salamanders) from Humboldt. Among other species of *Amphibia*, an adult form existed that was entirely air-breathing. But no adult terrestrial form of the axolotl was known. Cuvier argued the axolotl must be the larva for an unidentified species.[6]

In 1863, General Forey of the French Expeditionary Forces in Mexico sent 33 black and one white axolotl to the *Jardin zoologique d'acclimatation* in Paris. Six of these salamanders were given to Auguste Duméril, professor of ichthyology and herpetology at *Muséum d'histoire naturelle*. Duméril successfully bred the salamanders in captivity. In 1866 there were already 800 progeny. That same year he acquired a rare white axolotl from Léon-Eugène Méhédin. Duméril provided axolotls to individuals and institutions who requested

3 Erik Vance, "Biology's Beloved Amphibian—the Axolotl—Is Racing Towards Extinction," *Nature* 551 (2017): 286–289.

4 Hobart M. Smith, "Discovery of the Axolotl and Its Early History in Biological Research," in *Developmental Biology of the Axolotl,* ed. John B. Armstrong and George M. Malacinski (Oxford: 1989), 3–12.

5 Alexander von Humboldt, *Beobachtungen aus der Zoologie und vergleichenden Anatomie gesammelt auf einer Reise nach den Tropen-Ländern des neuen Kontinents, in den Jahren 1799, 1800, 1801, 1802, 1803, und 1804 von Al. von Humboldt und A. Bonpland* (Tübingen: 1806).

6 Christian Reiß, Lennart Olsson, and Uwe Hoßfeld, "The History of the Oldest Self-Sustaining Laboratory Animal: 150 Years of Axolotl Research," *Journal of Experimental Zoology* 324B (2015): 393–404. All following quotations refer to this entry.

them, even shipping them by train. Consequently, his initial set of seven became the stock for hundreds of thousands of axolotls found across Europe by the beginning of the twentieth century.

It was Duméril who first witnessed the metamorphosis of the gilled, aquatic form into the land-based form. The terrestrial amphibian, previously identified as a different species, also bred true to type in captivity. Duméril's 1865 observation of the transformation was met with skepticism and inspired renowned biologists, such as August Weissmann, to study the axolotls directly. By 1870, the year Duméril died, the biological explanation of the axolotl's transformation remained unknown, but its reality was unquestioned. The salamanders were thriving in European zoos, laboratories, and residences. As Christian Reiß, Lennart Olsson, and Uwe Hoßfeld observe, the emergence of aquaria as a new zoological infrastructure for science and recreation was crucial to the flourishing of axolotls in captivity. Axolotls were, in fact, the first exotic animals bred in aquaria.

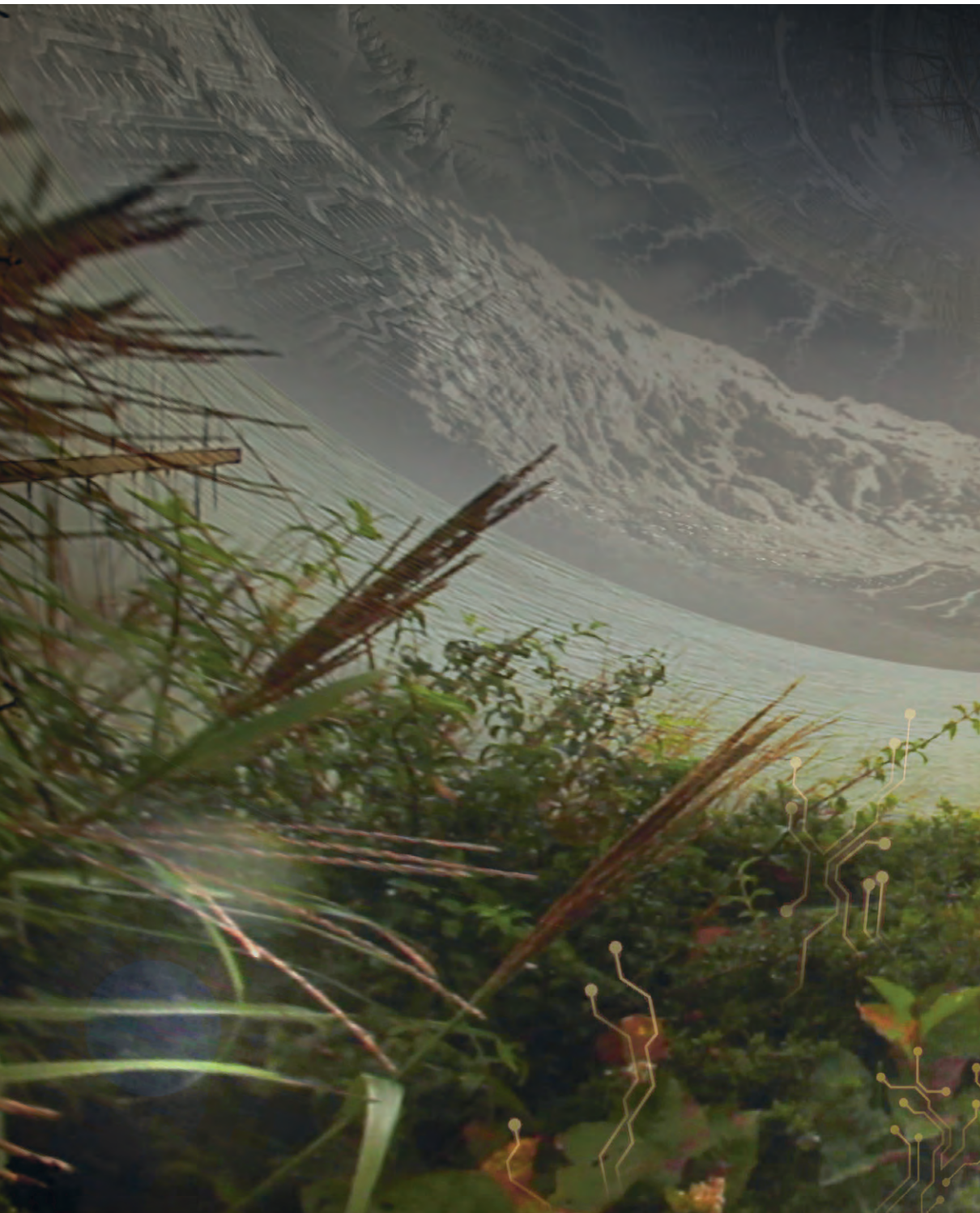
Axolotls are haunting, beguiling creatures. The pale pink skin and fleshy faces of some make them look strangely humanoid. Countless artists have portrayed them, often as monsters or hybrids.[7] They are symbols of metamorphosis in literature, most famously in Julio Cortázar's 1956 short story "Axolotl."[8] The tale is set at the *Jardin des Plantes* in Paris, early in spring after a wintry Lent. The narrator visits the aquarium and becomes obsessed with the axolotls. He returns day after day, transfixed in front of the glass, and then, at some point, is transformed: "Now I am an axolotl." (Kafka, meet magic realism.) From the other side of the glass, the narrator consoles himself with the hope that the visitor will "write a story about us." I would add, one that is as wonderful and sad as the axolotl's history.

7 Gerardo Villadelángel Viñas, ed., *Axolotiada: Vida y mito de un anfibio mexicano* (México, DF: 2011).

8 Julio Cortázar, "Axolotl," in *Final del juego* (México, DF: 1956), 121–130.

Strange-ing—Encounter—Site

Rohini Devasher



Spheres. Video stills from a single channel video with sound, duration 22 mins. Rohini Devasher, 2016.

Encounter

Directly ahead, the ground was indeed completely flat; to right and left, at the limits of the floodlit area, the rising curve could just be detected. They might have been walking along a very wide, shallow valley; it was quite impossible to believe that they were really crawling along the inside of a huge cylinder, and that beyond this little oasis of light the land rose up to meet—no, to become—the sky.[1]

An unidentified object enters our solar system. Soon it transpires that the object is a perfect cylinder—54 km long, 20 km in diameter—and it's heading straight for the sun. This is Arthur C. Clarke's 1973 novel *Rendezvous with Rama*. What follows is a lean and gradual unfolding of what lies within that alien cylinder—the Rama of the title: a world turned outside in, with a cylindrical sea that arches above the explorers' heads, possible cities dotted around the inner circumference and artificial light provided by three linear suns, embedded in giant trenches in the walls. Yet Rama the unfamiliar has strangely familiar undertones.

I first read the book more than 20 years ago, but Rama's "climate", if you will, has stayed with me, with its peculiar quality of light, ideas of interiority, inversion, and *strangeness*—not of haunting but of wonder. The theme of encounters between the "natural" and "technological," "human" and "non-human," where surprising intersecting patterns between the two are made visible, is something I continue to explore through my work today.

1 Clarke Arthur C., *Rendezvous with Rama* (1973).

Site

A site will never be what you expected. Neither will your reaction to the site be what was expected. The landscape, weather, your tools; the camera, audio recorder, sketchbook: all function differently. Circumstances come together to force you to do what you can under a very specific set of circumstances. Once you have collected and recorded what you "could," you make something of *this* collection, not of what you thought you might collect. You begin to speculate, to create fictions. My visit to the Mount Aso caldera during a 2014 trip to Japan was one such experience. Arriving there, within throwing distance of the most incredible active volcano, I realized I had forgotten the tripod camera mounting plate. As a consequence, I had to shoot all the footage with the camera on the ground. The result was a fascinating juxtaposition of foreground and background that would perhaps not have been possible with a tripod.

Spheres, a video- and drawing-based work, is the closest I have come to capturing or expressing the "climate" I associate with Clarke's book. The work lies somewhere between reality and fiction. The raw material or video footage was shot on site at the Caldera. But in the work, it is reimagined so that we seem to be looking inside some form of hollowed out space; a sphere? We see a volcanic cinder cone crater, which stands as a sentinel of past upheaval; we see mist, cloud and fog, a distant horizon, an atmosphere. A sun, possibly artificial, simulates a daylight cycle, illuminating and obscuring the landscape by turns—a recognizable pattern in an otherwise strange but not entirely alien landscape. The landscape, because of its scale, provides an almost mythic realization of oneself within an environment. Eventually, the film will be projected onto a wall drawing, where video and drawn marks will interact in unexpected ways and complete the work.

For me, surprise has come to be a crucial part of the site, as an activator, or catalyst. When applied as a mode or methodology within art, surprise allows you to explore something new. It opens up a space for the investigation of something unfamiliar rather than, necessarily, a moment of acquiring knowledge.

Strange-ing

Spheres explores the interconnectedness of our relationship to the planet and offers a perspective that may be useful to our imagination of our future in both shaping and living within it. The work becomes a proposition, both geographic and metaphoric, of an attempt to imply the unobservable on the basis of what can be observed. The images conjured are a species of "chimera." They are one thing, standing in for something else, pushing the limits of the known and the imagined.

What is that moment when the unexpected comes in and forces you to pay attention? Turning something on its head, asking the question "what if!" offers the possibility of chance and the equally real possibility of disappointment, and when it walks the line of the uncanny, it can change how we see the world.

Studies on creative problem solving have shown that one way of gaining new perspectives on a problem is to juxtapose it with something completely unrelated, thereby making the familiar … strange.[2] I like the analogy of a mirror in this context, not just because it references both the telescope and the microscope but also because when you mirror something, it is reversed, and very often that reversal is enough to make something familiar very strange.

Strange-ing then becomes a strategy for encountering, observing, and finally recording both environment and experience, while walking a fine line between wonder and the uncanny.

2 Bipin Indurkhya, *Metaphor and Cognition: An Interactionist Approach*, Studies in Cognitive Systems 13, (Dordrecht: 1992).

Quantification et imprévu

Emmanuel Didier

Rien ne semble plus étranger à la statistique que l'imprévu. Celle-là est la science de la régularité, de la répétition, de la liste, alors que celui-ci est surprise, inattendu, singularité. Pourtant, que serait un imprévu s'il ne contrastait sur un fond de régularités ? Symétriquement, la régularité n'émerge-t elle pas d'événements qui, initialement, étaient chacun surprenant ? Il serait donc bien trop simple, voire erroné, de limiter le lien entre statistique et imprévu à leur mutuelle exclusion. Ils se rapportent l'un à l'autre selon des modalités bien plus riches.

Les statisticiens sont à la recherche de régularités pour quantifier le monde. Par exemple, ils recherchent des registres (comme ceux de l'état civil) dont chaque ligne répète méthodiquement la précédente. Ils cherchent aussi des cartes géographiques dessinant des zones de taille comparable dans lesquelles ils envoient des enquêteurs. Ils cherchent tous les supports réguliers, répétitifs, grâce auxquels ils peuvent concrètement dénombrer des individus.

Mais la régularité est dans les listes, pas dans l'activité de recherche de ces listes, pour laquelle l'imprévu joue bien souvent un rôle capital. Ainsi, au début du XXème siècle, le Ministère de l'agriculture des Etats-Unis (USDA) avait organisé un réseau d'enquêteurs sur tout le territoire, un dans chaque état, chargé d'établir les statistiques de production des principales cultures. Verne Church, le responsable du Michigan, remarqua tout de suite l'importance locale du … cornichon, pourtant négligé par les statistiques fédérales. Il voulut absolument démontrer le poids économique de cette culture. C'est alors que la chance lui sourit. En voyage dans un train, il rencontra par hasard un représentant de commerce en sel qui, gracieusement, lui « a donné la liste complète des usines » de conditionnement du noble cornichon local ! Cette précieuse liste constituait le support matériel parfait pour compter le condiment. Ainsi, la statistique repose certes sur des répétitions, mais ces dernières surgissent volontiers de façon imprévue[1].

1 Emmanuel Didier, *En quoi consiste l'Amérique ? Les statistiques, le New Deal et la démocratie*, (Paris : 2009).

C'est d'ailleurs la raison pour laquelle il ne faut pas croire à l'image du statisticien rond de cuir, bêtes et terne que la comédie du XIXème siècle leur a construit[2]. Au contraire, les bons statisticiens sont rusés et malins car ils apprennent à susciter leur bonne étoile.

Si l'imprévu est un ingrédient, souvent inaperçu, entrant dans la méthode de production des statistiques, il arrive aussi souvent qu'il en soit l'objet. Ainsi, c'est pour se donner une certaine maîtrise sur les jeux de hasards et pour répartir les paiements, que les Lumières ont utilisé les probabilités[3]. Mais lorsque les statistiques ont cherché à comprendre l'imprévu, celui-ci consistait plus souvent en accidents néfastes. Ainsi, l'Etat providence constitué au début du XXème siècle est entré en lutte contre la maladie, l'accident au travail, la mort, que chacun connait mais sans savoir ni quand, ni comment ils vont frapper. Les actuaires, ces statisticiens spécialisés dans l'assurance, ont su produire des tables qui agrégeaient ces occurrences pour une population totale, ce qui fît apparaître leur régularité. Ce fut en rapportant les occurrences à une population et non à un individu, que les statisticiens ont trouvé des répétitions, grâce auxquelles les gouvernements ont pu en répartir le coût parmi les assurés[4].

Puis au début des années 1980, alors que l'Etat providence était de plus en plus affaibli, de nombreux gouvernement l'ont peu à peu transformé en Etat sécuritaire[5]. Les sombres surprises visées alors étaient les crimes et les délits subis au quotidien par la population. Pour en capturer les régularités, les statisticiens n'ont pas utilisé les méthodes actuarielles mais les registres administratifs de la police d'une part, et les enquêtes auprès des victimes de l'autre. Ils ont ainsi montré la régularité géographique et temporelle de la délinquance, qui a permis aux gouvernements de repenser et de mieux manager l'action policière.

2 Bernard Ycart, "1827 : la mode de la statistique en France," *Histoire & mesure* 31, no. 1 (2016): 161–194.

3 Lorraine Daston, *Classical Probability in the Enlightenment* (Princeton, NJ : 1988).

4 François Ewald, *L'Etat Providence* (Paris : 1986).

5 Philippe Robert, *Le citoyen, le crime et l'état* (Genève : 1999).

Press representatives waiting for the crop report release.
Courtesy of USDA, National Agricultural Statistics Service.

Ainsi, les statistiques prennent-elles pour objet des imprévus, souvent néfastes. Elles doivent alors trouver la perspective selon laquelle il leur apparaît que ces aléas, loin de la stupeur ou de l'ébahissement, sont aussi des événements qui se répètent et peuvent ainsi être gouvernés. Pour chaque type d'imprévu, une méthode statistique doit cependant être inventée qui lui corresponde au mieux[6]. A la santé publique, les statistiques actuarielles, à l'insécurité, les données de police. Imprévus et méthode s'expriment mutuellement, et différemment au cours du temps.

Pour finir, insistons sur le fait que la statistique peut même participer à produire de l'imprévu. A la bourse, par exemple, la divulgation des indicateurs a des effets spéculatifs immédiats sur les cours. La statistique essaye ainsi elle-même de contrôler les imprévus qu'elle provoque. Les fonctionnaires de l'USDA, toujours eux, avaient mis en place pendant tout le XXème siècle un processus de révélation des indicateurs très impressionnant. Les journalistes intéressés par les chiffres étaient convoquées au ministère, placés derrière une ligne tracée au sol et de l'autre côté de laquelle se trouvaient les rapports statistiques. A exactement 15 h 00, un fonctionnaire tirait au pistolet le départ de la course à la donnée ! Tout le monde avait ainsi la surprise de découvrir les résultats au même moment.

Malgré les apparences, la statistique connait donc très bien l'imprévu. Elle le fait entrer dans sa composition, elle le prend pour objet, elle peut même le produire. C'est cela qui en fait une discipline si étonnamment vivante !

6 Alain Desrosières, *La politique des grands nombres : histoire de la raison statistique* (Paris : 2000).

Verwunderungszeichen

Matthias Dörries

Punctuation marks have their own history. In their disputes with scholastics, Italian humanists of the fourteenth and fifteenth centuries revised punctuation, desiring to render texts more intelligible by progressively indicating and codifying their rhythms and logical relationships. Punctuation marks shaped sentences and articulated writing; they signaled delays and pauses; they invited the reader to a brief moment of review and afterthought. The new *signum admirationis*, or *punctus admirativus*, or *punctus exclamativus* demanded the reader's attention and focus. It corresponded in speech to a rising voice, to a brief textual fissure, to the *Augenblick* the speaker shares with the listener, before turning to something new. It was the rhetorical equivalent of the fermata on a closing chord in music. It left time for thought and admiration, for emotions and reflection, and for expectation.

Originally, the *punctus admirativus* existed in several versions, different from today's exclamation mark. However, the printers of the late sixteenth century soon chose the now-familiar typographical sign. For sixteenth and seventeenth century German grammarians, the new sign voiced the optative, and more importantly *Verwunderung*, hence the early preference for the term *Verwunderungszeichen* over *Ausrufungszeichen*.[1] Exclamation marks entered literary texts. In the Shakespeare First Folio of 1623, they accompany Othello's increasing agitation. Exclamation marks covered a spectrum of emotions, from astonishment to fear, as noted in Diderot and d'Alembert's *Encyclopédie*. The *point exclamatif* expressed not only "la surprise" but also "la terreur, ou quelque autre sentiment affectueux, comme de tendresse, de pitié, &c." In German literature, Goethe's *Werther* embraced the exclamation mark (now called the *Ausrufungszeichen)*.

During the nineteenth century, the exclamation mark refined literary style, energized political and philosophical agitation, and standardized mathematical notation. Heinrich von Kleist used it sparingly but to great effect; his distinctive punctuation gave his texts

1 Johannes Müller, "Übersicht über die Geschichte der Interpunktion," in *Quellenschriften und Geschichte des deutschsprachlichen Unterrichtes* (Gotha: 1882), 279–297.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J'Accuse...!

LETTRE AU PRÉSIDENT DE LA RÉPUBLIQUE

Par ÉMILE ZOLA

The headline of the French newspaper *L'Aurore*, January 13, 1898.

melody, rhythm, and drama. The exclamation mark was also mobilized against an increasingly codified, regulated, and docile language by novelists and even by some philologists. Heinrich Heine, during the Restoration period, rebelled against the grammatical norms and conventions of his day with his punctuation and shorter sentences. The scholar Olaf Briese aptly sums up Heine's style: "Schrift wird der Tendenz nach atemlos. Verschriftlichte Sprache. Kunstvoll – kunstlos, mittelbar – unmittelbar."[2] Friedrich Nietzsche mocked the impoverished academic writing of his time and advocated a return to great style, to the origins of language in the spoken word, to sound and rhythm, firmly anchored in action and life, in space and time. For Nietzsche, a text should not only be read; it should be experienced and excite—like music. The reader should be bodily moved when reading.[3] The physiognomy of the text, the graphical rhythm, mattered—with the exclamation mark echoing the finger raised for attention. Later, in fin-de-siècle France, the writer Émile Zola took the exclamation mark to new political and moral heights in

2 Olaf Briese, "Auslassungszeichen. Interpunktionsregime bei Heinrich Heine," in *Auslassungen. Leerstellen als Movens der Kulturwissenschaft*, ed. Natascha Adamowsky and Peter Matussek (Würzburg: 2004), 218.

3 Heinz Schlaffer, *Das entfesselte Wort. Nietzsches Stil und seine Folgen* (Munich: 2007), 29–38.

his open letter to the French president, published in the newspaper *l'Aurore* under the headline "J'Accuse…!," printed in massive, bold letters (figure).

Nineteenth-century scientists, on the other hand, had so little use for the exclamation mark that when a mathematician from Strasbourg, Christian Kramp, suggested in 1808 the sign "!" for factorial operations, he very much displeased the British mathematician Augustus De Morgan, who complained of the "barbarism" of introducing new signs drawn from common language in mathematics. The exclamation mark, he quipped, had "the appearance of expressing surprise and admiration that 2, 3, 4, &c. should be found in mathematical results."[4] Scientific writing should not be contaminated by spoken language; it should be free of the subjective and devoid of the emotion that impeded scientific objectivity. Using the vulgar exclamation mark in publication would undermine the skeptical reader's trust in the scientific argument.

Cultural differences in uses of the exclamation mark have persisted during the last two centuries. English and French speakers are still surprised by the ubiquity of exclamation marks in German, ranging from letter greetings to warning signs of all kinds. In German, the exclamation mark rather *fesselt die Aufmerksamkeit* of the reader, whereas in English, it often signals a vulgar attention-grab by the writer. The keyboards of German typewriters seem to have introduced an individual key for the exclamation mark much earlier than English or American ones. The philosopher Theodor W. Adorno deplored the expressionists' overuse of exclamation marks and compared them to the multiple zeros of worthless German bills during the inflation of the 1920s. For him, as for many English and American critics, the sign had lost its power and authority and become dilettantish. Still, for Adorno, punctuation could polish a writer's style when care and restraint guided the transgression of orthographic rules. There was room for subjectivity amid all conventions: the rules of punctuation would not always square with the subjec-

4 Augustus De Morgan, "Symbols and Notation," in *Penny Cyclopædia* (London: 1842), 23:444.

tive needs of logic and expression. For Adorno, the logical positivists were doomed to fail in their effort to replace stylish melodic prose with short protocol sentences.[5]

Computer technology has raised the exclamation mark again in a culture of rapidly exchanged messages that often add signs to make explicit the writer's intentions and emotions. Exclamation marks are ubiquitous in electronic messages; emoticons like :o to express surprise are tongue-in-cheek uses of dull punctuation signs and letters. Finally, more recently, emoji (a loan word derived from the Japanese *e* 絵, picture, and *moji* 文字, character), as 😮 for "surprised," have infiltrated word processors, new hybrid signs with both ideographic and linguistic meaning. These recent developments bespeak as much the fleeting character of instantaneous writing as the relentless search for original ways to overcome physical distance, to preserve the virtues and affections of direct personal interaction in writing.

5 Theodore W. Adorno, "Satzzeichen," in *Noten zur Literatur* (Frankfurt: 2002), 170.

Über Fundrecht

Anna Echterhölter

Chronometrisch versiegelte Schlösser, Luftkammern in den Metallwänden, die vor Sprengung schützen: In der Ära des Bankdepot-Fachs experimentiert man 1910 mit allem, was kostbare Dinge vor unerwünschtem Zugriff zu sichern verspricht. Selbst in diesen ausgezeichneten Räumen jedoch ist das Finden nicht ausgeschlossen. Denn nicht wenige dieser Tresore verwaisen, wie der langjährige Depothüter einer New Yorker Bank sich erinnert.[1] Öffnet man die Kammern nach festgelegtem Protokoll, treten Seltenheiten zu Tage: herrenlose Sachen. Oftmals liegt ihr Wert im Auge des Betrachters. Es finden sich Locken, hämische Kommentare über die Nachwelt und Souvenirs – aber auch Schmuck, Geld und Testamente. Ist ein letzter Wille fehlerhaft aufgesetzt, fallen selbst in Anwesenheit der Erben alle Güter durch die engen Maschen des Besitzrechts in eine unmögliche Position. Den Findern jedoch gehört hier nichts.

Außerhalb der doppelt verstärkten Metallkammern – dieser Gebäude im Gebäude – sind dem possessiven Blick und dem besitzergreifenden Sehen ebenfalls enge Grenzen gesetzt. Das Fundrecht gibt sich sperrig. Es ist vor wie nach der Kodifizierung „bunt", wie Ernst Eckstein konstatiert.[2] In der Tat: Was mit einer Entdeckung geschieht, kann von ihrer Position auf der Vertikalen abhängen. Liegt etwas tiefer als eine Pflugschar unter der Erde, entscheidet der Sachsenspiegel zugunsten des Königs. Selbst Landbesitzer können demnach nur Oberflächliches behalten. Sie können es allerdings auch dann behalten, wenn andere auf ihrem Land fündig werden. Denn insbesondere in Preußen durchkreuzt der Staat die ingeniösen Blicke der Finder. Alles wird dem Souverän zuerkannt: verlassene unbewegliche Dinge, die unterirdischen Schätze der Natur, Gegenstände, die „noch keines Menschen Eigenthume gewesen sind", nutzbare Tiere, die in Freiheit leben und erblose Verlassenschaften, wobei die „bloße Unfähigkeit oder Unwürdigkeit" der Erben nicht

1 John P. Carter, *In the Cave of Aladdin: A Little Narrative of the Safe Deposit Vault* (New York: 1911). My thanks go to Atiba Pertilla for surprising me with this source.

2 Ernst Eckstein, „Das Schatz- und Fundregal und seine Entwicklung in den deutschen Rechten," *Mitteilungen des Instituts für österreichische Geschichte* 31, nos. 1–4 (December 1910): 193–244.

hinreicht, um die Inbesitznahme durch den Staat zu begründen – wie das Allgemeine Landrecht für die Preußischen Staaten 1794 festsetzt.[3]

Auf öffentlichem Boden bestehen nur Teilauflagen: Ein Fund auf einer Böschung kann der Gemeinde gehören, die diese Böschung unterhält. Der Finder einer Sache hat die Hälfte an die Armenkasse abzugeben. Findet man hingegen einen Schatz auf fremdem Boden, so erwirbt ausgerechnet derjenige Anspruch auf die Hälfte des Wertes, der nicht die Absicht hatte, etwas zu finden. Ausschließlich dort, wo ein Schatz durch Zufall in den Blick fällt, kann sich Teilbesitz konstituieren. Suchende gehen grundsätzlich leer aus. Schlimmer noch, wer seinem Glück auf die Sprünge hilft, Experimente anstellt und sich mit übernatürlichen Kräften verbündet, hat stets das Nachsehen:

> Wer zur Nachsuchung von Schätzen vermeintlicher Zaubermittel, durch Geisterbannen, Citiren der Verstorbnen, oder andrer dergleichen Gaukeleyen, es sey aus Betrug oder Aberglauben, sich bedient; der verliert, außer der sonst schon verwirkten Strafe, sein Anrecht auf einen etwa zufälliger Weise wirklich gefundenen Schatz.[4]

Carl von Savigny (1803) und Berthold Delbrück (1859) stärken die Position, dass das zufällige Sehen Eigentum herzustellen vermag. Theodor Gimmerthal ist anderer Auffassung. Neben dem „totalen Mangel von egoistischem Interesse" begründet er Rechte des Finders mit dem drohenden Zerfall der Sache.[5] Die Existenz des fremden Eigentums muss auf dem Spiel gestanden haben, sonst lassen sich die engen Bande zwischen der verlorenen Sache und ihrem ursprünglichen Besitzer nicht lösen – wie im römischen Recht, das einen Fin-

3 Allgemeines Landrecht für die Preußischen Staaten (PrALR), Theil II., Tit. XVI, Abschnitt II, § 1–18.

4 PrALR, Theil II. Tit. XX. Abschnitt VI. § 82, § 86.

5 Theodor Gimmerthal, „Vom Finden verlorener, derelinquirter und herrenloser Sachen," *Archiv für die civilistische Praxis* 52, no. 2 (1869): 521–551; Nils Hansen, „Strandrecht und Strandraub – Bemerkungen zu einem Gewohnheitsrecht an den schleswig-holsteinischen Küsten," *Kieler Blätter zur Volkskunde* no. 33 (2001): 51–78.

derlohn nicht kennt. Gezähmte Tiere gehen deshalb früher in den Besitz über als undomestizierte.

Selbst die angeblichen Rechtsbräuche in „Übersee" – die im Auftrag des Berliner Reichskolonialamts anhand des Kohler'schen Fragebogens gesammelt und von landlos gewordenen Verwaltungseliten später kodifiziert werden – bilden ein Echo dieser Problematik ab. Bienenhonig wird unterschiedlich angeeignet, je nachdem auf wessen Land und in wessen Korb er von den Insekten zusammengetragen wurde. In Ostafrika sind kleine Objekte am Weg auf „Hölzchen zu stecken", bis der Eigentümer sie zurücknimmt.[6] Gesehene und gejagte Tiere gehören dem Jäger ganz, nicht jedoch, wenn jemand auf eigenem Grund ein Tier mit geliehenem Pulver erlegt. In diesem Fall kann der Pulvergeber Ansprüche geltend machen. Oftmals sind Dinge, die bereits gefunden wurden, mit Grasbüscheln oder Palmwedeln markiert. Selbst Riffe und Gräber können von Tabuzeichen geschützt sein:

> {Ein} 5–8 cm langes Holzstäbchen wird geschnitzt, so daß es an beiden Seiten die Form eines Haifisches bekommt. Leise werden einige geheimnisvolle Worte an das Bild gemurmelt und dasselbe dann in der Nähe des betreffenden Eigentums aufgehängt. An Stelle des Holzbildes werden auch zusammengeflochtene Blätter, die die Form eines Rachens oder Mundes bekommen, aufgehängt.

Dies erinnert an die Schürfzeichen der Bergleute, welche die Blicke der anderen Suchenden von ihrem Revier ablenken sollen. Ohnedies steht der Verdacht im Raum, dass das Fundrecht nicht von verlorenen Dingen und verschollenen Personen handelt; nicht von den vom Wind herbeigetragenen oder vom Meer fortgespülten Strandgütern, ja, nicht einmal in erster Linie von den antiken Schätzen im engeren Sinne. Vielmehr steht zu befürchten, dass es der Bergbau ist, der die Rechte der Finder verzerrt.[7] Auch zukünftige Zufallsfunde dürfen

6 Erich Schultz-Ewerth et al., Hgg., *Das Eingeborenenrecht. Sitten und Gewohnheitsrechte der Eingeborenen der ehemaligen deutschen Kolonien in Afrika und in der Südsee* (Stuttgart: 1929–1930), 1:239; für das folgende Zitat im selben Absatz, 1:518.

7 Eduard Gans, „Bemerkungen zur Lehre vom Schatz," *Jahrbücher für die preußische Gesetzgebung, Rechtswissenschaft und Rechtsverwaltung* 31, nos. 61/62 (1828): 3–11.

nicht einfach einbehalten werden, wie Überlegungen zu submarinen oder intergalaktischen Dingen bestätigen, etwa die Abkommen der „International Seabed Autority“ oder das „Agreement Governing Natural Resource Activities on the Moon and Other Celestial Bodies“.

* * *

Nachdenklich kehre ich aus der Universitätsverwaltung an den Platz in einem Berliner Rara-Lesesaal zurück. Im Stapel der unterschriebenen Formulare regelt eines die Besitzrechte der Universität an allen meinen zukünftigen Funden. Mein Auge streift über die Kanten eines Druckbogens, der seit 146 Jahren nicht aufgeschnitten wurde. Wenige wollten sehen, was Anton Menge auf 600 Seiten an „Preußischen Spinnen I.–XI.“ beobachtet hat.[8] Hartnäckig beliefert er das Journal der Naturforschenden Gesellschaft in Danzig mit verschwenderischen Details immer neuer Borsten- und Gliederkonstellationen. Mein doppelt verlorenes Sehen – das eine längst vergangene Possession für Spinnentiere bisher ergebnislos mustert – ist kaum merklich neu erfunden: Wenn auch Anton Menge zeitlebens wie besessen beobachtet, ohne jemals besitzen zu wollen, kann ich mir ganz sicher sein: Meine Suche steht seit wenigen Minuten auf einem anderen Blatt.

8 Anton Menge, „Preussische Spinnen. I.–XI.,“ *Schriften der Naturforschenden Gesellschaft in Danzig* (Danzig: 1866–1878).

Random Enough to Trust

Paul Erickson

Dr. Strangelove: Of course, the whole point of a Doomsday Machine is lost if you keep it a secret! Why didn't you tell the world, eh? Ambassador de Sadesky: It was to be announced at the Party Congress on Monday. As you know, the Premier loves surprises.

Perhaps humans are not so good at surprises. The Soviet premier's unfortunately timed announcement of the Doomsday Machine represented one possible way they could go wrong. As the nuclear strategists of the 1960s knew so well, the entire point of a threat is to induce change in your adversary's perceived incentives. Your adversary had to believe the threat; and to believe, he had to know. A threat *could* leave something to chance: as Thomas Schelling would point out, an element of uncertainty could be essential to turning an incredible threat in to a credible one. Or, as game theorists might suggest, the deliberate introduction of chance via some existential roll of the dice could blind an adversary to the specifics of your plan of action. But either way, the chance in question had to be a calculated chance—one honed with such mathematical precision that it seemingly left nothing important to chance at all. The truly spontaneous element, the "human factor," or the unaccountable vanity of world leaders had to be systematically removed from the social and technological systems of Dr. Strangelove's age if they were to keep the world safe.

This last claim was our central argument in *How Reason Almost Lost Its Mind* (2013)—and fittingly, from an early date, the computerized random number generator emerged as one of the enduring talismans of that project. Such a device's seeming ability to reconcile randomness with rule-bound, computerized algorithms perfectly captured the Cold War style of rationality whose ramifications we sought to trace.

As Dan Bouk shows in his essay in this volume, there had been both supply of and demand for tables of random numbers prior to World War II in connection with problems of random sampling. The advent of digital computing dramatically increased both in the years following the war. A crucial spur to postwar demand was, of course, the use of random numbers in computer programs that simulated the

progress of chain reactions inside different possible nuclear weapon configurations: the "Monte Carlo method," pioneered by Stanislaw Ulam and others. One such Monte Carlo simulation, described in a 1947 report by the polymathic John von Neumann and run on Princeton's ENIAC computer, utilized at least three 8-digit random numbers each time it recalculated the path of a neutron through a bomb assembly. The first "shake" (10^{-8} seconds) of the simulation would have required at least 300 such random numbers. A Nagasaki-sized bomb might last 50-odd shakes.[1]

Even in those early days, collections of random digits were widely available. The 1927 tables of L. H. C. Tippett provided over 40,000 such numbers; by 1939, Kendall and Babington-Smith's *Tables of Random Sampling Numbers* would provide an additional 100,000; and finally, by the later 1940s, the RAND Corporation would produce far more, all laboriously checked for randomness and conveniently recorded on punched cards. However, even feeding these cards into an electronic computer exacted a significant cost in terms of time. As von Neumann would explain in a 1948 letter, it took the ENIAC some 600 ms to read a punch card but only 3 ms to multiply two 10-digit numbers together. Hence, he sought to have the computer generate sequences of "good enough" random numbers via a comparatively fast algorithm that involved squaring an 8-digit number and extracting the middle 8 digits of the resulting 16-digit number.[2]

Our working group of six coauthors for *How Reason Almost Lost Its Mind* employed such a randomization algorithm, implemented via a few lines of visual basic code inserted into a Microsoft Excel spreadsheet, to help choose the order for our names on the cover of the book. Yet we didn't trust the computer alone. Perhaps it was due to a healthy skepticism of our Cold War rationalists' pretentions to algorithmic rationality. Or perhaps it was that, being the product of a specific programmer (me), the program was not a suitably impersonal

1 It is difficult to estimate, even roughly, how many random numbers would be required since it depended on the configuration of the bomb under consideration. See "Actual Running of the Monte Carlo Problems on the ENIAC" in John von Neumann Papers, Box 12, Folder 5, "Computers: ENIAC: Monte Carlo Method" (Library of Congress).

2 Miklós Rédei, ed., *John von Neumann: Selected Letters* (Providence, RI: 2005), 142.

and objective randomizer. The solution was precisely to reintroduce the human element into our randomizing system. That human element came in the form of a small child charged with the task of choosing a positive integer at random and pressing the randomizing button on the spreadsheet the requisite number of times. The child duly chose the number seven.

How random was this choice? In the mystic numerology of twentieth century psychology, seven looms large. George A. Miller, working at Harvard's Psycho-Acoustic Laboratory on behalf of the US Navy, reflected on this fact in his classic 1956 article, "The Magical Number 7, Plus or Minus 2." Synthesizing results from a wide range of studies, Miller remarked on how frequently seven represented a fundamental limit on human information-processing capacities. Briefly flash less than seven dots of light on a screen, and humans invariably get the number right; flash more than that, and they guess, usually incorrectly. Miller ultimately concluded that while seven's recurrence was suggestive, it might simply be a coincidence. Even so, his brand of information-theory-influenced cognitive psychology turned the randomizing capabilities of humans into a topic of inquiry from the 1950s onward. If the tone of this literature is any guide, humans are not particularly good randomizers, whether our randomization strategy involves flipping coins or simply naming sequences of digits off the tops of our heads. Yet, as von Neumann would point out in his musings on randomization algorithms, there is no such thing as a random digit: there are only methods for producing randomness. Even if it did not reduce randomness to rules, our method—algorithm plus child—was hopefully random enough to trust.

Strange Tales from a Glass Building

Fa-ti Fan

1.

The mountains look like an upturned, wounded hand, its gnarled fingers pointing slightly inward. Together, they dominate the southern corner of an island shaped like a yam. The area is sparsely populated and largely cut off from the outside world. But occasionally a traveler treks through the tall grass and dense woods and hurries on to one of the inns along the path around the mountains.

The sun is setting. The young man pushes forward, fighting the overgrown thorny brushes and tall grass that flank the narrow path. He is new to this island. He has been sent to the remote place to serve as the local magistrate, a post that has been left unfilled for three years. Scrambling downhill, he stumbles over a tree root. He picks himself up, mumbling a curse. And just then he hears the calls. They are floating over from a distance, across the field of waving grass. He can't see who is calling. He can't tell if it is a man or a woman. Maybe it is a child? The words become clear. "Where have you come from? Where are you going?"

When a traveler walks by, the serpent calls out and asks, Where have you come from and where are you going? Only these two questions are clearly audible, and the voice carries the accent of someone who hails from the central states. Those who don't know better and answer will be followed by the snake, even if they go for tens of li. When the snake arrives, the smell of its foul odor wraps around trees. It breaks into the room and swallows the traveler who answered its calls earlier. (*Inventory of Snakes*, Qing dynasty)

2.

The wind knifes through his tattered heavy coat. He bends down to deflect the slashes and cuts. He breathes hard, seized by a spell of dizziness. He tries to balance himself on his gloved, frostbitten hands. He knows he cannot stop. Still water freezes.

Only a week ago, five of them crowded into a pile and took a group photo. The youngest two crouched down in the front, and the others lined up in the back with their arms over each other's shoulders, their smiles visible behind their wiry beards.

Shadow puppet, snake (yao she), 1889, Guangxu period (1875–1908), Qing dynasty, leather, 13.5 × 93 cm. Accession No. 1994-04700, image courtesy of the Asian Civilisations Museum, Singapore.

They unfolded a large map, on which a well-marked red trail snaked through the void.

That was so long ago. Four lives ago.

He is thirsty, with millions of acres of solid water around him. He is but a speck in a vast white desert, devoid of any possibility of coming across a cactus or a palm tree. He reaches the edge of a ravine. Crawling slowly over, he looks down.

A large patch of shaggy grey on a wall of glistening ice catches his eye. Is it moving?

In the north, there is a thick layer of ice. It spreads out 10,000 li and measures one thousand feet deep. Underneath, there are giant plant-eating rats. They weigh ten thousand catties each. Their flesh can be made into dried meat, a few bites of which will warm one up. Their skin can be used to make drums, the sound of which can be heard one thousand li away. Their hair reaches eight feet long and can be used for bedding, which keeps one warm. (*Book of Marvels and Wonders*, attributed to the Han dynasty)

3.
"Look! A woolly mammoth!" A little girl points to a large stuffed animal towering over rows of fluffy, colorful tigers, pandas, seals, and bunnies. Her father, a bespectacled Asian man with odd resemblances to an older Queen Victoria, picks up the *Ice Age* character and hands it over to the girl.

4.
She smiles, returning the book she was leafing through to the shelf and heading out of the store, her blue Camper shoes matching her eyes. She loves the walk across the park, along the gentle bends of the river. The afternoon sun reflects off the rippling water, like an invisible dragonfly dipping its tail and leaving a trail of dancing circles of light.

She walks up a bridge and stops to see two ducks gliding by. The spire of a distant church pierces through the sea of treetops. A boy with a baseball cap leans against a tree on the riverbank, a fishing rod next to him. A large leaf flutters down and rests on his shoulder.

One day, with a few guests, Wen Hui watched people fishing on the river. Suddenly one of the fishermen jumped onto the shore and started running like crazy. Mr. Wen asked him what was wrong. The man couldn't say a word but pointed at his own back. When Mr. Wen looked closely, he saw something like a yellow leaf, about one foot long and with eyes all over it. It had attached itself so firmly to the man that it was not possible to remove it. Mr. Wen instructed a servant to burn it until it loosened its grip and fell off. In each of its many eyes, there were teeth like nails. The fisherman lost several liters of blood and died. (*Miscellaneous Morsels of Youyang*, Tang dynasty)

The boy stands up, stretches, and gathers his fishing rod and bucket. He looks up. She waves at him from the sun-gilt bridge. He smiles and waves back, "Hi, Mom!"

They'll walk home together.

After the genre of "records of strange occurrences" (zhiyi or zhiguai), a genre that often contained elements of surprise, wonder, marvel, and horror. Written under a large tree in front of a French bakery, with an occasional leaf drifting by and a sparrow pecking at my strawberry tart.

Humanities in Conflict Zones

Rivka Feldhay

For me, surprise is the "vanishing point of desire."[1] Obviously, I have not invented this elusive definition. In fact, the more I reflect upon it, the more ungraspable the concept becomes. On the one hand are the dark shadows of *das Unheimliche*, Freud's description of the bizarre feeling of *déjà vu*, and on the other, the Latin origin *stupendus*, meaning astonishment or amazement at some wonder. Moving between these is so precarious that at any moment one might be left with a big hole in the heart. The point of all this is to suggest that often we are caught off guard by something that has, in fact, been ingrained in us all along but escaped articulation or conscious awareness.

And so I have decided to let surprise reveal itself between two forms of expression. The first is the text offered below, in which I reflect on the scholarly activities I have been involved with in recent years together with a wonderful group of Israeli and Palestinian scholars at Tel Aviv University. This text is the result of a process that led us to an unexpected formulation about the inherently conflictual nature of the humanities. The second is a short film depicting our attempt to share something of scholarship in the humanities with Palestinian high school students. The result is a kind of transformative experience that seemed to come unexpectedly both to them and also to us, the organizers.

* * *

What is the relationship between "the humanities" and "conflict"? It seems to me that there are two ways to approach this question. One is to differentiate between the humanities as a field of knowledge and conflict as a condition of sociopolitical reality. Taking such an approach, the question arises: How do the humanities operate in and through conflicts taking place in the "real world"? Yet another way to approach the question is to adopt an inner gaze that recognizes the conflictual history of the humanities themselves, and ultimately faces up to that heritage.

The claim implicit in the latter approach is that those fields of scholarship that deal with human beings, their faculties (especially,

1 Jacques Lacan, "The Subversion of the Subject and the Dialectic of Desire in the Freudian Unconscious," in *Contemporary Continental Philosophy*, ed. D. K. Keenan (Albany: 2004).

but not only, language), the kind of knowledge they produce, their sociability, their norms, and their identities are always-already taking place in conflict zones. Formulated somewhat differently: *conflict is the existential mode of being of the humanities*. Any attempt to completely disengage the "world of knowledge" and the "real world" is not only an abstraction but also an illusion in the same way that any reduction of the "real world" to the "world of knowledge" is also an illusion. And so our task is always dual. We must both understand how humanistic bodies of knowledge are "in the world"—which is always conflictual, and perhaps even more so in our present—while also learning how the "real" world always informs the making of knowledge of and about that world. Our actions are highly dependent upon our worlds of knowledge and our worlds of knowledge are always embedded in the "real" world.

Humanists—those who study human beings and human forms of life—have always been involved in some form of conflict; sometimes it emerges from within their own communities, sometimes from outside of them with rivals coming both from non humanistic fields and from competing conceptions of human activity. To give just a few examples: Plato wanted to banish poets from his ideal city. Medieval universities distinguished the *trivium* (grammar, logic, and rhetoric) from *scientiae* (epistemic knowledge). Renaissance humanists bitterly fought scholastic philosophers for institutional academic dominance. In 1959, C. P. Snow delivered his well-known speech at Cambridge in which he claimed Western society was split between the culture of science and that of the humanities.

On yet another level, conflicts between the humanities and the environment within which those disciplines operate have always been simultaneously epistemic and political. At the epistemic level, we can mention the desire to try and purify the human experience of the world from any personal (subjective) elements by reducing that experience to facts deemed to be objective representations. Concomitantly, such attempts express a quest to cleanse language of any subjective elements so that scientists' representations are able to perfectly mirror the world. These qualities of "true science" are also taken to be moral virtues, expressing good judgment, fairness, and a

spirit of enlightenment. Thus, the battle is not simply epistemic: it is always-already political. Ultimately, there is always a conflict over *who* has the authority to give an account about the human world or to interpret it. Is authority held by scientists? Historians? Literary scholars, sociologists, jurists, theologians? And, *what* are the adequate tools for performing this job? Mathematical equations? Statistical probabilities? Literary interpretation?

The peculiar conflicts of the humanities relate to the nonnecessity, contingency, and indeterminacy of the human condition, which generate contradictions between the quest for theoretical and epistemic certainty and the need to accommodate local human perspectives. These tensions are connected to the status of interpretation as a method of attaching meaning, to the representative capacity of facts (or lack thereof), and to the inherently reflexive nature of the humanities.

To repeat, what is at stake is not only the relationship of scholarship in the humanities to the surrounding world, or its relationship with other fields of knowledge, but also the problem of contradictory quests *within* the humanities. That is to say, the central concern is the conflict between our idealistic yearning for the purity of knowledge and objectivity on the one hand and our desire for subjectivity and identity on the other. Such inner divisions, I am however arguing, are a source of strength and not weakness. For it is from this place of inner division—let me call it an *inner wound*—that critique of our flawed reality emerges and normative claims can be articulated.

* * *

Here is a short film that illustrates our space of freedom, as scholars of the humanities, to transform tension into a bond among young people in Israel/Palestine.[2] Don't their eyes really embody the transient experience of surprise?

2 insaan—Arabic Humanities Network, "Humanities in Conflict Zones—St. Josef Seminar," YouTube video, 13:05, posted by "insaan—Arabic Humanities Network," August 21, 2017, https://www.youtube.com/watch?v=Q01D64Y7KE8.

Through the Bog

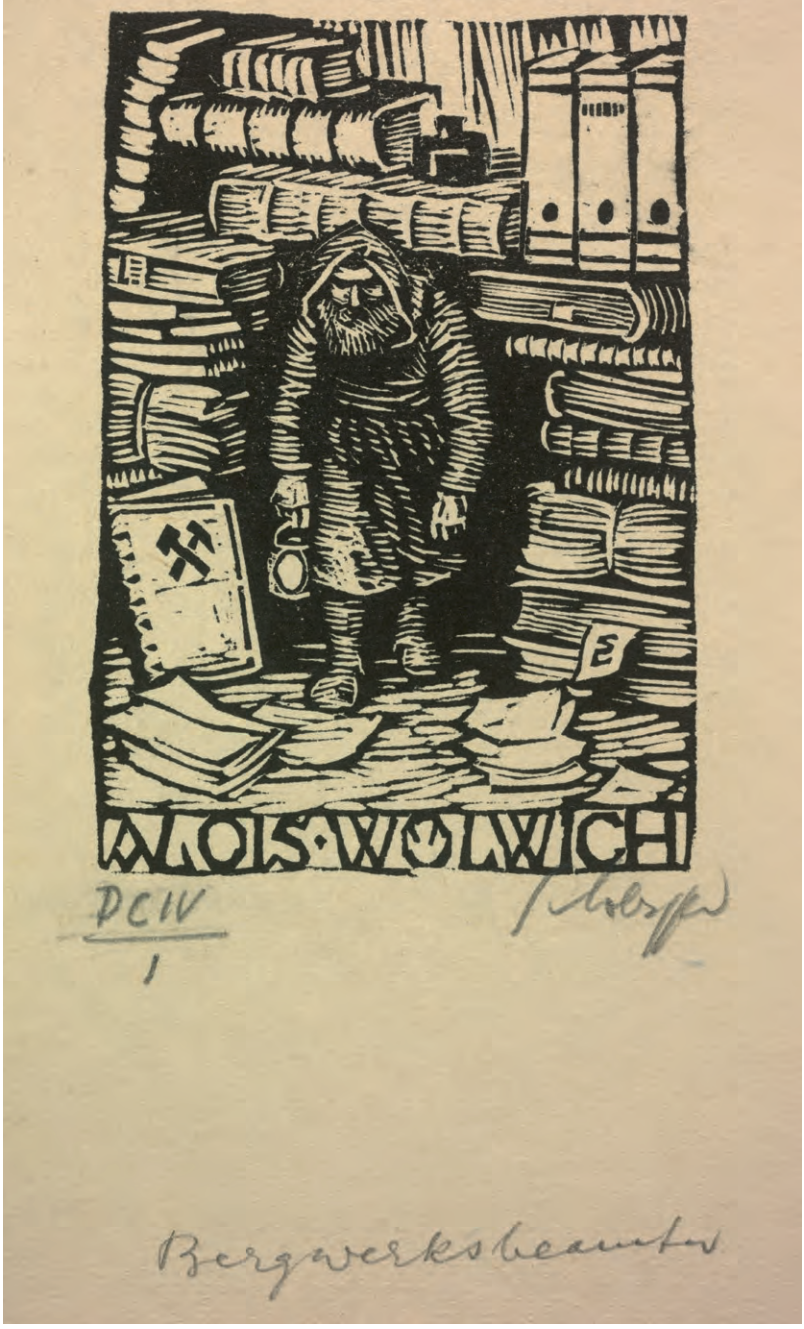
Sebastian Felten

Surprise means that our idea of the world is inadequate; this is why researchers rejoice in it. Scientists set up experimental systems not to prove their hypotheses but to generate novelty; scholars query their corpus only to be led astray by the unusual find. For historians, the unexpected in the archive can feel like a resounding veto of their sources, sweeping aside their armchair speculations. This jolting moment of recognition, that reality turns out to be utterly different than previously thought, promises to unlock superior knowledge.

Researchers like surprise not only because it propels their quest for knowledge. It also helps them justify the erratic course of their work that is sometimes difficult to convey to outsiders. Why fund open-ended research? Tales about unexpected windfalls can help argue that case. The list of useful things that are the purported result of serendipity is long and adequately incoherent: X-rays and Viagra, gunpowder and saccharine, Post-it notes and penicillin, dynamite, cornflakes, and, of course, America. Tales of serendipity in forewords, editorials, and memoirs can help carve out a space for research to follow its own rules; they are often told with an eye to outside audiences who might suspect idling in the ivory tower.

But storytelling aside, does surprise have a place in the realm of research? In the fable that Horace Walpole famously stumbled upon, the three princes of Serendip went on a journey in unknown lands only after a long education. Their wits were whetted to engage with twists of all sorts. Like them, researchers embark on the journey into the unknown with a ready and flexible mind. They aim a shifting battery of methods at a moving target. Researchers thus hedge surprise and harness it. By doing so they might dampen its effect. Can someone feel genuine surprise if they went out to look for it?

This question may become more acute as computers emerge as serendipity machines (not my term) in many aspects of our lives, research included. Algorithms roam gargantuan databases without knowing what to look for, baffling scientists and companies with what they find. Mechanical serendipity has slipped into the routines even of humanists who avow the traditional close reading of small samples. Aggregators like Google Books, JSTOR, and Europeana work to this effect.



Switbert Lobisser, ex libris for the mining official Alois Wölwich, woodcut, 1941, 9.4 × 6.6 cm. Österreichische Nationalbibliothek Vienna, E-20021.

Mechanical serendipity could bring about a new age of surprise. But perhaps the ubiquity of the lucky find will blunt its force. I suggested above that, by definition, research leaves very little space for genuine surprise because it expects the unpredictable. The new tools to quickly access a wide range of heterogeneous sources might proliferate petty surprises but make genuine surprise even rarer.

Why this may be so will become clearer by analogy with the business that is evoked by the metaphor of data or text mining. In mining lore, only the first veins are discovered unexpectedly. Bohemian cartmen ploughing through the wilderness, an Andean shepherd looking for his llama—engrossed in other activities, they come upon precious ores by accident. These are mere myths, to be sure, but they capture something about what people must have felt when they wandered in a barren landscape and came across a trove of possibility.

But this wondrous moment passes quickly. Soon adventurers arrive on the scene, already calculating for profit, soon followed by engineers and bureaucrats, who plan and predict. Happy accidents still happen. In fact, they become more numerous as the mines expand. Yet now these odd finds are greeted with relief rather than surprise. As loss and gain cancel each other out and risks evaporate, the heart rates drop. The adventure of mining a mysterious underground becomes compatible with papershuffling and clean shirts.

Heterogeneous data, easily and abundantly available, confronts historians with the diversity of the past more starkly than before. Because access to these aggregates is only partially curated—or not curated at all—conversing with algorithms produces surprising results—almost so often that they are anticipated. More than once, I've found myself disappointed by sensible results when hoping for odd ones. Serendipity machines evoke a quick and telematic harvest, a bounding increase of knowledge without getting our boots dirty. But the proliferation of petty surprises might mean that, perhaps more than before, one needs to "read and reread, trudging forward doggedly through this bog, without a breath of fresh air unless the wind picks up. And sometimes it does, often at the moment you least expect it."[1] This message from old hands to young ones might continue to hold. March long through barren land; look for the unexpected. What an enjoyable double bind.

1 Arlette Farge, *The Allure of the Archives*, trans. Thomas Scott-Railton (New Haven, CT: 2013), 62.

Raising Eyebrows

Mechthild Fend

It is hard to look surprised when you are actually bored. I imagine that this must have been a challenge for the models posing for the *tête d'expression* at the Académie Royale de Peinture et de Sculpture in Paris. They sat—holding and recomposing a facial expression during the two- or three-hour sessions—in front of a group of art students doing their best to draw the visible signs of a particular passion. The exercise had been introduced in the mid-eighteenth century after the Comte de Caylus, the antiquarian and amateur, lamented the lack of facial expression in painting. Determined to remedy the problem, he donated money for an annual competition for the best expressive head. Along with the new assignment, another novelty entered the art institution: female models. Life models serving for the study of the nude were, at the time, always male, as this exercise, which was the pinnacle of academic training, centered on the idea of an implicitly male, universal body.

Potential concerns about propriety should not have been an issue for the *tête d'expression* as the models remained dressed with only their countenance exposed. Still, the presence of women in the almost exclusively male institution (the number of female artist members was restricted to four at a time) caused some moral unease. Rather than opting for actresses, experts in the simulation of passions, Caylus advised the choice of honest and modest women with no such professional experience as models to facilitate the natural rendering of emotions.[1] His fellow academy members, the artists actually in charge of organizing the competition, agreed that the models should be young and, ideally, female, their expressions showing more subtlety and purity than faces furrowed by age and life experience. They cautioned, however, that it might be difficult to get

1 Anne-Claude de Caylus, "De l'étude de la tête en particulier," in *Les Conférences de l'Académie royale de peinture et de sculpture*, tome VI (1752–1792), ed. Jacqueline Lichtenstein and Christian Michel (Paris: 2007–2012), 2:565–569. See also Thomas Kirchner, *L'expression des passions. Ausdruck als Darstellungsproblem in der französischen Kunst und Kunsttheorie des 17. und 18. Jahrhundersts* (Mainz: 1991), 196–200.

hold of decent young women, available for the task. *Filles publiques* had to be avoided at all costs in order to keep students from "dangerous knowledge."[2]

Ever since its founding, the expression of passions had been a major concern for the Académie royale. The painter Charles le Brun, a key figure in the establishment of the institution, had attempted to organize the visual representation of the passions as part of his efforts to bring intellectual rigor into the teaching of art. In his influential 1668 lecture regarding the *expression des passions,* Le Brun elaborated on the various simple and mixed passions as well as their manifestation in the facial features of humans. In conjunction with this, he produced a series of drawings that demonstrated the visual alphabet of the passions. They condensed the emoting countenance to shorthand, the traces of which we can still see in today's emojis. Raised eyebrows, wide open eyes, and a gaping mouth were and are the visual signs of "astonishment." Le Brun agreed with René Descartes and his *Les Passions des l'âme* (1649) that the soul resides in the brain.[3] The artist was more interested in the physical manifestation and visual expression of the passions though, and he stressed the significance of the eyebrows in the communication of feelings; because they are so close to the brain, these hairy lines trimming the forehead were chief indicators of the passions and played a crucial role in his emotional alphabet.

As we have learned from Lorraine Daston, emotional dispositions like "wonder," "curiosity," and "surprise" were key both in the seventeenth-century nomenclature of the passions and in approaches to the natural world. Le Brun included *étonnement* among the simple passions, and yet he struggled with it as might be suggested by the fact that he struck out the word "simple" in the inscription for his drawing. It reads "Etonnement ~~simple~~ Mouvement

2 Charles-Nicholas Cochin, "Propositions et reflexions concernantes le prix fondé par Monsieur le Comte de Caylus, pour l'étude des têtes, et de l'expression," in Kirchner, *Ausdruck*, 374.

3 Jennifer Montagu, *The Expression of the Passions. The Origin and Influence of Charles Le Brun's* Conférence sur l'expression générale et particulière (New Haven, CT, & London: 1994), 17–18.

Jean-Baptiste Regnault, "Tête de jeune fille, la surprise melée de joie," Concours de la tête d'expression, 1776. Pastel on paper, 37 x 30 cm. École nationale supérieure des Beaux-Arts, Paris. Photo: Beaux-Arts de Paris, Dist. RMN-Grand Palais.

simple." The trouble seems to be that in the initial moment of *étonnement*, nobody can anticipate what happens next. Le Brun explains that astonishment is an excess of admiration, in which the person experiencing it initially doesn't know whether the "object is appropriate or not."[4]

There is also a distinction between *étonnement* and *surprise*: the former is potentially shattering, the latter uplifting. In fact, when *mouvements composés* were posed for the *tête d'expression* exercise, astonishment was typically paired with fear or terror and surprise with joy. Mixed feelings were, it seems, the academy's attempt to manage the unforeseen. After all, the exercise was meant to inform

4 Le Brun in Montague, *The Expression of the Passions*, 113.

history painting—highly valued as the most prestigious painterly genre. In a historical painting, a figure or narrative was meant not to be frozen in a flash of bewilderment but caught in what Gotthold Ephraim Lessing would later call "a fruitful moment"—a transitory instant that allowed the viewer to imagine the progress of a storyline.

The Académie Royale held the competition for the *prix d'expression* almost every year between 1759 and 1790; female models were used in most cases. *Étonnement* was only posed for once, and *surprise melée de joie* three times, making it the single-most studied passion.[5] One of the outcomes was Jean-Baptiste Regnault's prize-winning drawing showing the head of a woman with loose hair and a strange headscarf (figure). Caylus had suggested that the model should wear her hair in a natural and picturesque manner, without any "ornement moderne sur la tête" and without a *fichu* that would prevent the student from properly rendering the transition from head to neck.[6] In Regnault's drawing, the headscarf serves to frame the face and to focus on the expression, accentuated by the slight opening of the mouth—the codified expression of surprise.

But the head breached the framework of Le Brun's diagrammatic drawings, which were deemed too formulaic by the mid-eighteenth century. The eyebrows are not even lifted, and drawn from a slightly oblique angle, the head seems to have turned, suggesting a reaction to something happening to the woman's left. From the corner of her eye, the young woman is looking straight at the viewer. If the drawing was indeed made *d'après nature,* she would have met the eyes of the artist while he was trying to catch her expression. Her pose perhaps transformed into an actual glance, an unexpected moment in the academic exercise. The drawing seems to register that the model, while mimicking the passion, suddenly felt it for real and became conscious of the relationship between pose and experience. Maybe her eyebrows dropped in that instant of self-awareness, just as those of the artist rose.

5 See the list in Kirchner, *Ausdruck*, 372–373.

6 *Conférences*, tome VI, 2:567.

A Family Conversation

Erna Fiorentini with Vincenzo Fiorentini

Time and again, I have reflected on processes of discovery. One day I heard an interview with a condensed-matter physicist who spoke about "having been surprised" by a material that combined seemingly incompatible properties.[1] That physicist happened to be my brother, Vincenzo. What a wonderful opportunity, I thought, to pursue the making of knowledge in a discipline far from my own, the history of art and images (though I had previously trained in crystallography and geochemistry). I wanted to distill the nature of the surprise Vincenzo had experienced, and I asked him about it: "Si parva licet componere magnis …" he objected modestly when I opened the conversation with examples from the history of physics.

"Look," I said, "I want to think about this question to honor Lorraine Daston, who taught me that there is no high or low in things or in the methods of looking at them; what counts is not valuing achievements but asking how and why they come into being." Once I put it that way, Vincenzo agreed to continue the conversation. "You study the theory of condensed matter," I started, a little bit skeptical. "It sounds like a contradiction. How do you work in this gap between actual physical material and abstract assumptions about how it might behave?" As I had expected, Vincenzo's answer was incorporeal at first.

"We do computer simulations, on 'virtual' matter. If you were a cynic you might say none of the stuff we study actually exists." But then, suddenly, after an in-depth description of the path from the abstract problem of fermions in an external potential to its most arcane computational aspects, Vincenzo touched earth. "Based on these first principles, we reify. Our virtual sandbox *is* a real physical system that we observe and manipulate—structure, components, external conditions—and, for all practical purposes, there are an infinite number of states transforming into one another from which you can predict properties that are experimentally testable—and often tested successfully."

1 Alessio Filippetti, Vincenzo Fiorentini, Francesco Ricci, Pietro Delugas & Jorge Íñiguez, "Prediction of a Native Ferroelectric Metal," *Nature Communications* 7 (2016): 1–7.

I wondered whether and why he would look for any particular possible incarnation from among this infinity of possible kinds of matter. "Yes, if we work with experimentalists, who want help and have questions. But as theorists, we are not necessarily after something specific. There's no need for precise expectations that may or may not be fulfilled: that's the fun part, I guess."

I pushed further. "But how do you start studying one particular problem then, like that conjunction of incompatible properties you have predicted for your material?" I was eager to unveil a deliberate decision or a definite assumption as the origin of discovery and to take fortuitousness out of the equation.

He replied, "It is curiosity that mostly spins new problems out of old ones. That new result was an aside to other problems we had worked on involving materials with a certain layered structure—you know, looking, thinking, and fiddling with them, mixing in one species or another, say, or playing with the number of layers." As my brother talked, I saw him as a child combining the pieces of a Meccano set. "We draw from experience and intuition, which is fine as far as it goes. But Nature has its own evil ways," he added somberly, "and as you proceed, step by step, you ask new questions and invent new ways to answer them." I silently thought a concept like "operational creativity" would characterize that process. "Moreover," Vincenzo reflected, "at the intersection of different fields you tend to build a repertoire of ideas that more specialized people may not have. Sometimes insights from unrelated sources condense into clues." I considered that *this* was not surprise but rather a *redirection of attention*. Surely, it probably only works if you are open to reflection about what you have observed, beyond the standard paths. Or perhaps if you are the sort of person disposed to discovery. Vincenzo confirmed my conjecture: "The idea of a material with both ferroelectric and metallic qualities, which we have now discovered, had been suggested decades ago in a paper with a somewhat tongue-in-cheek title: *Ferroelectric metals?* Among colleagues we jokingly renamed it "Starry-eyed Unicorns in Condensed Matter?" I didn't get the joke. He explained that, in general, ordered dipoles and abundant mobile charge cannot coexist, as the latter would kill the former—

therefore, a few spin-doctored press releases aside, no one really talked seriously about "ferroelectric metals" outside scare quotes.

It seemed that people had been obstinately blind. "Is this lack of interest the reason why no one discovered ferroelectric metals until now? If you managed to see what no one else could see, what has been *your* secret?"

Vincenzo joked, "A serious stroke of luck." Then, more seriously: "When we found polar symmetry (the first necessary but not sufficient ingredient of ferroelectricity) in a metal, we were only mildly surprised but became hugely curious about an unexpected possibility. And so, we pressed on."

I interrupted. "So is this a particular form of surprise, a meta-surprise, as it were? One that keeps you asking, beyond complacency?"

"Yes," Vincenzo agreed, "giving up was now out of the question. And we were rewarded, not to mention flabbergasted: the 'impossible' property—polarization, the other key ingredient—turned out to be computable and potentially measurable."

"What was the impact? Were there follow-up experiments?"

"Not many," he grinned. "Everybody is too busy or cash-strapped to risk taking up a potential dead end. At conferences, most people don't seem to get it, and I understand their puzzlement." Look at that, I thought, even astonishment doesn't always manage to get beyond the conventional explanations. In Vincenzo's own discovery story, there was no trace of serendipity, no simple stumbling upon the unexpected, no unintended insight. His strategy was to keep his eyes open, take notice, recombine, and freshly direct attention.

"You immerse yourself in the interesting and the beautiful," Vincenzo said. "Like when you are dazed by a mountain wall with an elegant route offering itself, looking fresh and untouched: you go forward, hoping to discover a new view." I thought about how rewarding it would be if the alluring path were to keep its promise. "Quite so" he concluded, "provided you don't find pitons and fixed ropes along the way." That, I reflected, would be an entirely different kind of surprise in the process of discovery. What a wonderful opportunity for further family conversations!

Zufallsfunde

Markus Friedrich

It is a familiar scenario: A researcher walks into an archive or a library, planning to study a number of sources. The scholar begins reading but soon is distracted. The documents in front of him contain what he has been looking for, but not only this. He finds other texts that captivate his attention and distract him from his original research agenda. Or he finds curious, important, and unexpected information relating to what might become new and future projects. Since the Renaissance, many scholars have told versions of this story. Historians, in particular, have often come across important materials in more or less happenstance ways. "In reality it must be admitted that this kind of research needs at least as much good luck (*bonheur*) as systematic knowledge (*science*)," one French antiquarian commented in 1677.[1] Another historically minded amateur agreed about 100 years later in 1783, noting that he had found relevant materials by "lucky chance."[2]

Around 1900, German academics coined the term *Zufallsfund* (chance finding). However the term, while precise, also carried an aura of apology and ambivalence. In one typical instance, the archeologist Friedrich Koepp (1860–1944) wrote about the work of Ulrich Koehler (1838–1903), a prominent editor of Greek inscriptions: "The value of his publication is not diminished by pointing out that it was initiated by a gift of chance, the fragment of an inscription detected only a year before: what could have remained simply a Zufallsfund for others was turned into a proper intellectual possession by intensive work in this case."[3] Even in the hands of a respected scholar, the use of *Zufallsfund* required qualification and justification.

This ambivalence has remained. History as an academic discipline and the historian's professional persona rely on the assumption that

1 Ménestrier to de Grossi, in Paul Allut, *Recherches sur la vie et les œuvres du P. Claude-François Menestrier de la Compagnie de Jésus* (Lyon: 1856), 344–345.

2 René de Laigue, "Le livre de raison de Jehan de la Fruglaye, seigneur de la Villaubaust," *Bulletin archéologique de l'Association bretonne* 20 (1901): 109: "heureux hazard."

3 Friedrich Koepp, "Ulrich Koehler (1838–1903)," *Biographisches Jahrbuch für Altertumskunde* 29 (1906): 17: "Es tut dem Verdienst dieses Werks keinen Abbruch, wenn man es hervorhebt, daß den Anstoß dazu und seinen Kern sozusagen eine Gunst des Zufalls gegeben hat, jenes im Jahr zuvor erst gefundene Bruchstück der Quotenlisten: was einem anderen ein Zufallsfund geblieben wäre, das hatte hier eindringende Arbeit zum wohlverdienten Besitz gemacht."

historical analysis proceeds in a strategically planned manner, in particular in the systematic search for pertinent sources. *Quellenbeherrschung,* the mastery of sources, is a recurrent topos of praise in academic reviews, and such mastery seems contradicted by chance and surprise encounters. This is, of course, a paradox: no researcher can ever be sure to have read all the relevant sources for a given research question. The possibility, however unlikely, that additional material might surface somewhere can never be ruled out and is in fact constituent of historical research. But by claiming "mastery of sources," a researcher asserts at least that nothing of major importance is yet likely to be found. Such mastery, in a professional academic setting, supposedly does not rely on chance and other contingencies.[4]

Whether or not chance is acceptable as a propagator of knowledge in the humanities depends not least on how chance actually happened. "The question is how 'chance' is understood," one German historian blessed with making sensational findings wrote.[5] She stressed that in her case "chance" resulted from "systematic research." She found things that no one thought existed—things no one had thought to look for—but she did not find them in happenstance ways. This is usually still considered the *via regia* of historical research. Moreover, the researcher must not stop with his chance finding. A surprising and unexpected piece of evidence may initiate a new direction of research, but, as Koepp wrote, once the initial finding has occurred, all further research must shed the impression of coincidence. Systematic research is required to tame the impact of chance for the professional habitus of historians.

Historians are generally not too enthusiastic about acknowledging the impact of chance on their work. If stories about what actually

4 Amateurs are often more able to acknowledge chance as a key driving motor of historical inquiry. Several genealogical associations, for instance, maintain websites dedicated explicitly to the collecting and making available of *Zufallsfunde*; see http://www.zufallsfunde.net and https://www.familia-austria.at/index.php/datensammlungen/zufallsfunde.

5 Cornelia Jabs, "Ein Zufallsfund? Der besondere Weg zu den Kurras-Akten," *Deutschland-Archiv* 7, last modified July 25, 2012, accessed April 30, 2018, http://www.bpb.de/geschichte/zeitgeschichte/deutschlandarchiv/139632/ein-zufallsfund.

happened in the process of finding the sources that build historical narratives are told, they are usually either relegated to prefaces or kept apart entirely in letters or memoirs. Hiding the contingencies of research might be an understandable rhetorical strategy—particularly for junior members of the republic of letters—to protect publications against becoming easy targets for critical commentary. For at least three reasons, we might want to allow for a more open acknowledgment of the contingencies of fact-finding procedures in archives and libraries.

First, usually scholars in the humanities today combine research with teaching. As pedagogues, we should consider it one of our responsibilities to acquaint junior scholars with the contingent nature of knowledge-making. Surely students will learn a lot by simply observing the habits and practices around them as they are slowly socialized into the broader community of scholars. But familiarizing novices with the accidental and unpredictable nature of scholarly progress should perhaps go beyond anecdotal evidence and learning by doing.

This pedagogy of chance should highlight the connection between unplannable realities and systematic work. Reading sources can be a test of patience, indeed a feat of endurance. And yet, while turning page after page of often boring texts, historians must retain a high degree of alertness. They must notice things that are "interesting," though outside the current scope of research. To do this, scholars must be taught to expect the unexpected and to organize and manage their findings, especially those without immediate use.

Second, the digital age provides new stimulus for thinking about chance findings. Most scholars now make use of the various search engines available in the digital realm. But the results of full-text searches frequently resemble *Zufallsfunde*: they yield single items, largely devoid of context. What to do with them and how to build professionally valid scholarship on such accidental findings should be of paramount importance in our methodological reflections.

Third, most historians nowadays share an understanding that historical knowledge is never simply "found" or "there" but necessarily "constructed" or "made." However, the practices of constructing not

only historiographical narratives but historiography's empirical basis should be highlighted. Careful assessments of the realities of research should be added to ongoing critical discussions about historiographical narratives and popular historical imagination to round out our understanding of the constructed nature of history. In the long process of knowledge-making, *Zufallsfunde* should figure prominently in such an assessment.

In Praise of the Counterintuitive

Yulia Frumer

Defiance of expectation and learning are intimately intertwined. Humans form models based on learned categories and feel surprise upon realizing that their experience does not align with those expectations. The sense of surprise, therefore, is a sign that learned categories need to be revisited, revised, and refined, priming the mind for further learning. Psychologists have determined that 11-month-olds learn more when the learning experience is preceded by an event that they did not anticipate.[1] In the history of science and technology, too, the arising of the unexpected is a sure sign that there is something intriguing going on and that learning is about to happen.

My own research path has been paved with the unanticipated. In my work on the history of Japanese technology, one of my greatest joys has been to find an idiosyncratic object. If there is anything that dealing with Japanese scientific instruments has taught me, it is that whenever I feel that an object or a practice is "bizarre," I should reexamine my own assumptions about what is "normal." Perhaps I am the weird one! Or, perhaps what I assumed to be "common sense" is not, in fact, all that common. The feeling of unanticipated incongruency alerts me to the fact that there are things I take for granted because they are deeply engrained in my own culture, and in other historical realities there might be another "common sense" that is different from mine.

My first memorable scholarly astonishment was learning about Japanese clocks from the Tokugawa period. I was stunned to discover that the length of hours measured by these clocks was not predetermined and equal, as in the clocks I know, but varied according to the seasons. It sounded like both a technological impossibility and a recipe for endless missed meetings. In order to explain the apparent anomalies of Japanese clocks, I decided, I had to explore them further. This led me to realize how many assumptions about timekeeping, clocks, hours, and time I myself took for granted. For example, I assumed that an "hour" is defined by its length. I assumed that the only

1 Aimee Stahl and Lisa Feigenson, "Expectancy Violations Promote Learning in Young Children," *Cognition* 163 (June 2017): 1–14.

relevant criterion for time measurement is the degree of precision. That an equal-hour system ("our" system) is essential for the functioning of large social structures. That each hour digit has to have a determined location on a dial, so that even when digits are not written one can still know the time by looking at the position of the hands. My surprise, however, led me to learn that social coordination depends not on a technological system but on an agreement. That people can schedule meetings, plan ahead, work overtime, and be punctual regardless of the timekeeping system they use. That there are numerous ways of looking at a clock and learning what time it is. And I also learned that the uniformity of our own timekeeping system conceals the fact that when we say that we "measure time," we actually mean different things, depending on the situation. "Time," I discovered, was a proxy for something else—distance traveled, motion of the stars, level of hunger, work left to do, nostalgia, chemical processes, and much more.[2]

If Japanese clocks challenged my assumptions about the nature of time, another Tokugawa-period device defied my assumptions about space. This device was a compass in which directions were reversed so that east was placed where I expected to see west. This seemed to contradict everything I knew about spatial orientation. Exploring the actual use of reverse compasses, however, I discovered that they show the world from the eye-level point of view, always indicating the direction the user is facing. The source of my confusion was not so much the device itself as the assumption that compasses show us a physical reality that is independent of us and that using a compass requires imagining looking at oneself from above. "Space" too was a concept that should not have been taken for granted.

Another surprise allowed me an insight into a process of knowledge transfer. I was reading notes taken by the chief Tokugawa astronomer, Takahashi Yoshitoki, who in the early years of the nineteenth century was making his way through a Dutch translation of J. J. Lalande's *Astronomie*. On one page, Yoshitoki drew a diagram and

2 Yulia Frumer, *Making Time* (Chicago: 2018).

clearly labeled it "based on fig. 222 of § 2686, vol. 3, page 383." However, when I checked the relevant figure in *Astronomie*, I was surprised to see that the diagram did not look anything like the one Yoshitoki drew. My surprise was amplified by the fact that Yoshitoki knew very little Dutch; in numerous places throughout his notes, he indicated that because he could not read the text, he was interpreting the diagrams alone. Trying to understand how Yoshitoki got from the original to the picture he actually drew revealed that he was not learning *from* translation (as one might assume), but the other way around: he was only able to offer a kind of translation following an internal process of interpretation and learning.[3]

For me, surprise is not only beneficial but also fun. And I have been further delighted to discover that it is, in fact, *structurally* fun. When we look at the cognitive processes that result in a feeling of surprise, we discover that they are intriguingly (should I say "surprisingly"?) similar to those involved in creation of humorous effect. Humor, theorists say, relies on incongruities.[4] We find something funny when there is an apparent contradiction between categories, and we "get the joke" when we find a way to resolve this incongruity. In other words, we perceive something as funny when we find a way to make sense out of apparent nonsense. The learning process that follows a surprise is just like that: we are astonished by incongruities and find a way to reconcile them. We tackle the thing that affronts our common sense and find a resolution. No wonder the process brings us so much joy.

3 Yulia Frumer, "Before Words: Reading Western Astronomical Texts in Early Nineteenth-Century Japan," *Annals of Science* 73, no. 2 (2016): 170–194.

4 Jerry Suls, "Cognitive Processes in Humor Appreciation," in *Handbook of Humor Research*, ed. Paul McGhee and Jeffrey Goldstein (New York: 1983), 39–58; Thomas Schultz, "A Cognitive–Developmental Analysis of Humor," in *Humor and Laughter: Theory, Research and Applications*, ed. Tony Chapman and Hugh Foot (New York: 1976), 12–13.

A Fluid Ship and a Bloody Bowl

Claire Gantet

On the January 27, 1785, Madame de Montesson, the wife of the first Prince of the Blood, invited Armand Marie Jacques de Chastenet, marquis de Puységur, to her mansion together with her personal surgeon, Claude-Louis Berthollet, to prove the reality of magnetic somnambulism. While Puységur, an artillery officer from the most illustrious of French nobility, was still only partly convinced of the value of Franz Anton Mesmer's teachings, his brother, a navy officer, had persuaded so many sailors of the effectiveness and utility of animal magnetism that his whole ship had become a tremendous *baquet,* sailing on a sea of magnetic fluid. Magnetic spasms had replaced seasickness, and all the sailors obeyed the orders of their therapist-officer. Yet fantastic stories and accusations of charlatanism were exactly what Puységur, a man of the Enlightenment, wanted to avoid. Defining himself as a scientist and man of reason, assisted by an approved physician, and following the methods of academic medicine, he recorded each treatment with mention of date, name, age, sickness and its duration, and the final result, giving them the status of facts he soon published.

In his first work, *Mémoires pour servir à l'histoire et à l'établissement du magnétisme animal,* published in 1785, Puységur prefaced the account of his encounter with Madame de Montesson (initially called Mme de *** but identified by name in the 1820 edition) with a statement of his discovery of the power of magnetism. While he was trying his hand at a Mesmerian experience without any instruments, he unexpectedly and unwittingly happened to put his valet Victor in a state of lucidity without awareness. This had happened a year prior at Puységur's estate, Buzancy, on May 8, 1784. Victor not only spoke in this condition but also answered his master's questions, suddenly remembering very old events, detailing his own therapy, and proving to be more intelligent than in waking life. Victor was literally *surprised* since, according to what would have been the understanding of his contemporaries, "surprise" referred to a sort of

Defining facts and producing proof of somnambulism: Victor bleeding into a bowl in attendance of Puységur and Madame de Montesson. Louis Figuier, *Les Mystères de la science moderne*, vol. 2, *Aujourd'hui* (Paris: 1880), 353, plate 45.

partial paralysis and meditation in a dreamlike state. As Grimm's dictionary put it, "ein gedankenvolles sinnen und träumen."[1]

Puységur's healing method, based on inducing an artificial state of calm sleepwalking, contrasted sharply with the violent crises that Mesmer advocated and which had quickly attracted much public attention. To avoid the charge of quackery, Puységur offered to treat everyone for free: loads of soldiers, Freemasons (among whom were a considerable number of military officers), and ordinary men and women gathered around the tree he had magnetized.

Puységur brought Victor, who had fallen on his head and was suffering from headaches, to Madame de Montesson's mansion. Once magnetized, the valet predicted that his recovery would occur on the following Saturday between noon and 1 p.m., following a nosebleed in the right nostril. At the predetermined time, the magnetized valet was put on the floor, his face above a bowl. He began to bleed slightly from the right nostril and spat blood into the bowl. Puységur stood up, faced the patient, and leaned close to him, establishing intimate privacy in the space between them. All he knew was that the success of his therapy depended on will, belief, and confidence. Yet Madame de Montesson, as a proponent of the "severe sciences," which were dominated by the physical and mathematical disciplines then gaining ground, distrusted the scene and requested a secret moment with the valet in which she unsuccessfully tried to open his eyes. A few days later, again in state of somnambulism, Victor disclosed their discussion to Puységur and told him, "Il est malheureux pour moi d'être votre sujet d'expérience."

At the outset, Puységur had been astonished by his discovery, which had at once enthralled and disconcerted him. As a man of the Enlightenment, he did not want to go beyond surprise. He particularly rejected contemporary mystical, miraculous, spiritual, sympathetic, and imaginary explanations of somnambulism. The "invisible agent" was not a psychological spirit or virtue but a physical fluid:

1 *Deutsches Wörterbuch von Jacob Grimm und Wilhelm Grimm*, "Staunen," vol. 17 (Stuttgart: 1919), col. 1176–1192, on 1177, with reference to Albrecht von Haller's poem "Doris" (1730). The entry "Überraschung," vol. 23 (Stuttgart: 1936), col. 456–458, emphasizes the sudden state of uncertainty.

surprise was the expression of an epistemic bodily affect. Since abnormal phenomena were, for Puységur, simply facts yet to be explained, evidence had to be obtained less through a theoretical framework than, as in physics, by increasing the number of successful iterations of the experiment. The truth of treatment by somnambulism was clear for all who had eyes to see, compelling belief as irresistibly as a mathematical demonstration. The sensory evidence of the spectacular phenomenon of somnambulism was attested to in a range of publications containing witness statements of the sort normally seen in court cases; Puységur even asked his patients to notarize a treatment certificate. The public, rather than learned physicians, were expected to decide in favor of somnambulism—something that went against the spirit of the rising *science sévère*.[2]

The staging at Madame de Montesson's mansion was all the more surprising in that all the protagonists were frustrated: the lady, who did not want to see the therapy; Puysegur, whose evidence the public did not believe; and Victor, who was disregarded by all. In the salon, Puységur, in influencing Victor, and Victor, in grotesquely bleeding into a bowl on the floor, had not followed the scientific, moral, or social rules of medical evidence. Even Madame de Montesson did not bring Puységur's contradictions to light: Was somnambulism the effect of a physical, universal, and pure fluid, or of human will? She disqualified the evidence but could not disprove the experiment. For Puységur, facts were neither pure nor outside the observer but, in the patient's *sentiment intime*, embodied in the relationship between magnetizer and patient. Both Madame de Montesson and Puységur conducted therapeutic conversations with Victor, but by concluding "il est malheureux pour moi d'être votre sujet d'expérience," Victor had the last word. He not only suggested the difficulty of defining facts and producing proof in the realm of mental life but also brought into question the very possibility that experiment could answer such questions. All before psychology as science even existed.

2 Bruno Belhoste, *Paris savant. Parcours et rencontres au temps des Lumières* (Paris: 2011).

Shock Generator

Cathy Gere

In 1961, Yale psychologist Stanley Milgram crafted an answer to the period's most pressing question: What had turned orderly bourgeois Germans into genocidal psychopaths? Located on a dramaturgical spectrum somewhere between the Eichmann Trial and *Candid Camera,* Milgram's "Obedience to Authority" experiment revealed a universal human tendency to defer to authority, even at the cost of basic decency, a "prepotent impulse, overriding training in ethics, sympathy and moral conduct."[1] Milgram claimed that he had isolated a crucial element of the psychology of fascism and reproduced it in ordinary Americans.

Before embarking on the procedure, Milgram administered a questionnaire to 14 Yale seniors, asking them to predict what percentage of the unwitting research subjects would go all the way to "Very Severe Shock." The most pessimistic prognostication was 3 percent. The actual figure was close to 65 percent. Not only did the result confound the expectations of his surveyed students, Milgram explained, but it also shocked the laboratory personnel observing the experiment through a two-way mirror. In deadpan prose, Milgram also conveyed his own surprise at what he witnessed: "Subjects often expressed deep disapproval of shocking a man in the face of his objections, and others denounced it as stupid and senseless. Yet the majority complied with the experimental commands."

The unexpectedness of the result in Milgram's "Obedience to Authority" experiment was carefully staged in order to serve two important functions. First, it operated as a certificate of authenticity. The behavior of the subjects could not be the product of confirmation bias; after all, it completely failed to conform to the experimenter's expectations (a rather woozy social-scientific variation on the theme of mechanical objectivity). Second, it served to underscore the softheaded American innocence that Milgram had set out to shatter. Over the course of the decade, Milgram's insistence on the substantial overlaps between American democracy and German fascism gained in force and persuasiveness, becoming a truism in radical cir-

1 This and the following quotation are from Stanley Milgram, "Behavioral Study of Obedience," *Journal of Abnormal and Social Psychology* 67, no. 4 (1963): 371 and 376.

cles after the escalation of the American war in Indochina. The scorching critique so neatly anticipated by the "Obedience to Authority" experiment is summed up on the cover of Telford Taylor's 1967 lament *Nuremberg and Vietnam*, which features an image of the Stars and Stripes stamped with a swastika.

Milgram published his long-awaited book *Obedience to Authority* in 1974, the year of Nixon's resignation and the end of the "long sixties." In it, he devoted a short chapter to the question of "expected behavior."

> Should there be a disparity between what people expect and what actually occurs, we are left with the interesting problem of accounting for the gap. For the expectations then come to have the character of an illusion, and we must ask whether such an illusion is a chance expression of ignorance or performs some definite function in social life.[2]

By this time, Milgram's method for surveying expectations had a twist: now respondents were asked what they thought they themselves would do under the conditions of the experiment. The selected answers are reminiscent of any survey of American undergraduates today asking what they would have done in Nazi Germany: "I can't stand to see people suffer. If the learner wanted to get out, I would free him so as not to make him suffer pain."

A riveting chapter follows, describing the behavior of a small selection of individuals under the most disturbing variation of the experiment, in which the subjects were seated next to their supposed victims and had to force their hands onto a metal plate in order to administer the shocks. The cast of characters is arranged for maximum drama: the first is a 37-year-old Italian American welder, with "a rough-hewn face," who goes all the way to the end of the shock series: "The scene is brutal and depressing: his hard impassive face showing total indifference as he subdues the screaming learner and gives him shocks." The next subject is a professor of Old Testament

2 Stanley Milgram, *Obedience to Authority, an Experimental View* (New York: 2009), 27–31. All further references in this essay are to the same passage of this volume.

liturgy, who aborts the series at 150 volts and "seems in no way intimidated by the experimenter's status but rather treats him as a dull technician." About the theology that inspired this subject to disobey orders, Milgram is contemptuous, dismissing it as "the substitution of good—that is, divine—authority for bad." Next is a 35-year-old African American drill press operator, who executes the grim task right to the end, with "a sad, dejected expression," and whose obedience Milgram ascribes to "total faith in the experimenter."

The only character whom Milgram seems to admire is the fourth subject in the series, a Dutch engineer, who emigrated to the United States after the Second World War. Aborting the experiment at 255 volts, the Dutchman cries out, "I came here to help on my own free will. I thought I could help in a research project. But if I have to hurt somebody to do that … I can't continue." Afterward, in the debriefing, he sets the theme of unexpectedness on its head, expressing "surprise at the underestimation of obedience by the psychiatrists. He said on the basis of his experience in Nazi-occupied Europe, he would predict a high level of compliance to orders."

The *Obedience to Authority* experiment was Milgram's version of Sylvia Plath's "Daddy" poem of almost exactly the same date: "I have always been scared of *you,* / With your Luftwaffe, your gobbledygoo. / And your neat mustache / And your Aryan eye, bright blue."[3] In exposing the banality of American evil, Milgram wanted to turn his naive compatriots into world-weary Europeans, like the Dutch engineer, whose experience in Nazi-occupied territory had given him insight into the infinite capacity of ordinary people to defer to evil. After the experiment was over, the Dutchman sealed his place in Milgram's estimation by writing to the lab asking if he could work there: "Although I am … employed in engineering, I have become convinced that the social sciences and especially psychology, are much more important in today's world."

3 Sylvia Plath, "Daddy," in *Ariel: The Restored Edition* (New York: 2018), 75.

The Economic Miracle

Donatella Germanese

"Our view is that advertising ought to surprise and even mystify, and should engage people's imagination more than their reasoning." This was the manifesto-style declaration that appeared in the Italian business magazine *Civiltà delle Macchine* in July 1954. During the 1950s, public relations departments in the larger Italian corporations used contributions by specialists from a very wide range of disciplines in company magazines that circulated both among their own staffs and outside the factories. These publications became testing grounds for the blend of technical, scientific, artistic, and sometimes philosophical topics. The promotion of industrial products included the popularization of science and technology, while the fine arts were required to assist by providing an additional cognitive and affective dimension.

This was not just about selling things but about engaging the population, educating people, and turning them into active participants in Italy's social and economic recovery. While business magazines in the early postwar period emphasized the great strides made by Italy's reconstruction, after 1950 the range of things that evoked surprise was extended: they enthusiastically presented a variety of technological innovations, scientific discoveries new and old, and works by both professional artists and amateurs. The intersections and overlaps between different spheres were often highlighted.

The topos of wonder is implicit in the concept of "the economic miracle," the expression used for the economic expansion in the 1950s and early 1960s in West Germany, Italy, and Japan, the principal countries defeated in World War II, whose rapid recovery was indeed seen as "miraculous." "Economic miracle," *Wirtschaftswunder*, *miracolo economico*: the development of this label, applied retrospectively to a phenomenon perceived as astonishing, can be related to the multifaceted public discourse around the wonders of new industrial methods, their large-scale use, and the progress they delivered to society in general. The features of these fables can be delineated from a close examination of the magazines produced by Italian industry during the period 1949–1959; technology clearly proves to be the queen of surprise, followed by the fine arts, and then advertising.

Opening an issue of *Civiltà delle Macchine* (published by Finmeccanica and IRI), one found pages and pages of advertising, but there were no advertisements at all in *Esso Rivista* (Standard Oil) or in *Il Gatto Selvatico* (Ente Nazionale Idrocarburi and Agip), which were aimed mainly at each company's own employees. All the editorial teams, however, initiated discussions of advertising with journalists and other experts who presented historical surveys on the theme; they included Carlo Balestra in *Il Gatto Selvatico* in December 1955, Achille Perilli in *Esso Rivista* in early 1957, and Renato Giani in *Civiltà delle Macchine* in the summer of the same year.

The discourse *on* advertising was supplemented by advertising images with an illustrative and explanatory function. In the publications that otherwise carried no advertising at all, these images were taken from the campaigns of their parent companies: Agip's fantastical flame-breathing dog with six legs for *Il Gatto Selvatico* and for *Esso Rivista* the photograph of an elegant couple, out at night, strolling past an oil refinery. The latter magazine reported on the major campaign launched by the company in 1956 with the slogan "ESSO RESEARCH works wonders with oil" (note the assonance and alliteration). In Perilli's words, this was about "recalling the countless uses of oil and its derivatives in contemporary life," including nylon, the material for the elegant woman's red evening dress. "Wonderful new fibers that oil helped make," ran the photograph's subheading; Perilli explains that its advertising mechanism was "to make readers curious and draw them into reading the text, from which they would realize, with amazement, how oil is actually the subject of the photograph. Thus the advertising trap will be elegantly sprung."

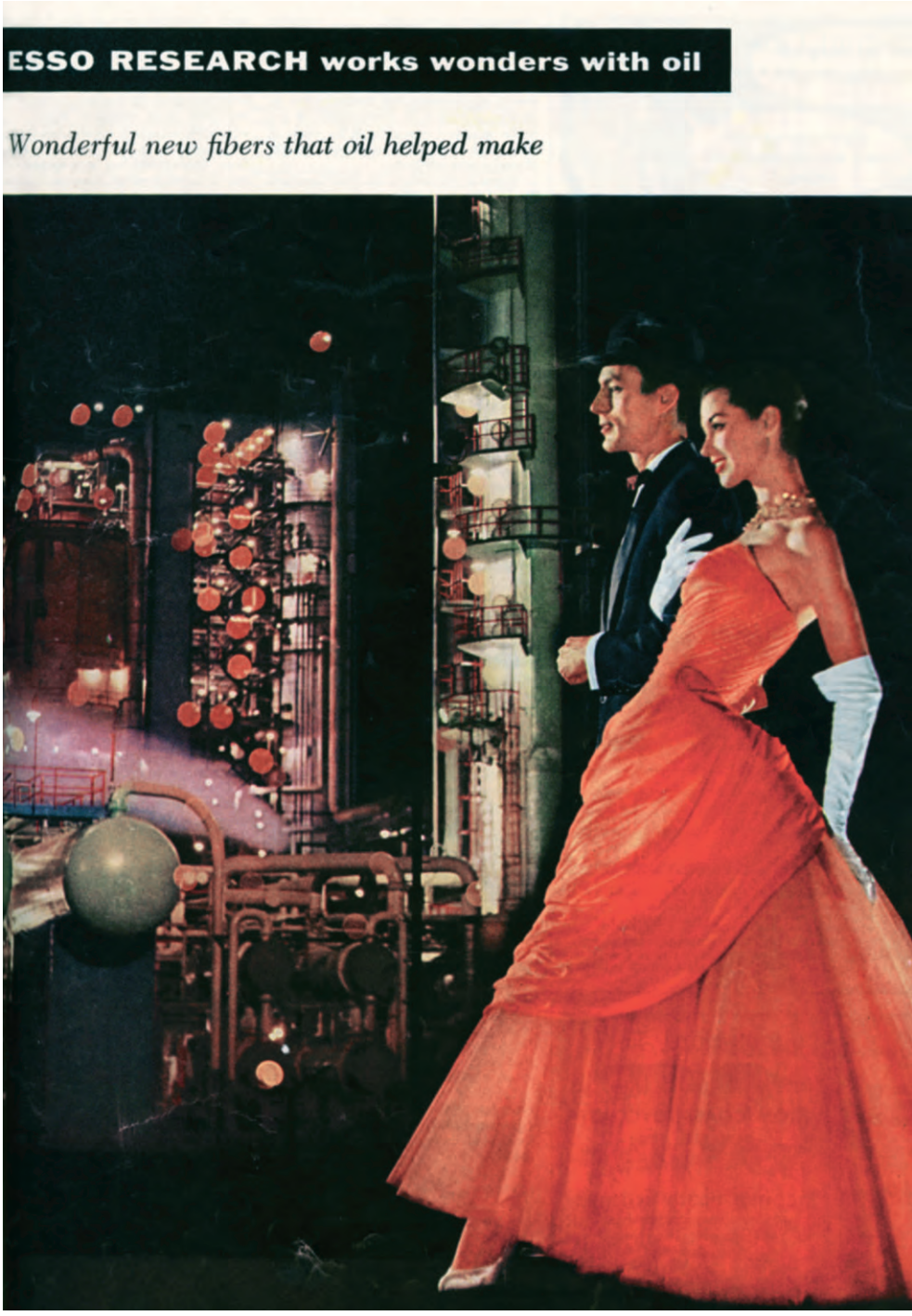
The magazines were playing with the expectations of readers who must have understood their connection with industry but who were also looking for scientific and cultural entertainment from publications that presented themselves as nonspecialist. From their titles, illustrated covers, frequently glossy paper, and numerous pictures, *Civiltà delle Macchine*, *Esso Rivista*, *Il Gatto Selvatico*, *Illustrato Fiat*, and *Rivista Shell Italiana* resembled the illustrated magazines of the 1950s that were popular in Italy as elsewhere. The periodicals published by industrial conglomerates reviewed the in-

ventions of the past, present, and future, from the wheel to the missile, ancient handmade artifacts to synthetic fibers, the dam to the atomic pile, the telescope to the unmanned satellite, the steam engine to the petrol engine, the earliest to the latest drilling techniques for finding oil, and the simplest tools to automation in industrial production, computation, translation, and robotics. Confronted by so many discoveries and inventions, all—the factoryworker and the scientist, the poet and the painter—might experience wonder.

In showcasing various creations, the aim was to construct consensus: to consolidate the social fabric at the levels of both the company and the nation, with a Western perspective during the Cold War era. A part was also played by strangers to the world of production, such as the artists invited into workplaces who then told the public about industrial activity in a manner exotic enough to interest readers without overwhelming them; according to Renato Giani, writing in the first issue of *Civiltà delle Macchine* for 1958, they were "gifted with that kind of marvelous outsider's eye whereby things seem surprising and novel, and are surrounded by an aura of mystery and miracle."

While medieval wonders were symbolic of wealth and power, the many wonders extolled by Italian company magazines in the 1950s needed to draw a veil over power relationships while emphasizing the democratic aspect of universal benefit in the spirit of general progress. This position changed notably during the next decade, when criticisms of uneven development started to emerge even in the industrial magazines. However, the effectiveness of the surprise mechanism itself seemed to be fading, as can be discerned from a piece by Giuseppe Dal Monte in the October 1958 issue of *Illustrato Fiat*: "All these discoveries, which yesterday seemed like figments of the imagination but today are in use and may lead to further developments, have now accustomed us all, whether dunces or scientists, to not being surprised by anything."

Translated by Stuart Oglethorpe



Esso Rivista 9, no. 1 (1957): 18.

Glücklicher Zufall

Hannah Ginsborg

In a famous remark from the *Critique of Practical Reason*, Kant mentions two things that fill the mind with "ever new and increasing awe and wonder": "the starry heavens above me and the moral law within me" (5:161).[1] That remark is quoted toward the end of the fascinating history of wonder and curiosity which Raine, together with her coauthor Katharine Park, narrate in their 1998 book *Wonders and the Order of Nature*. Their point is to underscore a shift in the object of the emotion of wonder that came about with the Enlightenment. The proper object of wonder is no longer the anomalous, the surprising, the unexpected—the "wonder" of the *Wunderkammer*—but rather its opposite: the immutable regularity of the universal laws of nature, associated, for Kant, with the absolute authority of the moral law.

Is the experience of wonder, for Kant, definitively dissociated from that of surprise, of our response to the unexpected? I would like to complement Raine's invocation of Kant by suggesting that Kant does allow for wonder as a reaction to the unexpected, although in a way compatible with the idea that it responds to the lawfulness of nature rather than to the apparently anomalous. The wonder I have in mind is described in the *Critique of Judgment*, where Kant has us reflect on the relation between nature's empirical laws—the ones we discover through observation and experiment—and our own cognitive capacities. What turns out to be unexpected, in this reflection, is that nature's empirical laws are such as to allow us to come to know them. There is nothing surprising about our capacity to know the a priori synthetic laws Kant identifies in the *Critique of Pure Reason*—for example, that substance is permanent or that every event has a cause—since these laws, like those of arithmetic and geometry, originate in our own cognitive faculties. But, Kant reminds us, these transcendental laws do not imply that "nature is a system comprehensible by the human cognitive capacity through empirical laws": they leave open the possibility that the diversity of natural forms and cor-

1 References to Kant cite volume and page number of Immanuel Kant, *Gesammelte Schriften*, 29 vols., vol. 1–22 ed. Preussische Akademie der Wissenschaften, vol. 23 ed. Deutsche Akademie der Wissenschaften zu Berlin, vol. 24–29 ed. Akademie der Wissenschaften zu Göttingen (Berlin: 1900–).

responding empirical laws could be "infinitely great," presenting us with "a crude chaotic aggregate without the slightest trace of a system" (20:209). That nature is, instead, comprehensible to us and indeed allows of being systematized by us in a thoroughgoing way, is entirely contingent—so much so that when we discover systematic unity among empirical laws of nature, it is like a "happy accident {glücklicher Zufall} favouring our intention" (5:184). The discovery that two or more apparently heterogeneous laws can be unified under a single principle yields "a very remarkable pleasure, often even a wonder {*Bewunderung*} which does not cease even when we are already sufficiently familiar with its object" (5:187). This is indeed close to the idea of wonder at the regularity of nature, but it includes an element of surprise. What we wonder at is not that nature is intrinsically regular but that it is regular *in a way that we can comprehend*—something that, given the independence of empirical nature from human cognitive faculties, we have no right to expect.

The wonder Kant describes here is linked with a different kind of wonder or admiration, that associated with pleasure in the beautiful. Like the first, it involves surprise. There are no rules for determining whether or not something is beautiful and thus no way that we could predict from the description of a beautiful object that we will find it beautiful (5:284–286). Like nature's comprehensibility to us, the beauty of objects we encounter can be regarded as a gift, a way in which nature favors us (5:380). Kant holds that the capacity to experience beauty is a condition of knowledge, so the fact that we are able in principle to feel pleasure in the beautiful is no more contingent than our capacity in principle to bring objects under concepts and to organize those concepts under higher concepts. What *is* contingent is the fact that objects exist that awaken this capacity. We could perfectly well conceive of a world without a single beautiful object, just as we can conceive of a world in which our capacities to conceptualize and systematize nature are constantly frustrated.

Is Kant—the prototypical philosopher of the Enlightenment—willing to settle for this radical contingency at the heart of his philosophical system? On the one hand, he does, in typical Kantian fashion, discipline it by making it the object of an a priori principle: the

principle of nature's purposiveness for our cognitive faculties. We have to presuppose a mutual fit between nature and our cognitive faculties as a condition of being able to bring the natural world under empirical concepts, and so of cognizing it empirically. On the other hand, unlike the synthetic a priori principles of the *Critique of Pure Reason*, the principle of nature's purposiveness is not one which we know to obtain. We have to proceed in our cognitive activity on the assumption that nature is going to favor our attempts to understand it, but we have no objective reasons for taking this assumption to be true or even probable. The fact that we cannot seek empirical understanding of nature without assuming it to be empirically comprehensible by us does not take away from the contingency of that comprehensibility. This contingency might be seen as a source of extreme anxiety. What if nature's comprehensibility fails from one moment to the next, leaving us cognitively adrift in a sea of alien phenomena? But Kant emphasizes instead the positive aspect of the contingency, as a source of pleasurable wonder: both at nature's unexpectedly satisfying our desire to understand it and at the unanticipated beauty that we encounter both in the products of human art and in nature itself.

"But Most by Numbers Judge …"[1]

Catherine Goldstein

The epitome of mathematical surprise is perhaps John McKay's observation in 1978 that $196883 + 1 = 196884$. Note that $196735 + 1 = 196736$ would not have done the trick. To become a surprise, the six-digit number on the right-hand side of the equation had to be associated with a well-known complex function, that on the left-hand side with an important finite group. Groups are perhaps the simplest mathematical structures used to encapsulate symmetries, from those of geometrical figures to those of roots of equations to those of movements of particles in physics. The classification of finite groups occupied dozens of mathematicians and thousands of pages in the twentieth century and involved constructions that amazed even the specialists of the field; John Conway, for instance, significantly described one of them in these terms: "In 1964, Zvonimir Janko gave us the first of a list of surprises, by announcing the discovery of a new simple group of order 175560, which at that time seemed quite a large number."[2]

The "large number" 175560 here is the order, that is the number of elements, in the group; we knew of groups of any order (for instance, the group of symmetries of the vertices of a regular polygon with any number of sides), but this new group did not belong to any well-known families and was simple, that is, indecomposable into other smaller groups. Since 1964, a handful of other new simple groups have been brought to light and their classification completed. The largest one has $2^{46} \cdot 3^{20} \cdot 5^{9} \cdot 7^{6} \cdot 11^{2} \cdot 13^{3} \cdot 17 \cdot 19 \cdot 23 \cdot 29 \cdot 31 \cdot 41 \cdot 47 \cdot 59 \cdot 71$ elements (a 54-digit number) and is known by the nickname "The Monster." To help understand such large structures, mathematicians represented them in various ways: in particular The Monster can be represented as the set of symmetries of a 196883-dimensional space. And here is our 196883.

As for the 196884, it appears totally independently, as one of the first coefficients of the Fourier development of the so-called *j*-function, a function introduced by Felix Klein in the nineteenth century

1 Alexander Pope, *An Essay on Criticism* (London: 1711), 21.

2 John Conway, "Monsters and Moonshine," *Mathematical Intelligencer* 2 (1980): 165–171, on 165.

to classify curves. It has been studied intensively ever since, both by function theorists and algebraic geometers. But the great sensation was not due to a simple numerical coincidence; who would have cared if the respective numbers had been the commonplace 5 and 6, or even 12 and 13? The mere size of the number 196883 involves a quality of individuality; that its six digits unexpectedly appear all together in far-distant areas did not look like a coincidence, and the size of 196883 was decisive in convincing several mathematicians that a hitherto undetected connection was indeed at work.

That large numbers can create astonishment is not particular to recent times. In 1643, Pierre Fermat wrote to Marin Mersenne, "Vous vous étonnerez bien davantage si je vous dis de plus que toutes {c}es questions sont possibles et que j'ai découvert leur solution,"[3] and then proceeded to exhibit 4687298610289, 4565486027761, 1061652293520 as the three sides of a right-angled triangle having a square as its largest side and also a square as the sum of its two smallest sides. How large must a number be to be a scientific surprise? Large is of course a subjective idea, but the point here is that the size itself is what explicitly mattered to provoke awe.

In this sense, large numbers are everywhere in the works and correspondence of Marin Mersenne's circle. Mersenne marveled at the 40320 songs constructed with only eight notes and at the words constructed with 22 letters or more: "ici l'esprit joue avec l'infini et par là 'l'homme s'assujettit le Ciel et la terre par la force de son entendement.'"[4] It is remarkable that the actual numbering of the possibilities—what Gaston Bachelard would see as the beginning of the scientific mind—did not decrease Mersenne's feeling of marvel and surprise but gave substance to it, freed it. The number of words with 30 consonants and 20 vowels, in an imaginary language constructed

3 Pierre Fermat, *Œuvres complètes,* ed. Charles Henry and Paul Tannery (Paris: 1894), 2:260.

4 Ernest Coumet, "Mersenne: Dictions nouvelles à l'infini," *XVII^e siècle* 109 (1975) in *Œuvres d'Ernest Coumet*, tome 1, ed. Thierry Martin and Sophie Roux (Besançon: 2016), 337. The inner quotation comes from Marin Mersenne, *L'impiété des déistes, athées et libertins de ce temps…* (Paris: 1624), 1:110.

with 19 consonants and 10 vowels, is thus said to be "prodigieusement grand, car il contient 73 caractères."[5]

But the effect of large numbers also lies in the display of mastery they imply. In the early seventeenth century, one would need to have, for instance, an intimate knowledge of numbers to recognize 1803601800 as the product of $2(2 \cdot 3 \cdot 5 \cdot 7 \cdot 11 \cdot 13)^2$, which is the exact shape required to be a certain number of times the hypotenuse of a right-angled triangle with given properties.[6] Or, as in the Fermat example above, it proves that talent and an authentic method, not pure trial and error, are in action here and responsible for finding the (10-digit) smallest solution to a problem.[7] The surprise here is caused not so much by the enormity of the world but by the mathematician's talent.

In other circumstances, however, smallness can be the key to the surprise. Let us think of the principle known as John Dalton's "law of multiple proportions": when two elements form several compounds, the ratios of the masses of the second element that combines with a fixed mass of the first element can always be expressed as small integers. With a very similar argument, René Hauÿ tried to defend his position on calcite against that of William Hyde Wollaston: "les mesures {de Wollaston} ne peuvent être rigoureuses," he writes, because "les rapports qui en dérivent seront représentés par de grands nombres."[8] Large numbers here would not have been significant because any real number can be approximated as closely as desired by fractions with large enough numerators and denominators. In natural phenomena, small often warrants the integer nature of the numbers

5 Quoted in Coumet, "Mersenne: Dictions nouvelles à l'infini," 336.

6 Catherine Goldstein, "1 803 601 800: de l'art des nombres à l'analyse, une autre voie?," in *Aventures de l'analyse. Mélanges en l'honneur de Christian Gilain*, ed. Suzanne Féry (Nancy: 2012), 41–57, on 50.

7 Catherine Goldstein, "Routine Controversies: Mathematical Challenges in Mersenne's Correspondence," *Revue d'histoire des sciences* 66, no. 2 (2013): 249–273, on 258–262.

8 Bernard Maitte, "Haüy et la cristallographie," in *L'École normale de l'an III*, vol. 3, *Leçons de physique, de chimie et d'histoire naturelle*, ed. Étienne Guyon (Paris: 2006), 19–22, on 22.

involved, which in turn suggests that structural properties (atoms for instance) are at play.[9]

Surprise is a cognitive emotion par excellence, writes Nathalie Mauriac Dyer.[10] As for integers, the variety of the surprises they encapsulate, "un bouquet varié de plusieurs fleurs de couleur et odeur différentes," is perhaps what is the most surprising for the historian.[11]

9 But not only there: the same issue appears in generalizations of the relation between The Monster and the *j*-function, where linear combinations with *small* coefficients of the data linked with groups appear as coefficients in the development of special functions.

10 Nathalie Mauriac Dyer, "Poétique de la surprise: Aristote et Proust," *Item* (online) March 6, 2007: http://www.item.ens.fr/articles-en-ligne/poetique-de-la-surprise-aristote-et-proust.

11 This quotation, from the conferences of the Théophraste Renaudot's Bureau d'Adresse, is mentioned in Simone Mazauric, *Savoirs et philosophie à Paris dans la première moitié du XVII^e siècle* (Paris: 1997), 79.

The Element Of

Michael D. Gordin

It's a pretty good joke the first time you hear it. I was 12 when I saw it in the form of a one-panel cartoon. Two scientists were standing before a large white board. (I could tell they were scientists because there were some beakers on the table, some math was scrawled around the board, and their coats were white.) Among the formulae on the board, there was a box with a number in its upper right-hand corner and some symbols in the center, something like "!?!??!" One of the scientists had turned to the other and said, "I've done it, Jones: I've found the element of surprise!" You get the joke, such as it is. In the realm of geeky science jokes it isn't bad, and it has been rediscovered (or simply plagiarized, but I expect not) dozens of times. The charm wears off.

Now let me suggest one of those things that make academics no fun at parties: let's dig a bit deeper into the joke. This move is a slantwise tribute to Robert Darnton's classic 1984 collection *The Great Cat Massacre and Other Episodes in French Cultural History*, especially the title essay. Darnton provided an account of a printer's shop in Paris where the apprentices had rounded up the stray cats and hung them en masse. To them, this was hilarious—to us, rather less so. Darnton's brief for the cultural historian was to make sense of the joke, to elucidate why this slaughter would have struck these Parisians not only as thinkable but as a knee-slapper.

At first blush, our case does not seem an especially appropriate opportunity to undertake a similar inquiry. There is no moment of puzzlement: the joke's funny enough. We even know *why* it is funny: the cartoonist has juxtaposed a common expression "the element of surprise" with the periodic table. That table classifies elements, and new elements would necessarily belong on it. The humor trades on the double meaning of "element" in English.

But there is something more to be said—two things, actually: one about the periodic table and one about the word "element." The joke does not just present a lump of metal and describe it as the "element of surprise"; it creates a box that looks like a position in the periodic system of chemical elements, like the one in every chemistry classroom you have ever been in. In each of the many incarnations littering the Internet, we have all the trappings, such as a chemical sym-

bol, an atomic number, and typically also an atomic weight: for example, "Ah!" (number 104, weight 213—by number this would be rutherfordium, but the weight is far too light, more in the vicinity of astatine or radon), "Oh" (dubbed "alarmose"—the name of a sugar and not an element, but why be pedantic?—atomic number 231, which is obscenely beyond the limits of any table, and the number 41.903, just above the relatively light calcium), and the rakish "Wtf" (atomic number 122, a plausible future transuranic, with an equally plausible weight of 317.4498, endowed with a few too many significant figures). The range of silliness points to something about how people understand periodic tables as emblems of science. Their "scientificity" is concentrated in the Helvetica font and some companion numbers, not in the relationships revealed by their placement in an array. This is how we end up with periodic tables of beer, of fruits and nuts, of desserts … In this context, the element of surprise is not terribly surprising.

There is a more interesting historical point if we concentrate on the fact that this is an *element* of surprise. The word has a rather intriguing chemical history. In antiquity, when atomism was a relatively fringe doctrine, the word "element" was not associated with the substances of matter. The most famous book of that period (indeed of all time) with the word in the title was penned by Euclid, and his elements were foundational notions from which one could build a glorious geometrical edifice. The Latinized Greek term became more common to distinguish substances in the early modern era, although, of course, plenty of vagueness and metaphor still surrounded its textual usage.

By the mid-nineteenth century, conceptual clarity about the technical meaning of "element" in English, French, German, and Russian lay at the root of the reasoning of chemists about the classification of inorganic substances and was particularly important for Dmitrii Ivanovich Mendeleev, whose 1869 version of the periodic system is the pedigreed ancestor of today's wall charts. What precisely do we mean, Mendeleev mused, when we say "carbon" belongs right there on a periodic table? We don't mean graphite or diamond, even though those things are pure carbon; what we mean is that some-

thing with atomic weight 12 exists and fits in this slot. For Mendeleev, the only property an "element" had was atomic weight (today, we say the property is more accurately atomic number). The periodic table classifies elements, but chemists work in laboratories with basic substances. This essential distinction differentiates how Mendeleev thought of elements from how Antoine Lavoisier did in the late eighteenth century. Lavoisier spoke of basic substances.

Ironically, Lavoisier's extremely influential 1789 textbook was translated into English the following year by Robert Kerr as *Elements of Chemistry*. In the original, it was *Traité élémentaire de chimie*—an elementary treatise of chemistry. Kerr was the one who changed the adjective to a noun, making Lavoisier's title seem like a pun. That is the final point about the double entendre nerdy joke about "the element of surprise": it only really works in English. Sure, by now you can find *élément de surprise* or *Element der Überraschung* or even элемент удивления, but these are importations from the English. The expression—and the joke implied by it—work in translation because of the prior anglicization of global science that has taken place in the past several decades. That *is* something of a surprise, but it isn't much of a joke.

The Egg

Nils Güttler

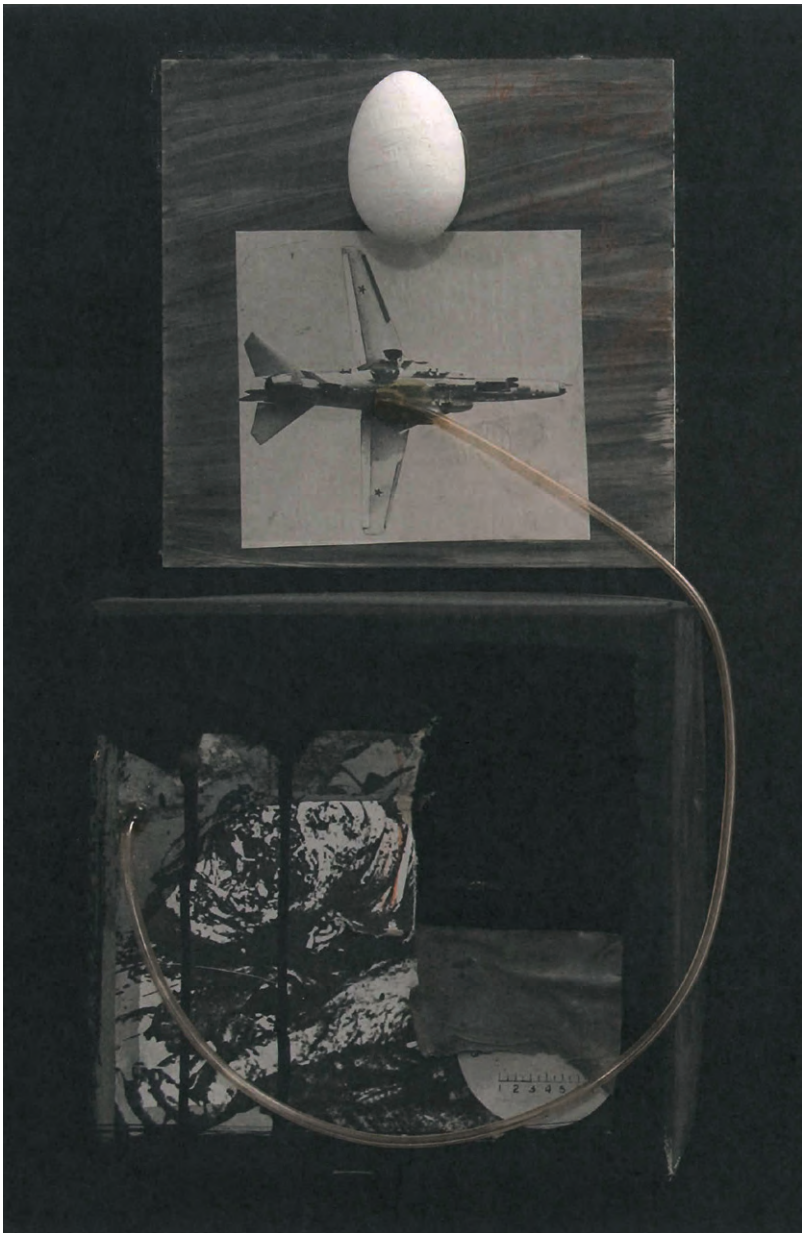
Kassel—Nairobi—Alba, Piedmont

"The egg is a metaphor for surprise" was the tagline of a proposal for a huge "media environment" titled *The Egg,* designed by performance artist Wolf Vostell. A pioneer of the Fluxus movement in postwar Germany, Vostell planned to exhibit his installation at documenta 6 in the summer of 1977. The idea was to place a military airplane, a NATO Starfighter, on the roof of the Fridericianum, documenta's main exhibit building. The airplane would be inhabited by an ant colony and connected by a tube to a room inside the main building so that, Vostell explained, "the ants can wander back and forth." The room would be filled knee-high with water, and the wreckage of airplanes would float on its surface. Visitors would wade through the dark water while watching footage of airplane crashes on TV screens. For Vostell, this was nothing less than the "bodily experience of information."

Apart from a critique of the Cold War arms race, *The Egg* addressed social dimensions of science and technology. While wading through the dark water, a German visitor was likely to remember November 20, 1974, when a Lufthansa jumbo crashed during take-off in Nairobi, killing 59 passengers. So there was something sarcastic about the subtitle of Vostell's proposal, especially if you consider that he was born in 1932 and had experienced the Second World War firsthand: "The airplane is the egg in the hands of the sky."[1] Along with his proposal, Vostell constructed several object box versions of *The Egg*.

Vostell's proposal also referred to science and technology in terms of consumer culture. In 1974, the Italian food manufacturer Ferrero had launched Kinder Sorpresa, Kinder Surprise, the famous chocolate egg that contains a toy inside. Created by product designer William Salice, it commercialized the idea of construction models that dated back to early twentieth-century hands-on education in

1 All quotes are from Harald Kimpel and Eckhart Gillen, *UTOPIEdocumenta: Unrealized Projects from the History of the World Art Exhibition* (Vienna: 2015), 86–93.



Wolf Vostell's object box on *The Egg*, 1977. In *UTOPIEdocumenta: Unrealized Projects from the History of the World Art Exhibition*, ed. Harald Kimpel and Eckhard Gillen (Vienna: 2015), 98.

engineering (the predecessor of LEGO). Kinder Sorpresa pointed to a long-standing epistemic association between eggs and surprises. For centuries, eggs had been a symbol of invention and discovery in Western culture, equally referring to biological fertility, intellectual mystery, and artistic creativity. Think of the Easter egg and Columbus's egg, but also of eggs in the history of science, Swammerdam's "ovism" in eighteenth-century debates about reproduction, for instance, or the rush for bird eggs in nineteenth-century natural history, as manifested in "oology," a subfield of ornithology. Thanks to the success of Kinder Sorpresa, egg-related surprises became ordinary events, whether around the kitchen table or in the back seat of the minivan. All of which is to say, the egg-surprise connection had had a global renaissance by the mid-1970s, and Vostell's installations displayed the results of smashing a handful of Kinder Surprise eggs and then trying to glue them back together again.

Darmstadt—Frankfurt—San Diego

Four years after Vostell's proposal, in the summer of 1981, a group of architecture students from the Technical University of Darmstadt spent several months in the Frankfurt City Forest. Guided by their professor, Helmut Striffler, they studied and documented a site that had made it into national and international news: a makeshift village, set up by local protesters to prevent the Frankfurt Airport from building a new runway that was to be called "Startbahn West." As the protesters saw it, the extension of the airport was another step toward the complete destruction of the living space of the region. This destruction was already manifested in pollution caused by traffic, the chemical and nuclear industries, and of course aviation (the noise of airplanes evolved into a nightmare for city planners at that time). The protest against the runway was pivotal for the rise of the Green Party in Germany; the architects, however, were only marginally interested in politics. Mostly, they were interested in the temporary dwellings built by the protesters.

In their eyes, the protesters had unconsciously created timeless "archetypes." According to the architects, the protestor-builders had

drawn on a specific form of knowledge: hands-on; *eggish*, if you will. They called their simple shacks "construction as original experience" (*Urerfahrung*). Following their intuition and emotions, the builders were like little children that made sketches on paper, unaffected by rationality. It was a little bit like Kinder Sorpresa: "Reasoning with their hands and inspired by the materials of the forest, the builders translate their unconscious idea of home into a constructed form."[2] In other words, in the heart of a highly managed airport region, the Darmstadt students spotted a representative of new epistemology. Like the *bricoleur* of Claude Lévi-Strauss, the shack builders performed a sort of knowledge that was wild, hands-on, and environmental, relying as it did only on materials readily available.

The years 1977 and 1981 were crucial for those in the humanities who particularly cared about new epistemologies. In California, for instance, laboratory studies emerged with a hands-on approach to rationality that was typical for that time (and has remained so since). The scientists in Karin Knorr-Cetina's *The Manufacture of Knowledge* (1981) acted no longer like the epistemic engineers of the Cold War years but rather like the bricoleur or the "tinkerer" (François Jacob), who constantly adapted to and chose from the material "environment" of the laboratory. According to Latour and Woolgar's *Laboratory Life* (1979), these "working environments" were inhabited by a plethora of writing and other sense-making technologies. Vostell's *The Egg* aimed to dismantle such technoscientific environments; the protesters had a similar ambition. A local politician from the conservative party intervened, and the installation never materialized (Vostell suspected censorship). The shack village was cleared in November 1981. Interestingly, Vostell's didactic goals were somewhat old-fashioned. *The Egg*, he wrote, should produce a "surprise for humans." Exactly at this point we find a cryptic addendum in his proposal, written in parentheses. Just two words: "(help—deconstruction)."

2 Ulrich Cremer, *Bauen als Urerfahrung: dargestellt am Beispiel des Hüttendorfes gegen die Startbahn West* (Munich: 1982), 8, 88.

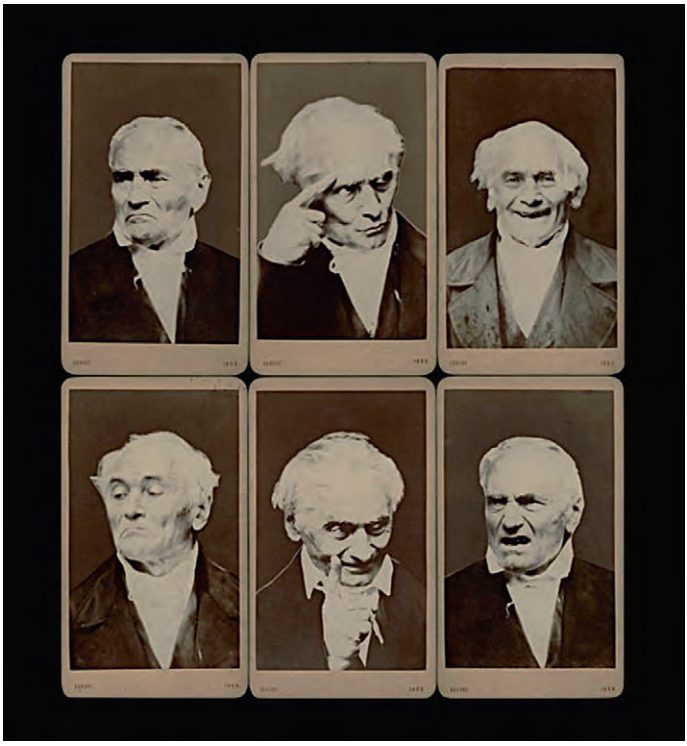
Purkyně, affektiv

Michael Hagner

Im ersten Band des *Encyclopädischen Wörterbuchs der medicinischen Wissenschaften* von 1828 bezeichnet Jan Evangelista Purkyně den „Affect" als eine „Erregung des Gemüths, wodurch die Besinnung und Freiheit der Person aus ihrer normalen Fassung gebracht, und die Thatkraft zu unwillkührlichen Äußerungen hingerissen wird". Neben sechs einander entgegengesetzten Affekten (Lust und Schmerz, Mut und Furcht, Begehren und Abscheu) wird noch ein siebenter aufgeführt: der Wissensaffekt. Purkyně versteht darunter eine Bewegung des Gemüts, mittels derer der Wissenstrieb seine Bedürfnisse befriedigt. Der Wissensaffekt artikuliert sich in positiven Äußerungen wie Bewunderung, Glauben oder Überzeugung, negativen wie Unglauben, Misstrauen oder Verbot, und schließlich solchen, die zwischen den beiden Polen hin und her schwanken. Dazu zählen Zweifel, Fragen, Wahrscheinlichkeitsannahmen, Überlegung, Erfahrung und Forschung, Erfindung und Entdeckung, Untersuchung und Überraschung – allesamt Affektäußerungen, die auch für die Wissenschaften von genuiner Wichtigkeit sind.

Purkyněs Einführung der Wissensaffekte ist ein Versprechen, das er nicht weiter eingelöst hat. Eine genauere Ausarbeitung der epistemischen Leidenschaften im Rahmen der physiologischen Psychologie hat er nicht vorgenommen. In den Notizen für eine Psychologievorlesung, die Purkyně an der Universität Breslau hielt, ist von den sechs oben aufgeführten Affekten die Rede, vom Wissensaffekt nicht mehr. Der vermutlich von ihm geprägte Begriff verschwindet, wie so viele Begriffe, die nicht gezündet haben und unterhalb des Radars der Begriffsgeschichte liegen. Man könnte es mit diesem kleinen Abstecher in die Sphären der kognitiven Leidenschaften bewenden lassen, wenn nicht der böhmische Physiologe im Alter, viele Jahrzehnte nach seinem Enzyklopädie-Artikel, noch einmal auf die Affekte im Allgemeinen und den Wissensaffekt im Besonderen zurückgekommen wäre – nun aber nicht mehr in schriftlicher Form, sondern im Medium der Fotografie.

Von Purkyně existieren einige fotografische Porträts, die sich ganz in den bürgerlichen Konventionen der Mitte des 19. Jahrhunderts bewegen. Hingegen gehören die hier abgebildeten sechs Selbstporträts aus der Zeit um 1860 zu den ungewöhnlichsten Fotografien



Jan Evangelista Purkyně, physiognomische Studien, ca. 1860–1862, carte-de-visite, Albuminabzug von Jindřich Eckert (?), 1869. Privatsammlung, www.scheufler.cz.

überhaupt aus jener Zeit. Man sieht sofort, dass sie wie andere Porträtaufnahmen als Visitenkarten gedruckt wurden und somit für Familienmitglieder oder Freunde bestimmt waren. Aber auch wenn sie nicht für eine breitere Öffentlichkeit, geschweige denn für eine Publikation gedacht waren, stellen sie doch einen Bruch mit der bürgerlichen Konvention des Porträts dar und markieren gleichzeitig einen süffisanten visuellen Kommentar zur damaligen Konjunktur von Physiognomik und Mimik. Einerseits passten starke Affektäußerungen und Fotografie im bürgerlichen Wertehaushalt nicht zusammen, denn die Menschen ließen sich in aller Regel so abbilden, wie sie von ihren Zeitgenossen und der Nachwelt gesehen werden wollten: würdig, aufrecht und ganz bei sich selbst. Unbeherrschtes Lachen, ag-

gressive oder ängstliche Gesichtszüge kamen in dieser von Selbstbeherrschung diktierten Bildwelt nicht vor, und allenfalls Kindern, Geisteskranken und Schauspielern wurden solche Gemütsbewegungen zugestanden. Andererseits gab es ein starkes wissenschaftliches Interesse an Mimik und Physiognomik, das Lavater auf die Spur gebracht hatte und mit der Einführung der Fotografie auf eine neue Stufe gehoben wurde. Grimassenschneiden für die Wissenschaften war jedoch nichts, für das sich die Wissenschaftler hergegeben hätten.

Guillaume-Benjamin Duchenne de Boulogne beispielsweise nahm für seine berühmten Stimulationsversuche einzelner Gesichtsmuskeln einen alten Mann als Versuchsperson, dessen schmales Gesicht mit gegerbt wirkender Haut ein ideales Untersuchungsfeld für die elektrophysiologische Affektenlehre darstellte. Charles Darwin wiederum integrierte in seine *Expression of the Emotions* Fotografien von Kleinkindern, jungen Mädchen und dem tapferen alten Mann von Duchenne. Unvorstellbar, dass sich Darwin oder Duchenne mit affektgeladener Mimik vor die Kamera begeben hätten, um an sich selbst deren Mechanismen zu demonstrieren. Immerhin finden sich in Darwins Buch einige Selbstporträts des Fotografen Oscar Gustave Rejlander, der seine mimisch-gestischen Fähigkeiten und seine Lust am fotografischen Experiment nutzte, um den Ausdruck von Abscheu, Hilflosigkeit und Schrecken darzustellen. Trotz dieser kleinen fotografischen Subversion gilt, dass die Heroik des Selbstexperiments Halt machte vor dem Fotoapparat, sofern dieser die öffentliche *persona* des Wissenschaftlers, die zunehmend durch Fotografien geprägt war, in Frage stellte.

Purkyněs Selbstporträts zeigen, dass er über solche Konventionen zumindest im privaten Raum anders dachte. Nicht, dass sich der über 70-jährige Physiologe noch einmal in die aktuellen Diskussionen um die Affekte einschalten wollte. Doch vielleicht kannte er Duchennes 1862 veröffentlichten Atlas, denn die Fotografien entstanden ungefähr zu dieser Zeit. Jedenfalls nahm er den Faden einer fotografischen Repräsentation der Affektäußerungen auf. Anders als Duchenne interessierte Purkyně sich jedoch nicht für eine vermeintlich unverfälschte Natur, sondern inszenierte sich selbst in verschiedenen affektiven Zuständen. Betrachtet man die sechs Bilder, deren

Zusammenstellung nicht auf Purkyně selbst zurückgeht, fällt auf, dass nur die vier äußeren Bilder in die typische Ikonografie und Beschreibung der Gemütsäußerungen passen, wie sie etwa auch in Darwins Werk zu finden sind: Übellaunigkeit (oben links), Lachen (oben rechts), Verachtung (unten links) und Abscheu (unten rechts).

Was aber ist mit den beiden erstaunlichen Bildern in der Mitte? In keiner einzigen fotografischen Abbildung bei Duchenne oder Darwin spielt der Zeigefinger eine Rolle, hier wird er zum wichtigsten Körperteil. Sich mit dem Zeigefinger an die Schläfe oder Stirn zu tippen, hieß damals wie heute, zumindest in der deutschsprachigen Welt: *Du hast einen Vogel*, oder, in der abgeschwächten Variante: *Denk nochmal nach!* Eine Geste, die dem Gegenüber so offensichtlich am Verstand kratzt, ist in der Bildwelt des 19. Jahrhundert verständlicherweise eine Seltenheit. Wenn Purkyně mit entschiedenem Blick und andeutungsweise gespitzten Lippen den Vogel zeigt, so ist die Geste unmissverständlich: Der Verstand des Adressaten muss nachbessern. Korrespondierend dazu ist auch das darunterliegende Bild zu verstehen: Wiederum ist der Kopf nach links geneigt, der Blick freundlich-belehrend, der Zeigefinger nach oben gestreckt. Die Geste könnte gutmütige, großväterliche Ermahnung bedeuten oder die Aufforderung, nun besonders gut aufzupassen.

Sozusagen durch die Hintertür ist Purkyně wieder in die Welt der Wissensaffekte zurückgekehrt. Hatte er in seinem Enzyklopädie-Artikel die negierende Seite des Affekts als Unglauben, Misstrauen oder Infragestellen beschrieben, so genügt ihm jetzt eine einfache Geste, um diese Negation auf den Punkt zu bringen. Und hatte er die Mitteilsamkeit des Wissensaffekts als „Lehrtrieb" bezeichnet, mit dem Wissen oder Überzeugung zum Ausdruck gebracht werden, so reduziert sich das im Bild auf die Geste des erhobenen Zeigefingers.

Verstehen wir diese beiden Gesten als hintersinnige Visualisierung epistemischer Leidenschaften, die ihren eigenen Anspruch mit einem Augenzwinkern vortragen, so bleibt noch zu konstatieren, dass es von der dritten Haltung des Wissensaffekts – das Schwanken zwischen einer affirmativen und einer zweifelnden Haltung – keine bildliche Überlieferung gibt. Vielleicht ist die Fotografie verloren gegangen oder noch nicht in den Archiven entdeckt worden, oder

Purkyně wollte ein solches Bild der Einbildungskraft seiner Nachwelt überlassen. Wer weiß das schon? Zweifellos beweisen die Selbstporträts, dass die Fotografie auch ohne besonderen technischen Aufwand Neues, Überraschendes, Subversives hervorbringen kann. Vor allem aber wird der Wissenschaft ihr eigener Wissenstrieb vorgehalten. Allein die unvorstellbare Vorstellung, Duchenne oder Darwin wären ihre eigenen Versuchspersonen gewesen, die sich in affektiver Bewegung fotografieren lassen, hätte manches humanwissenschaftliche Gesicht menschlicher aussehen lassen.

Beauty, Being, Bicycle

Anke te Heesen

Der Leserichtung folgend sehen wir in der ersten Reihe *Angel*, *Animal* und *Aristocracy*. Die zweite Reihe beginnt mit *Family*, geht über zu *Fate*, *Form* und *God*, um mit *Life*, *Logic* und *Love* zu schließen. Sie wird fortgesetzt mit *Man*, *Math* und *Matter*, und endet via *Quantity* und *Revolution* in *Wisdom* und *World*. Diese Schlagworte finden sich auf einer Doppelseite des LIFE Magazins vom Januar 1948, erkennbar in der unteren Bildebene als eingesteckte und nummerierte Reiter in umfangreichen Karteikästen. Insgesamt sind 102 Begriffe aufgestellt, die durch zwei weitere Ordnungssysteme flankiert werden. Oberhalb des Schilderwalds sitzen und stehen, im mimetischen Nachvollzug der Kartei, 24 Frauen und Männer. Kaum ein Lächeln huscht über ihre Gesichter. In ihrer Mitte wächst ein Regal mit Büchern hervor. Diese zunächst unscheinbare, aber zentrale Säule wird vorne durch zwei einsam stehende Männer ergänzt. Sie kontrollieren den Eingang in die Fotografie wie den Zugang zu den Kästen und Personen.

Was Mortimer Adler und William Gorman wie Torwächter eingeschlossen halten, ist die materielle und personelle Grundlage vieler Jahre Arbeit, in der die ihrer Überzeugung nach wichtigsten Bücher der Welt von dem hier abgebildeten Mitarbeiterstab indexalisiert, exzerpiert und zusammengestellt wurden. „The exhausted-looking people grouped about the books and files above have just finished a monumental intellectual task. [...] They have come up with the thesis that the basis of Western culture is the 102 great ideas displayed above.“[1] Im Verlauf der 1940er Jahre hatte der Präsident und spätere Kanzler der University of Chicago, Robert M. Hutchins mit dem Philosophen und Autor populärer Schriften Mortimer Adler an einem Kanon der wichtigsten Bücher der sogenannten westlichen Welt gearbeitet. Als Grundlage einer humanistischen Bildung und Wiederbelebung der freien Künste im Dienste der amerikanischen Demokratie, wurden so über 400 Werke ausschließlich männlicher Autoren zusammengestellt, übersetzt und in einheitlichen Bänden herausgegeben. „The Great Books of the Western World“ erschienen 1952 und wurden als Teil der *Encyclopædia Britannica*, Inc., ebenfalls unter

1 „The 102 Great Ideas: Scholars Complete a Monumental Catalog,“ *LIFE* 24, no. 4 (January 26, 1948): 92–102.

THE INDEXERS POSE WITH THE FILE OF GREAT IDEAS. AT SIDES STAND EDITORS ADLER (LEFT) AND GORMAN (RIGHT). EACH FILE DRAWER

The 102 Great Ideas

Scholars complete a monumental catalog

The exhausted-looking people grouped about the books and files above have just finished a monumental intellectual task. They have spent five years and nearly a million dollars making an index of every important idea of Western civilization. They have come up with the thesis that the basis of Western culture is the 102 great ideas displayed above.

According to them, almost every idea in the world appears in some form in 432 basic great books

92

George Skadding, "The 102 Great Ideas: Scholars Complete a Monumental Catalog," *LIFE* 24, no. 4 (January 26, 1948): 92–93.

CONTAINS INDEX REFERENCES TO A GREAT IDEA. IN CENTER ARE THE WORKS OF THE 71 AUTHORS WHICH CONSTITUTE THE GREAT BOOKS

written by 71 men from Homer to Freud. Each idea has more than 30 subdivisions. Woman, not a main idea, is included in Family, Man and Love.

The Great Ideas index started five years ago, when Robert M. Hutchins, chancellor of the University of Chicago and director of the Encyclopaedia Britannica, decided the Encyclopaedia would publish a 54-volume collection of the books. To go with the set to be published next year, he asked Dr. Mortimer J. Adler of the university and William Gorman of the Encyclopaedia to prepare an index of ideas so the reader could look up any topic and trace it through the books. Adler and Gorman rented an old fraternity house on the Chicago campus, moved in a staff of indexers whose job it was to read and reread two or three authors apiece until they knew them perfectly. After a couple of years the indexers began to think like their authors and even to assume their names. From her window every morning Mrs. Freud (*seated, front left, above*) would wave to Aristotle (*front, fifth from left*) as he bicycled to work. Near her would sit St. Thomas Aquinas (*rear, fifth from left*), who liked to work 36 hours at a stretch and relax by playing the horses. Kant (*rear, extreme right*) was a man who had written his college thesis on "Misspellings in Old Southern Cookbooks." For a sample of their treatment of a Great Idea, turn the page.

CONTINUED ON NEXT PAGE

der Ägide Hutchins, in einem feierlichen Akt der Öffentlichkeit übergeben. Ihnen war ein zweibändiges „Synopticon" vorangestellt, das als ein Führer durch den Inhalt der 443 Werke aus Literatur, Wissenschaft und Philosophie von der Antike bis in das 20. Jahrhundert dienen sollte. Entstanden war so ein Bildungskondensat der Nachkriegszeit, das nur verschlagwortet werden musste, um zugänglich zu sein.[2] Man hatte ein solides Fundament für ein sich selbst unterrichtendes Volk schaffen wollen, aber entstanden war ein unlesbares Vademecum, ein „antidote to pleasure".[3]

Genau davon berichtet die Momentaufnahme des LIFE-Fotografen, die den vorläufigen Abschluss der Arbeit der „indexer" festhält, „whose job it was to read and reread two or three authors apiece until they knew them perfectly." Man hatte alle Kästen über den Campus geschleppt, war in den dritten Stock eines der akademischen Bildung von Frauen gewidmeten Gebäudes (der „Ida Noyes Hall") gestiegen, wo Personen wie Materialien Aufstellung fanden. Die Gruppe war wahrscheinlich den Anweisungen des Fotografen gefolgt, hatte die Arme verschränkt, das Haar gerichtet, um gottergeben auf das Blitzlicht zu warten. Doch dann nimmt das zum Bild gefrorene „heavy reading" eine unerwartete Wendung, denn, so liest man unter der Fotografie: „After a couple of years the indexers began to think like their authors and even to assume their names. From her window every morning Mrs. Freud (*seated, front left, above*) would wave to Aristotle (*front, fifth from left*) as he bicycled to work. Near her would sit St. Thomas Aquinas (*rear, fifth from left*), who liked to work 36 hours at a stretch and relax by playing the horses. Kant (*rear, extreme right*) was a man who had written his college thesis on 'Misspellings in Old Southern Cookbooks.'" Das ins Bild gesetzte Wissensmonument der 102 Schlagworte ist wohl doch nicht ganz so zugeknöpft zu verstehen. Der Betrachter beginnt die Fotografie erneut

2 Mortimer J. Adler und William Gorman, Hgg., *The Great Ideas. A Synopticon of Great Books of the Western World* (Chicago, London, Toronto: 1952); Vgl. dazu ausführlicher Tim Lacy, *The Dream of a Democratic Culture: Mortimer J. Adler and the Great Books Idea* (New York: 2013).

3 James Campbell, „Heavy Reading," *New York Times*, Sunday Book Review, November 14, 2008, 18, https://www.nytimes.com/2008/11/16/books/review/Campbell-t.html.

zu erkunden: Frau Freud hat für diesen Tag eine weiße Bluse anzogen und lächelt sogar in die Kamera. Auch Thomas von Aquins Lippen umspielt ein feines Lächeln, während Kant ganz unsere Erwartung an aufrechter Haltung und gebotenem Ernst erfüllt. Ist der Blick einmal geschärft für dieses Beziehungsgefüge zwischen den Personen, werden der Untergrund der soliden Kartei und die aufrechten Bücher in einen leichten Tremor versetzt: Könnte Frau Freud im Flirt mit Aristoteles vielleicht ein Fehler mit ihrem Stichwort *Language* unterlaufen sein? War Aristoteles nach einer schnellen Fahrradfahrt erhitzt im Büro angekommen und hatte im Furor dem Begriff *Happiness* zu viele Belegstellen zugeordnet (was ihn immer noch beschäftigt und deshalb düster blicken lässt)? Und welche Blüten hatte die Bildung von Herr Kant getrieben, der durch die Kochbücher des Südens bestens gewappnet erschien für die herkulische Aufgabe der Geschmacksbildung? Und dann Thomas von Aquin: Er könnte im Verlauf der letzten Jahre gemeinsame Sache mit Frau Goethe gemacht haben; womöglich hatten sie liebestrunken Textstellen am laufenden Band angestrichen, an Nachmittagen auf der Rennbahn diskutiert und am nächsten Morgen in die Kartei eingefügt?

Liegt unter der schwarz-weißen Bildoberfläche der vergeistigten Ideen die Unberechenbarkeit des Lebens? Vielleicht war sie einfach nur für die Dauer eines Moments in den Bildhintergrund gerutscht. Denn dort, zunächst unbeachtet, bewegen sich weitere Personen, auf die Wand aufgetragene Figuren, die alle nach links zu streben scheinen. Ein den Raum umschließendes Fries tritt hinter Thomas von Aquin und den anderen Größen der letzten Reihe hervor: Rührige Gestalten, die ihre Hände erheben, sich wendende Köpfe, tanzende und prozessierende Männer wie Frauen. Es handelt sich um das 1918 geschaffene Wandgemälde „The Masque of Youth" der Künstlerin Jessie Arms Botke, einer Spezialistin für Wandteppichentwürfe und Wandbilder. Die Prozession allegorischer Figuren sollte an den zum 25-jährigen Bestehens der Universität veranstalteten Festumzug erinnern: Die personifizierte Alma Mater und der Geist der gotischen Architektur, die Jugend der Bildungseinrichtung und die Wellen des Michigan

Sees.[4] Oberhalb von Immanuel Kant schreiten persische Tänzer, rechts von Thomas von Aquin treten Teilnehmer der olympischen Spiele ins Bild und links streben Bauern und Tänzer der Alma Mater entgegen. Musik, Schauspiel, Sport und Tanz, kurz, das Gegenstück zum Maschinenwerk der logischen Ideen. Die präraffaelitisch anmutenden Personifikationen des Frieses treffen auf die wiedergeborenen großen Denker in den abgezirkelten Reihen vor ihnen. Aus der „Masque of Youth" war eine Quelle der ewigen Jugend geworden. Aristoteles hätte sich sein Fahrrad schnappen und den Umzug begleiten können. Und Frau Freud ist im Begriff, sich mit ihrer schönsten Bluse den ebenfalls hell gekleideten Olympioniken in der Friesmitte zuzuwenden.

Von der Frühzeit der Bildung im Hintergrund, über die Vergegenwärtigung durch die Personen im Mittelgrund, hin zu dem für die Ewigkeit konzipierten weißen Papier im Vordergrund war ein kondensiertes Programm der *liberal arts education* in Szene gesetzt und in der Ida Noyes Hall 1948 uraufgeführt worden. Das Maskenspiel der Jugend und die Ideen der Denker waren lebendiger, als ihnen von den flankierenden Wächtern zugestanden wird. Hinter den ernsten Gesichtern der Gruppe ist mehr zu erahnen als die Instantkörnung des auf Information reduzierten Wissens. Die großen Bücher der Welt können auch anders gelesen werden.

4 Vgl. Mary Lackritz Gray, *A Guide to Chicago's Murals* (Chicago: 2001).

*cdeegiinnoprrssu

Florence Hsia

"Smaismrmilmepoetaleumibunenugttauiras": such was the August surprise Galileo Galilei launched in a letter-writing blitz just a few months after stunning the astronomical world in 1610 with his "starry message" about towering lunar mountains, old constellations studded with new stars, and as many moons circling Jupiter as there were Medici sons. Johannes Kepler quickly set about reordering Galileo's "transposed letters," announcing a month later that the Italian had discovered two moons around Mars as well.[1] Or had he? Benedetto Castelli and the Jesuits at the Collegio Romano were among those who puzzled over the encoded missive—Galileo's special way of keeping his friends close and (potential) patrons and rivals closer—but we know that at least a few were surprised again when Galileo revealed his breaking news later that fall: neither Martian moons as Kepler had surmised, nor shadows on the sun as Thomas Harriot had guessed, but a tripled Saturn as seen through the telescope.[2] Kepler published Galileo's solution for the Saturnine puzzle together with a new Galilean anagram, this time set in a natural language: "Haec immatura a me jam frustra leguntur oy." In the end, though, it was Kepler who "read" Galileo's latest news "in vain." Venus's phases were at issue, not a red spot on Jupiter.[3]

Credit and priority motivated early modern encoding of astronomical news, as both codemakers and would-be codebreakers understood.[4] Scholars enciphered their discoveries to prove prior knowledge of what might later become contested intellectual capital, as did Christiaan Huygens in 1655 with an anagram encompassing a verse from Ovid: "ADMOVERE OCVLIS DISTANTIA SIDERA NOSTRIS, VVVVVVVC CCRRHNBQX." John Wallis quickly replied with a

1 Johannes Kepler, *Narratio* (Frankfurt: 1611), *3 verso: "Salue vmbistineum geminatum Martia proles."

2 Eileen Reeves, "Something of a Cypher: Galileo's Anagrams," in *Tintenfass und Teleskop: Galileo Galilei im Schnittpunkt wissenschaftlicher, literarischer und visueller Kulturen im 17. Jahrhundert*, ed. Andrea Albrecht, Giovanna Cordibella, and Volker R. Remmert (Berlin, Boston: 2014), 15–31.

3 Johannes Kepler, "Praefatio," in *Dioptrice* (Augsburg: 1611), 15–16, 18, 20–22.

4 Robert Iliffe, "'In the Warehouse': Privacy, Property and Priority in the Early Royal Society," *History of Science* 30 (1992): 29–68; Mario Biagioli, "From Ciphers to Confidentiality: Secrecy, Openness and Priority in Science," *British Journal for the History of Science* 45, no. 2 (2012): 213–233.

lengthy anagram that happened to use all the letters in Huygens's. After receiving Huygens's plaintext, Wallis unveiled the solution to his own cipher, which seemed to secure English priority in discovering the period of Saturn's moon. Early modern cryptography was both a matter of state and of mathematics, and Wallis, a master of both, had deliberately constructed an anagram that allowed for whatever solution Huygens might eventually disclose for his own.[5] This was no mere prank at Huygens's expense but a pointed comment on the multivalency of such ciphers and their utility in addressing priority claims.[6]

Early modern astronomical surprise was a staged enterprise. Galileo wrote in plain language of Saturn's three-bodied appearance and, lest there be any misunderstanding, drew a diagram for the benefit of his current patron, the Grand Duke of Tuscany, while holding other correspondents in anagrammatic suspense.[7] Undaunted by Wallis' sciphered riposte, Huygens produced yet another, this time rearranging all the letters of the plaintext message in alphabetical order—"aaaaaaaccccdeeeeeghiiiiiiiillllmmnnnnnnnnnoooooppqrrstt tttuuuuu"—and sending it to the press.[8] Huygens eventually disclosed its meaning (Saturn is surrounded by a ring inclined to the ecliptic) but only in stages, managing its impact through a print and manuscript campaign culminating in the lavishly illustrated 1659 *Systema Saturnium* dedicated to Leopold de' Medici.[9]

* Encoding surprise, early modern style, it stands in sharp contrast with the methods and motives of astronomers who, centuries later, sought immediacy in telegraphed astronomical news as a solution to the problems of awarding credit and coordinating labor within an internationalist astronomical community. Intelligibility,

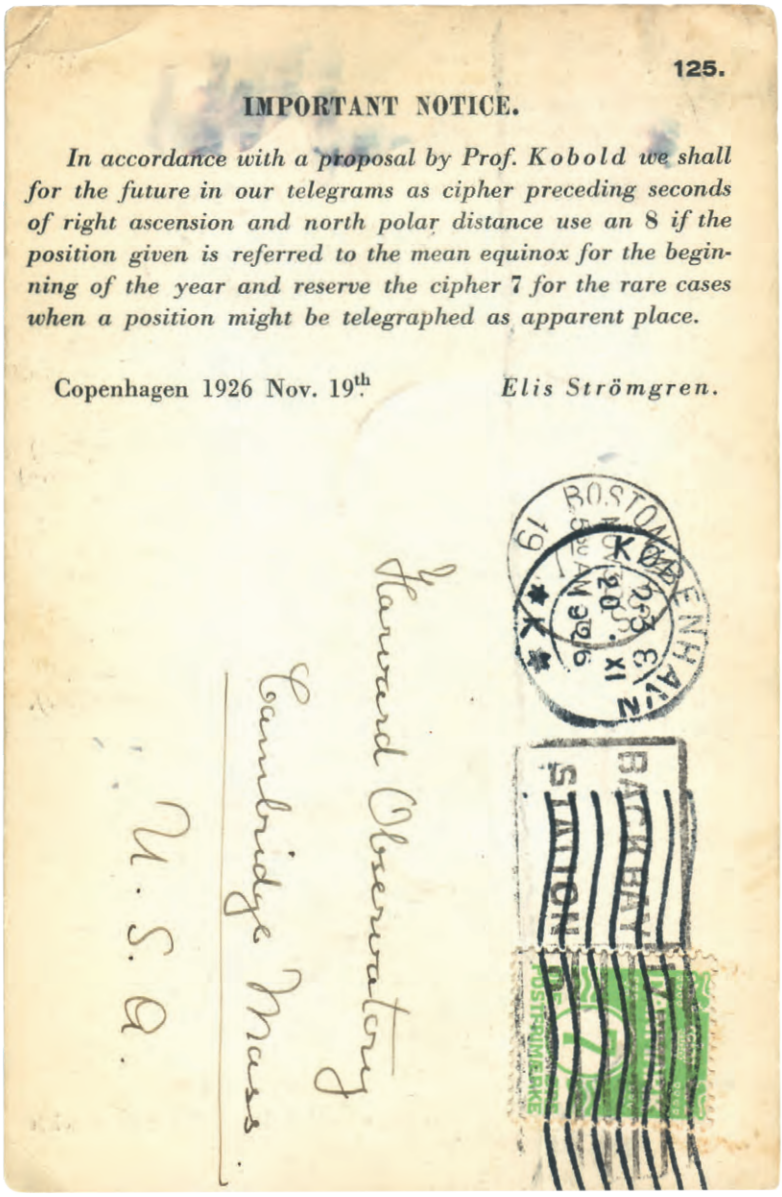
5 See Christiaan Huygens, *Oeuvres complètes de Christiaan Huygens* (The Hague: 1888–1950), 1:332–338, 392, 396, 401–403, and 2:305–306.

6 Iliffe, "Warehouse," 35–36; cf. Claude E. Shannon, "Communication Theory of Secrecy Systems," *Bell System Technical Journal* 28, no. 4 (1949): 657–658.

7 Antonio Favaro et al., eds., *Le opere di Galileo Galilei* (Florence: 1890–1909), 10:409–410.

8 Christiaan Huygens, *De Saturni lvnâ observation nova*, in Huygens, *Oeuvres complètes*, 15:177.

9 Nicole Howard, "Rings and Anagrams: Huygens's System of Saturn," *Papers of the Bibliographical Society of America* 98, no. 4 (2004): 477–510.



125.

IMPORTANT NOTICE.

In accordance with a proposal by Prof. Kobold we shall for the future in our telegrams as cipher preceding seconds of right ascension and north polar distance use an 8 *if the position given is referred to the mean equinox for the beginning of the year and reserve the cipher* 7 *for the rare cases when a position might be telegraphed as apparent place.*

Copenhagen 1926 Nov. 19th. *Elis Strömgren.*

Harvard Observatory
Cambridge Mass.
U. S. A.

Elis Strömgren, Bureau central astronomique de l'union astronomique international (Observatoire de Copenhague), circular no. 125 (November 19, 1926).

however, proved more elusive.[10] First published in 1881 and often revised, the Science Observer Code for the "telegraphic transmission of astronomical data" substituted dictionary words in place of numerals and common astronomical phrases. The resulting codebook—well over 200 pages long—replaced "December 22" with "UNEXPERT," "South preceding" with "UNHELPFUL," and "Dreyer's Supplement to Herschel's General Catalogue of Nebulae" with "UNHEATED." Promoted by the Harvard College Observatory in 1906, Willard P. Gerrish's telegraphic code relied instead on printed forms, a few additional syntactic rules, and a system of two-letter monosyllables for expressing numerals: "Memorizing the words "badefigoku, amenipotux, vy" (12345, 67890; "vy" had a variety of meanings) will give command of the code at all times."[11] In 1931, the International Astronomical Union's Central Bureau for Astronomical Telegrams sent out a circular acknowledging receipt of the missive "Buskin Ryves mipalone fodaship stop babble mofament fofimate fatilege honurant," but bluntly noted, "The telegram is given in a Code unknown here."[12] Like the eponymous discoverer of comet Ryves, early modern astronomers were frustrated by undecoded scientific news. Yet they knew its value in orchestrating scientific surprise.

10 Franciszek Karliński, "Schreiben des Herrn Prof. Karlinski, Directors der Sternwarte in Krakau, an den Herausgeber," *Astronomische Nachrichten* 66, no. 2 (1866): column 31 (no. 1562).

11 Seth Carlo Chandler and John Ritchie, *The Science Observer Code* ([Boston]: 1888); Harvard College Observatory and Willard P. Gerrish, *Telegraphic Cipher Code: Gerrish System* (Cambridge, MA: 1906), 9.

12 Elis Strömgren, Bureau central astronomique de l'Union astronomique international (Observatoire de Copenhague), circular no. 331 (August 15, 1931), accessed September 29, 2018, http://www.cbat.eps.harvard.edu/iauc/00300/00331.html. For Ryves's code, see Edward S. Holden, "A Cipher-Code for Astronomical Messages," *Publications of the Astronomical Society of the Pacific* 8, no. 49 (1896): 109–133.

Sur/Round/Re/Prise

Hansun Hsiung

Sur

Surprise begins with
behind smoke, screens, or simple darkness,
precisely because we
the world around us.
surprise may awaken in us
the apparent enjoyment we at times derive from surprise.
this enjoyment reveals a challenge for our
the very limitation of
the finitude of knowing
To embrace surprise thus suggests a different foundation
not to know.
hidden.

Round

the unidirectionality of time. Thrown irreversibly toward a future shrouded
we establish a horizon of anticipation. Any given surprise thus only truly occurs once,
are always already only partially apprehending
As a result,
a certain wistfulness towards its own Einmaligkeit—toward the unrepeatability of
The desire to somehow preserve
practice of writing. Against
surprise's unrepeatability, can we craft texts that play on the
such that every rereading produces surprise?
for writing, a writing which in place of communicating knowledge, dares the reader
If every rereading is to produce surprise, then different parts should at every moment remain

In March of 2016, from far beyond my horizon of anticipation, I found myself surprised by an e-mail signed “Lorraine Daston.” It was the first occasion for any direct communication between us—my first real interaction with the individual behind what had always been a near mythic name—and all the more shocking, as it contained within it news that she was offering me a postdoctoral fellowship in her department at the Max Planck Institute for the History of Science.

More than two years have now passed, and during these years, I cannot claim to have surprised Raine with any of my accomplishments, though she has never ceased to surprise me with her insights. Yet, for those such as myself less capable of these insights, another kind of surprise is still attainable. It is attainable in the manipulation of the space of page against the unrepeatability of time, such that each act of reading may find a new point of departure and follow a different trajectory—a different combination of lines, a different order of paragraphs, a different configuration of what is, at any moment, hidden and revealed.

This is possible in text, in ways impossible in life. As Department II reaches one end, I would thus like to believe that it still survives in this book.

I hope that for you, Raine, and you, reader unknown, this text and the others that stand beside it remain open always to reading and rereading, presenting ever the possibility of surprise.

The paper materiality of anticipation. Excerpts from a play produced at the Théâtre de l'ambigu comique (Paris), ca. 1780–81, using a system of folding paper flaps to simulate the unfolding of stage actions. Source: *Le Sérail à l'écran: petite pièce turque en I. acte, representée au Théâtre de l'ambigu comique* (Paris: 1785). Theater Collection, Houghton Library, Harvard University.

Re

Books may be used to amplify
a place imperceptible—from the page to which one has yet to turn,
such that when reading, we
the text around us.
reading is often fraught with
the observation that books, in some fundamental way, were designed for hiding.
the very materiality of books signal their ambivalent
the obscuring fold and the uncut leaf— in simple barriers to
by refusing easy access, by deferring the act of knowing over space and time, a book
It is perhaps in this sense that books should serve as a metaphor
to stand on a page's edge, awaiting the turn to come.
book.

Prise

the condition of hiddenness. From
something seizes us,
are always already only partially apprehending
Little surprise is it, then, that
anxiety. More surprising, rather, is
For
relation to knowledge. We take delight in
our senses. We recognize, if only tacitly, that
also enables the deepest of pleasures.
for epistemology. All humans by nature desire, too,
An indication of this is the delight we take in the

Philosophical Dignity

Lily Huang

By his own account, the philosophy for which Henri Bergson became known began in astonishment. In 1903, Bergson gave this origin story to Giovanni Papini for a feature in Papini's new pragmatist journal, *Leonardo*. Bergson told Papini that, when he began his doctoral thesis, he set out to do not psychology or metaphysics but philosophy of science. The thesis was to be a conceptual study of mechanics: "C'est ainsi que je fus conduit à m'occuper de l'idée de temps. Je m'aperçus, non sans surprise, qu'il n'est jamais question de durée proprement dite en mécanique, ni même en physique, et que le 'temps' dont on y parle est tout autre chose."[1] The story of this epiphany was more dramatic when Bergson told it later to William James—in part because James had asked for drama. James was about to deliver a Hibbert lecture on Bergson's philosophy and needed a sketch of Bergson's life. "Any remarkable adventures, romantic or heroic, as well as philosophic, in which you have taken part (!), etc., etc.," James wrote from Oxford. "Details help interest!"[2] Bergson replied that the one remarkable event in his life had been the realization that changed his doctoral thesis.

> Ce fut l'analyse de la notion de temps … qui bouleversa toutes mes idées. Je m'aperçus, à mon grand étonnement, que le temps scientifique ne *dure* pas, qu'il n'y aurait rien à changer à notre connaissance scientifique des choses si la totalité du réel était déployée tout d'un coup dans l'instantané, et que la science positive consiste essentiellement dans l'élimination de la durée.[3]

In the work itself, *Essai sur les données immédiates de la conscience*, this insight appears about midway through. Bergson helpfully gave James the page references. The discussion of scientific time comes after a long critique of the idea of intensity, after a critique of number, of the perception of space, of the nature of measurement, of the

1 Bergson, letter to Papini, October 21, 1903, in Henri Bergson, *Correspondances*, ed. André Robinet (Paris: 2002), 91.

2 James, letter to Bergson, May 8, 1908, quoted in Ralph Barton Perry, *The Thought and Character of William James* (Boston: 1935), 2:622.

3 Bergson, letter to James, May 9, 1908, in Henri Bergson, *Mélanges* (Paris: 1972), 766. Bergson's emphasis.

difficulty of conceiving what is not measurable, of Achilles, of the Tortoise, and of both being victims of mathematical sophistry. Only at this point does Bergson offer the thought that had been, for him, the beginning of everything. This is how he puts it.

> Ce qui prouve bien que l'intervalle de durée lui-même ne compte pas au point de vue de la science, c'est que, si tous les mouvements de l'univers se produisaient deux ou trois fois plus vite, il n'y aurait rien à modifier ni à nos formules, ni aux nombres que nous y faisons entrer. La conscience aurait une impression indéfinissable et en quelque sorte qualitative de ce changement, mais il n'y paraîtrait pas en dehors d'elle, puisque le même nombre de simultanéités se produirait encore dans l'espace.[4]

If Bergson had not told James how he had experienced this idea—if James had not pressed him for "adventures"—we might never have known that observing this had completely bowled him over. The thought is practically smuggled in: that dispassionate beginning—"Ce qui prouve"—muffles the shock of it, almost as though Bergson wanted to preserve the reader from the astonishment that it had given him.

And it is as though his own surprise might be too undignified to reveal in a work of philosophy. The word *surprendre* once had a martial sense, meaning sudden capture, being overtaken and taken prisoner, the consequence of a ruinous oversight; it is a word that, to be deployed to *philosophical* advantage, must be reserved for very particular occasions, moments of dire epistemological necessity. For the effect is detonation, and the philosopher must be willing to risk his own sovereignty with it. This was how Descartes described his predicament after being raided by his own doubt: "comme si tout à coup j'étais tombé dans une eau très profonde, je suis tellement surpris, que je ne puis ni asseurer mes pieds dans le fond, ni nager pour me soutenir au dessus."[5]

4 Henri Bergson, *Essai sur les données immédiates de la conscience* (Paris: 1889), 87–88.

5 René Descartes, *Méditations*, *Œuvres de Descartes* t. 9-1, ed. Charles Adam and Paul Tannery (Paris: 1982 {1897–1913}), 18. Spelling modernized.

It was not one of those times for Bergson. He was 26 years old and in need of a doctorate; it served him better not to show his own astonishment. "Ce qui prouve" made the argument without the backstory. And in this Bergson acted much like philosophers past and present, who, when not writing in a confessional mode, prefer to appear as clear-eyed councilmen who anticipate everything and keep their astonishment hidden.

Does this mean that a philosopher's surprise is but a rare disclosure and that we readers would never detect it, if not for William James helpfully bobbing here and there?

With Bergson, no. For there is a form of expression that trafficks in the unexpected, that has surprise built into it like the charge added to a currency conversion: find it, give it its due, and see how a philosophy itself betrays a philosopher's astonishment. Aristotle wrote of *metaphor* that it conveys "liveliness … and by the further power of surprising the hearer."[6] I think a metaphor also records the surprise of the writer, for this is the experience that prompts metaphor making. That distance between the ordinary and the unexpected that the reader, in a metaphor, finds reduced to the width of a wire is a distance that the writer, too, first tumbles over.

Bergson realized that time as it appeared in scientific calculations was only a placeholder. Time was really a medium of its own. Its closest likeness was water, but upon scrutiny Bergson's time resembles no actual body of water. For it moves least at the surface, most at depth—a property not of water but of the particular vessel Bergson chose to contain it. Bergson's time is a medium that resides in the mind. At its surface, floating "comme des feuilles mortes sur l'eau d'un étang," are our clear and distinct thoughts.[7] At depth, it is the mind in motion, whose every change changes the whole. Minds laden with time, time borne through the world by people: this was his dignified way of transmuting astonishment into philosophy, however undignified it would be for science.

6 Rh. 3.11.1412a18 in Jonathan Barnes, ed., *The Complete Works of Aristotle* (Princeton: 1984), 2:2253.

7 Bergson, *Essai*, 102.

Trautonium

Myles W. Jackson

The 1920s was a fascinating decade for Berliners. In the immediate aftermath of the First World War, it seemed unfathomable that the city would soon become the world's third-largest municipality. Despite the immediate political and economic turmoil, there was cause for optimism. The Bauhaus, originally located in Weimar and later resituated in nearby Dessau and Berlin, was establishing itself as the leading German school of architecture and design. German cinema was flourishing, featuring what would become classics, such as *Dr. Marbuse, der Spieler* and *Metropolis*, both directed by Fritz Lang. Berthold Brecht and Kurt Weill were entertaining the theatergoing throngs with rather poignant political morals, while similar messages from the pen of journalist and cultural critic Walter Benjamin could be read in the city's newspapers. The capital could boast that it was the home of some of the world's leading scientists, including the likes of Albert Einstein, Max Planck, Max von Laue, Gustav Hertz, Otto Heinrich Warburg, and Fritz Haber.

German radio was beginning to fill the airways with news and music. With this period of renewed industrialization and cultural, technological, and scientific achievements, a group of applied physicists, physiologists, engineers, musicians, and composers were tinkering away, inventing new musical instruments and genres. The technical expertise of radio engineers, who were contributing to the burgeoning form of communication, combined with the musical expertise present in the Berlin Hochschule für Musik (Conservatoire) and the financial backing of German companies and the Prussian Ministry of Science, Art, and Popular Education, enabled the production of a new electric musical instrument, the trautonium, which could be used for microtonal pieces and could mimic the timbre of numerous, more traditional instruments. In 1928, the Prussian Ministry for Science decided to address the issue of increasing the collaborations between musicians and engineers by creating the Rundfunkversuchsstelle within the Hochschule für Musik. Their solution proved to be extremely successful.

Radio and the research of applied, technical physicists, however, are not the only contexts in which we need to situate electric music in Germany during the late 1920s and 1930s. Also critical was the

research by physiologists into analyzing and synthesizing human sounds, particularly vowels and their corresponding formants, using gramophones. It was also a period of a new aesthetic, *Neue Sachlichkeit*, exemplified by avant-garde composers such as Paul Hindemith, Igor Stravinsky, and Arnold Schoenberg, who were trying to push the envelope of what constituted music and in essence saw themselves as following the calling of Ferruccio Busoni in 1907 to create a new form of music based on, among other things, atonality. It was an aesthetic of "absolute clarity," "perfected handiwork," "playful insouciance," "formal consolidation," and "'objective' forming" that distanced itself from emotional expression. The trautonium, it turns out, can be used as a heuristic tool to trace the contours of various disciplines, such as physics, electrical engineering, radio engineering, physiology, and musical aesthetics, which were actively coming together and cross-fertilizing in Berlin with funding from the Prussian government and German electrical companies during the 1920s and 1930s.

The initial trautonium was built in the Rundfunkversuchstelle by physicist and electrical engineer Friedrich Trautwein and the musician Oskar Sala in 1930.[1] It underwent various transformations throughout the 1930s and 1940s, including the *Volkstrautonium*, built in 1932 with the generous funding of Telefunken.[2] During the 1930s, Sala, who spent 10 semesters studying the natural sciences at the Universität Berlin, constructed the *Rundfunktrautonium* and its portable counterpart, the *Konzerttrautonium*, with which he toured Germany and its occupied territories during the Third Reich.[3] The Nazis in general, and Joseph Goebbels in particular, welcomed and actively supported the new genre of electric (later electronic) music. Rather than considering it *entartete Kunst*, the Nazis encouraged electric

1 "Oskar Sala – Trautonium Rundfunkversuchsstelle Berlin 1930," YouTube video, 0:49, posted by "Trautonist," April 19, 2011, https://www.youtube.com/watch?v=FrAcSxlpJgk.

2 "Telefunken Trautonium Volkstrautonium 1933," YouTube video, 1:37, posted by "Trautonist," June 14, 2011, https://www.youtube.com/watch?v=pOB6A26tfVY&t=14s.

3 "Electrische piano: Trautonium (1941)," YouTube video, 2:21, posted by "Nederlands Instituut voor Beeld en Geluid," October 16, 2011, https://www.youtube.com/watch?v=TQ4w-Gucalpc.

music, claiming it was a musical genre showcasing German inventors playing classic works on new musical instruments. Sadly, the hope of a number of composers, many of whom became enemies of the Reich, including Hindemith and Schoenberg, that these instruments would produce unique tones and inspire compositions involving the new theories of atonality and serialism never came to fruition.

After the war, Sala continually worked on improvements to the trautonium. In 1952 he finished his *Mixtur-Trautonium*, which was used in a number of Hollywood motion pictures, including most famously Alfred Hitchcock's *The Birds*, in which Sala's instrument created the sounds of the screeching birds and the flapping of their wings. He went on to enjoy an extremely successful career as an electronic music composer for numerous films in the Federal Republic of Germany. Trautwein, on the other hand, was far less successful. Having been a member of the Nazi Party, he had difficulty finding postwar employment. In the end, he struck up an ephemeral collaboration with Cologne's Studio für elektronische Musik, building a melochord, which was a version of his earlier trautonium. It was used in a number of the Studio's early musical pieces, including Herbert Eimert and Robert Beyer's *Klangstudie I* and *II* of 1952.[4]

In short, electrical engineers, physicists, and physiologists working on the synthesis and broadcasting of speech and music provided musicians with the long-coveted ability to generate new tones. Electrical engineers spoke of how science and technology enabled an aesthetic of precision that was part and parcel of the new music of the age. While music, engineering, and science were by now clearly separate professions and domains of knowledge—certainly more so than they had been a century earlier—the boundaries between them were still at times porous as collaborations flourished, and they sought each other out to create new musical instruments, sounds, and aesthetics.

4 Herbert Eimert, "Herbert Eimert – Klangstudie I (1952)," YouTube video, 3:53, posted by Sebastian H. M. Murdock, November 10, 2016, https://www.youtube.com/watch?v=BLSZ-3cTI-6Y; Herbert Eimert, "Herbert Eimert: Klangstudie II (1952)," YouTube video, 4:30, posted by TheWelleszCompany, March 24, 2011, https://www.youtube.com/watch?v=HTS-ed3Ybzhg.

Thinking Winds with Leniarrd

Vladimir Janković

Seneca was probably the first meteorologist. I don't think he'd be displeased with this designation, applied to the select few interested in the most aleatory of things, *meteora*. The cryptic, inflammatory claim that "wind is fluent air" opens Book Five of Seneca's *Naturales quaestiones*. That Nero's Cordovan advisor would consider it important to open a work with a sentence that—to our ears—appears to be as plain as indisputable signals either a discerning genius or an iconoclast armed against a vulgar error. An error the nature of which, at the time of my first reading, I knew nothing.

It took seven years before I discovered the likely explanation in, of all places, Israel's Negev desert. Following a visit to the Blaustein Institutes for Desert Research, our host invited us to dinner at the home of her colleague, ethnologist and *aridista* Atonos (Ati) Leniarrd. Leniarrd's reputation rested on two books: *Faraway Places* (1979) and *Plants of Truth* (1987). Both books challenged accepted views of traditional environmental knowledge. I had read neither.

Following dinner, our group sipping wild mint tea as the desert landscape assumed an ochre tint before the sunset, Leniarrd, in half-voice, casually remarked about the breeze that had just twisted the smoke of the dying coals: "We have been seeing less and less of this one in recent years," he said. "It's called *Tarasq-al*. People fear it may disappear. The Al-Tarabin tribes don't mention it anymore, and the Al-Tayaha have not it seen in 60 moons. Some think it's changed into *majha*, a dawn breath, detectable by feathers only." A colleague asked how a wind could disappear. It's not a wind, Leniarrd answered. He was speaking of *Tarasq-al*, not of a wind.

"Look at the smoke," he said, "only a *Tarasq-al* can make it move this way." When we pushed him to speak further, we learned that *Tarasq-al* was not only a matter of the weather but a name for a state of things that can be understood only through the traces of its presence: herbs smelling stronger, consonants sounding harsher, hills seeming closer, echoes not returning, children running restless, scorpions hiding in the *Pistacia* bushes. None of this would happen during *Sharqi*, *Khamsin*, or *Simoom* (the last so dry, it stops newborn babies from crying).

What Leniarrd said next, however, suggested an uncanny possibility. Not only did different "winds" vary among themselves, one from another, but particular instances of each differed as well. There was no *absolute Tarasq-al*. Think of a fugue without the main theme, he said: its contrapuntal melodies would imitate a nonexistent template. But without a main theme, I said, would there not be a possibility—an absurdity—of a "wind" appearing only once, blowing only once in the whole course of known history? Perhaps, he nodded. And if so, did he think such a wind would have a name? *Should* it have a name?

Our conversation would have remained forgotten had it not been for a meeting titled "Wind und Wetter: Die Ikonologie der Atmosphäre" organized at the Kunsthistorisches Institut in Florenz in 2006. My talk was on the "hidden" history of European tornadoes. In the preparation, however, I stumbled upon Richard Bentley's *Remark upon a Late Discourse of Free-Thinking* (1725) in which he engages in a discussion of the theological meaning of the wind *Euroclydon*. The term appears in *Acts 27*, where Luke names *Euroclydon* as the cause of the storm that led to the terrible but ultimately miraculous wreck of St. Paul's ship on the ancient Melita. What vexed Bentley was that *Euroclydon* was a *hápax legómenon:* a word which occurs *only once* in a language or a corpus.

But Bentley's theory had suffered a blow in John Brekell's *Euroclydon or the Dangers of the Sea* (1744). Luke knew better than to misspell the name of a wind, argued Brekkel. Stunningly, Brekell then argued that Luke *intended* "Euroclydon" to be a *hápax*. In so doing, he was identifying the wind as a providential agent in a theodicy that required the deliverance of all 276 passengers on board the doomed Alexandrian freighter. This was no less than establishing that the storm, the shipwreck, and Paul's actions created a monumental *hápax historicon* that led to "the greatest moral revolution the world ever saw," as the *Wesleyan-Methodist Magazine* put it in 1859. Whether Brekell entertained the possibility that the *hápax legómenon* referred to a *hápax phenomenon* remains moot.

Days before the Florence meeting I dropped a line to Ati Leniarrd: "Dear Ati, Just a quick note before I go off to a conference on wind and weather. I've recently dug out something that goes back to our

conversation about *Tarasq-al*. You will remember the possibility that in the vast spaces of time there could indeed be a 'wind' so unique as to have a singular appearance, a nonce wind, a wind of such profound consequence that it could come only once in the course of history and subsequently even be known as such! I might have something to report on that matter, but let me see if there's any feedback from the meeting."

What Is It That Lastingly Steals Your Mind?

Sonam Kachru

Consider an abstract object. It is made with language, though it can exist at several scales, from individual phonemes to entire chapters. This object collocates or rearranges several beautiful or uncanny or marvelous things in a novel way, so as to promote a particular aesthetic response, a distinctive and distinctively pleasurable experiential texture of responsiveness to the heterogeneous world brought into view by a work of art. Such textual objects are everywhere in South Asia, where surprise and wonder can be found not only as classifiable psychological or existential phenomena to which we are susceptible: wonder in South Asia can involve the creation of textual objects that seek to keep in view not particular bits of the world so much as *ways of having a world in view*.

Such wonder as these abstract textual objects exemplify does not typically involve curiosity, being rather more closely related to desire and its satisfactions. When strangeness or the uncanny are counted among the possible moods sustained by such objects, they do not serve as goads to inquiry. The Buddhist poet Aśvaghoṣa (*fl.* first to second century CE), the first poet in Sanskrit whose work has come down to us, offers us a metapoetic contrast to help with this. Contrast Siddhārtha's thought-inducing shock at what the world showed him of himself with the effect on his family of a story of his departure. This version is narrated by a character in Aśvaghoṣa's *Life of the Buddha*, and though we do not hear it in its entirety, we may gather that it echoes but does not repeat Aśvaghoṣa's own narration of the event. Of the story within the story, we are told that it is constituted of many uncanny marvels and that it promotes the reoccupation of grief by wonder (*vismaya*).[1] For Aśvaghoṣa, however, the uncanny offers only a momentary suspension of one's psychological life. This semblance of being drawn out of oneself ought to be contrasted with Siddhārtha's own existential shock and variety of wondering steps into analytic inquiry: the former, concealing the world in a variety of shared aesthetic responsiveness, only perpetuates the undertow of

1 Verse 8.50 in Aśvaghoṣa, *Life of the Buddha,* trans. Patrick Olivelle (New York: 2008), 227.

our infelicitous cognitive and affective norms. The latter breaks things open.

Does wonder mark a beginning to thought or an (sometimes dead) end? Is it correlated with doubt and cognitive unease or with some variety of intellectual and aesthetic satisfaction? Aśvaghoṣa's (ironic) suspicion of aesthetic moods notwithstanding, the evidence of Buddhist philosophers themselves is intriguing. They can recruit the rhetoric of wonder not at the beginning of inquiry but at its edges, when a limit to analysis or persuasion has been reached. Thus Vasubandhu, the philosopher from Peshawar (*fl.* late fourth to early fifth century CE), concludes his (to my mind, self-consciously inconclusive) analysis of mirror images—are they or are they not a variety of visible stuff on, or in, the surfaces of mirrors?—with an exclamation of wonder: "Indeed, one just can't think of all that phenomena are capable of!"[2] Such examples used by philosophers like Vasubandhu do not only exemplify the wondrous. They clarify for us what wonder can be. That mirrors "respond" to the presence of objects by mirroring them, that magnets attract iron, or that "moonstones" liquefy in moonlight can illustrate this general sense of wonder: it marks our responsiveness to the responsiveness of phenomena in the world to one another.

Vasubandhu's concluding exclamation is no lament. It is a confirmation of a long-held expectation regarding what the world is really like; so too is the use of the mirabilia invoked by the *Compendium of the Mahāyāna* 8.17, such as the gem that can illuminate a place with all manner of light and so fulfill everyone's wishes or the musical instruments of the gods, which respond with exactly the right sounds corresponding to the (secret) desires of those present.[3] These, used as *proof* that responsive activity without intention or calculation is possible, appeal to shared norms regarding the intelligibility of the world, paradoxically perhaps, invoking natural phenomena that exceed any natural account on offer.

2 *Abhidharmakośabhāṣyam of Vasubandhu*, Tibetan Sanskrit Works 8, ed. Prahlad Pradhan, K. P. (Patna: 1975), 121.

3 Étienne Lamotte, *Mahāyānasaṃgraha. La Somme du Grand Véhicule d'Asaṅga,* vol. 2, *Translation and Commentary* (Louvain: 1938–1939).

But that paradox can be softened by noting that the expectation that inquiry bottomed out in wonder serves as a criterion for orienting oneself successfully in thought to the world. What I mean is this: that the mirabilia that can be found to dot the romances of poets and (on occasion) the exempla of the proofs of philosophers in South Asia might not be token instances of irrationality, the breaking off of thought, but part of a tissue of shared conventions and sensibilities that transmute the skeptic's dogged questioning into the satisfaction of knowing that reality, if it is to be worth the name, still exceeds the grasp of any final conceptual vocabulary.

The lives of wonder in South Asia have yet to find their biographer. But let's close with that which has pleasantly surprised me, a philosopher's take on the wonder of public events of revelatory significance, or *pratihāra*, in South Asian Buddhism. "Miracle" is the usual translation, but the instances of *pratihāra* do not correspond especially well either to the private medieval experience of grace or to the new variety of evidence of the senses Lorraine Daston has taught us to find in sixteenth- and seventeenth-century European literature on prodigies and miracles. The *pratihāra* is a kind of public achievement of salience and significance, testimony to the power and worth of the one who brings it about, but not for that an event that stands as evidence for a proposition. It is an accomplishment that effects something in the world, valued for its ability to capture and reorient the minds and hearts of those who witness it. Now Vasubandhu for one asks, What is the greatest miracle for which we praise the Buddha? His answer, offered once at the beginning of his magisterial *Treasury of Metaphysics* and once again toward its close, is this: we praise the Buddha for the pedagogical miracle that is his use of arguments in conversation. Why? Because a mind changed by argument, unlike a mind stunned by coercive displays of power and magical ability, is a mind lastingly altered. A miracle we take for granted, then, though no wonder, thought Vasubandhu, is more worthy of praise.

The Family Business

Judy Kaplan

It was my third year in graduate school, and I was digging in to a history minor with an independent study on the intellectual history of German anthropology. Rudy Koshar was advising the project, and following the swerve in his own research program to issues of political theology, I was casting about for a focus that would allow me to digest a lot of literature on exchanges between secular and religious commitments. I was intrigued by the work of Wilhelm Schmidt, SVD (1868–1954)—known to me at the time as the founder of *Anthropos* and the author of a curiously late book (1937) on the rudiments of the "cultural-historical" approach to ethnology.[1] Here was a self-trained institutionalizer, an apologist wielding "scientific" methods, and a diffusionist thinker curiously out of step with his time. It seemed likely that he would open a number of doors, and I wanted to learn more.

It didn't take long—a quick Google search, really—to discover that Schmidt was also the author of the first European study of Mon-Khmer (known today as Austroasiatic), an ethnolinguistic grouping at the heart of a debate that had structured *my own mother's* research since the early 1980s. Surprise! Like generations of linguists before, my mother has assembled historical linguistic evidence with bearing on the question of the Austroasiatic *Urheimat* and, more specifically, its relationship to the homeland of a smaller language family, Hmong-Mien. At the moment when I was supposed to be turning toward a dissertation—the biggest independent undertaking I could imagine at that point—it seemed that there was no escaping the family business. Was I doomed to perpetually reinvent the wheel … and what would *Kulturkreis* theorists say if I did?

This focus on Schmidt gave me an excuse to read Bastian, Ratzel, Graebner and a raft of contemporary scholarship that subsequently informed my dissertation project. But Schmidt was fascinating in his own right as well: here was the exception that proved the ruling fieldwork imperative in early-twentieth-century anthropology, an armchair missionary, a proponent of an ethnological theory that

1 Wilhelm Schmidt, *Handbuch der Methode der kulturhistorischen Ethnologie* (Münster, Westfalen: 1937).

justified its own conservatism. In ways that I couldn't appreciate at the time, Schmidt also prefigured my current interest in long-range comparative linguistics. He emphasized deep history—"the time factor," as he called it—allowing connections to be drawn between spatially discontinuous groups. Fast-forward to Ed Vadja's 2010 proposal of *The Dene-Yeniseian Connection*, linking Alaskan languages to a mostly extinct family based in central Siberia. Describing core commitments of the culture historical school, Schmidt wrote, "it does, of course, recognize but few culture circles for the beginning, which *go back to the oldest one*."[2] Was that a whisper of Proto-World? Suffice it to say, the independent study was, eventually, absorbing despite the initial flush of embarrassment.

It was only after arriving at the MPI that I started thinking seriously about what it might mean to study the history of my mother's chosen discipline. In Berlin, I enjoyed talking with other members of Department II who found themselves—always partly accidentally, it seemed—tracking the imprints of their parents' lives in science. We talked about how to seriously interrogate figures who might have stopped by for family picnics when we were children; what memories to trust and which ones to question; how to negotiate areas of tension between our own narratives and those put forward by our mothers and fathers. The last question is one that I continue to mull over daily.

I had always explained my interest in linguistics on methodological and historiographic grounds. Methodologically, I was intrigued by a number of parallels with evolutionary biology; historiographically, I thought the instability of linguistic research might highlight the importance of a contextual definition of science. With the characteristic defensiveness of a graduate student, this latter investment in the organization of knowledge grew to outsized proportions. It took a long time to realize that my preoccupation had much to do with the personal—and explicitly feminist—transition my mother had undergone in her own career as a student of language.

2 Wilhelm Schmidt, *The Culture Historical Method of Ethnology: The Scientific Approach to the Racial Question*, trans. S. A. Sieber (New York: 1939), 60.

A onetime English major, my mom was teaching ESL at Senn High School on the North Side of Chicago around the time I was born. She liked her coworkers and felt sufficiently compelled by the service aspect of what she was doing to don a pink collar and board the Green Line from Oak Park to Edgewater five days a week. But eventually, she came to realize that the job was unfulfilling. "Science," as I always heard her tell it, set her free. For the first time it allowed her to be a disembodied mind hunting down the truth of how it (language) actually *was*. This is not to say that social roles completely fell away in the process: she passed over an opportunity to specialize in Mayan hieroglyphs to work on the phonology of white Hmong instead, as this could be studied with a local refugee population in Chicago and she did not want to uproot me so young.

The shift from English to linguistics was enormously important for my mother—an example that taught me to indulge the kind of curiosity that led me to consider the work of Wilhelm Schmidt in the first place. More than that, I am so grateful to be a part of a discipline with such inspiring women leads. It all allowed me to grow up with the luxurious delusion that being a female academic didn't matter. Now I am trying to recover all the ways in which it does.

Ein Affe ist ein Affe, ist ein Affe?

Doris Kaufmann

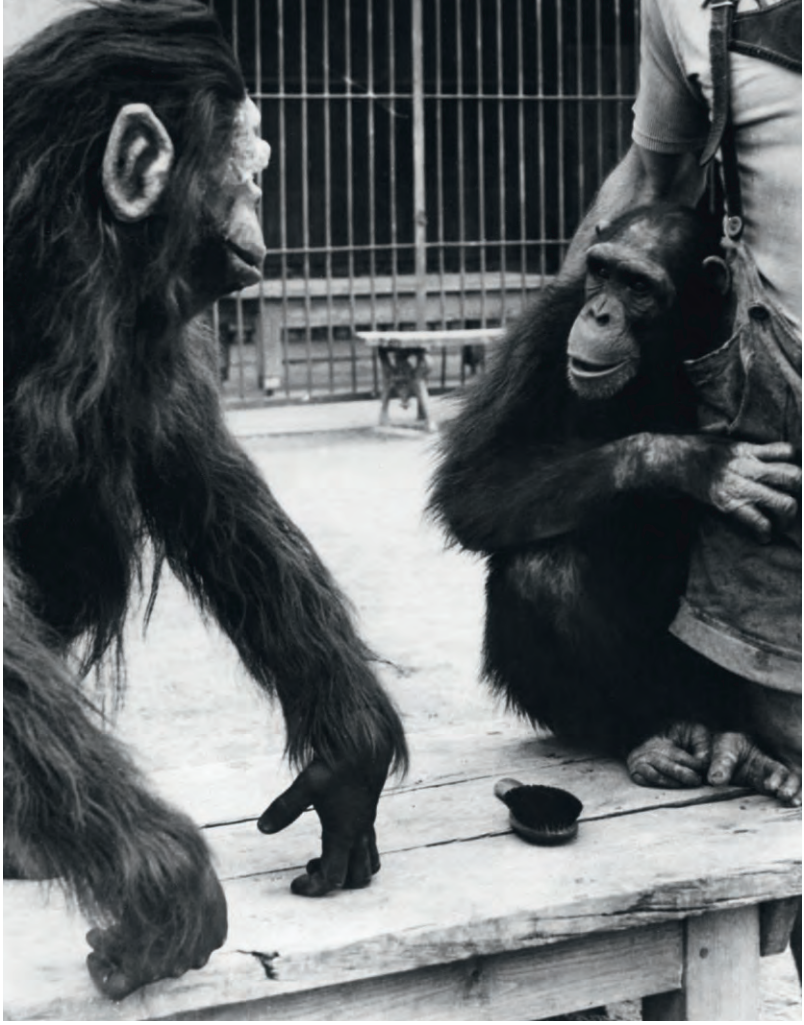
Der Artist Fritz Roth hatte starke Bedenken. Es war eine Sache, die Bewegungsabläufe von Menschenaffen gründlich studiert zu haben und so das Publikum bei den abendlichen Auftritten als „King Kong" am Hochseil unter der Zirkuskuppel erfolgreich täuschen zu können, aber in einem Affenkostüm realen Schimpansen im Münchener Zoo Auge in Auge gegenüberzutreten, war eine andere Sache. Galten diese Affen doch in der Verteidigung ihres Reviers gegen fremde Artgenossen als äußerst aggressiv und kampfbereit. Warum sich der Artist ebenso wie der Hellabrunner Zoodirektor und der zuständige Tierpfleger schließlich auf diese Begegnung einließen, kann nur vermutet werden, lässt sich jedoch als deutliches Zeichen für eine zeitgenössische Popularität der (Tier-)Verhaltensforschung[1] lesen.

Unsere Geschichte ist angesiedelt in den späten 1950er Jahren, im *golden age* dieses Wissensfeldes zwischen Zoologie, Biologie und Psychologie, für das Namen wie Konrad Lorenz und Bernhard Grzimek standen. Die Verhaltensforschung Lorenzscher Prägung mit ihrem methodischen Kernstück der beschreibenden Beobachtung sprach Amateur-BeobachterInnen von Haustieren und freilebenden Vögeln an und verzichtete auf eine pointierte Abgrenzung zwischen TierliebhaberInnen und WissenschaftlerInnen. Das große öffentliche Interesse, „den Tieren auf (die) Spur"[2] zu kommen, beflügelte nicht nur den Tier(sach)buchmarkt der 1950 und 1960er Jahre, sondern stieß auch Tierbeobachtungsversuche außerhalb des wissenschaftlichen Raums an. So war der Initiator des Begegnungs-Szenariums von „King-Kong" mit den Hellabrunner Schimpansen der bekannte Kriegs- und Nachkriegs-Fotograf und Bildberichterstatter Gerhard Gronefeld,[3] der die Arbeiten von Lorenz und seinen MitarbeiterInnen seit Beginn der 1950er Jahre fotografisch festhielt und in der illustrierten Massenpresse verbreitete. Hinter seiner Versuchsanordnung stand die Frage, ob die Menschenaffen den Affenmenschen als

1 Umfassend Richard W. Burkhardt, *Patterns of Behavior: Konrad Lorenz, Niko Tinbergen, and the Founding of Ethology* (Chicago/London: 2005).

2 Hilde Barisch, *Den Tieren auf der Spur. Die Geheimnisse der Tierwelt erzählt von den bekanntesten Verhaltensforschern* (Würzburg: 1975).

3 Siehe Winfried Ranke, *Deutsche Geschichte kurz belichtet, Photoreportagen von Gerhard Gronefeld 1937–1965*. Ausstellungskatalog des DHM Berlin (Berlin: 1991).



Eine furchterregende Begegnung. Gerhard Gronefeld, „Der Affenmensch und Menschenaffe trauen einander nicht," Foto, 1956. Deutsches Historisches Museum, Bildarchiv, 96/771.

einen der ihren erkennen und wenn ja, dann mit den zu erwartenden Konsequenzen reagieren würden. Zur Vorsicht wurden die erwachsenen Schimpansenmänner weggesperrt. Allein fünf jugendliche Affen begleitet von ihrem vertrauten Pfleger sahen sich im Tierpark-Freigehege mit dem hereinhopsenden verkleideten Artisten konfrontiert. Zur Überraschung der Zaungäste reagierten sie wie das Kinopublikum auf den Monsteraffen im zuerst 1933 gezeigten US-Film *King Kong* – nämlich mit Erschrecken. Drei junge Schimpansen klammerten sich an den Pfleger, zwei flüchteten auf ein Käfigdach. Nur eine Äffin näherte sich auf Zureden des Betreuers schließlich dem falschen Affen und untersuchte die unbekannte starre Lippenpartie der Maske, die unbeweglich blieb und keine Auskunft über das Befinden geben konnte und damit eine Art-Zugehörigkeit des Gegenübers ausschloss. Dies löste erneut große Angst bei ihr aus. Gronefeld

brach an dieser Stelle das Experiment ab und forderte den Artisten auf, den Maskenkopf abzunehmen. Mit Erleichterung und Freude reagierten alle Schimpansen auf den Anblick des Menschen, untersuchten und umarmten ihn anschließend ausgiebig. Diese Stimmung schlug allerdings in ihr Gegenteil um, als der Artist seinen Affenkopf wieder aufsetzte und so erneut Fluchtbewegungen der Schimpansen hervorrief.[4]

Es ist verständlich, dass der Fotoreporter Gronefeld die Originalität seines Affenversuchs in Hellabrunn in seinen Veröffentlichungen für ein breites Lesepublikum hervorhob. Er folgte jedoch mit seinem Versuchsaufbau den Arbeiten des Veterinärmediziners und Verhaltensforschers Bernhard Grzimek, der die Frage, an welchen sensorischen Merkmalen und Eigenschaften Tiere ihre Artgenossen erkennen, mit dem Einsatz von Attrappen zu beantworten versuchte. Bereits in den frühen 1940er Jahren hatte Grzimek eine größere Anzahl Pferde und zwanzig Jahre später wildlebende Zebras und andere Wildtiere mit plastischen Nachbildungen und Flächenbildern ihrer Artgenossen konfrontiert und seine Forschungsergebnisse breit publiziert.[5]

Doch letztlich interessierte sich Gronefeld – wie vermutlich viele seiner Leserinnen und Leser – nicht für detaillierte ethologische Fachfragen, sondern für „das Menschliche im Tier". So erinnerte er sich am Ende seiner kleinen Affenerzählung an seine Kindheit und an den Weihnachtsmann, der unter seiner Maske furchtbare Drohungen aussprach, die ihn zum verzweifelten Heulen trieben. Zwar beruhigte er sich, als der Großvater die Maske abnahm, um dann wieder loszuschreien, als dieser sie erneut aufsetzte. Er glaubte, den Schimpansen ging es mit dem King-Kong nicht anders, obwohl sie doch gesehen hatten, dass unter der Maske ein Mensch steckte.[6]

4 Gerhard Gronefeld, „Der Affenmensch und die Menschenaffen," in *Verstehen wir die Tiere? Bildberichte aus der modernen Tierforschung* (Braunschweig: 1963), 37–42, Fotos 29–34; erstmals abgedruckt in *Weltbild* 18 (1959).

5 Bernhard Grzimek, *Und immer wieder Pferde* (München: 1977), dort alle Angaben seiner einschlägigen Fachveröffentlichungen; für eine breitere Leserschaft zu diesem Thema siehe Grzimek, *Grzimek unter Afrikas Tieren* (1959); und *Auch Nashörner gehören allen Menschen* (1962).

6 Gronefeld, „Der Affenmensch," 42.

Getting One's Hands Dirty[1]

Stefanie Klamm

Das Arbeiten in und mit wissenschaftlichen Fotoarchiven konfrontiert die Forscherin oft mit erstaunlichen Massen von Bildern eines Objektes – seien es Aufnahmen des *David* von Michelangelo oder der Friese des Pergamonaltars – bzw. sehr ähnlicher Bildmotive wie zum Beispiel die Hauseingänge kolonialer Bauten an der Ostküste der USA. Diese Fotografien, zum Teil aus verschiedenen Zeiten stammend, können dasselbe Artefakt aus verschiedenen Blickwinkeln zeigen. Sie können aber ebenso unterschiedliche, wenn auch ähnliche Objekte aus derselben Perspektive darstellen. Ihre Fülle erzeugt häufig den Eindruck von Gleichförmigkeit, denn die Aufnahmen greifen auf standardisierte Ansichten zurück oder lassen durch standardisierende Praktiken im Archiv, wie das Montieren des fotografischen Abzugs auf einheitliche Kartons, den Eindruck des Immergleichen entstehen. Und manchmal kommt dann sogar ein Gefühl von gähnender Langeweile auf: Was soll ich mit 50 Hauseingängen aus Salem/Massachusetts anfangen?

Schaut man jedoch genauer hin, gibt es in Fotoarchiven immer wieder Foto-Objekte, die aus der Reihe tanzen, aus den archivalischen Ordnungen herausfallen, in den Sammlungen teilweise marginalisiert sind und oftmals gar nicht in deren klassifikatorische Logik aufgenommen wurden. Die Forscherin entdeckt sie zufällig und zur eigenen Überraschung. Sie war nicht nach ihnen auf der Suche, und doch entzündet sich plötzlich ein Funken der Aufmerksamkeit an ihnen. Das können Foto-Objekte wie bei meiner Projektkollegin Franka Schneider sein, die, zerschnitten nun zu „Papier-Objekte[n]" geworden, als Trennblätter in Ordnern von anderen Archiven fungieren.[2] Oder die übrig gebliebenen beschrifteten Schnittränder von Fotokartons aus der Sammlung Fotografie der Kunstbibliothek der

1 „Getting One's Hands Dirty" war der programmatische Titel einer Sektion der Tagung „Photo-Objects. On the Materiality of Photographs and Photo-Archives in the Humanities and Sciences" unseres Verbundprojektes "Foto-Objekte. Fotografien als (Forschungs-)Objekte in Archäologie, Ethnologie und Kunstgeschichte" im Februar 2017 in Florenz (http://fotobjekt.hypotheses.org/1479).

2 Dazu siehe Franka Schneider, Julia Bärnighausen, Stefanie Klamm und Petra Wodtke, „Die Materialität des ‚punctum'. Zum Potential ko-laborativer Objekt- und Sammlungsanalysen in Foto-Archiven", in *Eine Fotografie. Über die transdisziplinären Möglichkeiten der Bildforschung*, hgg. Irene Ziehe und Ulrich Hagele. (Münster: 2017), 217–241, hier 224.

Staatlichen Museen zu Berlin. Um in ein neues Schrank- bzw. Regalsystem zu passen, waren die Kartonunterlagen in ihrer Größe beschnitten worden. Einige der Ränder blieben als Überbleibsel dieser großen Transformation des Archivs erhalten. Oder die gedruckte Systematik der Architekturfotografien des in den 1960er Jahren umgeformten Bildarchivs der Sammlung Fotografie. Deren einstmalige

Funktion als Stellvertreter für die Ordnung des Archivs an den Regalkompartimenten konnte ich an dem einzigen Exemplar wiedererkennen, das sich noch als Trennblatt (sic!) in einem Ordner mit verschiedensten Unterlagen zur Sammlungsgeschichte im Büro der Sammlungskuratorin befand. Überhaupt stellte sich das Schneiden, zu meiner Überraschung, als eines der wichtigsten Handlungen im Fotoarchiv und als wesentlich für viele Transformationen der Sammlungen heraus.

Zum einen sind es Zufallsfunde wie diese, die sich nicht in sorgfältig geordneten und systematisch abgelegten Aktenbeständen einer Sammlung befinden, sondern für die man sich häufig die Hände im wörtlichen Sinne schmutzig machen muss. Nur so lassen sich in den oft als „Reste," „Unsortiertes" oder „Varia" titulierten Kisten, Schubern und Kästen Objekte finden, die das Verständnis von einer Sammlung, von ihrer Ordnung und Geschichte plötzlich verändern.

Zum anderen entstehen beim gemeinsamen Forschen Aha-Momente von großer epistemologischer Bedeutung für das eigene Arbeiten. Für meine Kollegin Franka Schneider, eine Europäische Ethnologin, bedeutete der Blick auf eine Fotografie im Passepartout etwas völlig anderes als für mich. Er war mir wie selbstverständlich disziplinär aus vielen Kunst- und Fotografieausstellungen vertraut. Einige der von mir analysierten Aufnahmen des amerikanischen Architekturfotografen Frank Cousins waren für die Ausstellung *Ein neuer Blick. Architekturfotografie aus den Staatlichen Museen zu Berlin*, 2010 im Museum für Fotografie gezeigt, passepartouriert worden. Die vielfach beschrifteten, beschnittenen und bestempelten Ränder der auf Karton aufgezogenen Fotografien wurden durch das Passepartout abgedeckt, und die Aufnahme dann gerahmt an der Wand präsentiert. Wieder in der Sammlung zurück verblieben die Foto-Objekte in ihren Passepartouts, die jedoch nicht geschlossen montiert worden waren und so weiterhin geöffnet werden können. Dies erlaubt den Blick auf die Fotografie in ihrer ursprünglich in der Sammlung überlieferten Gestalt. Durch diesen Überlieferungsumstand wurde in unserer Forschung die Aufmerksamkeit auf das, was das Passepartout bewirkt, gelenkt: Erst das Erstaunen meiner Kollegin über den Effekt des „Auf"–„Zu" des Passepartouts erlaubte auch

Auf–Zu: das passepartourierte Foto-Objekt. Frank Cousins, Boston: Daniel P. Parker's Mansion, Wandnische, um 1900. Staatliche Museen zu Berlin, Kunstbibliothek, Foto: Dietmar Katz, 2017.

mir, die wahrnehmungsstrukturierenden Wirkungen dieser Präsentationsform zu sehen:[3] Im geschlossenen Zustand wird der Blick auf das Bildmotiv und seine ästhetischen Effekte unter Ausschluss anderer materieller Charakteristiken der Fotografie gelenkt, geöffnet weist die Sichtbarkeit der zahlreichen Annotationen auf dem Karton der Fotografie auf die Geschichte des Foto-Objektes in der Sammlung hin. In beiden Fällen verändern sich der epistemische Status der Fotografie und ihre Funktion.

Es sind gerade diese – häufig überraschenden – Irritationen des Forschungsprozesses, die sich für das eigene Arbeiten als äußerst produktiv erweisen. Ausgelöst werden können sie durch Kommentierungen des eigenen Blicks aus anderen disziplinären Positionen und Traditionen. Vor allem aber sind es auch die Foto-Objekte von den „Rändern" des Archivs, die Dissonanzen erzeugen, Wissensstrukturen offenlegen und damit epistemisch fruchtbar sind. Um überhaupt auf diese in den Sammlungen marginalisierten Objekte aufmerksam zu werden, muss man sich die Finger schmutzig machen.

3 Schneider et al., „Materialität," 230.

Good Deceptions

Cynthia Klestinec

If pleasure courted surprise in the eighteenth century, risk married it in the prior centuries. And the marriage was full of violence. Readers of early modern texts would probably have found William James's sentiment that "it is only by risking our persons from one hour to another that we live at all" incoherent in its formulation of what it means to live. Death, not life, lay at the doorstep of surprise.

Stories of surprise appear even in the more didactic texts of the period, including those of medicine. Take the bloodletting manual of the ambitious Roman barber Pietro Paolo Magni. Magni knew that all the operations of the barber were "annoying and displeasing to the patients." For his reluctant patients—those noncompliant figures who help us to see the bounded nature of medical authority—Magni recommended the following: "in a friendly way, say to him {the patient} that you do not wish in any way to take up the knife but only to see the arm, tied with a rag and anointed with oil, where the vein would be cut." Then, tell him, "I do not have the soul to let blood from you," and "with a rested soul {*animo riposato*}," "with a knife hidden in the sleeve of my left arm or in another place, I am able to make the operation with quickness {*prestezza*} and without him seeing it."[1] Ouch.

Admittedly the strategy had certain limitations. For starters, it couldn't be used repeatedly on the same patient. It also couldn't be revealed to patients beforehand, and thus we must conclude that Magni did not intend the reader to be a patient. This vignette appears in a chapter on "wimpy men" (*pusillanimi*) and children and is posed as a more efficacious procedure than the routine one whereby family members had to hold down the limbs of these patients so that the barber could cut them. All too frequently, Magni knew from experience, these patients screamed at the sight of the knife, causing the family members to let go of their bodies. To deal with that reaction, Magni developed his innovative procedure, the sudden, swift, unex-

1 Pietro Paolo Magni, *Discorsi di Pietro Paolo Magni Piacentino intorno al sanguinar i corpi humani, il modo di ataccare le sanguisuche e ventose è far frittioni è vesicatorii* (Rome: 1584), 10.

pected attack, substituting the touch of the practitioner and his knife for the touch of kin. He called this one of his "good deceptions" (*buoni inganni*).

The theatrics of the vignette might surprise us—attack metaphors in modern medicine are more familiar as features of chemical therapy, chemotherapy—but they reflected a persistent feature of medicine. In Hippocratic and other early medical texts, the techne of the practitioner was sometimes figured through the language of agonism: "the agon of the techne," explains Heinrich von Staden, was not only with diseases but also with the patient, with his nature (*physis*).[2] This figuration was more widespread than we might think.

It appealed to Magni and also to the roughly contemporary playwright, Ben Jonson. In *The Alchemist*, Jonson turned to barbering in a scene that toyed with the agonistic orientation of techne.[3]

> Face: But, Dol, Prithee go heat a little water quickly;
> Subtle must shave me. All my Captain's beard
> Must off, to make me appear smooth Jeremy.
> You'll do it?
> Subtle: Yes, I'll shave you, as well as I can.
> Face: And not cut my throat, but trim me?
> Subtle: You shall see, sir.

Face and Subtle have proven themselves to be cutthroats—the wordplay is evident—but the techne of the practitioner (Subtle) is here potentially but nevertheless tantalizingly agonistic. Smooth Jeremy is not the essential character, hidden just beneath the surface, waiting to be revealed with the help of Subtle's techne. No, Jeremy, for all his smoothness or subtlety, is a more radical transformation of Face, and the passage implies that he is born out of an agonistic and antagonistic struggle between Subtle and Face, art and nature, techne and physis. The heady concoction raises the question of trust, for these

2 Heinrich von Staden, "Physis and Techne in Greek Medicine," in *The Artificial and the Natural: An Evolving Polarity*, ed. Bernadette Bensaude-Vincent and William R. Newman (Cambridge, MA and London: 2007), 21–50.

3 Ben Jonson, *Ben Jonson's Plays and Masques*, ed. Richard Harp (New York: 2001), act 4, scene 7, 128–135.

characters are engaged, along with a third character named Dol, in a joint venture, one brokered on an exceedingly precarious notion of trust (that will evaporate in the final scenes of the play). Can Face trust Subtle? Or in Face's words: "And not cut my throat, but trim me?" Subtle reminds rather than diminishes the risk that Face, as it were, faces: "You shall see." Trust is a weak antidote to the agonistic forces of techne and to the agonistic orientation of the practitioner. Such agony was a part of the earliest medical interventions that we know about, though Magni reframed it as a surprise.

Aus heiterem Himmel

Charlotte Klonk

Tagespolitische Nachrichten kommen und gehen wie das Wetter oder die Jahreszeiten. Wir nehmen sie zur Kenntnis oder ignorieren sie und denken nur manchmal kurz über ihre Konsequenzen für unser Leben nach. Doch hin und wieder geschieht etwas, das plötzlich die Zeit still stehen lässt und zugleich merkwürdig beschleunigt. Auf allen Kanälen wird nur noch über ein Ereignis berichtet. Wir verfolgen die Meldungen wie besessen und wissen doch zugleich, dass wir in einer Schleife hängen. Mitteilungen von Terroranschlägen gehören in diese Kategorie.

Viele erinnern sich noch genau, wo sie waren, als die Nachricht von den Einschlägen der Flugzeuge in das World Trade Center in New York am 11. September 2001 eintraf. Man sah die Bilder mit Fassungslosigkeit und reagierte wie im Ausnahmezustand. Mit der Zeit jedoch wurde deutlich, dass zwar das Attentat an Spektakularität kaum zu überbieten war, die Bilder in ihrer Sequenz aber einem hinlänglich bekannten Muster folgten, denn weder war das höchstsymbolische Anschlagsziel im Herzen einer westlichen Metropole und der Einsatz modernster Technologien neu, noch die Tatsache, dass es sich um Selbstmordattentate handelte.[1]

Entsprechend sah man wie immer bei Terroranschlägen seit dem Ende des 19. Jahrhunderts zunächst bestürzende Bilder der Zerstörung. Doch den Aufnahmen der Verwüstung folgten sogleich Ansichten, die vor allem den Einsatz von Sicherheitskräften und Rettungshelfern zeigten. Intakte zivile Ordnung und gesellschaftlichen Zusammenhalt signalisierten auch die zahlreichen Fotos von überlebenden Opfern und ihre Versorgung sowie Szenen, die das kollektive Trauern der Menschen vor Ort und in der Welt zum Ausdruck brachten. Weitgehend ausgeblendet blieb hingegen das tatsächliche Leid der bei diesem Anschlag qualvoll ums Leben Gekommenen. Die *New York Times* zum Beispiel zeigte am Tag nach dem Anschlag auf ihrer Titelseite in Großaufnahme ein Foto der brennenden Hochhäuser aus der Ferne, darunter eine Armee von Feuerwehrleuten in den Ruinen sowie das Bild einer verletzten Frau in der Fürsorge von Sanitätern (Abbildung). Daneben erschien eine Aufnahme vom Pen-

1 Charlotte Klonk, *Terror: Wenn Bilder zu Waffen werden* (Frankfurt am Main: 2017), 33–93.

"All the News That's Fit to Print"

The New York Times

Late Edition
New York: Today, sunny, a few afternoon clouds. High 77. Tonight, slightly more humid. Low 65. Tomorrow, sun then clouds. High 83. Yesterday, high 81, low 63. Weather map, Page C19

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U.S. ATTACKED

HIJACKED JETS DESTROY TWIN TOWERS AND HIT PENTAGON IN DAY OF TERROR

A CREEPING HORROR

Buildings Burn and Fall as Onlookers Search for Elusive Safety

By N. R. KLEINFIELD

It kept getting worse.

The horror arrived in episodic bursts of chilling disbelief, signified first by trembling floors, sharp explosions, cracked windows. There was the actual unfathomable realization of a gaping, flaming hole in first one of the tall towers, and then the same thing all over again in its twin. There was the merciless sight of bodies helplessly tumbling out, some of them in flames.

Finally, the mighty towers themselves were reduced to nothing. Dense plumes of smoke raced through the downtown avenues, coursing between the buildings, shaped like tornadoes on their sides.

Every sound was cause for alarm. A plane appeared overhead. Was another one coming? No, it was a fighter jet. But was it friend or enemy? People scrambled for their lives, but they didn't know where to go. Should they go north, south, east, west? Stay outside, go indoors? People hid beneath cars and each other. Some contemplated jumping into the river.

For those trying to flee the very epicenter of the collapsing World Trade Center towers, the most horrid thought of all finally dawned on them: nowhere was safe.

For several panic-stricken hours yesterday morning, people in Lower Manhattan witnessed the inexpressible, the incomprehensible, the unthinkable. "I don't know what the gates of hell look like, but it's got to be like this," said John Maloney, a security director for an Internet firm in the trade center. "I'm a combat veteran, Vietnam, and I never saw anything like this."

The first warnings were small ones blocks away. Jim Farmer, a film composer, was having breakfast at a small restaurant on West Broadway. He heard the sound of a jet. An odd sound — too loud, it seemed, to be

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A Somber Bush Says Terrorism Cannot Prevail

By ELISABETH BUMILLER with DAVID E. SANGER

WASHINGTON, Sept. 11 — President Bush vowed tonight to retaliate against those responsible for today's attacks on New York and Washington, declaring that he would "make no distinction between the terrorists who committed these acts and those who harbor them."

"These acts of mass murder were intended to frighten our nation into chaos and retreat, but they have failed," the president said in his first speech to the nation from the Oval Office. "Our country is strong. Terrorist acts can shake the foundation of our biggest buildings, but they cannot touch the foundation of America."

His speech came after a day of trauma that seems destined to define his presidency. Seeking to at once calm the nation and declare his determination to exact retribution, he told a country numbed by repeated scenes of carnage that "these acts shattered steel, but they cannot dent the steel of American resolve."

Mr. Bush spoke only hours after returning from a zigzag course across the country, as his Secret Service and military security teams moved him from Florida, where he woke up this morning expecting to press for his education bill, to command posts in Louisiana and Nebraska before it was determined the attacks had probably ended and he could safely return to the capital.

It was a sign of the catastrophic

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Steve Ludlum

Associated Press/The New York Times

Paul Hosefros/The New York Times

Paul Hosefros/The New York Times

AMERICAN TARGETS A ball of fire exploded outward after the second of two jetliners slammed into the World Trade Center; less than two hours later, both of the 110-story towers were gone. Hijackers crashed a third airliner into the Pentagon, setting off a huge explosion and fire.

President Vows to Exact Punishment for 'Evil'

By SERGE SCHMEMANN

Hijackers rammed jetliners into each of New York's World Trade Center towers yesterday, toppling both in a hellish storm of ash, glass, smoke and leaping victims, while a third jetliner crashed into the Pentagon in Virginia. There was no official count, but President Bush said thousands had perished, and in the immediate aftermath the calamity was already being ranked the worst and most audacious terror attack in American history.

The attacks seemed carefully coordinated. The hijacked planes were all en route to California, and therefore gorged with fuel, and their departures were spaced within an hour and 40 minutes. The first, American Airlines Flight 11, a Boeing 767 out of Boston for Los Angeles, crashed into the north tower at 8:48 a.m. Eighteen minutes later, United Airlines Flight 175, also headed from Boston to Los Angeles, plowed into the south tower.

Then an American Airlines Boeing 757, Flight 77, left Washington's Dulles International Airport bound for Los Angeles, but instead hit the western part of the Pentagon, the military headquarters where 24,000 people work, at 9:40 a.m. Finally, United Airlines Flight 93, a Boeing 757 flying from Newark to San Francisco, crashed near Pittsburgh, raising the possibility that its hijackers had failed in whatever their mission was.

Paul Hosefros/The New York Times

SECOND PLANE United Airlines Flight 175 nearing the trade center's south tower.

There were indications that the hijackers on at least two of the planes were armed with knives. Attorney General John Ashcroft told reporters in the evening that the suspects on Flight 11 were armed that way. And Barbara Olson, a television commentator who was traveling on American Flight 77, managed to reach her husband, Solicitor General Theodore Olson, by cellphone and to tell him that the hijackers were armed with knives and a box cutter.

In all, 266 people perished in the four planes and several score more were known dead elsewhere. Numerous firefighters, police officers and other rescue workers who responded to the initial disaster in Lower Manhattan were killed or injured when the buildings collapsed. Hundreds were treated for cuts, broken bones, burns and smoke inhalation.

But the real carnage was concealed for now by the twisted, smoking, ash-choked carcasses of the twin towers, in which thousands of people used to work on a weekday. The collapse of the towers caused another World Trade Center building to fall 7 hours later, and several

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Awaiting the Aftershocks

Washington and Nation Plunge Into Fight With Enemy Hard to Identify and Punish

By R. W. APPLE Jr.

WASHINGTON, Sept. 11 — Today's devastating and astonishingly well-coordinated attacks on the World Trade Center towers in New York and on the Pentagon outside of Washington plunged the nation into a warlike struggle against an enemy that will be hard to identify with certainty and hard to punish with precision.

News Analysis

The whole nation — to a degree the whole world — shook as hijacked airliners plunged into buildings that symbolize the financial and military might of the United States. The sense of security and self-confidence that Americans take as their birthright suffered a grievous blow, from which recovery will be slow. The aftershocks will be nearly as bad, as hundreds and possibly thousands of people discover that friends or relatives died awful, fiery deaths.

Scenes of chaos and destruction evocative of the nightmare world of Hieronymus Bosch, with smoke and debris blotting out the sun, were carried by television into homes and workplaces across the nation. Echoing Franklin D. Roosevelt's description of the attack on Pearl Harbor as an event "which will live in infamy," Gov. George E. Pataki of New York, a Republican, spoke of "an incredible outrage" and Senator Charles E. Schumer of New York, a Democrat, spoke of "a dastardly attack."

But mere words were inadequate vessels to contain the sense of shock and horror that people felt.

As Washington struggled to regain a sense of equilibrium, with warplanes and heavily armed helicopters crossing overhead, past and present national security officials earnestly debated the possibility of a Congressional declaration of war — but against precisely whom, and in what exact circumstances? Warships were maneuvering to protect New York and Washington. The North American Air Defense Command, which had seemed to many a relic of the cold war, adopted a pos-

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MORE ON THE ATTACKS

New York Times, September 12, 2001

tagon in Washington, auf das fast zeitgleich ein Anschlag verübt worden war. Doch auch hier war der Einschlagsort nur als Sachschaden und aus der Distanz zu sehen. Im Kern nichts anderes boten die Bildschleifen im Fernsehen, die viele in den Stunden und Tagen nach den Anschlägen wie gebannt verfolgten, obwohl es wenig Neues zu sehen gab.

Die Spurensuche nach bildlichen Mustern und ihren Abweichungen gehört zum Kerngeschäft der Kunstgeschichte. Kein Kunstwerk entwickelt seine Wirkung im echolosen Raum. Man braucht eine Folie, um Ungewohntes und Überraschendes als solches überhaupt erkennen zu können. Bilder vom Terror sind hier keine Ausnahme. Das Besondere an den Aufnahmen vom 11. September 2001 war nicht, dass sie etwas noch nie zuvor Gesehenes zeigten, sondern dass sie in einem zentralen Aspekt vom üblichen Muster abwichen. Was das war, hat der Historiker Gerhard Paul treffend auf den Punkt gebracht, als er feststellte, dass auffallend viele Bilder in Umlauf kamen, die das Ereignis „in die bekannte Ikonographie des konventionellen zwischenstaatlichen Krieges" überführten und so „zugleich den wieder gewonnenen Selbstbehauptungswillen und den patriotischen Siegeswillen der Amerikaner über das unbekannte Böse" symbolisierten.[2] Das berühmteste Beispiele dieser Art ist vielleicht Thomas E. Franklins Foto von Feuerwehrleuten (Abbildung 2), die bereits wenige Stunden nach dem Anschlag eine US-amerikanische Flagge auf Ground Zero hissten. Das über Associated Press verbreitete Bild war schon am folgenden Tag auf den Titelseiten zahlreicher amerikanischer Zeitungen zu sehen und bald in der ganzen Welt. Rasch wurde deutlich, dass es sich hier, ob bewusst oder unbewusst, um ein Zitat einer früheren Bildikone aus dem Zweiten Weltkrieg handelte: Joe Rosenthals Aufnahme von US-Soldaten, die am 23. Februar 1945 eine Fahne auf der von den Japanern zurückeroberten Pazifikinsel Iwo Jima aufstellten. So wurde früh schon militärisch konnotiert und mit Sieg und Niederlage assoziiert, was zunächst vor allem eine enorme innenpolitische Herausforderung war.

2 Gerhard Paul, *Bilder des Krieges – Krieg der Bilder: Die Visualisierung des modernen Krieges* (Paderborn: 2004), 448.

Thomas E. Franklin, „Firefighters Raising the Flag at Ground Zero," New York, September 11, 2001. © *The Record* (Bergen Co., NJ)/Getty Images.

Vor dem Hintergrund der langen Tradition von Kriegsbildern, in der Gerhard Paul die Fotografie von Franklin verortet, mag diese Form der patriotischen Selbstbehauptung vielleicht nicht erstaunlich sein. Im Kontext des Terrors aber war sie beispiellos, denn nie zuvor hatte Kriegsrhetorik hier in dieser Weise in Wort und Bild eine Rolle gespielt. Auch bei den weiteren Anschlägen von *Al Qaida* in Europa zu Beginn des 21. Jahrhunderts gab es keine entsprechenden Reaktionen. In den USA aber wurde nach dem 11. September 2001 durch die patriotische Heroisierung der Rettungskräfte der Krieg als Gegenschlag vorstellbar und mit der militärischen Intervention in Afghanistan im Herbst 2001 und im Irak 2003 schließlich auch realisiert. In Großbritannien hingegen stand nach den U-Bahn-Anschlägen in London vom 7. Juli 2005 vor allem der Zusammenhalt der Gesellschaft im Mittelpunkt der Selbstbehauptungsbilder. Das Bild, das hier zur Medienikone wurde, zeigte ein Opfer mit Gaze-Maske, dem ein Passant am Ausgang der Station *Edgware Road* umsorgend zu Hilfe gekommen war. Metaphern des Krieges gab es keine, denn im Unterschied zu den New Yorker Anschlägen waren die meisten Täter Briten, so dass eine militärische Lösung ohnehin nicht in Frage kam. In Spanien wiederum herrschte nach den Bombenexplosionen auf Madrider Bahnhöfen vom 11. März 2004 politische Konfusion. Die Regierung machte zunächst die baskische Terrororganisation *ETA* für

die Anschläge verantwortlich, doch es dauerte nicht lange bevor bekannt wurde, dass auffällige Indizien in eine andere Richtung wiesen. Ohne klare politische Linie und ohne ein konturiertes Feindbild gab es am Ende auch keine einheitliche, identitätsstiftende Narration wie in New York oder London und somit auch keine einschlägige Medienikone. Erst im Vergleich der jeweiligen Bildberichterstattungen kommen entscheidende politische Unterschiede zum Vorschein, die gerade wegen des gemeinsamen Rahmens – Ansichten der Zerstörung, der kollektiven Trauer und der Rettungs- und Sicherheitsdienste im Einsatz – im Zuge der jeweiligen Ereignisse nicht wahrgenommen wurden.

Bedeutung ist bei Bildern selten offensichtlich, Überraschung ihr Geheimnis. Was in der Plötzlichkeit ihres Auftretens unterzugehen droht, taucht häufig im Kontext anderer Bilder und als unerwartete, manchmal minimale Abweichung von einem Muster wieder auf. Die Folie ist historisch gewachsen und formt einen Erwartungshorizont, dessen Unterbrechung erst eigentlich Erkenntnis stiftet. Entsprechend ist in der Regel nicht der Augenblick der Betrachtung für das Verständnis ausschlaggebend, sondern der langsame Blick von der Seite und aus der Tiefe der Geschichte. Das gilt auch für Bilder des Terrors in den westlichen Medien, obwohl oder gerade weil sie uns jedes Mal wieder und aufs Neue wie ein Schlag treffen.

Urweizen

Fabian Kraemer

On June 18, 1906, a young agronomist and self-fashioned botanist with a sturdy physique, the Romanian-born Zionist Aaron Aaronsohn (1876–1919), made a surprise discovery. He had returned to the northern part of Galilee earlier that month to search for specimens of a plant whose significance for the history of human civilization could not be overestimated: *Triticum dicoccum* var. *dicoccoides*, or *Urweizen*, the wild progenitor of cultivated wheat. His attempt to locate it in 1904 had failed. And were it not for a group of German botanists whom he met in Berlin in 1905 and who had asked him to find the plant, he might not have picked up the thread of his quest again.[1]

But on that particular Monday in June, Aaronsohn happened to be preoccupied with a different (albeit related) question. He was in the vineyards of the Jewish settlement Rosh Pina trying to prove to his travel companion and friend, the agronomist M. Bermann, that the area had its origin in the Eocene epoch, when a solitary plant growing in the crack of a nummulitic rock caught his attention. It was the fabled *Urweizen*. This finding caused quite a stir both for historical and political reasons since it constituted fresh evidence that the cultivation of wheat and other grains originated in the region.[2]

Aaronsohn's account strikes the reader as strangely familiar because it reiterates a *topos*: that of the serendipity of the scholar or scientist who chances upon something when least expected. Dusty drawings by a famous painter found on a cupboard in an otherwise well-catalogued collection or an anomaly encountered in experimentation—narratives of serendipitous discovery are legion. But almost 200 years elapsed after the inception of the term before it became a widespread narrative device and a template for lived experience among scientists. Why?

1 Aaron Aaronsohn, "Über die in Palästina und Syrien wildwachsend aufgefundenen Getreidearten," *Verhandlungen der k.k. zoologisch-botanischen Gesellschaft in Wien* 59 (1909): 485–509, on 491–492. See also for the following reference to *Urweizen*. The author extends his heartfelt thanks to Donna Bilak and Dana von Suffrin for their insightful comments on earlier drafts of this article.

2 Most recently on Aaronsohn and his discovery see Dana von Suffrin, *Pflanzen für Palästina! Otto Warburg und die Naturwissenschaften im Jischuw, 1900–1930* (PhD. diss., Ludwig-Maximilians-Universität München, 2017).

It was the English author and Whig politician Horace Walpole (1717–1797) who invented the term. He introduced it in a letter to his namesake and long-term correspondent Horace Mann, dated January 28, 1754, drawing on his memory of "The Three Princes of Serendip," a medieval detective story about three princes who hunt down a stolen camel (Walpole misremembers it to be a mule).[3] It is key to Walpole's neologism that throughout the narrative, the princes are keen observers *and* chance upon discoveries of different types, which occur "by accident and sagacity." This inspired Walpole to create the word "serendipity" to characterize the sort of luck that had just enabled him to make a "critical discovery" about the arms of the Capello family in an old book on Venetian heraldry.[4]

It is arguably due to its double nature that academics eventually came to find this concept attractive. If serendipity only comes to the aid of the knowledgeable, then it allows you to be lucky *and* to deserve being so at the same time. But while the role of chance in research was discussed intensely throughout the nineteenth century, the term "serendipity" came to be regularly used in the sciences and in writings about science only from the mid-twentieth century onward, which warrants an explanation.[5]

One reason lies in the traits of the term's inventor: Walpole made a point of stressing that he invested no real work in any of his pursuits. For this and other reasons, he did not have a good reputation with the early Victorians. It was only in 1833 that his correspondence with Horace Mann was first published, and by then a negative pattern of critical reaction to his letters had been established. They were at best considered amusing monuments of their author's wit but, like their author more generally, hardly ever taken seriously. It was only

3 See "A Short History of the Word 'Serendipity,'" *Interesting Literature: A Library of Literary Interestingness*, last modified January 28, 2015, accessed August 10, 2017, https://interestingliterature.com/2015/01/28/a-short-history-of-the-word-serendipity. On Walpole's encounter with the tale, see Robert King Merton and Elinor Barber, *The Travels and Adventures of Serendipity: A Study in Sociological Semantics and the Sociology of Science* (Princeton, NJ: 2004), 1–21.

4 Horace Walpole to Sir Horace Mann, January 28, 1754, in *The Yale Edition of Horace Walpole's Correspondence*, ed. W. S. Lewis (New Haven, CT: 1937–1983), 20:407–411.

5 On the entire paragraph, see Merton and Barber, *The Travels*, 41–46 and ch. 7; on the following paragraph, see chs. 3 and 4.

around 1870 that critical opinion became more favorable. And this also affected the reception of Walpole's neologism, "serendipity". It was late-Victorian collectors and literary men on the fringes of professional academe who started adopting serendipity into their vocabularies—and into their practices, as it were.

But it never ceased to be problematic. Several more decades elapsed before scientists followed suit because the concept of "serendipity" seemed too whimsical for professional researchers. Against the backdrop of a prevalent empiricist methodology that considers discoveries as a key to the progress of science, serendipity needs careful policing.[6] It is for this reason that many authors who relate a case of serendipity of their own stress at the same time that serendipity does not pay surprise visits to just anyone. In the words of the microbiologist Salvador E. Luria (1912–1991), serendipity is "the chance observation that comes falling on a receptive eye."[7]

Aaronsohn is no exception. The narrative of his unexpected discovery makes up but a short passage in a lengthy article.

> Now, on June 18 I was in the vineyards of the Jewish agricultural colony Rosh Pina with my loyal and always helpful friend and travel companion M. Bermann to prove to him that the area was of Eocene origin, when I noticed a solitary cereal plant in the crack of a nummulitic chalk rock. Upon first sight, it looked like a type of barley but upon closer inspection it turned out to be a *Triticum*, the rachis of which was brittle and the small spikes of which became loose when shaken even very softly.[8]

The other parts of the text leave no space for doubt about their author's learning, his practical ability as a biologist and agronomist, and the diligence with which he scoured the region.

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6 Cf. Merton and Barber, *The Travels*, ch. 7; Lorraine Daston, "Are You Having Fun Today? Review of The Travels and Adventures of Serendipity: A Study in Sociological Semantics and the Sociology of Science by Robert Merton and Elinor Barber," *London Review of Books* 26, no. 18 (2004): 29–31.

7 Salvador E. Luria, "The T2 Mystery," *Scientific American* 192, no. 4 (1955): 92–98, on 92.

8 Aaronsohn, "Über die in Palästina und Syrien," 492; all translations are the author's.

Finally, he left unmentioned that it was not in fact he who first spotted the isolated *Urweizen* specimen but Bermann. In another article, aimed less at his scientific than at his Zionist community, he states, "Mister Bermann, whom I made aware of the plant's characteristics, found the plant here {in the vineyards of Rosh Pina; F. K.} first."[9] Aaronsohn had prepped him so well that the latter was sagacious enough to find the plant in a model serendipitous situation: when neither of them was looking for it.

9 Aaron Aaronsohn, "Die Auffindung des wilden Emmers (Tritium Dicoccum) in Nordpalaestina (Vorläufige Mitteilung)," *Altneuland* 3, nos. 7–8 (1906): 213–216, on 214.

Unfassbar

Katja Krause

(Albert dem Großen nachempfunden)

Nach der Komplet im Kölner Chorgestühl saß Albert tief versunken ins Gebet.

A: Schwach war meine Einsicht, groß mein Wissensdrang
Dich, o Herr, zu fassen, dass ich Deiner hab.
Furchtlos griff ich zu! Deinem Buch des Lebens rang
Ich durch die Zeiten alle Wahrheit ab.

Philosoph bin ich! Von Profession kann
Ich die Welt erschließen mir in voller Pracht.
Derbei muten Geistes Grenzen reglos an,
Deine Dignität entzieht sich meiner Macht.

Und doch! Du bist doch Der, Der fügte alle
Menschenleben nach Seinem Angesicht und
Zu Sich hin. Auch nach dem Sündenfalle

Verloren wie ich war, unfähig jeden
Wortes und der Vernunft, gabst Du mir Mund
Und Aug' Dich zu bestaunen, edensgleich.

Als fast wie aus dem Nichts Epimetheus erschien und sprach ihn an.

E: Mein Magister, großer Albert, bitte lehre auf der Stelle mich die Wahrheit! Dieser Tag darf niemals enden ehe du mir nicht erhellst die unlösbare Frage, die ich habe.

A: Epimetheus, was auf dieser Welt kann es nur diesmal sein, das dich nicht schlafen lässt zu später Stunde?

E: Erinnerst du dich, Albert, großer Wissender, an das, was du uns letzten Sommer lehrtest?

A: Worauf genau beziehst du dich, Epimetheus?

E: Auf Folgendes: Es notierte ganz erfahren dereinst Adelard von Bath in seinen *Fragen zur Natur* an seinen Neffen: „Was erstaunt dich nur an diesem einen Ding so ausgesprochen? Wieso bist du so verwundert und warum nur so perplex? {…} Deine Seele, voll und ganz erfüllt vom Staunen in Ermangelung der Kenntnis, wenn sie nun aus großer Ferne voll der Ehrfurcht den Effekt aller Objekte untersucht ohne dessen Grund mit zu bedenken, hat sie nie sich ihrer Aporie befreit. Doch genau schau hin und bedenke die Gegebenheit, schlage Gründe vor; und dein Staunen über den Effekt wird sehr schnell weichen."[1] Oh Magister, lehrtest du uns dieser Tage denn nicht ähnlich teure Dinge über Aristoteles? Gleich am Anfang seines Buches zu der ersten Wissenschaft schrieb der Philosophenkönig, dass wir zu Beginn des Wissensweges staunen, und dass dieses Staunen unsern Eifer für die Weisheit setzt in Gang. Sowie jedoch wir um die Gründe der Objekte wissen, erfolgt alsdann, was Adelard von Bath an seinen Neffen niederschrieb, und werden wir dann sein ganz ohne *admiratio*?

A: Ganz Recht hast du mit dieser Frage, eifriger Epimetheus. Doch sollst du mitbedenken zweierlei: Vergiss das Ziel des Wissens nicht, das ich dich lehrte um die Weihnachtszeit. Vermische nicht in deinem Denken die erstgenannte Wissenschaft mit der, die ganz und gar die höchste ihrer Zunft darstellt.

E: Beide Dinge steigen derzeit mir nicht in Erinnerung. Aber sehnlichst bitt' ich dich, Magister Albert, lehre mich!

A: Meinetwegen. Zunächst die Konflation, die schwerer wiegt als dein Vergessen. Am Anfang jedes Wissensweges steht die *admiratio*. Doch sollst du mitbedenken, dass sie auch an dessen

1 Adelard von Bath, *Conversations with His Nephew: "On the Same and the Different," "Questions on Natural Science," and "On Birds,"* hgg. und übers. C. Burnett mit I. Ronca, P. Mantas España, und B. van den Abeele (Cambridge, UK: 1998), 202–204. Meine deutsche Übersetzung des Textes ist frei angefertigt, um dem Rhythmus der Päon-Prosa gerecht zu werden.

Ende steht. Der Unterschied ist der, dass das Objekt ein jeweils and'res ist. Fragt der Forscher der Natur nach Pflanzen, Sternen, Donnerblitz, ist der erste Grund schlechthin das Objekt des strengen Denkers über Gott. Mit dem Wissen, welches anbricht bei den Sinnen, ist's unmöglich Gott zu greifen. Daher bleibt uns nur zu staunen über Ihn als Gegenstand, ohnedies wir längst erkannten alle Gründe dieser Welt. Mag dies Staunen, welches einst in uns entfachte unsern Wissensdrang, auch erloschen sein; jenes Staunen über Gott jedoch wird nie vergeh'n. In der Tat! Wird nicht die Wissenschaft vom Herrn bestimmt als Forschen, das nur allergrößtes Staunen bringt, und dies noch tut ganz ohne Unterlass? Daher hat der Philosoph mit seiner Weisheit nicht das letzte Wort.

E: Diese Worte leuchten ein mir in der Tat, oh Meister Albert.

A: Voran, voran, Epimetheus! Vergessen lass uns nicht, dass das Ziel des Wissens hier liegt im Erwerb des Intellekts. Der Philosophen alle Großen haben dies durchweg erkannt. Ja, so steht fest: Mit jedem Allgemeinbegriff, den wir erworben uns vollends, wächst heran ganz unbegrenzt in uns das Licht des Intellekts. Es wird stärker jeden Tag, dass wir befreien uns vom ratenweisen Denken dieser Welt, und eines Tages bar des Zeitverzugs erfassen instantan des Herren *Opus*, Gottes Meisterstück. Und so gibt es wahrhaft letzter Weisheit keine, ohne Eintracht zwischen Platon und beileibe Aristoteles. Alles and're wäre Bruchwerk, Strohhalm, nach-gedacht! Doch das Staunen über Gott erreicht auf diese Art des Wissens noch nicht seinen letzten Schluss. Ganz im Gegenteil! Denn jener Intellekt, der so erworben schaut die Welt, verlangt vielmehr nach Wissen uferloser Art – nach Gott allein. Ja, so kann die letzte Lösung uns'res Staunens nur ereignen sich in der Vollendung, die die höchste Wissenschaft uns weist.

E: Großer Albert, mein Magister, danke, weiser Mann. Ihr habt mir des Intellektes Aug' geöffnet ganz und gar. Und so kann ich jetzt beruhigt das Aug' des Körpers schließen gehen und begeben mich zur Ruh in dieser Nacht.

A: Noch nicht ganz, Epimetheus, nicht bevor du Folgendes bedenkst.

Da sein Schüler nun der Lösung ward gewahr, bot Albert mahnend ihm dies Fazit dar.

Begeh' den Weg des Staunens und weiche
Niemals davon ab. Erwirb' der Weisheit
viel, die dir im Hier zum Glück gereiche,
und die dich führend, sanft ins Licht befreit.

Trotz Glanz und menschlicher Vollkommenheit
Wird sich dein Staunen über Gott bewahren,
wirst du im Streben, Sehnen Drang erfahren,
dass Er dir bietet dauerhaft Geleit.

So muss Er letzten Endes dich reißen
Aus der Welt, muss das, was Er verheißen,
dir kundtun klar, befreit. Muss schauen lassen

dich, Sein Sein mentalen Auges fassen.
Zum Hier steht dies in keinerlei Vergleich.
Bei Ihm, da ist das wahre Himmelreich.[2]

2 Zentrale Textpassagen zu *admiratio* finden sich in folgenden Werken von Albertus Magnus: *Metaphysica*, XI.2.35 (Ed. Colon. XVI/2, 527.52–54); *S. Dion. Ep.*, ep. 7 (Ed. Colon. XXXVII/2, 505.6–43); *S. Eth.*, X.16 (Ed. Colon. XIV/2, 774.80–775.13); *S. theol.*, I prol. (Ed. Colon. XXXIV/1, 1.5–4.14). Zentrale Passagen zum Ziel der menschlichen Erkenntnis und zum Verhältnis der Philosophie zur Theologie finden sich in *S. I Lib. Sent.*, I.1 (Ed. Colon. XXIX/1,10–18); *De anima*, III.3.6–11 (Ed. Colon. VII/1, 214.83–223.38); *De anima*, III.3.13 (226.53–59); *Metaphysica*, I.1.5 (Ed. Colon. XVI/2, 7.83–8.4); *Metaphysica*, II.2 (93.81–94.6); *Metaphysica*, XI.3.7 (542.25–29); *De intellectu et intelligibili*, II.6 (Ed. Borgnet IX, 513a); *S. theol.*, I prol. (Ed. Colon. XXXIV/1, 3.29–47); *S. theol.*, I.1.1–6 (5–23).

Peculiar Expectations

Richard L. Kremer

Back in the 1950s, when history of science was a smaller, more familial discipline, referee reports could be blunt, as when T. S. Kuhn wrote *Isis* editor Harry Woolf, "Harry—you were a bastard to send this to me. … I don't know altogether what to say to you about it. After a good deal of wrestling with my soul … I conclude it is a fundamentally silly piece. Hanson seems unable to separate his own initial surprise at discovering how hard Kepler's job really was … from his {Hanson's} scholarship." The paper, "The Copernican Disturbance and the Keplerian Revolution," had been authored by the philosopher of science N. R. Hanson. Reading Kepler under the guidance of C. S. Peirce, Hanson found himself personally amazed at how the astronomer came upon the idea of elliptical orbits. The other referees were scarcely more temperate. "This paper adds nothing to existing knowledge of the subject" (Edward Rosen); "the author's thesis is not at all novel. … I find no information—aside from the errors—which is not commonplace among historians of astronomy" (William Stahlman). Hanson's paper did not appear in *Isis* (but it did in the *JHI*).[1]

That Kuhn in 1959 disparaged surprise as an epistemic tool for the historian might seem ironic to readers of the famous opening paragraph of *The Structure of Scientific Revolutions* (1962): "I was a graduate student in physics … {when} a fortunate involvement provided my first exposure to the history of science. To my complete surprise, that exposure to out-of-date scientific theory and practice radically undermined some of my basic conceptions about the nature of science." In this case, Kuhn's surprise about science's history led him to write one of the classic books of the twentieth century, whereas according to the *Isis* referees, Hanson's personal surprise about that history led to commonplaces not worthy of publication. In both cases, however, challenges to initial expectations provoked impassioned historical work.

At the same time, several other historians of science announced a momentous discovery with no expression of surprise. In 1957,

1 History of Science Society Papers, Smithsonian Institution Archives, acc. 95–152, box 15. I thank Jay Malone, executive director of the History of Science Society, for granting me permission to examine these editorial records and Amy Ackerberg-Hastings for help with this archival research.

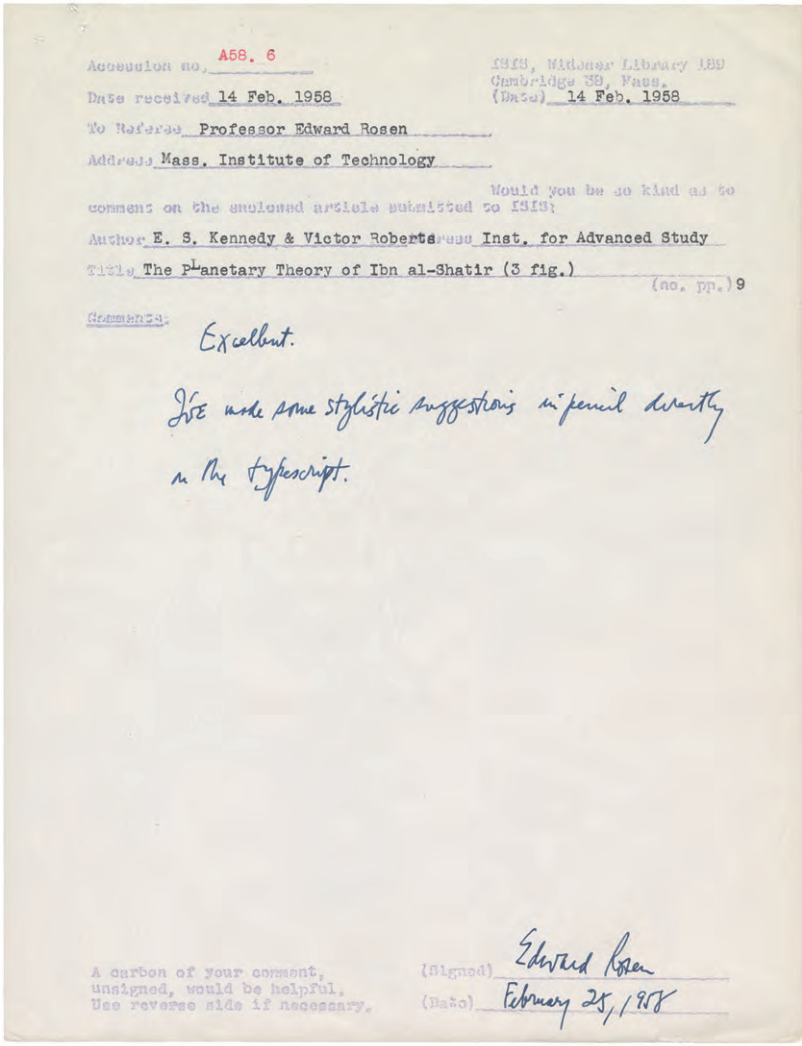
Victor Roberts, an Iranian student of E. S. Kennedy at the American University of Beirut, published a short note in *Isis* (48, 428–432), claiming that the lunar theory of a fourteenth-century Damascene astronomer, Ibn al-Shāṭir, "is identical with that of Copernicus." The referee reports for this article have disappeared, but surviving correspondence between Kennedy and O. Neugebauer illuminates some of the expectations in play.[2]

In 1954, Kennedy, teaching a history of math class, assigned Roberts to work on Ibn al-Shāṭir's planetary theory. By December 1954 the two had "some results to announce … the solar model uses an epicycle … my man … is now looking through the manuscript to see if any observational data are given justifying the new model." In February 1955: "The enclosed slip of paper {not preserved} gives essentially al-Shāṭir's lunar model. It is suppo{s}ed to be based on observational data the which {*sic*} he has written up in a previous treatise. … I think the former is non-extant, but we must check in Brockelman." Neugebauer replies, "As to ibn al-Shāṭir it seems to me you should sent {*sic*} a short paper about it to the 'Centaurus.'" No mention of Copernicus.

The next month, however, Kennedy began thinking about transmission: "There is no notice we can find of any translation of the work ever having been made into Latin or otherwise, and I would be surprised to find one." In April 1955: "We had a quick look at the diagrams for the other planets, and all of them have more than the usual number of epicycles, hence are not like the Copernican planetary models. I think this supports the natural assumption of Copernicus having worked out his things in ignorance of Ibn ash-Shatir." Now Copernicus is granted independence.

By August 1955 Roberts had sketched al-Shāṭir's Saturn model and drafted an article on the solar and lunar models that Kennedy edited "severely." Kennedy hopes that Roberts can "get the same material for the other planets." In May 1956 Kennedy reports, "We sent off the Ibn al-Shāṭir paper to *Isis,* … Full title is Roberts, V., 'The solar and lunar theory of Ibn al-Shāṭir.'" Note that the title submitted does

2 Neugebauer Papers, Institute of Advanced Study, Princeton, Box 13.



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1958, Widener Library 139
Cambridge 38, Mass.

Date received 14 Feb. 1958 (Date) 14 Feb. 1958

To Referee Professor Edward Rosen

Address Mass. Institute of Technology

Would you be so kind as to comment on the enclosed article submitted to ISIS:

Author E. S. Kennedy & Victor Roberts, Inst. for Advanced Study

Title The Planetary Theory of Ibn al-Shatir (3 fig.) (no. pp.) 9

Comments:

Excellent.

I've made some stylistic suggestions in pencil directly on the typescript.

A carbon of your comment, unsigned, would be helpful. Use reverse side if necessary.

(Signed) Edward Rosen

(Date) February 25, 1958

Rosen's referee report, February 28, 1958. See note 1.

not mention Copernicus. At this point, the Kennedy-Neugebauer correspondence dries up as Kennedy spent a sabbatical year in Princeton with Neugebauer. In the 1957 edition of his *The Exact Sciences in Antiquity* (p. 197), Neugebauer cited Roberts's forthcoming article and announced, without comment, that Copernicus and al-Shāṭir used the "same method" for correcting Ptolemy's lunar model. At some

point, Roberts's article acquired its subtitle: "A Pre-Copernican Copernican Model."

In February 1958, Kennedy and Roberts submitted a second article to *Isis* (50, 227–235), in which they claimed that the "planetary machinery" in Copernicus's *De revolutionibus* "show a remarkable similarity" to those of Ibn al-Shāṭir. "To assume," they concluded, "that the later astronomer operated in total ignorance of the work of his predecessor would be to ask a good deal." The referee reports for this article are extant (figure). The leading Copernicus scholar of the 1950s, Edward Rosen, was exceeding terse: "Excellent. I've made some stylistic suggestions." Slightly less pithily, medievalist Marshall Claggett wrote, "Looks like an excellent piece of analytical work, but rather awkwardly presented." Neither referee expressed surprise at the article's claim; both worried more about writing style than Copernicus's originality.

In the late 1950s, Kennedy flipped from the "natural assumption" that Copernicus had no knowledge of earlier Arabic astronomy to the opposite view, undoubtedly with nudging from Neugebauer. Arguably the leading historian in his generation of the early "exact sciences" (Babylonian, Egyptian, Greco-Roman, and Islamic), Neugebauer expected ideas to circulate. In his notorious 1951 jeremiad on "the study of wretched subjects," Neugebauer wrote that "to the historian of science the transmission of ideas is rightly one of his most important problems" (*Isis* 42, 111).[3] That Copernicus might have borrowed some mathematics from Ibn al-Shāṭir certainly did not surprise Neugebauer. That it surprises some scholars today shows how expectations change. Historians' surprises tell us little about history, much about historians.

3 See also Francesca Rochberg, "The Brown School of the History of Science," in *The Circulation of Astronomical Knowledge in the Ancient World*, ed. John M. Steele (Leiden: 2016), 5–17, on 8.

An Empty Treasury

B. Harun Küçük

In 1970, economic historian Halil Sahillioğlu used the 11-day difference between the lunar and the solar year as an explanation for the financial crises that occurred around 1644 and 1677.[1] Such crises came as very unpleasant surprises, both to the administrators and to those who drew salaries from the treasury, and calendar reform was only one of the tools in the administrative arsenal. Both before and after calendar reform, the empire turned these hard corners by transferring funds from the sultan's inner treasury to the public treasury. And by the second half of the eighteenth century, when the 1677 calendar reform was finally made universal beyond financial matters, the inner treasury had been almost completely drained.

And so, when in 2016 Saudi Arabia switched from the traditional Hijri calendar to the Gregorian calendar in order to cut public spending, it was not the first time a Muslim state introduced a new temporal regime of finance. That honor goes to the Ottoman Empire's 1677 reform, which switched from the lunar calendar to a luni-solar calendar, with the sun determining the year. As the ruler of a Muslim-agrarian state, the sultan collected taxes according to the seasons but paid salaries on a schedule set by the moon, meaning that about every 33 years, state expenditures were a full year behind. After the reform, the financial officers used the *Rumi,* or Roman/Julian calendar, without completely eliminating the Hijri calendar, which continued to coordinate religious observance. Once, with the help of Istanbul's astrological almanac named for the fifteenth-century Sufi Sheik Vefa, they skipped a whole Hijri year: nothing could be more Ottoman than relying on saintly charisma to justify tax collection.

It is hard to lionize tax collectors, but they were certainly among the most reasonable individuals in Istanbul, perhaps also the best of the city in science and scholarship. Long before the treasury had been entirely emptied, bureaucrats were observing financial matters with a cool numeracy. In the 1650s, Ottoman historian, geographer, and accountant Katip Çelebi opined that the state was paying salaries to too many people and that the number of Janissaries on the

1 Halil Sahillioğlu, "Sıvış Year Crises in the Ottoman Empire," in *Studies in the Economic History of the Middle East: From the Rise of Islam to the Present Day*, ed. M. A. Cook (London: 1970), 230–254.

payroll was unreasonably inflated. Other erudite bureaucrats, such as 'Ayn Ali (fl. 1607) and Hezarfenn Hüseyin (d. 1691?) responded to financial woes by sitting down to calculate the imperial budget, also known as the *Canons of the Ottoman State*, without having the luxury of centralized records. The most extreme measure, violently levied emergency taxes, repulsive to any bureaucrat, could permanently damage imperial legitimacy and did in fact lead to the deposition of Sultan Mehmed IV in 1687. But before that, the calendar reform of 1677 came in a year when the public treasury borrowed a whopping 140 million *akçe*, roughly 160,000 English pounds, from the sultan. Not a single *akçe* was ever paid back.

But how did the Ottoman Empire formulate and implement a new calendar when, apparently, it did not have the technologies or the institutions to do so? The entire Catholic Church and innumerable ambitious printers had propped up the proposed Gregorian calendar reform after 1582, but the new Ottoman calendar had neither religious legitimacy nor the benefit of print. When the Ming dynasty was considering calendar reform in the early sixteenth-century, it could rely on the massive Astro-Calendric Bureau that printed and sent out millions of almanacs across the empire. In addition, China had hundreds of thousands of bureaucrats to enforce its temporal regime, compared to far less than 1,000 at the disposal of the Sultan.

The answer was that the reform was implemented very slowly and with the help of a growing number of bureaucrats, who, one by one, demonstrated their astrological talents until the balance of authority finally tipped in their favor in 1662.[2] The astrology-accounting connection went all the way back to the early seventeenth century. The same 'Ayn Ali who had calculated the imperial budget was, for example, also the author of the most popular version of the *Almanac of Sheik Vefa,* which was part tax calendar and part natural

2 Joel Shinder, "Career Line Formation in the Ottoman Bureaucracy, 1648–1750: A New Perspective," *Journal of the Economic and Social History of the Orient* 16, no. 2/3 (1973): 217–237.

astrology.[3] In 1662, Grand Vizier Fazıl Ahmed, who is often credited with creating a centralized financial bureaucracy, had in his winter camp in Belgrade no less than five heavenly practitioners who did the bookkeeping for the campaign and cast horoscopes for the siege of Neuhäusel.

This group included Panagiotes Nikousios (d. 1673), the grand dragoman to the Imperial Treasury and an astrologer of remarkable skill, and İbrahim of Szigetvar (fl. 1660), a tax registrar and the now-well-known translator of Noël Durret's *Nouvelle theorie des planetes* (1635). Fazıl Ahmed's bureaucrats had proven their mettle by out-calculating the sultan's astrologer, Müneccimek Mehmed (d. 1668).[4] İshak Efendi, chief accountant in 1677 and one of the protagonists of reform, was a junior accountant at that winter camp.

The best-known and most common artifacts of the new Ottoman fiscal calendar are the innumerable two-meter-long almanac scrolls of the eighteenth and nineteenth centuries, a nod to the bureaucratic faith that the Ottoman state would last forever.[5] These calendars no longer contained the astrological annotations, pointing to a bureaucratic rationality that prized long-term planning and administrative continuity over fortune and war, thus ensuring Ottoman longevity. The taming of chance created a clearer sense of the future, one with much less room for surprise.

3 B. Harun Küçük, "Early Modern Ottoman Science: A New Materialist Framework," *Journal of Early Modern History* 21 (2017): 407–419.

4 Georges Koutzakiotis, *Attendre la fin du monde au XVIIe siècle: Le messie juif et le grand drogman* (Paris: 2014).

5 Monika Dahncke, "Eine Osmanische Pergamentrolle," *Mitteilungen aus dem Museum für Völkerkunde in Hamburg* 17 (1987): 55–73.

Newton Reads *Micrographia*

Sachiko Kusukawa

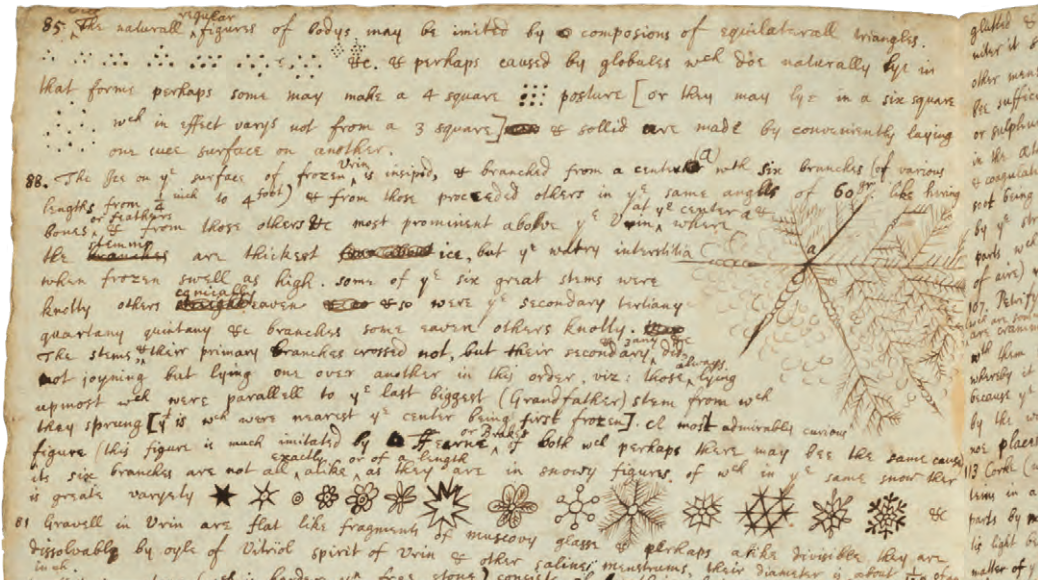
At some point in our training in history of science, we have all come across Newton's ink drawing of a prism experiment in a room, his diagram of the "philosopher's stone," or that disconcerting figure of an eyeball with a bodkin thrust into its underside—the one to which Derek Gjerston felt compelled to add, "The reader is urged not to replicate this experiment."[1] Perhaps less well known is the fact that Newton drew when he read, as he did with Robert Hooke's *Micrographia* (1665). His manuscript notes, better known to Newton scholars interested in his early work on fluxions, include a pen drawing of the figure of frozen urine and snowflakes copied from scheme VIII of Hooke's book. The first line of Newton's note reads,

> The Ice on ye surface of frozen Urin is insipid, & branched from a center (a) with six branches (of various lengths from ¼ inch to 4 foot) and from those proceeded others in ye same angles of 60 degrees, like herring bones and feathers.

In *Micrographia,* Hooke described the figure as branching out of "centre (a)" at the start of the section on frozen urine (88); the taste of the frozen urine as "insipid," and the analogy with feathers is mentioned toward the end (90); the herringbone pattern is mentioned in the next section on figures of snow (92). Newton thus did not copy out Hooke's words verbatim as he read but rather read through chunks of text and then made notes. Hooke, taking into account the thickness of the branches, had pointed out that the angles between the branches were "very neer" but a little less than 60 degrees (89), while Newton jotted down "the same angles of 60 degrees" without qualification. Hooke described (88) the size of these figures as "no bigger than a two-pence, others so bigg, that I have by measure found one of its stems or branches above four foot long," which Newton reduced to "from ¼ inch to 4 foot."

When Newton copied out the image of Hooke's frozen urine, he copied out only the lettering, "a" to indicate the center, from which six branches issued, three of them showing knots in the middle section of the branch (as in Hooke's scheme), which Hooke described in

1 John Fauvel et al., eds., *Let Newton Be!* (Oxford: 1988), 87, 156, 35.



Isaac Newton's reading notes and drawings from Robert Hooke's *Micrographia* (1665). Cambridge University Library, MS Add. 3958, fol. 2v. Copyright © Cambridge University Library (CC BY-NC 3.0).

the text using the keyed letters. Having drawn the knots, Newton presumably didn't need to mark them in the figure for himself. Newton filled in part of the figure (as Hooke had done) to indicate how smaller branches stemmed progressively from the main branches. In denoting these branches and their relationships with each other, Hooke used the letterings ab, ac, ad, qm, st, and so on, and rather cumbersomely described them as "lateral," "collateral," "subcollateral," and "latero-subcollateral" (89). Newton required no further lettering for his grasp of the different levels of branching and instead called them "secondary, tertiary, quartany, quintanay etc." Noting that each branch was parallel to the penultimate branch out of which it grew, Newton called the latter a "grandfather" stem, which neatly encapsulated Hooke's point described in six lines of text. Newton's hand-drawn figure, however, seems to emphasize more the herringbone or feather-like pattern, rather than the strong parallel lines visible in Hooke's image. Newton summarized Hooke's next section about figures of snow in a line, saying that a large variety within the six-branched pattern could be observed in figures of snow. While the "figured flakes" of snow were randomly arranged at the top of scheme VIII in *Micrographia,* Newton rearranged them in a row, perhaps in some order of increasing complexity.

The economy with which Newton parsed this section of the text and the images of *Micrographia* may not surprise us. He did something similar at the top of the same page by reducing Hooke's circles

packed in geometric shapes (85f. scheme VII) into dotted patterns. After all, this is Isaac Newton, whose mathematical acumen is not in doubt, while Hooke was writing for a nonspecialist audience: the king. But it seems worth emphasizing that Newton still thought it worthwhile to copy out some of the figures from *Micrographia* and that this is not the only example where he bothered to do so. Images could capture variety better than textual description, and the act of drawing must have helped him to grasp the images and thus dispense with copying out lettering or the accompanying textual description. Hooke said of the figure of the frozen urine, "The exactness and curiosity of the figuration of these branches, was in every particular so transcendent, that I judge it almost impossible for human art to imitate" (90). Newton concurred: "A most admirably curious figure."

More than half a century ago, Newton's reading notes for *Micrographia* were published as an example of his "strange habit" of note taking, and while the edition included all the diagrams and notations found in the other parts of the manuscript, the drawings in Newton's reading notes were not included. As the editors explained, "We have omitted the sketches which Newton made from Hooke's figures and to which he occasionally refers in lettered points."[2] This omission may have been a financial decision on the part of Cambridge University Press, but it may also represent the historiographical preoccupations of the time.

We are no longer surprised that Newton took reading notes and that such reading notes could include images. Raine Daston incisively pointed us to the usefulness of reading practices in tackling assumptions held about the universality of scientific texts. It is in no small part due to her example and encouragement that the threshold for surprises in history of science has advanced—curiously, admirably and irrevocably so.

2 A. Rubert Hall and Marie Boas Hall, eds., *Unpublished Scientific Papers of Isaac Newton: A Selection from the Portsmouth Collection in the University Library, Cambridge* (Cambridge: 1962), 397, 400.

As Odd as Kangaroos

Nicolas Langlitz

Psychedelics opened the *Wunderkammern* of the scientific mind. At a time when God had long lost the spontaneity that made for the unexpected in the established order of things, the Euro-American discovery of mescaline, psilocybin, and ayahuasca—drugs that Native Americans had long used in shamanic ceremonies—confronted anthropologists, botanists, pharmacologists, psychiatrists, and other scholars with vast inner worlds that bordered on the preternatural. Shouts of surprise resound through this literature. The English physician Havelock Ellis expressed his amazement in the face of an "artificial paradise" he had stumbled upon after eating peyote buttons.[1] Perpetually new kinds of imagery appeared in his field of vision, sometimes a dull, somber richness of color, sometimes glitter and sparkle, once a startling rain of gold, glowing effects, as of jewels, fibrous structures, as of insect wings, objects made of exquisite porcelain, and exotic architectural forms resembling Maori buildings and the carved wooden balconies of nineteenth-century Cairo. Throughout the twentieth century, such gasps of amazement would continue to set many serious scholars on the track to an intellectual demimonde filled with the curiosities and wonders that their colleagues had come to sneer at.

In his address to the Parapsychology Foundation's 1954 annual symposium, Aldous Huxley suggested that both mescaline and hypnosis could serve as vessels to cross the ocean between the Old World of personal consciousness and the uncharted New Worlds where "the naturalist of the mind" could gather his data on "all sorts of creatures at least as odd as kangaroos {…} as they go about their mysterious business."[2] These antipodes of the mind were not just psychologically but also ontologically different. For the exotic beings populating this terra incognita similar to the heavens and fairylands of folklore and religion "exist 'out there,'" the writer maintained.

Huxley amalgamated this modernist appetite for the new with a rearticulation of the Neoplatonic *philosophia perennis,* assuming

1 Havelock Ellis, "Mescal: A New Artificial Paradise,"*Contemporary Review* 73 (1898): 132–133.

2 Aldous Huxley, "The Far Continents of the Mind (1954)," in *Moksha: Writings on Psychedelics and the Visionary Experience, 1931–1963* (London: 1980), 58.

eternal truths shared by all peoples across all times. He attributed this "metaphysic that recognizes a divine Reality," which he considered "immemorial and universal," to Gottfried Wilhelm Leibniz.[3] But the German polymath had borrowed the idea from the Vatican librarian Agostino Steuco's 1540 book *De perenni philosophia.* At the dawn of modernity, the Renaissance theologian did not proclaim a break with the past as the Protestant reformers did when seceding from the Roman Church. At a time when Europeans began to encounter more and more ethnic groups unlike themselves, Steuco explained the corruption of the divine wisdom, in which men in paradise had still participated, by the human race's scattering into all parts of the world. But, in principle, all people, including pagans and Protestants, continued to have access to the same original wisdom.[4] Half a millennium later, when Vedanta yoga began to seep into Huxley's Hollywood, the British intellectual sought to reconstruct the transhistorical and transcultural core of all religions in the form of an anthological potpourri, including mystical thinkers from many different traditions that ranged from Hinduism and Sufism to Christianity and Taoism while ignoring Confucianism and Judaism.[5] His 1953 mescaline experience suggested to Huxley that the drug provided a shortcut to *the* mystical experience as the "highest factor" shared by all spiritual traditions: it temporarily impaired "the cerebral reducing valve" that filtered out biologically useless perceptions but also prevented the finite human mind from communing with the cosmic Mind at Large.[6]

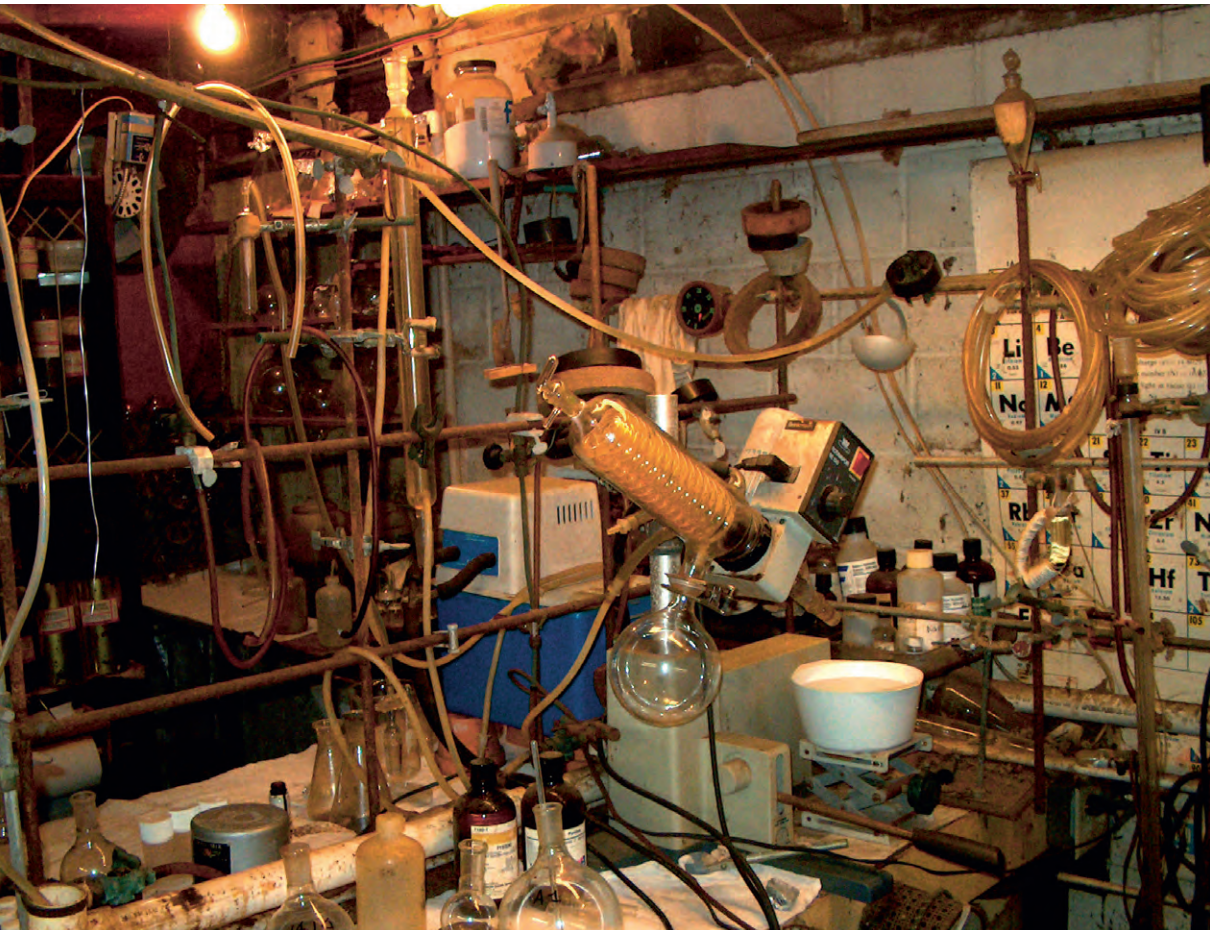
To this day, Huxley's perennial philosophy has left its mark on the psychedelic intelligentsia but also on neuroscientific and clinical research with hallucinogenic drugs, from so-called gating paradigms to psilocybin-assisted psychotherapy for end-of-life anxiety in termi-

3 Aldous Huxley, *The Perennial Philosophy* (London: 1974), vii.

4 Charles Schmitt, "Perennial Philosophy: From Agostino Steuco to Leibniz," *Journal of the History of Ideas* 27, no. 4 (1966): 505–532; Wilhelm Schmidt-Biggemann, *Philosophia Perennis: Historical Outlines of Western Spirituality in Ancient, Medieval and Early Modern Thought* (Dordrecht: 2004), 428–434.

5 Johannes Bronkhorst, "The Perennial Philosophy and the Law of Karma," in *Aldous Huxley between East and West*, ed. C. C. Barfoot (Amsterdam: 2001), 175–189.

6 Aldous Huxley, *The Doors of Perception* (London: 1954), 26.



Shulgin's farm shack laboratory: new psychedelic compounds surprised the chemist with old truths. Photo: N. Langlitz.

nal cancer patients.[7] When psychedelic research blossomed in the underground after the prohibition of the late 1960s, the former industrial chemist Alexander Shulgin invented about 200 new compounds in a shack on his farm in Lafayette, California. He tested each substance in a series of self-experiments, learning especially from those bewildering and sometimes dangerous trips when he experienced effects that diverged from the expected structure/activity relationship.[8] Following Huxley's idea that psychedelics opened the "doors of perception," he suggested, "different drugs open different doors."[9] One day, he ingested 500 mg of mescaline and hit upon the very core of perennialism: "Funny, I'd forgotten that what comes to you when you take a psychedelic is not always a revelation of something new and startling; you're more liable to find yourself reminded of simple things you know and forgot you knew—a seeing them freshly—old, basic truths that long ago became clichés, so you stopped paying attention to them."[10] This sense of surprise by the always-already known exemplifies the very tension between the psychonautic exploration of new frontiers and the perennialist anamnesis of eternal verities that has animated psychedelia since the mid-twentieth century.

7 Nicolas Langlitz, *Neuropsychedelia: The Revival of Hallucinogen Research since the Decade of the Brain* (Berkeley, CA: 2012); Nicolas Langlitz and Anne Kirstine Hermann, "Der Tod, in anderem Licht betrachtet," *Frankfurter Allgemeine Sonntagszeitung*, July 22, 2012.

8 Alexander Shulgin and Ann Shulgin, *PIHKAL: A Chemical Love Story* (Berkeley, CA: 1991), 341.

9 Alexander Shulgin and Ann Shulgin, *TIHKAL: The Continuation* (Berkeley, CA: 1997), xxvi.

10 Shulgin and Shulgin, *PIHKAL*, 262.

Der Lesekasten

Philipp N. Lehmann

In one vignette of his *Berliner Kindheit*, Walter Benjamin describes a didactic device called a *Lesekasten*, a box full of small wooden tiles printed with the letters of the alphabet that could be ordered into different combinations on the slender rails of the open lid. Since its invention by the teacher and pedagogical innovator Johann Peter Hundeiker (1751–1836) in the late eighteenth century, the "reading box" had become one of the most widely used educational tools of literacy training in German primary schools. When Benjamin shared his personal recollection of handling and arranging the wooden tiles as a child, he also described what must have been a shared collective childhood memory—or at least a shared glimmer of recollection—among many of his contemporaries.

For Benjamin, however, the *Lesekasten* was more than one among a wide range of common childhood objects. It was the instrument that formed enduring habits and abilities in him— the "Lesen und Schreiben" that would become one of the central activities of his life. The *Lesekasten* thus becomes a bridge between the child and the adult Benjamin, albeit a bridge that can no longer be walked across. Recollecting the tactile sensation of manipulating the tiles, Benjamin senses a feeling of loss. The hand that once moved the tiles to arrange them hesitantly into words "kann diesen Griff noch träumen, aber nie mehr erwachen, um ihn wirklich zu vollziehen."

The hand's inability to awake and replicate the uncertain *Griff* of the preliterate child contains all of Benjamin's longing and nostalgia for a childhood lost irrevocably. But beyond this wistfulness, Benjamin's reflections also speak to the nature of learning in general and, more to the point, the difficulties—or even the impossibilities—of unlearning and relearning. The last few lines of the vignette leave the *Lesekasten* behind and venture even deeper into early-childhood development: "So kann ich davon träumen, wie ich einmal das Gehen lernte. Doch das hilft mir nichts. Nun kann ich gehen; gehen lernen nicht mehr."

Benjamin's conclusion here is absolute and unconditional: once we have learned, we may recall glimpses of the process of learning, but we will not be able to go back to a state that antecedes the experience of learning; nor can we replicate the learning process in either

Vetter's Sütterlin *Lesekasten*. Photo: R. Herrmann, Typografie.info.

its original or any alternative form. This is not an outlandish conclusion, and it may even seem intuitive. It is almost impossible to will ourselves back into a state of ignorance and, what may be even more difficult, back into a state before the acquisition of a particular ability or piece of knowledge has impacted other parts of our activities and our thinking. While learning enriches, it also erases.

Despite the apparent impossibility, unlearning and relearning may be among the most important (if rare) skills of any scholar and, in particular, the historian. To avoid going down ever-narrower paths of specialization and fragmentary history, to avoid seeing the current path as the only feasible one, the historian has to be unafraid to go back to the drawing board, to tackle the big issues and topics anew, from alternative perspectives, with different time frames, and with new methods and collaborations. Without forgetting what has come before, the historian has to unlearn the prevailing ways to think and write in order to relearn to think and write in ways that open new avenues for research, pose new questions, and point toward new answers. It is only then that the reader will experience that moment of wonder and surprise, which is ultimately nothing other than the recognition that some authors do come close to achieving the impossible. These authors, rare as they may be, allow us all to believe that we may, after all, be able to learn to walk, to read, and to write all over again.

Brian and the Air Pump

Daryn Lehoux

The 2014 BBC Two television program *The Human Universe* ran a segment in which host Brian Cox visited NASA's Space Power Facility outside Sandusky, Ohio, in order to run a simple experiment. The crew hoisted a bowling ball and a clump of feathers up to a height and then released them, with entirely predictable results. But a second run of the same experiment changed a single one of the variables: it removed all the air from the massive chamber. In this second experiment, the bowling ball and the feathers, in the absence of a resistant medium, fell in exactly the same time and struck the target together. Although this outcome should be expected in a post-Galilean universe, the observers in the video—filmmakers, NASA technicians, and spectators alike—universally expressed both surprise and delight at the outcome. My question is this: What, precisely, is *surprising* about an experiment that produces entirely predictable results? When everyone in the room and everyone watching at home knew—*absolutely knew*—what would inevitably happen under the vacuum's test conditions, what is it that still manages to trigger surprise at the result?[1]

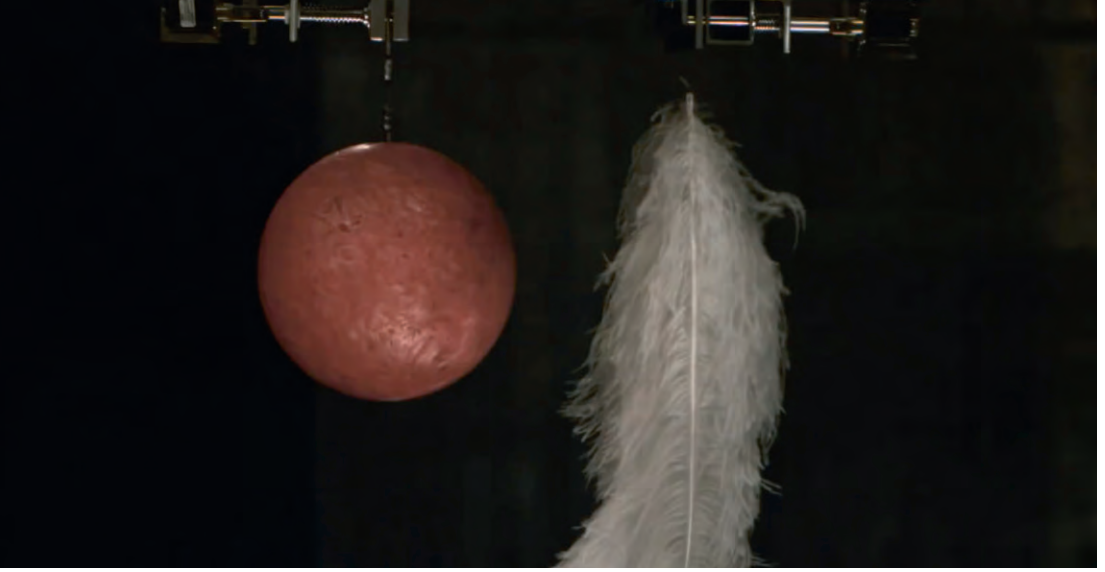
The clip is at https://www.youtube.com/watch?v=E43-CfukEgs.[2]
(Take a minute now, it's fantastic.)

To begin, there are three moments in particular that I would like to highlight in the video.

(1) [2:36]
"We are go for drop."

1 I find it particularly astounding since I would expect many of the crew to have seen the experiment as performed *on the actual moon* by the Apollo 15 crew in 1971. See "Apollo 15 Hammer and Feather Drop," YouTube video, 1:22, posted by "Stop And Think," April 27, 2009, https://www.youtube.com/watch?v=-4_rceVPVSY. I note that the Apollo crew is unfazed. Perhaps astronauts are a different breed of human. Many thanks to Jay Foster here and throughout.

2 BBC Two, "Brian Cox Visits the World's Biggest Vacuum Chamber—Human Universe: Episode 4 Preview—BBC Two," YouTube video, 4:41, posted by "BBC," October 24, 2014. The images on p. 234 and 235 are stills from this video, at minute 2:52 (release) and ca. 3:24 (landing).



It's amazing just how *seriously* everyone takes the experiment. They do a countdown! Yes, it makes for good television, but this is also a NASA control room. I suspect this is just how they do everything. On the other hand, keep in mind how big the machine is that they are working—how much power does it take to remove 800,000 cubic feet of air from a (now highly depressurized) chamber? Look at the size of that thing. Just *two grams* of matter by the end—this amazes me.

(2) {2:52}
Watch the feathers as they are released in the vacuum. The barbs actually move—on semiplume feathers these structures are so sensitive as to show us what pure *inertia* looks like. Lovely. But then something strange happens. Is it just me, or does the clump of feathers actually *spread* as it falls? (Compare their relative spreads at 3:00 and 3:15.) How much resistance could a few molecules of air offer? Could it be due to gravitation to the massive walls of the chamber?? *What,* I want to shout at my screen, *could possibly be causing that?!?*

(3) {3:24}

Technician 1:	They came down *exactly* the same. Wow!
Brian Cox:	Look, look, look. Look how they hit. Right there. {Laughs delightedly}
Technician 2:	*Holy Mackerel!!*
Brian Cox:	*Exactly.* Exactly the same.
Technician 2:	Feathers don't move. Nothin'.
Brian Cox:	Look at {vocal fry} thaaat. That's just … *brilli-ant.*

I will let this section speak for itself about the vanishing line between surprise, wonder, and awe. It makes for fascinating viewing. Again: everything in the vacuum chamber happened exactly as everyone knew it would.

But now a question: Does the video prove Galileo at the expense of old Aristotle? My first history-of-science teacher said that our instincts about physics were *fundamentally Aristotelian*—he was wrong, but it got me thinking. It is a commonplace to characterize Aristotle's law of falling bodies thus:

(L1) The speed of fall is proportional to a body's weight.

Where many accounts still miss the point, though, is that weight is only one variable for Aristotle. The medium also matters.

At the same time, however, Aristotle doesn't actually have a lot to say on the relationship between weight and speed of fall. He occasionally says something vague about weight, speed, and "proportionality," but in only two passages does he say that speed and weight are, to be specific, *inversely* proportional:

(L1a) For two bodies, the times of fall from the same height will have the inverse proportion that their weights have. (*De caelo* 273b32.)

What is assumed throughout is that everything happens *in the same medium*. Turn to the *Physics,* and we get a second law:

(L2) The speeds of a body through two different media are inversely proportional to the densities of the media. (215b1 ff.)

And the relative densities of the two media at the NASA facility are:

30t : 2g (of air) : : 30,000,000 : 2

So, both bodies should fall 15 million times faster in the vacuum than they did in the air. Their relative speeds due to (estimated) weight give us 7000 g : 100 g, or 70 : 1. Now, in the air, the bowling ball takes two seconds to reach target, whereas the feathers take more like nine (Aristotle's in trouble!). In the vacuum of space, 15,000,000 times thinner than the air, Aristotle should, following (L2), expect their fall times to be

Bowling ball: 0.000 000 13 sec.

Feathers: 0.000 000 6 sec.

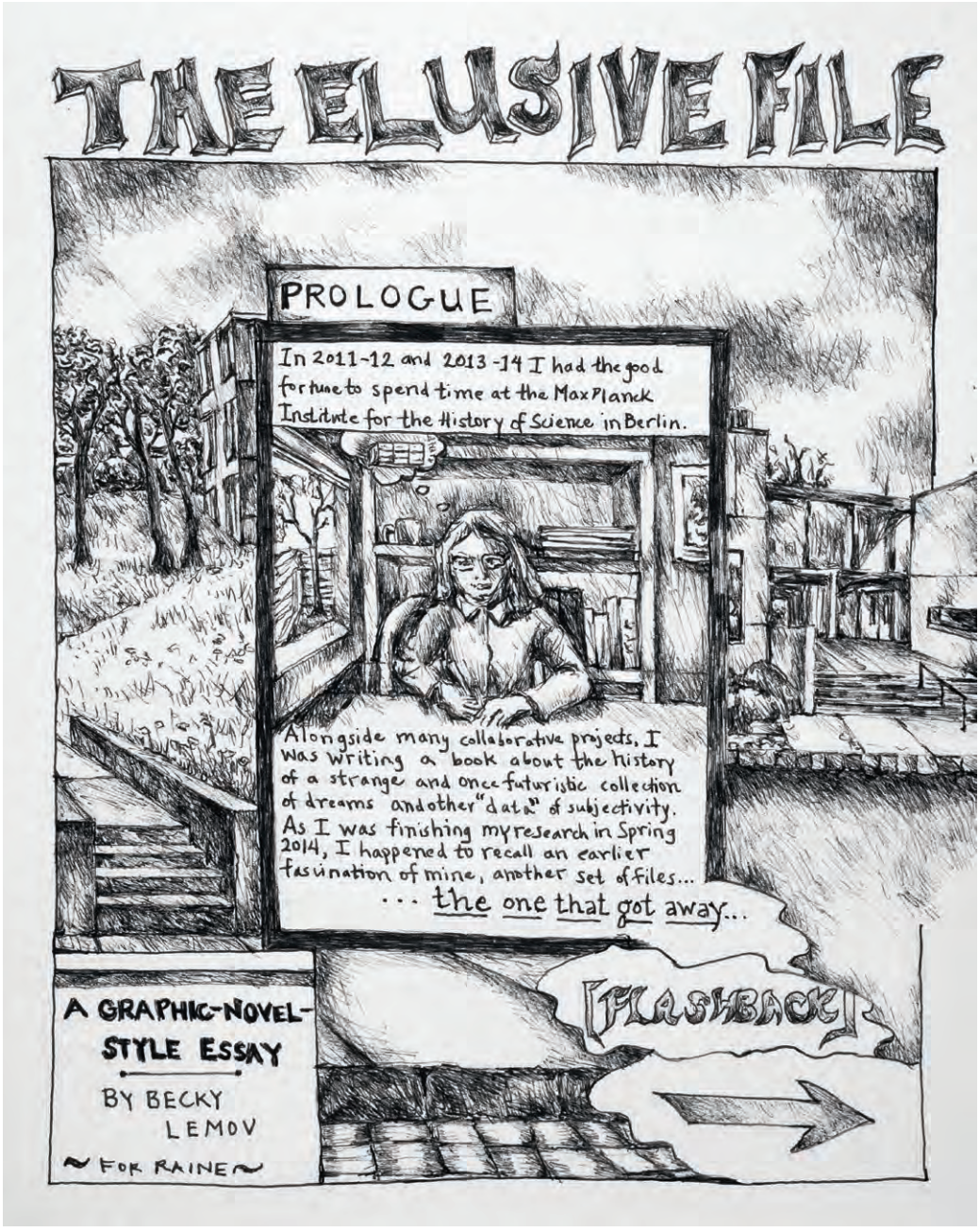
This is a difference of just 47 ten-millionths of a second—nowhere near enough to be detectible by the eye. The conclusion? Aristotle *should have expected* the bowling ball and the feathers to hit the target together over this distance. And now our suspicions are raised. We note that the BBC *never* shows that fall in real time; even the technicians are only ever shown watching in slow motion.[3] So who knows whether this didn't happen exactly as Aristotle might have predicted? And I bet the real-time version of feathers falling in a vacuum was even more delightful than what the BBC showed us. Too bad for television tropes and dramatic music, I suppose.

Epilogue: a blue-sky wish. Look at the ceiling shot at 3:54. They did their experiment from merely partway up. Shouldn't someone go back and try it from the tippy top? Maybe we don't know *everything* about what would happen after all. (Those spreading feathers are still bothering me.)

3 There is a quick glimpse of what *looks* like real time at 4:15–17, but if you pay attention you can see that chicanery is afoot! Watch the barbs on the feathers: this is a reuse of the slow-motion nonvacuum shot from 1:40 (oh, BBC!). Can we really trust that 4:16–17 is not similarly hijinksical?

The Elusive File

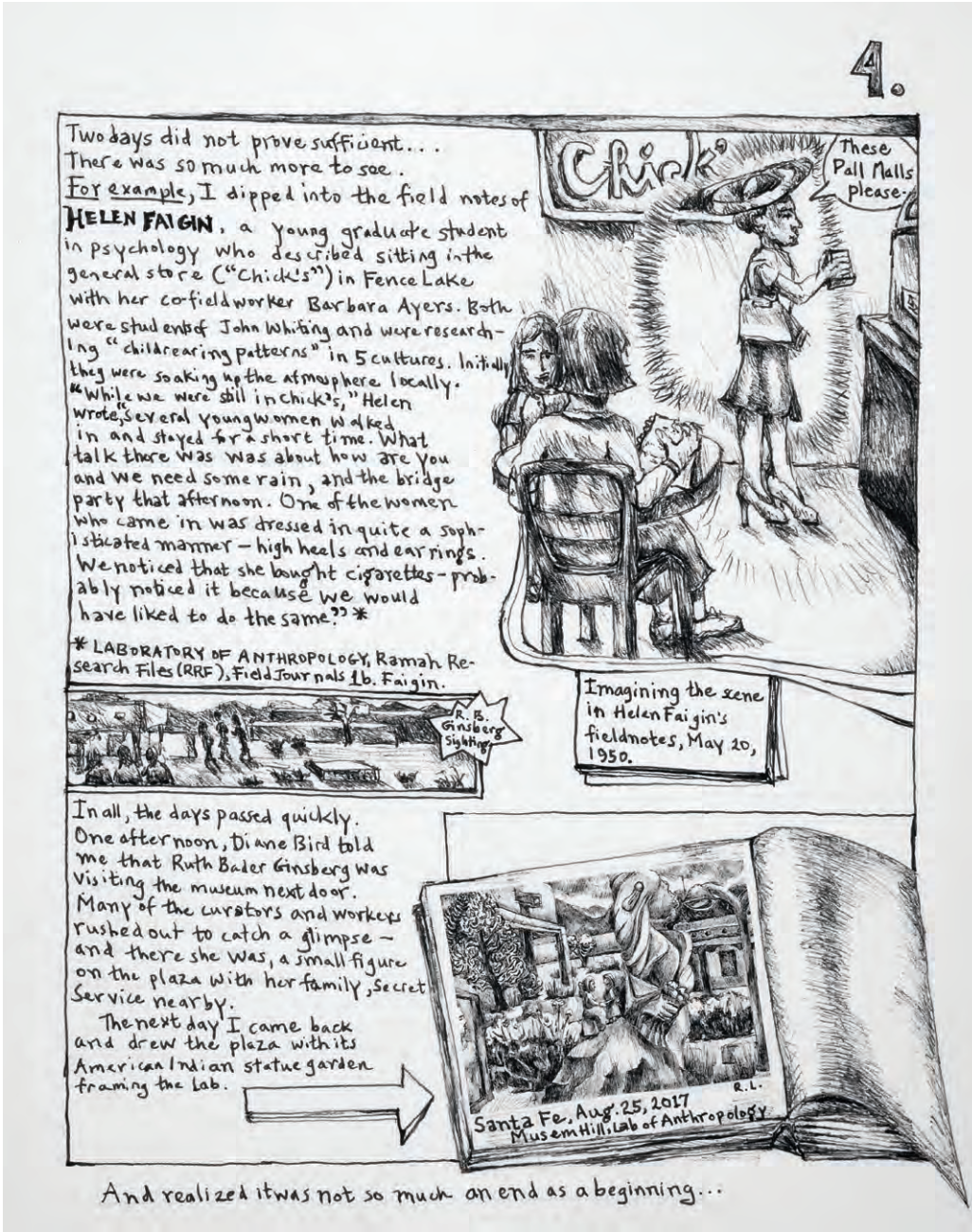
Rebecca Lemov




THE ELUSIVE FILE
1998
In 1998 (or '97) I visited Cambridge, MA from Berkeley, CA, where I was a grad student.
"green fields of Harvard University"
I was visiting the archives of the Social Relations department, a massive experiment from 1946-1976 or so - but most of my interest was in the early years before it became what Katy Park calls "a joke.")
T. Parsons C. Kluckhohn G. Allport
THREE "FOUNDERS" of "SOC REL"
pron: "RAY-MUH"
1.
2.
3.
4.
5.
One of the department's most ambitious projects was called "Five Cultures" or the "Values Project." It focused on RAMAH, NM, where five different cultures happened to live in close proximity.
Five simultaneous studies would take place -- and so, from 1949-1956, 63 Harvard fieldworkers flooded the Ramah area: anthropologists, sociologists, psychologists, political scientists.
"an ongoing field laboratory"
ALFRED KROEBER
RAMAH AREA
The five cultures being studied were:
1. Zuni
2. Navaho
3. Texan/White-anglo
4. Spanish-American
5. Mormon
All researchers were instructed to tag their notes according to an elaborate + comprehensive filing system, The OUTLINE OF CULTURAL MATERIALS (OCM): Its 98 major categories + 663 subcategories were said to include everything that was part of social life.
OUTLINE
FIELD NOTES ON FILE
for 1st TIME
These notes arrived "fresh from the field" in Cambridge, where 29 analysts and 4 clerk-typists processed them. They filed 310,050 notes.
These files were not to be found in the archives in 1998. I ran out of time and returned to Berkeley.
but one day, I thought, I'll come back...


EIGHT YEARS LATER
2
2006
My family and I moved to Cambridge, so I could start as a Postdoctoral fellow in the History of Science. Immediately I wrote to the Peabody Museum about seeing the RAMAH files...
... which I imagined sitting in a room undisturbed since 1957
[PARAPHRASED]
Dear Ms. Lemov:
... We have no record of such files here at the Peabody.
However, I received an email that was discouraging.
2008
Two years later, I was in Santa Fe, New Mexico, as a fellow for the summer at the beautiful School for Advanced Research, located on the grounds of The White sisters' historic estate, "El Delirio."
When I started out, I thought peoples' dreams were the fragile part, but it turned out to be the data that disappeared.
One day, I was asked to give a talk about my new project, "The Database of Dreams."
No one knows where these files went...
A voice rang out in the back of the room:
I know where they are!
I gave an example from my previous research: the lost RAMAH files of five cultures.
The voice belonged to Willow Powers, scholar and former curator at the Laboratory of Anthropology. The files were about a mile away, housed in the Lab.


NINE YEARS LATER...
3.
2017
I returned to Santa Fe in August to track down the Harvard RAMAH files at last, now that I was finished writing my book about dreams.
NB. A Honda FIT can fit a family + dog + 3 bamboo trees.
Another reason to visit Santa Fe is the doorways. These are beautiful -- and who doesn't love a door-in-a-wall?
ALSO
It turned out the files were not so hard to find. I emailed and followed up with a phone call.
You want to see what? Who is this?
The files were "restricted" according to the archivist.
The conversation was not encouraging.
NEXT MORNING
I walked up Museum Hill to meet in person with the archivist.
LABORATORY OF ANTHROPOLOGY
Archivist Diane Bird told me the Ramah files were difficult to work with, easy to scramble, and full of sensitive information.
Some people come just to find out about their grandparents.
D. BIRD
And down a corridor, behind an unmarked door, behold!
THE FILES, IN THEIR ENTIRETY
NEXT WEEK
I began going through the files by "fieldworker," beginning with Clyde Kluckhohn, who was the project's originator.
A file slip
1950 July 9: 4-- C. Kluckhohn
Navaho: 184, 241, 315, 586, 797..
Chris is now living with Bob's mother. He is so blind he doesn't go around much.
Fred spoke of the best Nazarenes as being [illegible]. He says the new missionary doesn't talk much but "he doesn't bother us."
Each slip was duplicated under the cross-reference "codes."
Here the codes are:
• 184 "Cultural Participation"
• 241 Tillage
• 315 Oil & Gas Wells
• 586 Terminating Marriage
• 797 Missions
Kluckhohn's fieldnotes were frankly a bit gossipy.


4.
Two days did not prove sufficient...
There was so much more to see.
For example, I dipped into the field notes of HELEN FAIGIN, a young graduate student in psychology who described sitting in the general store ("Chick's") in Fence Lake with her co-fieldworker Barbara Ayers. Both were students of John Whiting and were researching "childrearing patterns" in 5 cultures. Initially they were soaking up the atmosphere locally. "While we were still in Chick's," Helen wrote, several young women walked in and stayed for a short time. What talk there was was about how are you and we need some rain, and the bridge party that afternoon. One of the women who came in was dressed in quite a sophisticated manner – high heels and earrings. We noticed that she bought cigarettes – probably noticed it because we would have liked to do the same?" *
* LABORATORY OF ANTHROPOLOGY, Ramah Research Files (RRF), Field Journals 1b. Faigin.
Chick's
These Pall Malls please.
Imagining the scene in Helen Faigin's fieldnotes, May 20, 1950.
R. B. Ginsberg Sighting
In all, the days passed quickly.
One afternoon, Diane Bird told me that Ruth Bader Ginsberg was visiting the museum next door.
Many of the curators and workers rushed out to catch a glimpse – and there she was, a small figure on the plaza with her family, Secret Service nearby.
The next day I came back and drew the plaza with its American Indian statue garden framing the lab.
R.L.
Santa Fe, Aug. 25, 2017
Museum Hill, Lab of Anthropology
And realized it was not so much an end as a beginning...

The Dog Days of Summer

Elaine Leong

The day was swelteringly hot. Emerging from the oven-like tunnels of the London underground, I slowly meandered toward the cool rooms of the British Library. We were indeed, as Renaissance physicians and astrologers would say, in the midst of the "dog days of the summer," when Sirius reigned high. The heat of the sun, combined with the humidity, felt oppressive to the body and mind. No wonder early modern writers warned against bloodletting, the taking of physic, sex, and so much more. As I entered the welcoming doors of the library, I thought to mysel, Surely this is the perfect place for a day like this. After all, libraries are for archival work and not the activities forbidden by Renaissance physicians. And archival work, mostly, is not so taxing on one's body.

Seated in 135, my favorite spot, I "unboxed" my first manuscript. The brown leather-bound notebook was unassuming. It was one of the many notebooks created by various members of the Brockman family at Beachborough, Kent. Opening the volume, I began to read through pages of personal and rental accounts, interspersed with dance tunes. And then, per my usual practice, I flipped the book upside down. And it was here that things began to get interesting. The page was headed "Whelpes by Bonny bitche whelped the last day of Aprill 1606."[1] Four curious entries followed, each describing in detail the puppies (white, tawny, motley, and spotted on their ears, backs, and rumps) and the name of the person who adopted the dog, perhaps receiving the animal as a gift.

The entries continued. Damsell had a litter of nine puppies on the May 6, 1606. Blouse gave birth to a litter of three puppies on the May 20. A few months later, in August, the Brockmans gained another three puppies by Tomboy and Roller. After a long fall and winter break, additional puppies were born in June 1607. Over that summer, the kennels welcomed (and said good-bye) to 21 additions. The spring and summer of 1608 saw similar movements in and out of the kennels with the arrival of another 10 puppies. Contrary to contemporary advice that spring is the best time to breed animals, the Brock-

1 British Library, Additional Manuscript 45206, fol. 38v. The records can be found at 34v–38v.

mans certainly did not shy away from timing the births to the height of summer.[2]

Over the three-year run of data, the Brockmans' attitudes toward record keeping (and perhaps dog breeding) changed gears ever so slightly. The initial entries functioned much like a ledger of gifts and obligations, noting on whom each puppy (from which mother) was bestowed. Starting in 1607, the Brockmans began keeping more detailed records, carefully detailing not just the parents of each litter but also the appearance of each puppy. In 1607, they mated Rockwood with Ladie, Bonnie, and Flower and Roller with Damesell and Tomboy. In 1608, they both retained particular pairings—Damsell with Roller and Ladie with Rockwood—and tried new parent pairings, each time observing and describing the resulting puppies in minute detail. For example, the September 20, 1608, entry for "Whelpes by Bonnye & Swilbowbe" reads as follows:

1. Tawney pyde dog, w*ith* the right eare red
   the left eare halfe white halfe redd, w*ith* motely spotts
   in the whyte, w*ith* a Tawney spott on the left lippe,
   and w*ith* twoe Tawney twelvepeny spotte*s* on the forhead,
   and w*ith* other Tawney spotte*s* kept by Thomas Harrison.
2. whyte Bytch w*ith* Tawney eares, a Tawney
   spott about the middle of the backe; *and* a Tawney
   spott on the Rumpe, kept by Thomas Pelham.[3]

It is clear that the Brockmans were engaged in structured practices of animal breeding, consciously experimenting with mating pairs and observing resemblances between parent and offspring. In choosing to breed their own hounds, they participated in a common contemporary pastime. Hunting manuals of the period were filled with instructions on breeding hounds but tended to offer advice on the right season for coupling and whelping and on strategies for raising whelps to adulthood. In line with contemporary notions of genera-

2 On contemporary advice, see, e.g., George Gascoigne, *The Noble Art of Venerie or Hunting* (London: 1575), ch. 8: "Of the Seasons in Which It Is Best to have young Whelpes, and How You May Best Governe Them."

3 British Library, Additional Manuscript 45206, fol. 34v.

tion where mothers often passed on characteristics to their offspring, authors encouraged breeders to select "Fair Bitches … strong, and well-proportioned in all Parts, with great and large Ribs and Flanks."[4] Little is said about her partner in coupling.

The Brockmans might show more curiosity than some in constructing their dog-breeding practices, but, of course, domestic animal breeding is not an unfamiliar topic to historians of science. Medieval (and earlier) hunting and husbandry manuals often offer advice, and we might draw a line (though indirect) to well-known episodes such as Charles Darwin's study of pigeon breeding, described by some as an "intensive research program." Would the Brockmans' activities in their kennels also qualify for such a designation?

As I returned the manuscript to the librarian, I reflected a little on the Brockmans' "puppy records," if we can call them that. The notebook containing this information is one of dozens of domestic manuscripts discovered in a boarding school in the 1930s and subsequently donated by Phyllis Brockman to the British Museum (in that sense, my encounter was only one of a number of surprising unboxings in the life story of the object). The Brockman manuscripts offer a glimpse into the minutiae of the everyday from French exercise books to sketch books to diaries of the grand tour to recipe collections. And certainly the "puppy records" belong to the everyday in more ways than one. The conclusion of each entry with the name of the puppy's new owner highlights that the records acted as accounts of the Brockmans' social obligations and networks, constructed through animal gifts. This was not only about observation of the quotidian but also about meticulous notation of social knowledge.

One final thought about dogs, whelps, and the summer. Like so many things in the early modern everyday, there is a recipe involved. For those whose dogs might be shy in the act, a remedy made of garlic and castorum would move things right along.[5] Though, as one should definitely avoid welcoming puppies in the dead of winter, one assumes that this remedy was not intended for the dog days of summer.

4 Richard Blome, *The Gentlemans Recreation in Two Parts* (London: 1686), 69.

5 Blome, *The Gentlemans Recreation,* 70.

Jan Brueghel the Elder, “Animal Study (Dogs),” ca. 1616.
Kunsthistorisches Museum Wien, Austria.

Bewildered Observation

Elizabeth Lunbeck

The notion, taken from cybernetics, that "the less probable a message, the more information it contains," served as a guiding precept to post–World War Two psychoanalysts seeking an alternative to the linearity and predictability foundational to their discipline. Setting spontaneity and surprise against the compulsion to repeat, authenticity and the real against "as-if" construals of the psychoanalytic relationship, and the accidental and fortuitous against the fatalism of the analytic mainstream, they proposed that unbidden thoughts and perceptions and unformulated experience offered a way into the patient's unconscious—a relational, democratic, and decidedly not royal road.

What interests me here is the need to reinscribe spontaneity and surprise into the analytic encounter. Freud was himself a connoisseur of the unexpected. Indeed, the unanticipated finding figured centrally in his autobiographical narrative. Years after the fact he characterized himself as surprised, in the 1880s, to discover that the hysteric's symptoms disappeared once he'd led her back to the traumatic scene that had provoked them, a discovery foundational to his nascent clinical science. From this followed, in 1897, the horrified realization that so many hysterics meant so many guilty, perverted fathers, a reckoning at once surprising and inconceivable that snuffed out his dreams of "eternal fame," dependent as they were on whether hysteria "would come out right."[1] Receptivity to the unexpected also figured centrally in his recommendations on technique. In 1912, he counseled his colleagues to enter the clinical setting with a mind open to spontaneity, "free from any presuppositions" and ready "to be taken by surprise" by what the patient had to offer: "the most successful cases are those in which one proceeds, as it were, without any purpose in view."[2] Finally, bewildered observation accompanied by fervent disavowal was central to Freudian theory,

1 Letter from Freud to Wilhelm Fliess, September 21, 1897, in *The Complete Letters of Sigmund Freud to Wilhelm Fliess, 1887–1904,* trans. and ed. Jeffrey Moussaieff Masson (Cambridge, MA: 1985).

2 Sigmund Freud, "Recommendations to Physicians Practising Psycho-analysis (1912)," in *The Standard Edition of the Complete Psychological Works of Sigmund Freud* {hereafter *SE*}, ed. James Strachey (London: 1953–1974), 12:109–120.

perhaps nowhere more so than in his treatment of the penis. The boy-turned-fetishist who can never accept that his mother hasn't got one; the girl-turned-bluestocking who likewise can't accept she hasn't one either: both are iconic figures in the Freudian oeuvre, optimistic fantasists unable to accept the "fact" of female castration.

But what was at first unexpected could become routine, conscripted into theory that was startling only to the uninitiated. Freud retained his capacity for astonishment to the end, but his theorizing increasingly fixed individuals into exemplary narratives, casting them as fated to drearily reenact by now familiar roles. That the boy would want to murder his father so as to sexually possess his mother might shock and dismay the laity attending Freud's "Introductory Lectures" in 1916 and 1917, but to him and his like-minded colleagues the Oedipus complex had by then achieved the status of shibboleth, fealty to which usefully discriminated between friend and foe. More and more, it would be no matter for surprise that, for example, the mother remains the boy's love object or that the girl reproaches her mother for depriving her of "the only proper genital."[3] Freud's penchant for issuing *ex cathedra dicta,* applicable to everyone and every situation, only drew the net of inevitability tighter. "A dream is the fulfilment of a wish," without exception (even if the wish was only to prove Freud's theory wrong).[4] His own experience of being in love with his mother became "a universal event in early childhood."[5] And, famously, anatomy became inescapable destiny, at least for the girl. Fate overwhelmed serendipity.

Freud's certainties calcified into inflexible dogma in the hands of the émigré Viennese ego psychologists who installed themselves at the center of the American analytic establishment in the postwar years. With system replacing spontaneity, the mysteries of the unconscious that had delighted Freud (think here of his *Jokes and Their Relation to the Unconscious,* published in 1905) were minimized as the ego—its structure and functions, "equilibrium and harmony"—

3 Freud, "Female Sexuality (1931)," in *SE,* 21:221–244.

4 Freud, *The Interpretation of Dreams*, *SE,* vols. 4 and 5.

5 Freud to Fliess, October 15, 1897.

assumed a more central role. Notably, in 1945 no less an exemplar of Viennese orthodoxy than Anna Freud characterized the ego's functioning as "as accurate and reliable as a mechanical apparatus."[6] Ego psychologists held that only a strictly enforced orthodoxy of by-the-book technique would yield the patient (and analyst) the autonomous and well-adjusted ego, in conflict-free harmony with "external reality," that was treatment's Holy Grail. Analysis was a hard slog ("working through" being the watchword), governed by emotional abstinence and the refusal of all gratifications. Cast as objective, neutral, and scientific by its adherents, this forbidding technique, in the estimation of one particularly sharp contemporaneous critic, sacrificed the analyst's humanity at the altar of "schematic perfection," treating patients as if surgically anesthetized, comatose, or even cadaverous and making of the analyst a "robotlike" figure more machine than fellow human possessed of "warmth, decency, reliability" and so on.[7] Psychoanalytic treatment had become so rule bound and predictable by the 1960s that glimpses of the analyst's individuality could occasion astonishment, and, relatedly, the question of whether Freud was actually a Freudian could be seriously debated.

The reclamation of an alternative, vigorously suppressed analytic tradition by the Viennese-born, Chicago-based analyst Heinz Kohut in the 1960s and 1970s offered analysts one way out of ego psychology's many dead ends. So, too, did the freedom offered by the new theory of cybernetics, which some analysts configured as another escape route. The equation of mind and machine that seemed so apt—signifying cool certainty—to Anna Freud and that discomfited our contemporaneous critic had first to be recast in a decades-long project that saw its emotional logic inverted. Now, spontaneity and "the opposite of business as usual" could be aligned with, not against, the machine, cast as roughly analogous to the feedback loops of cybernetics. Analysts impatient with ego psychology's fixities and

6 Anna Freud, "Indications for Child Analysis," *Psychoanalytic Study of the Child* 1 (1945): 127–149.

7 On egopsychology, see Robert Wallerstein, "The Growth and Transformation of American Ego Psychology," *Journal of the American Psychoanalytic Association* 50 (2002): 135–168; critic: Leo Stone, *The Psychoanalytic Situation* (New York: 1961).

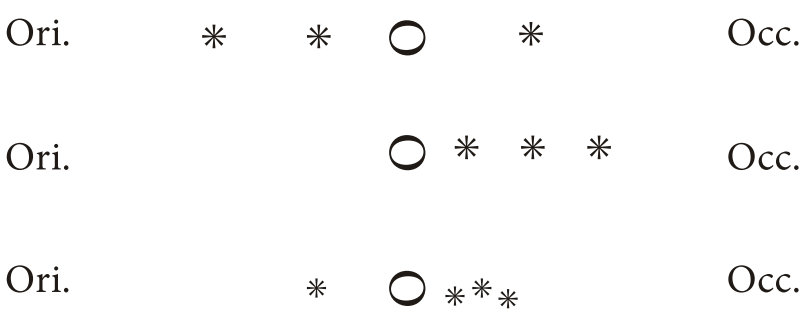
reaching for "something more" than predictable interpretation twigged that cybernetics, as well as field theory and dynamic systems theory, could lend the imprimatur of science to their endeavors, allowing them to legitimately celebrate moments of improvisation, creativity, and authenticity between analyst and analysand and to break decisively with ego psychology's linear maturational teleology.[8] Somewhat improbably, then, the science of cybernetics served as a vehicle for recouping some of the artful play, spontaneity, and surprise that characterized Freud's work and that had been drilled out of it in the interest of sterile systemization.

8 For an example, see Gary Taerk, "Moments of Spontaneity and Surprise: The Nonlinear Road to Something More," *Psychoanalytic Inquiry* 22 (2002): 728–739.

De admiratione

Opusculum admirabilia spectacula vetustiora pandens, discrimenque novum proponens

Abigail Lustig



Mirabile est, cum primum discipula discipulusve per perspicillum aut microscopum spectat, admirationem amoremque novum reperiendi videre flagrantem, hac admiratione ipsa persimile admirationi Galilei et Leeuwenhoek ipsorum cum primum per organum spectavissent. Hic sensus, haec facultas admirationis, vel potentissimus est omnium Scientiae potestatum – sed vero in nostris ludis nimium rare doctus. Discipuli quidem saepe attoniti sunt cum audiunt philosophos attonitos posse.

Galileus perspicillo iterum atque iterum admiratione replebatur. In figuris celebribus *Siderei Nuncii* Lunae cavitatem magnam imitatus est in medio, Sole illuminatem, quam 'non nisi aliqua cum admiratione adnotavi'—etiamsi nulla cavitas istiusmodi, admiratione Galilei sola ficta, exstat, et quae, si exstitisset, spectabilis non modo perspicillo sed etiam oculo libero esset.

Perspicillum Galileum ad reperiendum duxit miraculi necopini vel maximi historiae scientarum. 'Die itaque septima Ianuarii,' scripsit, 'instantis anni millesimi sexcentesimi decimi, hora… noctis prima, cum cælestia sidera per Perspicillum spectarem… tres {Iovi} adstare Stellulas, exiguas quidem, veruntamen clarissimas, cognovi; quae, licet e numero inerrantium a me crederentur… nonnullam tamen intulerunt admirationem, eo quod secundum exactam lineam

rectam atque Eclipticæ parallelam dispositæ videbantur, ac cæteris magnitudine paribus splendidiores.' Sed inter mirabilia innumerabilia iam perspicillo elata, tres stellulae novae initio fortasse minorae erant, etiamsi Eclipticae parallelae. Die octava tamen, 'nescio quo fato ductus, ad inspectionem eandem reversus essem' stellularum. Attonitus quidem hac nocte erat, quod 'erant enim tres Stellulae occidentales omnes, a Iove atque inter se, quam superiori nocte, viciniores.' Primum haesitavit, utrum contra omnia tabella repperisset Iovis orientalior—id est, dubitavit intelligentiam suam philosophorumque, quae dixit Iovem plus quam decem dies ab occidentalior esse, magis quam aspectum caeli noscere. Diebus decima et undecima tandem intellexit, 'apparentem commutationem, non in Iove, sed in Stellis adnotatis repositam esse.'

Die decimatertia habuit, verbis J. L. Heilbronis, 'another stupefying surprise,' cum 'primum a me quatuor conspectae fuerunt Stellulae' (erat cum in dies intellegeret significationem motionum stellarum Ioviarum quod Galileus coeperat observationes suas lingua Latina scribere et non Italiana). Galileus intellexerat stellulas circum Iovem vagare; neque Telluri neque Soli solum centrum universi conversionum licuisse. Galileo hypothese Copernicenso iam convicto, hoc repertum nihilominus numquam expectatum erat.

Experientiae Galilei perspicillo nobis ostendunt admirationem scientiis duobus modis venire. Primum est admiratio repens improvisaque (montes cavitatesque Lunae exempli gratia), cuius significatio statim perspicua est. Est tamen admiratio quoque gravitatis modo comprehensae multum post adspectandum cogitationemque (quod stellulae non stellae sed satellites Iovis erant). Forsitan mihi liceat, has *admirationem ociorem* vel *lentiorem* appelare. Oportet discipulas discipulosque hodie utrasque admirationes experiri.

Admiratio ocior quidem facilior est discipulis ostendere. Non modo perspicillum sed etiam microscopum occasionem praebet admirandi (et opportunius cum diurnam). Dulcissimum est, puellae aut puero assidere, ut simul per microscopum ista 'animalcula' Leeuwenhoek spectat. Attoniti semper sunt; attoniti, mundo invisibile invistatoque subito exsiliente, attoniti, tota arte in corporibus talibus minutis ostensa. Talis admiratio erat Leeuwenhoek ipsi: 'I saw to my great

admiration such moving instruments all over the Body within, that not one of a thousand would be perswaded to believe, that in such a contemptible Insect there is so much to be seen.' Saepe nihilem dies multas volunt discipuli nisi per organum spectare illumque novum mundum scrutari.

Admiratio autem lentior difficilior est ostendere atque docere, et discipulis est difficillima intelligendi. Galileus non statim gravitem observationem suarum satellitum Iovis agnovit—neque agnoscere potuisset. Necesse erat series multarum observationum, intentione factarum, et, magis etiam, cogitatio assidua. Prima nocte erant illae stellulae modo. Sequentes noctes solae ei significationem inferre potuerunt, et menti volenti modo. Natura erat, quae miraculum finxerat (quod quidem semper exstiterat), sed hoc sensus admirationis lente modo gradibusque creabatur, ut scripsit Galileus ipse, 'ambiguitatem in admirationem permutans.' Intellegere atque admirari admirationem lentiorem gignunt iuncti, id quod voluptas vel maxima scientarum est.

(Philosophi novissimi fortasse quaerent utrum haec admiratio in rebus Naturae gignatur an in acto intelligendi, hoc modo discriminem novum creantes. Immo discriminem vero creant, ubi non exsistare oportet. Factum intelligendi quidem miraculum plane aperiat, sed creator solus non potest.)

Discipuli discipulaeque saepius credunt omnias scientias iam inventas esse et nulla eis permanere. Librum Naturae pensunt exsistere, non quidem illum librum Galilei, mathematicis scriptum, sine quibus mundus non intellegi possit, quem librum legere vix incepimus et qui infinitus est, sed magis credunt commentarium scriptum esse simplicum sicut sese in ludo legere. Hic liber, ut opinio fert, iam integralis perfectusque est, omnibus responsis cognitis magistris suis—atque illa responsa ad examinationes dumtaxat memoria comprehenda sunt.

Ludus magnus novas investigationes inveniendi saepius deest. Hanc voluptatem tum discipulis apportare tempus egit et consultum, eis opportunitatem dare intelligendam et admirandam. Necesse quoque est ut propensi sint ipsi animis commutari. Cum pictor, quae petit, res videre cum sunt, ut admirationem spectatoris creet novis

picturis suis, tum oportet philosophum Naturae praebere sensum curiositatis fortiorem quam 'ego'.

Necesse est discipulis quoque ut frustrentur. Nam voluptas intelligendi tanta commoda est, quantus conatus expenditur. Qui miraculum necopinum intellexit, se putare possit, cum Galileo, doctissimum vero, nam illi periti scientarum bene sciunt responsum vel frequentissimum Naturae 'erras' esse, nam cum admiratione est enim frustratio prope complexa. Ad admirationem ociorem opus est quidem nonnihil praeparationis, ad admirationem lentiorem autem nihil possit sine consuetudine cogitationis attentionisque et tempus multum, omnia quae fructus addunt conatui. Admiratio numquam vilis philosophis emitur, at gaudia sempiterna donabit.

Gratias J. L. Heilbroni et K. Murray et S. Leleu consiliis ago.

Galileus Galileus, *Sidereus Nuncius*. Venetiis, MDCX.
J. L. Heilbron, Galileo. Oxon., MMXII.
Antonius van Leeuwenhoek, 'Part of Two Letters from Mr. Antony van Leeuwenhoek, F.R.S., concerning Worms pretended to be taken from the Teeth.' *Phil. Trans. Roy. Soc.*, v. XXII (anni MDCC et MDCCI), dcxxxv–dcxlii.

On Surprise

A tiny work laying out some older marvels worthy of admiration and proposing a novel distinction

It is wonderful to see, when a student looks for the first time through the telescope or the microscope, surprise, wonder, astonishment (the Latin *admiratio* encompasses all of these), and a new love for discovery flame up, this wonder being just like the surprise of Galileo or Leeuwenhoek themselves when they first looked through their instruments. This feeling, this capacity for surprise, is perhaps the most powerful of all the powers science has—but is rarely taught in school. Students are often astonished, indeed, when they hear that scientists *can* be surprised.

Galileo was filled with *admiratio* over and over by the telescope. In the famous figure of the moon in the *Starry Messenger,* he drew a great crater in the middle, illuminated by the sun, which "I remarked upon not otherwise than with surprise"—although no such crater, which was created only by Galileo's own astonishment, exists, and which, if it did exist, would be visible not only with the telescope but also to the naked eye.

The telescope led Galileo to perhaps the greatest surprise in the history of science. "On the seventh day of January, 1610," he wrote, "in the first hour of the … night, when I was looking through the Telescope at the constellations, I noticed three little Stars next to Jupiter, very small, but very bright; which were believed at the time by me to belong to the number of the fixed stars. … Nevertheless, they caused no little wonder, because they seemed to be in a straight line and to be parallel to the ecliptic, and they were each equal in brightness to the others" (translations mine). But among the innumerable marvels he had already found with the telescope, three new little stars were at the beginning perhaps minor, even if aligned with the ecliptic. On the eighth, however, "led by I know not what fate, I had come back to the same observation" of the little stars. On this night, Galileo was astonished, because "the three little stars were now all *west* of Jupiter, and closer to each other than they had been the previous night." At first he wondered whether, contrary to all the astronomical tables, Jupiter had exited retrograde—that is, he doubted his own understanding and that of other scholars, which said that Jupiter was more than ten days from turning back east—rather than believe in what he saw in the sky. It was only on the tenth and eleventh that he at last understood that "the apparent movement was not in Jupiter but in the stars I had observed."

On the thirteenth he had, in the words of J. L. Heilbron, "another stupefying surprise," when "first *four* little stars were seen by me" (it was, in fact, as from one day to the next he understood the significance of Jupiter's stars' motions, that Galileo switched to taking his notes in Latin rather than Italian). Galileo had understood that the little stars were going around Jupiter; it was thus not possible that either the earth or the sun was the sole center of motion in the uni-

verse. Galileo was already a convinced Copernican, but this discovery was nevertheless entirely unexpected.

Galileo's experiences with the telescope show that surprise can come in two ways in science. The first is the quick and unforeseen surprise (the mountains and craters on the moon, for example), whose significance is immediately apparent. There is, however, also a kind of surprise whose importance is only understood after much observation and thinking (that the little stars were not stars but satellites of Jupiter). Perhaps I may be permitted to call these *fast surprises* and *slow surprises*. Students today should have the opportunity to experience both.

Fast surprises are, of course, easier to share with students. Not only the telescope but also the microscope works well to inspire surprise (and more conveniently, since it can be used during the day). It is delightful to sit next to a girl or boy who is first looking through the microscope at Leeuwenhoek's "animalcula." They are always astonished: astonished, at the invisible, unexplored world that suddenly jumps out at them; astonished, at the intricacy and detail revealed in such minute bodies. Leeuwenhoek felt such marvel himself: "I saw to my great admiration such moving instruments all over the Body within, that not one of a thousand would be perswaded to believe, that in such a contemptible Insect there is so much to be seen." Often students want to do nothing in class for days afterward except look through the microscope and explore this brand-new world.

Slow surprise, however, is harder to show and to teach and is very difficult for pupils to understand. Galileo did not immediately recognize the importance of his observation of Jupiter's satellites—nor *could* he have recognized it. Only a series of observations, made according to a plan, made this possible, and, even more importantly, careful thought. The first night, they were just little stars. Only the following nights could bring home their significance to him, and only to a willing and ready mind. It was nature that had arranged the surprise (which, indeed, had always existed), but this *sensation* of surprise was created only slowly and stepwise, as Galileo himself wrote, with "doubt transforming into wonder." Understanding and

marveling create slow surprise together, which is perhaps the greatest pleasure in science.

(There are, perhaps, modern scholars who may ask whether this surprise is engendered in the phenomena of nature or in the act of understanding them, thereby creating a new distinction. But they are making a distinction where none such need exist. The act of understanding of course makes the surprise apparent but cannot be its sole creator.)

Pupils often believe that all of science has already been discovered and that nothing is left for them. They believe that there is a Book of Nature, not indeed that book of Galileo's, written in mathematics, without which we cannot understand the world and which we have barely begun to read, but rather they think it is a textbook like the ones they read for school. This book, they think, is already entire and finished, and the teachers already know all the answers—and all they have to do is memorize them for the tests.

The great game of devising new investigations is too often missing for them. Bringing this pleasure to students, however, takes time and planning, to give them the chance both to understand and to marvel. It is also necessary that they themselves accept that they must be able to change their minds. Just as a painter, who tries to see things as they are so that she can create a sense of wonder in the viewer with new pictures of the world, so also the scientist has to cultivate a sense of curiosity stronger than her sense of self.

It is also necessary that students be frustrated and fail, for the pleasure of understanding is in proportion to the effort expended. She who understands the meaning of a surprise may think herself, along with Galileo, very clever indeed—for experienced scientists know very well that nature's most frequent answer to our questions is, "You've got it wrong"; and surprise is tightly bound up with failure. One must have no little preparation to be ready for a fast surprise, but no slow surprise can ever happen without the cultivated habits of thinking, attention, and time, which all add enjoyment to the endeavor. Surprise is never sold cheap to scientists, but it will give eternal pleasure.

Excitement, Déjà Vu, Boredom

Christoph Lüthy

Not only in private life but also in the domain of science, we encounter the classical sequence of emotions that goes from initial surprise to bored indifference. An illustrious example is the public response to Antoni van Leeuwenhoek's reports on microscopic life. Contemporaries were at first enthralled by his news, but after an unending sequence of nearly identical announcements, they began to respond with yawns. The tale is known but not often told well. It starts with a 1673 letter of introduction in which Dutch anatomist Renier de Graaf presented fellow countryman, Antoni van Leeuwenhoek, to the Royal Society: draper, haberdasher, city hall chamberlain, land surveyor, and assessor of wine in the city of Delft. "Leeuwenhoek hath lately contrived Microscopes excelling those that have been hitherto made by Eustachio Divini and others," de Graaf explained.[1] And, indeed, Leeuwenhoek's microscopes were very powerful.

At the time, all compound microscopes suffered from chromatic aberration: behaving like multiple prisms, they produced blurry images. Leeuwenhoek's solution was a single-lens microscop, composed of a minuscule glass bead inserted between two small metal sheets. The magnifying power of these beads was impressive, but given their short focal length, Leeuwenhoek literally had to press the microscope into his eye, trying to avoid his lashes. Had he not been extremely myopic, the instruments he made would have been of no use to him. In fact, only about 1 percent of users are able to recognize anything through the extant exemplars, and even fewer can do so without feeling acute pain. Even Leeuwenhoek reported that at times, in the act of observation, "I break into a sweat."[2]

De Graaf's recommendation letter initiated a relationship between Leeuwenhoek and the Royal Society that was to last for a full 50 years. More than half of Leeuwenhoek's roughly 300 scientific letters were addressed to the Royal Society, which elected him a fellow

1 Letter of Regnerus (Renier) de Graaf to the Royal Society, April 28, 1673, in *Alle de brieven van Antoni van Leeuwenhoek*, vol. 1, *1673–1676*, ed. Commissie van Nederlandsche geleerden (Amsterdam: 1939–1999), 30.

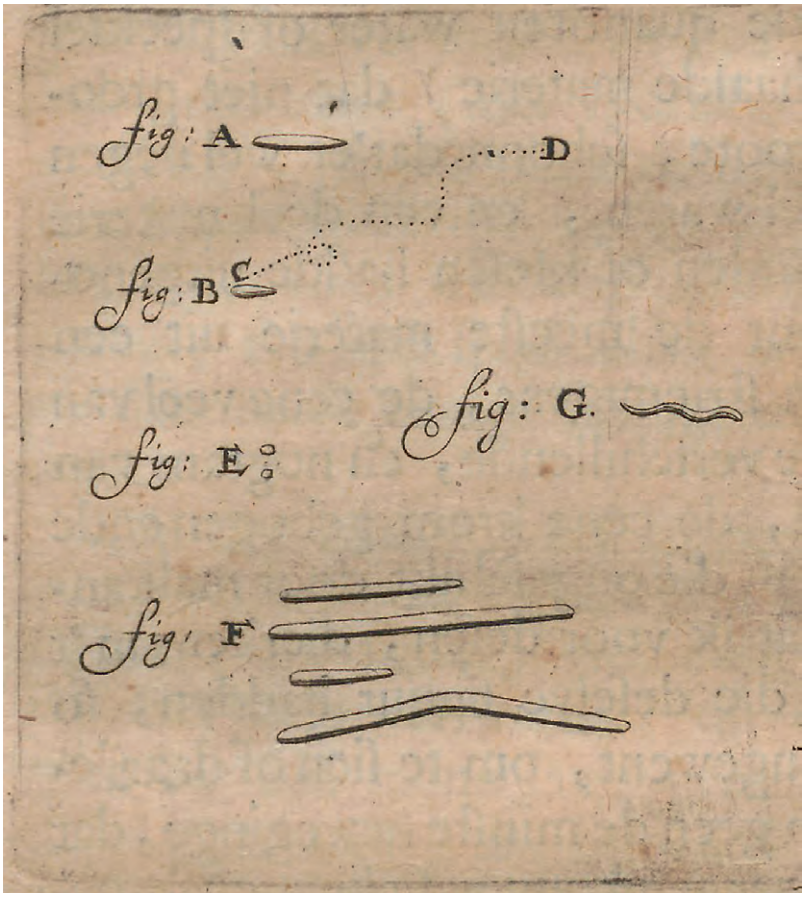
2 Letter of Antoni van Leeuwenhoek to Henry Oldenburg, October 9, 1676, in *Brieven*, vol. 2, *1676–1679*, 80–81.

in 1680—a rare honor for a Dutch artisan who had, as he himself confessed, "not been brought up in language or arts."[3]

In the days when Leeuwenhoek started to report his findings to the Royal Society, the adepts of then fashionable mechanical philosophy were imagining a world of invisibly small material particles, corpuscles or atoms, which possessed shapes and movements such that the visible phenomena of the physical world could be deduced from them. Microscopists eagerly participated in this enterprise. When, for example, René Descartes imagined screwlike corpuscles as an explanation for magnetism, microscopists like Henry Power tried to find them; Nathanael Highmore actually reported that he had observed them swarming about. Very much in keeping with these expectations, microscopists, including Leeuwenhoek in his earliest letters, sought and found corpuscular structures: "cells," "pores," "bladders," "utricles," and "globules" were everywhere.

But Leeuwenhoek's story soon developed in an unexpected direction. As he studied liquids—infusions, and later murky pond waters, rain water, spermatic liquids—in search of particles that might explain their respective properties, Leeuwenhoek saw under strong magnification, for the first time in 1674, minuscule forms of life. Initially, he mentioned these "animalcules" only in passing, as something he had noticed while looking for more important things. But as these little creatures popped up everywhere, Leeuwenhoek began to pay attention, sending dozens of letters over almost five decades in which he described them in great detail. Nineteenth-century biologists, who with their achromatic lenses had overcome the limitations that had previously hampered microscopic research, hailed Leeuwenhoek as the first to have seen bacteria, unicellular algae, flagellates, and spermatozoa. These attributions are both correct and false. They are correct in the following sense: among the types of animalcules that Leeuwenhoek found in 1683 in the tartar of teeth—his own, his wife's, and their daughter's—whose tiny shapes he asked Abraham de Blois to engrave (figure), a modern bacteriologist would

3 Letter of Antoni van Leeuwenhoek to Henry Oldenburg, October 15, 1673, in *Brieven*, 1:43.



Antoni van Leeuwenhoek, *Ondervindingen en Beschouwingen der onsigtbare geschapen waarheden* (Delft: 1694), 13, figs. A–G.

recognize *Selenomonas sputigena* (B), *Pseudomonas* spec. (E), *Leptothrix buccalis* (F), and *Spirillum* (G).

But these claims are also false, because what Leeuwenhoek saw and reported on were "little animals," not "bacteria" or "protozoa." Indeed, it is doubtful whether one can claim a discovery if it is given no distinctive name, assigned to no taxonomic place, or given no function or explanatory role. "Our" bacteria fulfill important functions in myriad respects pertaining to health and disease; Leeuwenhoek's not only served no purpose but did not even constitute a

separate kind, for he viewed them as the offspring of what to us are "protozoa." What for us are different species of bacteria, protozoa, algae, or flagellates, for Leeuwenhoek, all belonged to that endless stream of minuscule life; both he and Robert Hooke, who concurred with him, reckoned that "millions of millions might be contained in one drop of water."[4] Admittedly, this infinity of life forms enchanted the monadologically minded Gottfried Wilhelm Leibniz, who famously remarked, "I prefer a Leeuwenhoek who tells me what he sees to a Cartesian who tells me what he thinks."[5] On the other hand, it stirred critics of microscopy like Jonathan Swift to laughter: "So, Nat'ralists observe, a Flea / Hath smaller Fleas that on him prey, / And these have smaller Fleas to bite 'em, / And so proceed ad infinitum."[6]

Whether it was applause or laughter that was elicited by the unending descent of animalcules into unknown depths of invisibility, there was no call for further research. Neither Leibniz nor Swift needed additional observations or a taxonomy to make their points. Nor, for that matter, could Leeuwenhoek have offered anything beyond stating that his animalcules were everywhere, had a variety of appearances, and engaged in curious movements to and fro.

Despite its sponsorship of pan-European microscopical research, even the Royal Society was quickly bored by Leeuwenhoek's ubiquitous animalcules and tried to steer his research elsewhere. In fact, microscopy as a whole started to look stale. Surely, if the strongest available magnification produced ever new life forms, it was useless to seek any longer for the ultimate constituents of matter or life. Enthusiasm for the microscope, which had reached its peak in the 1660s, gave way to a sense of disenchantment. In 1692, Robert Hooke lamented that microscopical studies "are now reduced almost to a

4 Robert Hooke, comments on a letter of October 5, 1677, by Antoni van Leeuwenhoek, published under the title "Microscopium: Or, Some New Discoveries Made with and Concerning *Microscopies*," in *Lectures and Collections Made by Robert Hooke* (London: 1678), 83.

5 Letter of Gottfried Wilhelm Leibniz to Christiaan Huygens of May 2, 1691, in *Oeuvres complètes de Christiaan Huygens*, ed. Hollandsche Maatschappij der Wetenschappen (The Hague: 1888–1950), 10:52.

6 Jonathan Swift, "On Poetry: A Rhapsody" (1733), in *The Poems of Jonathan Swift*, ed. Harold Williams (Oxford: 1937), 2:639–659, lines 337–340.

single Votary, which is Mr. Leeuwenhoek."[7] According to bibliometric analyses, between 1685 and 1723 Leeuwenhoek's published letters accounted for a full three-quarters of all microscopical studies.

To be sure, Leeuwenhoek died a famous man. And yet, it is telling that in remembering his achievements, the Royal Society only mentioned one type of "little animals": "that famous Discovery of the Animalcula in *semine masculino*, which has given a perfectly new Turn to the Theory of Generation."[8] Their innumerable siblings in other liquids had failed to cause any "new Turn." They had provoked initial astonishment but, because of their apparent uselessness, were soon forgotten, invoked only occasionally by the parson who, in his Sunday sermon, wished to provide an example of God's incomprehensible subtlety.

7 Robert Hooke, "Discourse Concerning Telescopes and Microscopes," in *Philosophical Experiments and Observations of the Late Eminent Dr. Robert Hooke*, ed. William Derham (London: 1726), 261.

8 From Martin Folkes's obituary for Leeuwenhoek, in *Philosophical Transactions* 23, no. 380 (November/December 1723): 449.

Anything You Change Can Make a Difference

Harro Maas

In May 2010, my former student Andrej Svorenčík and I organized a witness seminar to document and examine the history of laboratory experimentation in economics. We invited a mix of 12 economists, some of whom were surprised by the invitation, as they did not and do not perceive themselves as experimental economists, and some of whom considered their participation self-evident, such as the late Reinhard Selten, Vernon Smith, or Al Roth. As is typical for a male-dominated discipline like economics, we had only one female economist at the table, Elizabeth (Betsy) Hoffman, who had started her career as an economic historian only to become infected by the "experimental bug" after taking Charlie Plott's course in experimental economics at Caltech in the early 1970s, a course that was at the time considered the "hottest thing in town."

Plott taught that course in a master-apprentice fashion. He asked students to choose a topic they considered fit for an experiment and then worked with each student individually to tailor and narrow the initial question to manageable proportions; only then did he trust them sufficiently to actually perform the experiment. In quite a few cases this led to joint journal publications. Hoffman remembered a famous experiment, in which experimental subjects—students, housewives, staff, basically anyone who wanted to earn some easy money—were spread out across the building after hours to participate in a market experiment aimed at testing the efficiency of different market pricing rules. Seated in separate offices, after hearing the blast of a horn, subjects were supposed to start trading by phone. In those days, technology was such that telephone communication got jammed up very quickly, and participants simply decided to take the offer from whomever they managed to get on the phone. The published article argued that it was the pricing rules that made the difference, but participants such as Hoffman wondered afterward whether it was the pricing rules or the communication technology that explained the different outcomes.

Indeed, for Hoffman, the potential instability of test environments became a matter of lifelong concern. At the witness seminar, Charlie Plott gave some other down-to-earth examples of why experiments could fail. In market experiments where subjects were sup-

posed to buy and sell, they might buy but forget to sell; they might read tables from left to right where the experimenter intended them to be read from top to bottom; or they might simply forget to watch the screen. Philosophers nicely classify such issues under the Duhem-Quine problem, but classifying issues does not solve them in practice. Prompted by the witness seminar's moderator, Chris Starmer, Hoffman explained her concerns.

> I have always taken the approach that anything you change can make a difference. If you change experimenters, if you change location, and if you are going to—so if I am going to do—trying to replicate an experiment or do a variation on an experiment. Since I have moved a lot, I have a lot of experience with this. My view has always been that you have to be sure that your new subject pool and your new collaborators can get the same results as the previous subject pool and the previous collaborators. I always had a set of experiments that I would insist on replicating at the new place.[1]

When asked for details, Hoffman further explained that when she moved from Northwestern to Purdue and her regular coauthor Matthew Spitzer, moved to USC, in order to rule out any influence of the experimenter on the results, they would run half of the experiments at Purdue and half of the experiments at USC and then trade places and run the other half. The experiments she used to establish a trustworthy baseline were the ultimatum and the dictator game, a choice that spurred a lively discussion between the participants of the witness seminar, because these two seemingly innocuous games continue to produce outcomes that some experimentalists considered "just notoriously unstable." In both games, a proposer is endowed with a sum of money (tokens) from which she can offer an amount to a receiver, who can either accept or refuse, and who can punish the proposer (or not, as in the dictator game) if the offer is considered too

1 This and all following quotations are from: Andrej Svorenčík and Harro Maas, *The Making of Experimental Economics: Witness Seminar on the Emergence of a Field* (Dordrecht: 2016), 130–133.

low. Typically, proposers offer more than the theoretical minimum (one token), and receivers refuse what they should accept (that very one token). But that seems to be about the only stable fact in such games.

The specific rules of the game as well as small changes in its wording and framing all matter substantially to the outcome. If subjects are told to donate to a charity, they give everything away. Do subjects feel it is their own money or the experimenter's money from which they are supposed to make an offer? This was a question about which our seminar participants had "no idea, what the full implications" might be. Vernon Smith suspected that "almost certainly, for many experiments, it will make no difference at all, but if you have got one counter example where it makes all the difference, you have got to ask: 'Whoops, how far does that go?'"

Not only the auxiliaries but in fact everything about such experiments was up for grabs. Neither rules nor procedures could guarantee stable outcomes from experiments that were inherently unstable. "Things like that" brought Smith back to Betsy Hoffman's initial point about experiments, "and it is a really good starting point because you will be less surprised."

Un Savant Rêveur

Andreas Mayer

À la fin du XIX^e siècle, les tentatives d'étudier les rêves en laboratoire sont encore à leurs débuts. Les travaux du philosophe norvégien John Mourly Vold sont à considérer comme le premier projet systématique de mettre en place un régime expérimental pour l'étude du corps rêvant.[1] Ses recherches personnelles menées tournent autour d'un problème précis : il s'agit d'articuler les postures et les mouvements du corps pendant le sommeil avec l'activité onirique. Afin d'établir une causalité directe entre les positions du corps pendant le sommeil et la production d'images oniriques, il transforme son lit et par la suite celui de ses collaborateurs en un dispositif susceptible d'exercer des stimuli durables sur les parties du corps. C'est son approche qui lui dicte la forme de son grand ouvrage *Über den Traum* : Mourly Vold l'organise suivant les parties et membres du corps sur lesquels portent ses séries d'expériences allant des pieds au corps entier. Le mouvement de la marche joue un rôle capital dans les rêves expérimentaux du philosophe norvégien : le stimulus exercé sur la jambe ou sur la plante des pieds produit presque toujours une illusion de mouvement dans le rêve, soit que le rêveur lui-même se croie danser ou courir, soit qu'il perçoive ces mouvements chez une autre personne ou un animal[2].

Le dispositif expérimental de Mourly Vold s'élargit à une étude de masse à laquelle participent ses propres étudiants, des professeurs et élèves d'école de deux sexes. À l'instar de la psychologie expérimentale telle qu'elle s'organise à partir du laboratoire de Wilhelm Wundt à Leipzig, les étudiants sont les meilleurs collaborateurs : non seulement ils doivent être des « bons rêveurs », mais aussi des « bons sujets », donc instruits et honnêtes à la fois, pour assurer l'objectivité des résultats recueillis.

C'est à la fin de son ouvrage, fort volumineux, où son lecteur tombe sur la surprise. En raisonnant sur des expériences dans les-

1 John Mourly Vold (1850–1907) avait obtenu un doctorat en philosophie et enseignait comme professeur à l'Université de Christiania (aujourd'hui Oslo) à partir de 1890 jusqu'à sa mort. Pour des références plus détaillées, je me permets de renvoyer à Andreas Mayer, « Des rêves et des jambes : le problème du corps rêvant », *Romantisme* 178, no. 4 (2017): 75–85.

2 John Mourly Vold, *Über den Traum. Experimental-psychologische Untersuchungen*, 2 tomes, éd. Otto Klemm (Leipzig : 1910–1912).

quels le professeur attachait plusieurs bûches à son dos, action qui déclenchait des rêves de vol ou de suspension, il se rend à l'évidence que le motif de ces rêves se trouve dans une force qui est « sans doute de nature sexuelle ». Et il n'hésite pas à donner en latin plusieurs détails sur ses érections et pollutions nocturnes. Cette discussion est le seul moment où il lie ses propres expériences à un exemple historique, à savoir les « hallucinations des sorcières » se rendant au sabbat nocturne. Dans une page de médecine rétrospective qui fait exception dans son ouvrage, le philosophe livre une explication de ces rêves ou hallucinations qui réduit le voyage imaginaire de ces femmes, selon lui pour la plupart atteinte d'hystérie, à leurs sensations corporelles et notamment à la « vibration érotique » accompagnée d'un sentiment de réalité et d'orgueil pendant la nuit.

Le rêve de vol porte l'expérimentateur onirique donc sur un terrain qui dépasse le cadre restreint de son champ d'investigation. Depuis l'Antiquité ce genre de rêves est considéré comme relevant d'un phénomène collectif que l'on retrouve dans une même culture chez différentes personnes ou même dans différentes cultures à des époques différentes. Dans sa version diabolique, ce rêve se rapporte à une image stéréotypée que Carlo Ginzburg, dans sa grande étude comparative sur le sabbat des sorcières, qualifie de « formation culturelle de compromis[3] ». Ajoutons que cette image culturelle se forge lors du XIX[e] siècle aussi à travers une littérature et une iconographie médicale, telle qu'elle émerge dans le sillage de la clinique des maladies nerveuses de Jean-Martin Charcot.[4] L'explication de l'expérience collective des femmes accusées de sorcellerie en termes d'hallucinations et de contagion par imitation ancre l'image stéréotypée du sabbat dans la sensibilité du corps de la femme hystérique, entièrement soumise à des dispositifs et mesures physiologiques. Les idées avancées par Mourly Vold sur la nature sexuelle de ses propres expériences de rêves de vol s'articulent ainsi sous une forme ambiguë :

3 Carlo Ginzburg, *Le Sabbat des sorcières*, trad. Monique Aymard (Paris : 1992), 37.

4 Ainsi, Charles Richet dénomme en 1880 les femmes hystériques de la Salpêtrière les « démoniaques d'aujourd'hui » et l'aliéniste D.-M. Bourneville se livre dans sa « Bibliothèque diabolique » à la republication d'ouvrages historiques traitant de la possession diabolique et de la sorcellerie comme d'autant de cas de médecine rétrospective.

Bernard Picart, T*he Witches' Sabbath,* 1732, etching, in *Impostures Innocentes* (London: 1756), fig. 12. © Trustees of the British Museum, CC BY-NC-SA 4.0.

d'un côté, la sexualité du rêveur apparaît sous une forme purement physiologique, de l'autre, elle la dépasse de façon inattendue par une féminisation qui met le rêveur dans la peau d'une sorcière.

Cette ambiguïté n'échappera pas à Freud et à ses disciples. Dans la quatrième édition de la *Traumdeutung* (1914), Freud revient sur Mourly Vold, en affirmant que la production expérimentale de sti-

muli somatiques est susceptible de provoquer des images oniriques d'une grande diversité, position déjà défendue en 1900 ; les protocoles détaillés et méticuleux du philosophe norvégien ne seraient que d'une « infime utilité » pour la compréhension du corps rêvant. Or, dans la discussion des rêves typiques, l'interprétation sexuelle des rêves de vol et de suspension en l'air avancée par le philosophe norvégien, ce *Traumexperimentator*, « qui est un homme tout ce qu'il y a de sérieux, et à vrai dire hostile à toute espèce d'interprétation », surprend Freud, qui ne peut y lire qu'une confirmation inespérée de sa propre théorie[5].

Force est de constater que la surprise débouchera sur une articulation orthodoxe dans le milieu psychanalytique, mais elle donnera aussi lieu à d'autres lectures et figures expérimentales plutôt inattendues. Dans son premier « essai philosophique et littéraire », le jeune Henri Michaux part du couple Freud/Mourly Vold pour célébrer« l'intelligence de la jambe » qui semble entièrement désarticulée par rapport à « l'homme total »[6]. Selon l'écrivain belge, le « morceau d'homme » éveillé opère en suivant une logique de l'absurde pendant que « l'homme total » sommeille. La signification sexuelle des rêves, cheval de bataille des psychanalystes, est sobrement rapportée à l'évidence d'un « morceau homme sexuel » combattant le « bloc homme public » dont le compromis serait le symbolisme. Les apports de la « sciences des rêves » se trouvent ainsi retranscrits dans un langage aphoristique censé indiquer les traits essentiels du rêve, à savoir son caractère fantastique, absurde, insensible et chaotique. Le défi, désormais, est à la fois poétique et expérimental : comment écrire le corps rêvant « en style morceau d'homme, en style rêve[7] » ?

5 Sigmund Freud, *L'interprétation du rêve*, trad. J.-P. Lefebvre (Paris : 2010), 437 (ajouté en 1914). Le néologisme « Traumexperimentator » lancé par Freud a ici une connotation quelque peu railleuse.

6 Henri Michaux, « Les rêves et la jambe », *Œuvres complètes,* Bibliothèque de la Pléiade (Paris : 1999), 1:18 et suiv.

7 Michaux, « Les rêves et la jambe », 24.

Embarrassed Mastery

J. Andrew Mendelsohn

"Le fait d'Omdurman" was a gem of a fact, one of many collected in the quarantine laboratories of Egypt. Two soldiers in garrison, hence of known health and environment, suddenly dead of cholera in April 1914: no cases could be found nearby, no contacts tested positive. Then there was the "Russian pilgrim on his way from Djeddah," seized with cholera: typical lesions at autopsy, "no trace" of vibrios. Or the postman struck "one fine morning" in 1916 by cholera at its most textbook—relentless vomiting, profuse diarrhea, pronounced cyanosis (turning blue) of the face, cramps, aphonia, hypothermia—except that he recovered in one day and intensive microscopy found no vibrios. Or the five immigrants from Anvers succumbing to those same symptoms upon arrival in New York. Vibrios: nonspecific. Autopsy verdict: phosphoric acid poisoning. Trying for order in the quarantine laboratory of Alexandria only made it more a *Wunderkammer*, as in the devilish collection of sera *confectionné* from 31 typical cholera cases yet testing into an "almost complete absence of groups," an "individual autonomy," the director shook his head, even as he went on running microbial traffic control in the world's epidemiological entrepôt before global air travel: the Egyptian ports and cities that funneled the Hadjj from Africa and the Indian Ocean to and from Mecca every year.[1] A modern laboratory for mastering disease was also a premodern cabinet of curiosities. That's the argument here in a nutshell—and a Petri dish.

We are as far from premodern virtuosi as we can get while still collecting microscopical surprises; as though not far at all from those illustrated in Hooke's *Micrographia*, Leeuwenhoek's reports "met verwonderingh" of identical globules in the bile of rabbits and cows, or from the millions of intricate creatures in a drop of water, which John Ray compared to the rare miniatures of art "beheld with admiration, … treasured up" by "the Curious."[2] Both premodern cabinet and technoscientific laboratory accumulated observations made and

1 *Rapport du directeur du laboratoire du Conseil sanitaire maritime et quarantenaire d'Alexandrie à M. le président de ce Conseil* (1919), 1–2, 4, 7.

2 Antoni van Leeuwenhoek, *The Collected Letters* (Amsterdam: 1939–1989), 1:174–175 (October 19, 1674), 2:254–255 (October 5, 1677); Ray quoted in Lorraine Daston and Katharine Park, *Wonders and the Order of Nature,* 1150–1750 (New York: 2001), 314.

specimens seen with a gasp. "Almost incredible," one investigator had exclaimed in 1891 of the days, weeks, months that a rabbit and the deadly bacilli injected into it had gone on living together. Knowing about the rabbit did not keep another from finding his analogous human case "not a little surprising." Still another, knowing neither, narrated the "surprise" with which he showed hospital colleagues a similar "anomalous fact."[3] Throughout its growth from a few laboratories to a global system, the technoscience that bore no resemblance to Leeuwenhoek's letters and wonders was nonetheless in a state of recurring amazement—at infection without disease, disease without infection, and varieties of each that would not match.

Anomaly accumulated within a paradigm yet precipitated no crisis and even became part of normal science. Bacteriology both exemplifies and contradicts Thomas Kuhn's model. It belonged to the model's genealogy via Kuhn's reading of the "thought styles" and "thought collectives" that had become visible to bacteriologist Ludwik Fleck through the same long growth of anomaly displayed in the quarantine and hospital laboratory reports quoted above. Even more genealogical of STS models, through the work of Bruno Latour, bacteriology built the world of its own validity and success—domesticating actants (microbes), making the laboratory an obligatory passage point, translating interests and aligning forces to build and maintain networks, winning trials of strength (against spontaneous generation), extending the Archimedean lever of the laboratory to turn farms into theaters of proof, making the immutable mobiles and metrology by which universals exist through the circulation of particulars (whichever navy's volt you could get in Sinai ports in 1919, you could definitely get Berlin sera).[4] Yet bacteriology thereby also built the world of its surprises and limitations, built the unknown into the interstices of the known, what it could not do into what it could, the inex-

3 Sources quoted in J. Andrew Mendelsohn, *Cultures of Bacteriology: Formation and Transformation of a Science in France and Germany,* 1870–1914 (PhD diss., Princeton University, 1996), ch. 8.

4 Joseph O'Connell, "Metrology: The Creation of Universality by the Circulation of Particulars," *Social Studies of Science* 23 (1993): 129–173.

plicable into the explained. Winning and losing, strength and weakness, laws of nature and "individual autonomy" went hand in hand.

Anomalous rabbits did not vanish with a wave of Jastrow's pen into the gestalt-switch of paradigm shift or get neatly lost in translation into an actor network. They were treasured up. Modern or premodern, this was far from the singular surprise of discovery; far, too, from the unexpected in investigative pathways (F. L. Holmes) or the creativity of experimental systems (H. J. Rheinberger). Their productive unpredictabilities did not accrue. Such accumulation is unlikely to happen everywhere in science, not even in natural history, where iterative confrontation with possible novelty became annotative and additive; Linnaeus' copies of his books interleaved with blank pages ready to place whatever came next, monuments to an open yet unsurprisable system.

Cabinets of things made curious by their exception to what nature does most of the time or what most people can do with a chisel or paintbrush; anomaly accumulating within paradigms and becoming part of normal science; embarrassing facts and their continual generation and preservation woven into technoscience: what these share is collective experience of disjunction (not private notebook surprise), created by shifts in human organization on a grand scale, ever since the emergence of "new worlds" heavenly, microscopic, exotic. Across centuries and sensibilities runs a history of recurrent openness to anomaly, indefinitely prolonged, rather than an age of wonder turning to disenchantment.

There may be more under the sun—and in dark larders and bright bureau—than strange facts and Gradgrind ones, customs and laws of nature, *miscellanea curiosa* and scientific disciplines, delighted virtuosi and disenchanted technicians. Global technosciences like those of bacteria or electromagnetism, building up technical systems yet also kicking up the sparks of novel effects,[5] could tolerate and even cultivate the unexpected; the laboratory master of quarantine, an amasser of its *faits embarrassants*.

5 Thomas P. Hughes, *Networks of Power: Electrification in Western Society*, 1880–1930 (Baltimore: 1983); Jed Z. Buchwald, *The Creation of Scientific Effects: Heinrich Hertz and Electric Waves* (Chicago: 1994).

Knowing the Orient

Minakshi Menon

To SURPRI'SE v. a. {Surpris, French, from Surprendre}

1 To take unawares; to fall upon unexpectedly.

2 To astonish by something wonderful.

3 To confuse or perplex by something sudden.

Samuel Johnson, *A Dictionary of the English Language, 1755*

Hinzuan, an island in the Indian Ocean, surprised Sir William Jones on his way to India. It came upon him unexpectedly although he had prepared himself for it. On Monday, July 28, 1783, after two months aboard the ship *Crocodile*, there it was.

> It was the sun rising in full splendour on the isle of *Mayata* (as the seamen call it) which we had joyfully distinguished the preceding afternoon by the height of its peak, and which now appeared at no great distance from the windows of our cabin; while *Hinzuan*, for which we had so long panted, was plainly discernible a-head, where its high lands presented themselves with remarkable boldness.[1]

For Britons traveling east, Hinzuan was their first experience of the Orient. Jones, though, had made a career of experiencing the Orient through reading. The structure of its languages was familiar to his eye and spoke to him of the truths of its nature. Hinzuan exceeded the grasp of that reading and changed its affect. Pleasure turned to perplexity.

Remarks on the Island of Hinzuan or Johanna opens with a comfortable proposition, in the traditions of conjectural history, on the historical development of societies: the slow approach to civilization made by a small community with many natural advantages but few means of improving them. Jones invites his readers to contemplate the sylvan verdure of the island, whose natural diversity would have failed the best pencil. He had known mountains in Wales and

1 William Jones, "Remarks on the Island of Hinzuan or Johanna," *Asiatick Researches*, 5th ed. (London: 1807), 2:77–107, here 77–78. The quotations that follow are from this essay and are to be found (in order of appearance) at pages 79, 101–102, 78, 103, 103, 107, and 106. The modern name of Hinzuan is Anjouan. It forms part of the Union of the Comoros, a sovereign archipelago island nation off the eastern coast of Africa.

Switzerland of stupendous height but never before those "round the bosom of which the clouds were almost continually rolling." Here were palms, tall and graceful *Arecas* on the shores, so regular they might have been planted by design. Such picturesque observations on natural bounty weave through the account of his days on the island—ripe dates from Yemen, the fresh milk of coconuts, and the finest pomegranates he had ever seen. His remarks on the island's people are less certain. Surprise breaks through the calm surface of the telling.

Hinzuan had been colonized by Arabs, who represented a peak of civilizational achievement for European Orientalists. The king of the island was a *black* man but of *Arabian* politeness. He had Arabs in his train and views on the benefits of trade, "which could hardly have been expected from a petty *African* chief, and which if he had been sovereign of *Yemen*, might have been expanded into rational projects proportioned to the extent of his dominions." Jones was among a people who could not read English. Yet Alwi, second cousin to the king, perused the opening of an Arabic manuscript and explained it in English "more accurately than could have been expected." Alwi astonished with his questions about the independence of America, the power and resources of England, France, and Spain, and the character and strength of the Russian and Ottoman armies.

An intrepid Arab, it was said, had had the courage and address to establish a form of government on the island. That government, bad in itself (a violent oligarchy), was administered with advantage to the original inhabitants. Or was it? The theft of a pair of blue Morocco slippers from the *Crocodile* by Alwi's son-in-law "proves, that no principle of honour is instilled by education into the gentry of this island." Alwi himself was knowledgeable but equivocal. On remarking that it was unlawful to paint with henna or tell lies during Ramadan, he was asked by Jones whether both were lawful the rest of the year. "Lies were innocent, if no man was injured by them," he replied.

Jones heard from Alwi, though, how he had personally rescued the captain and crew of a wrecked European ship from slavery to an African prince, and having "supported them at his own expence, enabled them to build another vessel, in which they sailed to *Hinzuan*,

and departed thence for *Europe* or *India*." Perhaps the black man could not be further improved. His generosity represented the outermost limit of his development: "I hope that neither an expectation of treasures, nor of any other advantage, will ever induce an *European* power to violate the first principles of justice by assuming the sovereignty of *Hinzuan*, which cannot answer a better purpose than that of supplying our fleets with seasonable refreshment."

Knowledge produced through reading was beginning to acquire a geography. The surprise that accompanied it, like its offspring wonder, limned cultural boundaries between the domestic and the exotic, between the West and the Orient, which disarrayed certitudes about the stages of human progress. "All of these boundaries were electric, thrilling those who approached them with strong passions: to run up against any of these limits was necessarily to challenge the assumptions that ruled ordinary life."[2] Jones's life in India was witness to the truth of this statement. Darkening surprise would colour the Oriental quotidian. It would move him from the declaration of love with which he greeted two visitors from Yemen to Hinzuan, to a description of the shock of borrowing money from a black man: "it was like touching a snake or the South American eel."[3]

2 Lorraine Daston and Katharine Park, *Wonders and the Order of Nature, 1150–1750* (New York: 1998), 20.

3 William Jones to John Macpherson, February 27, 1786, in *The Letters of Sir William Jones,* ed. Garland Cannon (Oxford: 1970), 2:694.

Galápagos

Erika Lorraine Milam

In 1981 Kurt Vonnegut and his second wife, Jill Krementz, stepped foot on the Galápagos Islands. "Of course I was fascinated by the island's natural life," he reported. "I spent as much time there as Charles Darwin did—two weeks." He added, "We had advantages that Darwin didn't have. Our guides all had graduate degrees in biology. We had motorboats to move us around the islands more easily than rowboats could when Darwin visited the Galapagos in the 1830's. And, most important, we knew Darwin's theory of evolution."[1] Vonnegut had another benefit, too: an extensive familiarity with the popular writings of Stephen Jay Gould.[2] Thanks to Gould, Vonnegut saw in evolution an intriguing, playful capriciousness.

Soon after returning, Vonnegut gave a lecture in New York City at the Cathedral of St. John the Divine. (According to its advertising materials, the cathedral is the length of six blue whales.) He spoke about the strange creatures he had seen on the Galápagos Islands—especially the blue-footed boobies, who in courtship iteratively and solemnly raised each beautiful, bright foot to show their mates. He thought about the millions of years needed to create such natural intricacies, a span of time vast to us but a mere wink of Nature's eye. However long it had taken for nature to craft humans, he feared we were running out of time. Death itself was old, he noted, but the scale of our destructive capacity threatened our very existence as a species. The previous night, Vonnegut told the gathered crowd, he had dreamed of meeting the descendants of humanity in 1.000 years. In his dream, he asked these survivors how humanity had managed to survive for so long. Their reply? "By preferring life over death for themselves and others at every opportunity, even at the expense of being dishonored."[3]

Three years later, Vonnegut published a longer reflection on what would be required for humanity to survive for a million years

1 Lorrie Moore, "How Humans Got Flippers and Beaks," *New York Times,* October 6, 1985: A7.

2 Stephen Jay Gould, "The Misnamed, Mistreated, and Misunderstood Irish Elk," *Natural History* 82, no. 3 (1973): 10–19.

3 Kurt Vonnegut, "Fates Worse Than Death," *North American Review* 267, no. 4 (1982): 46–49.

and titled it *Galápagos*.[4] In Vonnegut's fantasy, an ill-fated celebrity cruise to the renowned islands stranded a handful of lost souls on the entirely fictional Santa Rosalia. At the same time, civilization collapsed as a result of growing economic inequality around the world. Also, a voracious strain of bacteria consumed human egg cells and rendered all but a handful of women infertile. This remarkable confluence of events marooned a small group of people who became humanity's sole future progenitors. The members of this genetic bottleneck were rich, poor, likeable, insufferable, and ethnically diverse. Vonnegut took great care in establishing the random circumstances that had led each individual to a place on *Bahía de Darwin*, humanity's new ark.

Humanity's sleek, furry future as "innocent fisherfolk," descended from this small band of fellow travelers, was greatly speeded up by the opportune presence of one female child born to this new population. An unpredictable consequence of her grandmother's exposure to nuclear radiation after the American government had detonated two atomic bombs in Japan, Akiko's fine dark pelt of fur protected her from the sun and kept her warm in the water. She represented a punctuated leap in humanity's destiny, a fate sealed by her many furry children. As Vonnegut painstakingly showed, evolution depended on accidental preservation. Yet he suggested, too, that our aquatic future would have come eventually, the gradual result of natural selection favoring humans with keen fishing skills and small brains. Akiko merely spurred things along.

Shortly after its publication, Gould read *Galápagos* quickly, over one weekend. He wrote to Vonnegut the following Monday, praising his novel as "beautifully accurate" in its depiction of evolution's quirkiness and punctuated progress. Vonnegut replied immediately, admitting that Gould had been constantly on his mind as he wrote.[5] Like Gould, he sought to undermine sociobiological arguments that

4 Kurt Vonnegut, *Galápagos* (New York: 1985).

5 Letter from Stephen Jay Gould to Jill Krementz and Kurt Vonnegut, October 7, 1985, Box 111, Folder 6; letter from Kurt Vonnegut to Stephen Jay Gould, October 10, 1985, Box 698, Folder 3; M1437 Stephen Jay Gould Papers, 1899–2004, Department of Special Collections & University Archives, Stanford University Libraries, Stanford, California.

implied the most successful members of society had attained their positions because they were smarter or more attractive. In *Galápagos*, no one survived because they were more fit than their neighbors; they survived thanks to sheer chance.

Vonnegut's wry account of humanity's foibles additionally posited that our most flamboyant characteristic was also our most dangerous: our three-kilogram brains. If evolution could cure us of our self-destructiveness, Vonnegut appeared to ask, would that be worth sacrificing the creativity that had allowed Beethoven to write his Ninth Symphony? There is no satisfying answer in *Galápagos*, but throughout the novel its narrator repeatedly compared human brains to the massive antlers of the extinct Irish elk. (Despite its name, it was neither Irish nor an elk.) Biologists had long blamed the disappearance of this massive deer on the size of its antlers, and Vonnegut followed suit, using the metaphor to invoke human brains as responsible for our own potential demise. Yet if Vonnegut really had read Gould as closely as he claimed, he likely knew that evolutionists no longer propagated this monocausal tale of the Irish elk's extinction. Gould argued that the immense antlers of this deer were ideally suited for mating displays. Their extinction thus came not from self-destructive evolutionary trends but as a result of changes in climate at the end of the ice ages. The metaphor between brawn and brains in the novel then quickly breaks down. This opens the possibility that, for Vonnegut, humanity might not have been as doomed as the narrator—already reconciled to humanity's fate as fisherfolk—insisted.

In *Galápagos*, Vonnegut's depiction of the interconnectedness of life, with its random connections and intricate patterns, was thus both pessimistic and hopeful. He embraced chance and yearned for progress, crafting happenstance into evolutionary adventure. Vonnegut and Gould alike, by invoking disparate pasts and imaginative futures, each wrote hoping their words would defamiliarize the present and challenge readers to be newly surprised by the world in which they live. Historians, in our braver moments, do the same.

The Anecdote

Gregg Mitman

On October 10, 2003, Eleanor collapsed to the ground while walking in the semiarid savanna of Samburu National Reserve, a popular destination for wildlife safari tours, located approximately six hours north by jeep from Nairobi. Within a few minutes, her companion, Grace, had successfully helped lift Eleanor back onto her feet. Shaken by the fall, Eleanor wobbled under the heavy weight of her body. Grace tried to nudge Eleanor along. But Eleanor fell again as she tried to walk. Grace appeared distraught as she tried in vain to get Eleanor back to her feet. As night fell, Grace stayed by Eleanor's side. By morning, Eleanor had died. Over the next few days, kin, distant relatives, and acquaintances came from the surrounding area to gather around and attend to Eleanor's body.

Eleanor was an elephant. Her death and the events that transpired around it caught ethologist Iain Douglas-Hamilton by surprise. Her story is one of the most cited anecdotes among ethologists and animal rights activists as evidence of a widespread behavioral response among elephants to suffering and death among their kind.

Anecdotes abound in the history of animal behavior. The power of their telling lies in the element of surprise. Charles Darwin, himself, scoured far and wide for anecdotes of curious behaviors across the animal kingdom in gathering evidence for his work, *The Expression of the Emotions in Man and Animals*. Darwin was particularly fascinated with an anecdote told by Sir James Emerson Tennent of his witnessing Indian elephants weeping upon being captured and bound in Ceylon. Eager to verify Tennent's observations, Darwin made a number of trips to the London Zoological Gardens to interview the keeper of Indian elephants, who confirmed that he had "several times seen tears rolling down the face of the old female, when distressed by the removal of the young one." A handful of trusted correspondents, the word of a knighted British politician and Fellow of the Royal Society, and the intimate knowledge of an animal keeper were enough for Darwin to transform Tennent's anecdote into evidence to support his claim that the distance between humans and animals was one of degree and not kind. Tears, Darwin argued, were

an outward expression of "grief, dejection, and despair." As in man, so, too, in elephants, Darwin reasoned.[1]

But the anecdote has had a rather sordid past in the annals of science and nowhere more than in the study of animal behavior. In the dogmatic days of behaviorism, the Columbia comparative psychologist C. J. Warden wrote in 1928 a stinging criticism of what he described as the anecdotal school that followed in the footsteps of Darwin. Darwin's extension of evolution by natural selection to include explanation of human mental and moral traits sent his followers in search of concrete evidence documenting animal behavior in an effort to prove the continuity between man and beast. This was all well and good. But, lacking firsthand observations, they appealed, much to Warden's dismay, to the anecdote, long a staple in natural history writing. By the early twentieth century, scores of anecdotal collections had appeared in "which the tendency to humanize and eulogize the mental power of higher animals," Warden exclaimed, "reached the ridiculous." Even Teddy Roosevelt used his bully pulpit as president of the United States and reputation as a sportsman-naturalist to denounce what he saw as a plethora of tales being told about the mental life and behavior of wild animals that he regarded as false to Nature. Among Warden's criticisms against the anecdote as evidence, one stands out. The anecdote, in Warden's view, most often represented "highly selected and atypical behavior," which, he argued, had little, if any, statistical validity.[2]

And there's the rub. It is the chance encounter, the rare event, that often sparks one's curiosity, captivates the attention, and sends one down a path of inquiry. When, in 1960, the young Jane Goodall saw a large male chimpanzee in the Gombe rainforest huddled over a termite nest, she paused to take notice. With binoculars, she watched as he broke off the twig from a plant, stripped it of its leaves, and poked it into one of the mound's many passages. A few moments later, the chimp pulled out the twig coated with tasty termites and promptly

1 Charles Darwin, *The Expression of the Emotions in Man and Animals* (New York: 1872), 166.

2 C. J. Warden, "The Development of Modern Comparative Psychology," *Quarterly Review of Biology* 3 (1928): 491–492.

popped the morsels into his mouth. Goodall remarked with astonishment and disbelief at what she observed. "I remember the day as vividly as it was yesterday," she recalls.[3] Her observations of toolmaking among nonhuman primates swept the scientific community by storm. What began as an anecdote, after repeated observations, became what the late paleontologist Stephen Jay Gould regarded as one of the "Western world's greatest scientific achievements."[4]

Warden may have thought behaviorism had banished the anecdote from science forever. Yet few ethologists can resist its appeal. Over the last century, a new range of techniques has developed to shore up the anecdote in the study of animal behavior. The permutations ethologists now perform to make the anecdote statistically respectable would dazzle even the most strident skeptics. In the case of Eleanor, GPS tracking of three females, each with different genetic relationships to her, permitted Iain Douglas-Hamilton and his team to statistically analyze the time each spent with her body. They hoped to ascertain whether the alleged compassion displayed was confined to Eleanor's closest kin. It was not.[5]

Surprise and wonder in coming to know the life of another organism have often drawn the curious observer into the world of science. Should we be shocked at the continued reticence to jettison the anecdote and deny the emotional life of animals among contemporary ethologists? After all, who can resist a good story? And it is storytelling, which in its many forms has been animating the meaning making of humans for millennia, that might set our species apart from the rest of the animal world.

3 Robin McKie, "Chimps with Everything: Jane Goodall's 50 Years in the Jungle," *Guardian*, June 26, 2010.

4 Stephen Jay Gould, "Introduction," in Jane Goodall, *In the Shadow of Man,* rev. ed. (Boston: 1988), v.

5 Iain Douglas-Hamilton et al., "Behavioural Reactions of Elephants toward a Dying and Deceased Matriarch," *Applied Animal Behaviour Science* 100 (2006): 87–102.

Philosophy Begins in Wonder

Glenn W. Most

In early Greek epic, words of the family θαῦμα (*thauma*) occur fairly often to denote a specific variety of joyous, overwhelmed surprise. Derived from θεάομαι (*theaomai*), a verb that means "to gaze upon" but also "to contemplate, to observe," these terms indicate a rapturous, astonished admiration: never for an unexpected outcome, or indeed for an event of any sort, but instead always for some entity, a person or an object. Almost always, the admiration is the result of a sensory perception, originally sight, though with time this is enlarged to include hearing. In most cases, the subjects who feel the surprise are one or more human beings, and the single, indeed singular, object that provokes it is divine in nature or origin or fabrication—or else monstrous. In any case, it far transcends ordinary humanity.

Very often, the noun is combined with an epexegetic infinitive denoting sight—above all in the epic phrase θαῦμα ἰδέσθαι (*thauma idesthai*), "a wonder to look upon"— emphasizing that it is the visual impact of the astonishing object, which strikes its viewers once and then continues to affect them, that causes this effect. These terms denote the startled human recognition that there is a realm that transcends humanity; it provokes neither consternation nor dread but a kind of hypnotized joy. While in some passages the astonishment may imply a certain uncanniness or intractability, there is no implication of terror. But, by the same token, there is no cognitive component or effect to early epic θαῦμα: this wonder stupefies and exhilarates, but it does not teach.

So it is all the more surprising that Plato, in his aporetic dialogue about the definition of knowledge, the *Theaetetus*, shows Socrates prominently asserting an essential link between θαῦμα and philosophy. Socrates and the young Theaetetus have been debating Theaetetus's first proposed definition of knowledge, that it is simply identical to sense perception, and Socrates has had little difficulty in enwrapping his inexperienced interlocutor in inextricable swaths of objections and paradoxes. When Theaetetus announces that perplexities like Socrates's last barrage of absurd consequences make him feel an extraordinary wonder (ὑπερφυῶς ὡς θαυμάζω, *huperthuôs hôs thaumazô*, 155c) and even dizziness, Socrates replies, "Theodorus

seems to have made quite a good guess about your natural disposition. For this feeling, to feel wonder (τὸ θαυμάζειν, *to thaumazein*), belongs especially to a philosopher, for there is no other beginning of philosophy than this, and the man who said that Iris was the child of Thaumas created quite a good genealogy" (155d).

The genealogy asserted derives ultimately from Hesiod's *Theogony* (lines 265–266, 780), but it is doubtless Plato himself who invents the pseudo-etymological link between Thaumas and θαῦμα and who attributes a philosophical significance to the Hesiodic genealogy. We can easily see, in phonic terms, why Socrates could associate Thaumas with θαῦμα; but why should Iris signify "philosophy"? Elsewhere, Plato's Socrates etymologizes the name of Iris as meaning "to speak" (from εἴρειν, *eirein*, "to speak"; *Cratylus* 408b), but this sense seems far too general to be of much help here. Instead of looking to the name of Iris, let us think instead of her function as the divine messenger who brings humans the announcements of the gods. If she is the mediator between gods and men, then, in Platonic terms, she can be seen as embodying the activity of philosophy itself: for philosophy is the insatiable human desire (*philo-*) for a divine wisdom (*sophia*) that belongs by right to the gods and that humans can never fully attain (*Apology* 20d–23c).

So too, Eros is a philosopher (*Symposium* 204b), for Eros is neither a god nor a human but instead a *daimôn*, a being intermediate between gods and men who carries human things to the gods and divine things to men (*Symposium* 202e–204c). And so Socrates can claim that he himself possesses an "erotic art" (*Phaedrus* 257a) or that he knows nothing about anything except *eros* (*Symposium* 177e). To be a philosopher is to feel dizzy, astonished by aporia—but also to be able to move beyond momentary stupefaction, in the direction of a better argument, a truer doctrine. Plato insists that not everyone is up to the challenge of this philosophical wonder: at the beginning of the dialogue, Socrates goes to great lengths to ascertain from Theodorus that Theaetetus really has a natural aptitude for philosophy (143d–144b)—indeed, Theaetetus even has the very same snub nose and bulging eyes as Socrates does (143e).

Plato's greatest pupil, Aristotle, took up the link between wonder and philosophy that Plato had established, but in conspicuously reasserting it, he gave it a characteristic twist. In the second chapter of the first book of his *Metaphysics*, Aristotle demonstrates by reference to the first philosophers that wisdom is not a practically productive science.

> It is through wonder (τὸ θαυμάζειν, *to thaumazein*) that men now begin and originally began to philosophize; wondering (θαυμάσαντες, *thaumasantes*) in the first place at obvious perplexities, and then by gradual progression raising questions about the greater matters too, e.g. about the changes of the moon and of the sun, about the stars and about the origin of the universe. Now he who wonders (θαυμάζων, *thaumazôn*) and is perplexed feels that he is ignorant (thus the myth-lover is in a sense a philosopher, since myths are composed of wonders {θαυμασίων, *thaumasiôn*}); therefore if it was to escape ignorance that men studied philosophy, it is obvious that they pursued science for the sake of knowledge, and not for any practical utility.
> (A.2 982b11–23, trans. H. Tredennick).

Aristotle retains Plato's interpretation of wonder as a dynamic impulse that pulls men from ignorance of the world to awareness of their ignorance about it to a desire for knowledge of it to, finally, knowledge itself. But he universalizes wonder and the desire for knowledge beyond Plato's tiny elite to all human beings. In the words of the very first sentence of the *Metaphysics*, "All men naturally desire knowledge" (A.1 980a22).

We may contrast this Greek view of the joyous wonder that leads to philosophical knowledge with another ancient tradition, one that likewise posits the recognition of human limits as the first step on the way to true wisdom—except that in this other tradition the recognition occurs under the sign not of joyous admiration but of sacred dread: "The fear of the Lord is the beginning of wisdom" (Proverbs 1:7, 9:10, cf. 2:5, 15:33).

Déjà Vu in Lapland

Staffan Müller-Wille

On May 22, 1732, a day before his 25th birthday, Carl Linnaeus left Uppsala to journey through Sweden's northern regions. It would take him 55 days by foot, horseback, and boat to reach his ultimate destination, Lapland's fell in Norrbotten. In June 2016, I boarded a plane at Arlanda airport near Uppsala to fly to Luleå, the capital of Norbotten on the shores of the Gulf of Bothnia. With me were James Prosek, an American artist, writer, and fly fisherman, and Kristof Zyskowski, an ornithologist from Yale's Peabody Museum of Natural History. In Luleå we were met by another writer, fly fisherman, and bird-hunter, this one the public relations strategist of the Swedish Lapland Visitors Board, Håkan Stenlund. "Team Linnaeus" was now complete. We would spend the next four days retracing the leg of Linnaeus's journey, which took him inland along the Lule River, through the market town Jokkmokk, and on from there to the former silver-mining outpost of Kvikkjokk, where he finally ascended to what the Sámi call "the higher land," or Padjelanta, now a national park.

"Team Linnaeus" makes it sound as if we had a plan. With the likely exception of Håkan, none of us quite did. James wanted to come to terms with the hubris of Linnaeus, imposing order and names on a fluid nature that had already been given names from time immemorial.[1] Kristof, among other things, saw the trip as an opportunity to extend his personal "life list" of observed bird species.[2] I had brought high-resolution images of the manuscript of Linnaeus's Lapland journal but was skeptical that anything mentioned therein would reveal itself simply and directly to the modern observer.[3]

I was wrong, and Florence Caddy (1837–1923), who had herself journeyed through Sweden, was right: Linnaeus's journals were "as

1 See the article he wrote and illustrated for the *New York Times* ("A Botanist in Swedish Lapland," May 16, 2017, https://www.nytimes.com/2017/05/16/travel/carl-linnaeus-swedish-botanist-in-lapland.html).

2 For an image of a vocalizing adult Eurasian Golden Plover (*Pluvialis apricaria* {L.}) from Padjelanta, see Kristof's webpage at the "The Internet Bird Collection," accessed August 13, 2017, http://www.hbw.com/ibc/u/21177.

3 Images of Linnaeus's original manuscript are available from the Linnean Society's Collections at www.linnean-online.org/165368.

clearly descriptive as Baedeker."[4] On the very first evening I was stunned by the accuracy with which Linnaeus had documented the local flora and fauna. Not only the endless variety of willow shrubs along the shores of Lule River but also the tiny black flies that pestered us were readily recognizable from the terse descriptions and lifelike little drawings in his journal (see figure). The next morning, we visited the imposing fourteenth-century church in Luleå Old Town. The procession statues that Linnaeus described—with their moveable limbs and eyes "weeping" from cupped heads filled with water—were sadly gone.[5] But a small round hole in the wall next to the choir entrance, which Linnaeus had measured with a hilarious level of detail, was still patently there.[6] We decided to set the stakes high and look for a pine tree that Linnaeus reported had been "marked with the yearly elevation of the water" of the Lule River in 1667 and 1669. It was not difficult to find. When we stopped at a river islet once famous for its salmon fishery, Håkan asked an elderly local man about it. "Funny that you should ask," he answered, "years ago, people came here all the way from London to see this tree."[7] The pine stump that he showed us only bore a mark from 1758, but that was good enough. When we arrived in Stáloluokta—a village within Padjelanta used by Sámi communities for fishing and pasturing reindeer during the summer—we were no longer surprised to recognize many of its features, like the architecture of the goahti in which our hosts treated us to cold-smoked arctic char and freshly baked flat bread.

Has Lapland been standing still, as traditional as it is remote? It is not standing still at all, as we witnessed when passing by windowless "server farms" or groups of young refugees bent over their smart-

4 Florence Caddy, *Through the Fields with Linnæus: A Chapter in Swedish History* (London: 1887), 1:170.

5 They seem to have been destroyed some time after 1832; see Barbro Flodin, *Nederluleå kyrka, Norrbotten*, Sveriges Kyrkor, Konsthistorisk Inventarium 223 (Borås: 1986), 116.

6 This and the following quotation are from Carl Linnaeus, *Lachesis Lapponica, or a Tour in Lapland*, trans. Charles Troilius, ed. James Edward Smith (London: 1811), 1:240, 253.

7 The company in question was in all likelihood the Linnean Society; see John R. Packham and Roland Moberg, *In the Footsteps of Linnaeus, Lapland 1988: An Account of the Journey Organized in the Bicentenary Year of the Linnean Society of London* (London: 1989).

Insect drawings from Linnaeus's Lapland journal. The upper drawing shows the longhorn beetle *Monochamus sutor* (L.), the lower, a black fly of the genus *Simulium*. The insects are life-sized, the lower drawing measuring ca. 4 mm in length. Carl Linnaeus, "Iter Lapponicum" (1732), Linnean Society of London, Linnean Collections, call no. GB-110/LM/LP/TRV/1/2/1. Reprinted with kind permission of the Linnean Society of London (www.linnean.org).

phones. Linnaeus was not, as Caddy phrased it, "on a Robinson-Crusoe-like form of a Journey"; nor was Lapland, during his time, "one vast emptiness, like the rest of the world in the days of paradise."[8] Travelers from the South had reached the North long before Linnaeus, and northerners had likewise long been traveling to the South. The Lulean Nils Hackzell (1703–1755), for example, publicly defended a "historical dissertation on the city of Luleå and its adjacent parishes" at Uppsala University in 1731. It contains an account of the procession statues that is strikingly similar to that of Linnaeus.[9] Similar dissertations were published on the cities and hinterlands of Umeå, Piteå, and Torneå. They were all inspired by seventeenth-century Gothicism and made liberal use of the many manuscript reports that Count Erik Dahlbergh (1625–1703) had commissioned from munici-

8 Caddy, *Through the Fields*, 169.

9 Nils Hackzell, *Dissertatio historica de urbe Lula eique adjacentibus paroeciis* (Uppsala: 1731), 26.

palities in Norrbotten for his *Suecia Antiqua et Hodierna* (1660–1716), a magnificent collection of drawings that was supposed "to show foreigners how many great and beautiful things are to be found in our fatherland."[10]

Linnaeus thus built on a long tradition of writing (and talking) about Lapland.[11] In addition, he was never alone during his journey. In the old Luleå church, he wrote that "they showed me" the statues; the salmon migrating up Lule River "were said" to come all the way from the Atlantic, and Norwegian-style fishhooks found in the fish "were produced" to prove the point; on Padjelanta, finally, Linnaeus was accompanied by a Sámi guide, spoke of his "hosts" and himself as a "guest." He spent a whole evening with "a Lapp who was citizen of both Sweden and Denmark, and gave me liquor, which I refused, but he made me swig, the same with tobacco." The next day, he set out with two other Sámi in order to cross the mountains into Norway (during this time unified with Denmark), and at this point, his narrative suddenly switches to the first-person plural.[12]

Just like ourselves, Linnaeus was on a guided tour through Lapland. Producing the same tokens and telling the same stories creates a feeling of having been there already, of being at home, wherever we are. Without that feeling, we would not be able to navigate the world or produce anything new and surprising about it.

10 Nils Hackzell, "Staden Luleå och dess gransocknar," trans. Henrik Sundin (Norrbotten: 1928), 33–62; Helmer Lagergren, "Luleå stad med omnejd i slutet av 1600-talet. En beskrivning avsedd för Erik Dahlbergs sueciaverk" (Norrbotten: 1927), 51–69, on 51.

11 Lisbet Koerner, *Linnaeus: Nature and Nation* (Cambridge, MA: 1999), 62–63.

12 Carl Linnaeus, *Iter Lapponicum. Lapplänska resa 1732*, vol. 1, *Dagboken*, ed. Algot Hellbom, Sigurd Fries, and Roger Jacobsson (Umeå: 2003), 83, 86, 103, 107. My translation.

Gallic Acid

András Németh

Recently, 196 lines were discovered from a previously unknown comedy of the Athenian Menander (342–292 BC) in addition to 196 lines of his *Dyskolos*, both copied in the fourth century AD, each on a double parchment leaf. These leaves would be recycled twice. First, in the seventh or eighth century, they were overwritten with Nemesius of Emesa's (390 AD) renowned work *On Human Nature;* then, two centuries later, in 886 the latest layer of texts, a collection of Christian sermons in Syriac, was copied over a massive collection of recycled parchment sheets (*Vat. sir.* 623, pt. 2).[1] In addition to other recycled texts in Greek, Palestinian Aramaic, and Armenian, the same collection of Syriac sermons hid other writings of high significance for the history of science, for example, a Greek version of Ptolemy's *Handy Tables*, an Arabic translation of Theon's *Small Commentary* on Ptolemy's latter work (a copy itself witnessing to the Arabic translation movement in Bagdad, which was the ʿAbbāsid capital in the ninth century), and a Syriac translation of Galen's treatise *On the Qualities of Simple Medicines* completed between the seventh and ninth centuries. Although the number of similarly rich and exciting palimpsests is small, hundreds of textual fragments, long hidden, have been waiting to be uncovered and identified. For more than two centuries, this challenge has stimulated productive collaboration between cutting-edge science and philology.

Driven by the desire to uncover old and important texts, in the late eighteenth century scholars began to make major discoveries by experimenting with substances offered by chemists. From Wolfenbüttel to Paris, from Milan to Verona and Rome, from London to Oxford and Cambridge, textual scholars busied themselves with revealing forgotten and unknown classical texts in palimpsests much as Poggio Bracciolini and his humanist colleagues had sought new texts in the fifteenth century. Among these scholars, Angelo Mai (1782–1854) gained prominence for the many significant discoveries he made using Gallic ink to remove the uppermost texts from re-

1 The abbreviation *Vat.* (*Vaticanus*) refers to manuscript collections within the Vatican Library, each distinguished by language such as *sir.* (Syriac), *gr.* (Greek), and *lat.* (Latin). The Arabic numeral identifies the individual manuscript within the respective collections.

cycled parchment sheets. In addition to his own industrious publishing activity, he was a pioneer in the use of chemistry in the service of philological and codicological studies.[2] In Milan's Biblioteca Ambrosiana and other libraries across northern Italy, Mai studied many codices written on recycled parchment sheets, discovering hidden texts. In 1819, he was appointed *custos* of the Vatican Library, where he immediately began a systematic survey of palimpsests. He usually published the new texts with critical notes, including, among others, perhaps his most important discovery: Cicero's *Republic* (*Vat. lat.* 5757).

The criticism that Mai received from many scholars, frustrated by lack of access to his new finds and relegated to correcting his abundant mistakes, was perhaps justified by an unfortunate consequence of his method, applied mostly on the pages of promising new discoveries. The iron component of his reagent, the Gallic ink, reacted with animal skin, oxidizing and effectively rusting the parchment, often making both the upper and lower scripts illegible and rendering the parchment dry, broken, and blackened. Because of such damage, institutions including the Vatican Library eventually stopped authorizing ambitious requests from textual scholars who continued experimenting with chemical methods into the 1880s and 1890s.

Shortly after his appointment as prefect of the Vatican Library in 1895, Franz Ehrle, a German Jesuit scholar and the father of book conservation as an internationally accepted profession, paid special attention to the palimpsests treated with chemical reagents. At the international conference he convened at Sankt Gallen in 1898, Ehrle suggested the use of gelatin to stabilize and prevent the chemically treated parchment sheets from further deterioration. At the same time, he promoted document photography, a relatively new method at that time, as a useful conservation tool for the palimpsests and other significant, fragile, or damaged manuscripts. In 1906, for the

2 Angelo Mai tried different recipes in *Vat. gr.* 19, as his own notes demonstrate, "Idrosulfuro di potassa" (in left column) and "Galla" (in right column) on f. IIv, "Syruppo di potassa" on f. IIIr. See "Manuscript–Vat. gr. 19," Vatican Library, accessed September 1, 2017, http://digi.vatlib.it/view/MSS_Vat.gr.19/0012 and http://digi.vatlib.it/view/MSS_Vat.gr.19/0014.

first time ever, the facsimile of an entire palimpsest (*Vat. lat.* 5750) was published despite its originally poor legibility.

Without entering the complex history of palimpsest photography, my story ends with the great potential for the latest digital photography to reveal hidden texts. The basic challenge for the photography of palimpsests is to bring the often hopelessly faint traces of a script into the spectrum of visibility to the human eye. This challenging process is made significantly more complex by prior conservation using gelatin, damage from chemical reagents, or biological organisms such as mould. Using mathematical algorithms, however, multispectral photography (also used in biological and aerial photography) offers advantages for processing by combining sets of images captured with different wavelengths of light (natural, ultraviolet fluorescent, and infrared). This new alliance of natural scientific and philological methods continues to generate excitement and new discoveries. Recently, in close collaboration with the image scientists Mike Toth and William Christens-Barry and palimpsest expert Jana Gruskova, I managed to decipher much of the preface to the *Scythica*, authored by Dexippus of Athens. In the style of Thucydides, the text gives an account of the first big wave of migration of Nordic peoples to southern Europe, which the author witnessed firsthand in the third century. His preface survives only in *Vat. gr.* 73, fol. 54r, an original copy of Emperor Constantine VII's (d. in 959) historical encyclopaedia (*Excerpta Constantiniana*), the work at the center of the research project that brought me to the MPIWG and then to the Vatican.

Not only had Angelo Mai been unsuccessful in reading this page, but his chemical reagents had very nearly destroyed it. But by washing off the upper text of the fourteenth century, he had nevertheless unintentionally removed the major obstacle to deciphering the text beneath it; something that is now manageable via multispectral photography. From this new find, we learn how Dexippus defines his role as a historian able to anticipate how immediate moments will influence and change the distant future. Indeed, his very presentation technique would provide future readers with the sensation of participating in crucial moments of a distant past.

Baby Ruth

Christine von Oertzen

Baby Ruth was lying in her crib, making cheerful little sounds, when, accidently, she uttered a short, high caw. The infant instantly fell silent, and "a ludicrous look and astonishment overspread her face."[1] This fleeting moment would have gone unnoticed in most babies' lives, but in Ruth's case, her aunt Milicent Shinn fixed it on paper. Shinn reckoned that the muscular sensation in the infant's throat, in combination with the odd sound itself, must have sparked the appearance of a new emotion in the six-week-old; that emotion was "genuine surprise: a simple nerve shock, closely related to fright."

These notes were jotted down in November 1890, at the heyday of what became known as the American child study movement. As one of the first women to graduate from Berkeley, Milicent Shinn had been on the lookout for opportunities to engage in scientific work compatible with her day job as an editor of a literary magazine and her duties at home. Inspired by Charles Darwin and William Preyer, she viewed her niece's arrival as a unique chance to participate in a citizen science project avant la lèttre, unlocking the secrets of the evolving human mind, through minute, daily observations in the nursery. Quickly hooked, Shinn stuck to this project for years, amassing the most comprehensive individual data set from a single infant's development that would be produced for decades to come. In the process, her family homestead in Niles, 30 miles south of San Francisco, came to resemble an observational habitat, where the baby's grandparents, as well as her mother and father, all supported Shinn's scientific observational zeal.

What fascinated me, when I discovered Shinn's work and her efforts to establish a network of at-home baby observers, was her distinctive voice as a faithful observer, deliberate author, and loving aunt enchanted by the wonders of her niece's evolving mind. Without formal training in psychology, physiology, or biology, Shinn found the challenges in collecting and interpreting her material almost insuperable. Over time, however, she developed a distinct and unerring style, realizing that her radically inductive method let her

1 This and the following quotation are from Milicent Shinn, *The Biography of a Baby* (Cambridge: 1900), 86.

see things that professionally trained observers overlooked, misled as they were by theories based on the adult mind.[2] Against common perception, Shinn claimed that interest and pleasure steered the course of each infant's development in a unique way. And along with interest and pleasure, Shinn's observations uncovered surprise as central to this process.

When present at all, surprise had played merely an accidental role in other scientific baby diaries of the time and had, by and large, been only noticed in much older children. Introduced by Darwin as an emotion manifest in facial and bodily expressions rooted in deep evolutionary history, surprise was mainly regarded as an adaptive ability of heightened attention that enabled many organisms to react quickly in unexpected situations. In Shinn's careful day-in and day-out account of Baby Ruth's development, however, the emotion became apparent as one functionally linked to processes of cognition.

Ruth's reaction in the crib had first seemed a singular event to Shinn. But the baby's amazement developed into a "striking feature" when her visual attention expanded beyond fixation on faces. Her grandfather had the habit of playfully lifting Ruth above his head, and until the end of her third month, Ruth responded with delight. All at once, however, she displayed a completely different reaction, looking around silently, absorbed in the novel appearance of things. From up in the air, the baby inspected the familiar room for many minutes, fixing her gaze, in turn, on every single object within her field of vision. She would "then turn her head quickly, and examine another section; when this was done, she would fret till carried to another place, and there renew her inspection of the room in its changed aspect,—all this with an expression of surprise and eagerness, eyes wide and brows raised. … The habit was striking from the fourteenth week through the seventeenth, most of all in the fifteenth; it then declined, but would recur in a new room."[3]

2 Milicent Shinn papers (Drafts 15th month, p. 8, rs), Bancroft Library, University of California, Berkeley.

3 Milicent Shinn, *Notes on the Development of a Child,* vol. 1, *1893–1899* (Berkeley, CA: 1909), 79–80.

Shinn's findings, accomplished in at-home seclusion and published with much delay, went largely unnoticed. During the 1960s, more than 70 years later, the triad of surprise, pleasure, and interest made a comeback in research and theories of the infant mind, but without reference to her work. In the wake of Jean Piaget's model of cognitive development, psychologists focused on the responses to rather than the occurrence of surprise. In so doing, they redefined the phenomenon from an emotion unrelated to other behaviors to a sequence of events constituting a cognitive mechanism crucial for the progression of the infant mind from sensorimotor intelligence to formal thought.[4] Silvan Tomkins vividly described surprise as a "resetting affect," or "circuit breaker," imposing an interruption through which attention is turned away all at once from one thing to another. He asserted that this pause had a clearing function, crucial for arriving at heightened attention, which in turn enabled interest, pleasure, and curiosity (or fear and distress), ultimately contributing to changes in human cognitive structures.[5] Especially younger children and infants were thought to have a low threshold for surprise, as the novelty of the world startled them with such intensity and frequency, giving way to maturation and experience.

Since the 1960s, models of cognitive structures as well as devices such as refined eye-tracking technologies have made it easier to detect surprise behavior in very young children as a means of further unlocking the capacities of infant thinking. If, as developmental psychologists following Piaget have put it, babies from very early on are "little scientists," geared to learn and grow by surprise, then the most intriguing common feature in human nature may be the ability to see the world anew—ever and anon. Milicent Shinn, I believe, would have agreed wholeheartedly.

4 William R. Charlesworth, "The Role of Surprise in Cognitive Development," in *Studies in Cognitive Development,* ed. D. Elkind and J. H. Flevell (New York and London: 1969), 257–314, on 307.

5 Silvan Tomkins, *Affect, Imagery, Consciousness,* vol. 1, *The Positive Affects* (New York: 1962), 506.

The Hunt

Brian W. Ogilvie

Some animals come to you. In minutes, with a white sheet and a flashlight, a lepidopterist can summon thousands of moths. Most are more elusive. Hares, wrote the English divine Edward Topsell, sleep during the day and eat at night, far from their burrows, perhaps "by secret instinct of nature, to conceale their forms and lodging places unknown."[1] Anyone who has moved closer to get a good look at a bird, only to have the creature fly just too far away to identify, again and again, knows how skittish some wildlife can be. To study it, to catch nature in the act, the naturalist must take it unawares. The hunt reminds us that surprise is not only an emotion; it is also an act.

Hunting is, indeed, the paradigmatic form of taking nature by surprise. In times and places where zoology has emphasized anatomizing and classifying animals, the hunter and the fisher have been the naturalist's chief allies. Those of us who love natural history must remember this fact—and remember that, in terms of the history of natural history, until very recently surprising animals for scientific purposes typically involved capturing or killing them. In the 1550s and 1560s, Ippolito Salviani visited the Roman fish market to find new species. A century and a quarter later, Nicolas Venette identified migratory restlessness in the behavior of caged nightingales.[2]

We can surprise nature in other ways. Confronted with elusive or concealed animals, the naturalist might take another tack: rear a creature from its egg or an immature form. Artists and naturalists who studied and depicted insects and other small creatures often raised captives: Clara de Bock, the widow of the Middelburgh artist Johannes Goedaert who published three books on insects' metamorphoses, complained about the bug jars cluttering her home.[3] The French academician René-Antoine Ferchault de Réaumur reared insects in large numbers to increase his chances of being present at crucial moments, such as when a butterfly emerged from its chry-

1 Edward Topsell, *The Historie of Foure-Footed Beastes* (London: 1607), 266.

2 Ippolito Salviani, *Aquatilium animalium historiae, liber primus, cum eorundem formis, aere excusis* (Rome: 1558); Tim R. Birkhead and Isabelle Charmantier, "Nicolas Venette's *Traité du rossignol* (1697) and the Discovery of Migratory Restlessness," *Archives of Natural History* 40, no. 1 (2013): 125–138.

3 Johannes Goedaert, *Metamorphosis naturalis* (Middelburgh: 1660–69), vol. 3.

salis.[4] The naturalist gains close access to captives, but at the cost of removing them from their original environment.

Still, being a crack shot came to be a useful qualification for a field naturalist. That was one skill that recommended Charles Darwin as a naturalist and gentleman companion to Captain FitzRoy on HMS *Beagle*. In the published *Ornithology* of the *Beagle*, Darwin referred many times to specimens he had shot or killed.[5] A mid-nineteenth-century guide to collecting from the Smithsonian Institution recommended trapping or poisoning mammals if possible, but its list of collecting supplies included a "double-barreled gun and rifle" as well as "fine shot for small birds and mammals." A similar recommendation was made by the handbook of the Agassiz Association, an 1880s publication intended for American high school boys and girls.[6]

Naturalists still surprise animals, but rarely with guns. The camera trap was invented in the late nineteenth century by George Shiras III, initially as a way to stalk animals outside hunting season. Shiras used hunting techniques to capture stunning images of often stunned animals.[7] Sometimes he used the Ojibwa technique of jacklighting: attracting animals to a canoe with a flame in the front, then identifying them by the glow of their eyes. At other times he employed a tripwire to activate a camera shutter and magnesium flash. Like traditional trapping, successful camera trapping required an intimate knowledge of animals' habits in order to know where to set up the camera, flash, and trigger.

In their names, the camera trap and the photo safari reveal the venatic ancestry of techniques still used in zoology and nature films. Movie cameras, fiber optics, infrared sensors, and a host of other

4 Mary Terrall, *Catching nature in the act: Natural History in the Eighteenth Century* (Chicago and London: 2014).

5 Charles Darwin, ed., *The Zoology of the Voyage of H. M. S. Beagle,* pt. 3, *Birds* (London: 1839–1843).

6 Spencer Fullerton Baird, *Directions for Collecting, Preserving and Transporting Specimens of Natural History*, 3rd ed. (Washington, DC: 1859); Harlan H. Ballard, *Hand-book of the St. Nicholas Agassiz Association* (Lenox, MA: 1884).

7 George Shiras III, "Photographing Wild Game with Flashlight and Camera," *National Geographic Magazine* 17, no. 7 (1906): 367–423; Jean-Christophe Bailly, *George Shiras: In the Heart of the Dark Night*, ed. Sonia Voss (Paris: 2015).

"Snowy Owl, White Fish River, Michigan," by George Shiras III, *National Geographic Magazine*, July 1906 (cropped). Image from the Biodiversity Heritage Library. Digitized by Smithsonian Libraries (www.biodiversitylibrary.org).

technical improvements have produced astounding images. But they have also contributed to a surprisingly quick shift in attitudes in the industrial West. Victorians protested cruelty to domestic animals, especially those of the working classes, but had few qualms about killing wild animals for sport or science. George Shiras initially turned to the camera as a way to hunt out of season. But he soon adopted the motto "Gun gives way to camera" and urged other hunters to trade their rifles and shotguns for camera, plate, and flash. Museums and zoos continued (and continue) to surprise animals to capture and kill them, but image and data capture has largely superseded creature capture in the worlds of scientific and amateur zoology. Concern for invertebrates came later, but as Peter Marren has noted, the butterfly collecting that had been a common practice from the eighteenth century through his youth in postwar Britain went out of fashion over the course of the 1970s.[8]

The camera trap holds out the hope of surprising wildlife without disturbing it. Henry Carey, an enthusiastic early promoter of the device, made that bold claim, but the owl that fell from a branch into a river and "swore like a trooper" after the flash fired or the bull moose that overturned Shiras's canoe would have disagreed.[9] They remind us that observing nature is an intervention and that when we set out to surprise nature, we ought to expect, in return, to be surprised ourselves.

8 Peter Marren, *Rainbow Dust: Three Centuries of Butterfly Delight* (Chicago: 2017).

9 Henry R. Carey, "Camera-Trapping: A Novel Device for Wild Animal Photography," *Journal of Mammalogy* 7, no. 4 (1926): 278–81.

Before Wonder

Katharine Park

L'admiration est une subite surprise de l'ame, qui fait qu'elle se porte à considerer avec attention les objects qui luy semblent rares & extraordinaires. Ainsi elle est causée, premierement, par l'impression qu'on a dans le cerveau, qui represente l'object comme rare, & par consequent digne d'estre fort consideré; puis ensuite, par le mouvement des esprits, qui sont disposez par cette impression à tendre avec grande force vers l'endroit du cerveau où elle est, pour l'y fortifier & conserver....Ce qui n'empesche pas qu'elle n'ait beaucoup de force, à cause de la surprise, c'est à dire, de l'arrivement subit & inopiné de l'impression qui change le mouvement des esprits; laquelle surprise est propre et particulière à cette passion....

-Descartes, *Les passions de l'ame,* 2.70 and 2.72

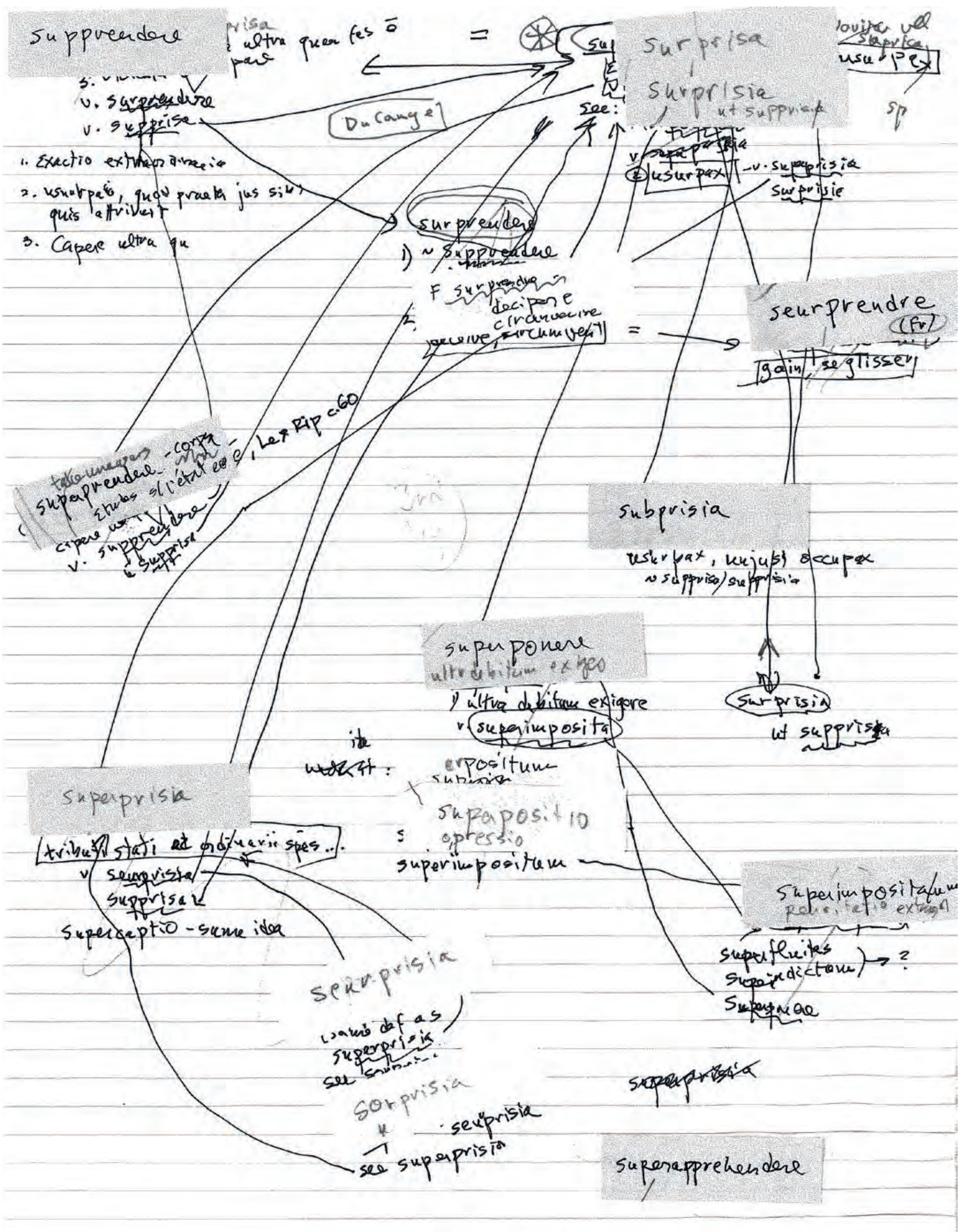
So surprise is particular to wonder but is not itself either a passion or the impression made on the matter of the brain by the object of wonder. It's evanescent and abstract, more adverb than noun. It connotes the force, suddenness, unexpectedness, and all-at-onceness with which that impression is received...

...Weird idea. I wonder where it came from. Checking out the Perseus online Latin dictionary...

Hmmm... Strange. Nothing under *surprendo* there. Or under *superprendo* either. What about *surprehendo*? Na

...Must be postclassical. Let's check out Ducange's *Glossarium mediae et infimae latinitatis*....

HOLY S***!


supprendere
surprisa
surprisia
Du Cange
surprendere
seurprendre
(Fr)
subprisia
superponere
superimposita
superprisia
superimpositum
superimpositafum
seurprisia
sorprisia
see superprisia
superapprehendere

OK, get a grip... There's got to be some kind of story in this morass of redundant and circular references. Let's see...

1. So, the Latin ancestor of "surprise" *is* postclassical! First references are to the law code of the Ripuarian Franks (sixth/seventh century), where "surprise" (as a verb, *superprendere*) means spatial encroachment. For example, if you encroach even a little (*quantulumcunque*) on your neighbor's land, you have to pay a fine of 15 solidi, but if you actually *invade* someone else's land, you have either to "swear with six"* that you have authorization from the king or pay a fine of 60 solidi. There's a related meaning in the law code of the Salian Franks: to bury a corpse in a grave that is already occupied. So the generic definition is to take more (originally, space) than is legal or permitted.

2. Then, by the thirteenth century, the meanings of "surprise" have ramified. The nominal form is now most common (*supprisa/supprisia/ seurprisia/*surprisia, *sorprisia/seurprisia*), and instead of land or space, we're now talking mostly money. A "surprise" is an extraordinary tax, originally unsanctioned by custom but now accepted as legitimate, like the English "surtax"; you may be asked to pay both *prises* and *surprises*. There's still a strong whiff of excess or injustice about the word, however: this word cluster is associated with usurpation or oppressive rule maintained by violence or the threat of violence.

3. Only in the fourteenth century do we find Latin usages suggestive of Descartes's *surprise*. In 1311 Philippe le Bel issued a cartulary referring to a new tax, imposed *preter consuetudine*, as a *novitas vel supprisa*.** Ducange also records the introduction of a fancy new version of the verb *superapprehendere*, with a single witness: an agreement from somewhere (unspecified) in Tuscany in which an Italian individual (unspecified) promises not to seize and occupy church lands "unexpectedly" (*improviso superapprehendere et occupare*).

But Descartes is, after all, writing in the vernacular, so let's move on to medieval French, with the aid of Classiques Garner online, starting with Godefroy's *Dictionnaire de l'ancienne langue française* (1888). The first witnesses from the twelfth century: the noun *surprise* still mostly refers to taxation, though it's nice to see a French source (1365) linking *surprise*

* I had a hard time with the meaning of *cum sex jurare* (swear with six) because of a rookie mistake: I initially read *sex* as *fex*, which I now know is the singular of *feces*. It turns out that swearing with six means that you find six legally eligible men willing to put their hands on a shrine or reliquary, one on top of another (uhm, not on a "fex"). You then put your hand on top of the pile and swear that you're telling the truth. Apparently it's one of the first references to the so-called *Hantgemal*. Whatever that is.

** For some reason this witness appears under *superprisia*.

and *novalité*, as in Philippe le Bel's Latin cartulary. In contrast, the various verbal forms of "surprise" the verb—*sourprendre, seurprendre, sousprendre, sosprendre, souzprendre, suzprendre, soubprendre, sousprendre, souprendre, souspenre,* and *suprendre*—have broader, mostly negative associations, as in "to get a nasty surprise," examples being illness, death, enemies, and unexpected guests. Also, in a more elegiac vein, love, which is always depicted as bittersweet, as in Marie de France's *Eliduc* (late twelfth century): "Lasse! Cum est mis quers suzpris/Par un hum d'altre pais." NB: Men get all kinds of surprises. Women's are mostly amatory or sexual.

So from the very first, in French, we're in the world of (among other things) affect rather than merely struggles over territory. But how do we get from Marie's heart in *Eliduc* to Descartes's brain in the *Passions* of 1649? Using Champier's online *Dictionnaires des XVIe et XVIIe siècles*, bien sûr. Robert Estienne's *Dictionnaire françoislatin* of 1549 is still in the lexical world of the later Middle Ages. *Surprendre* means to take someone unawares by trickery or deception (active) or to be exposed in adultery or a lie (passive). It's adversarial, with connotations of injustice: to "surprise" is to exploit or oppress by violence or deception, preying on the weak, ignorant, or unready, often in relation to taxes and dues. The most common synonym of *surprinse* is *oppressio*.

By the early seventeenth century we're edging toward the realm of Descartes's *admiration*: alongside the many unpleasant surprises recorded in Jean Nicot's *Thresor de la langue francoyse* (1606), we find the phrase *surprins de ioye*. Even more resonant is the entry for *surprendre* in Randle Cotgrave's French-to-English *Dictionary* of 1611, where he defines *surprinse* as in the first instance "a surprisall, or suddaine taking; an assaulting, or comming vpon, a man ere he is aware." Turn that usage into a metaphor for cognition, and it has most of the ingredients of Descartes's "subite surprise de l'ame." And indeed the two principal dictionaries of the late seventeenth century take Descartes's unconventional use of *surprise* on board: alongside the more conventional *prendre à l'impourvu* and *decevoir*, Pierre Richelet's *Dictionnaire françois* (1680) (1) defines *surprendre* as *étonner*, and (2) imports this meaning into Richelet's succinct definition of *admirer*: *s'étonner, être surpris*. Antoine Furetière's posthumous *Dictionnaire universel* (1690) also links wonder and surprise, defining *admirer* as *regarder avec estonnement quelque chose de surprenant, ou dont on ignore les causes*.

But which came first, Descartes's egg or Richelet's and Furetière's chickens? I'd say the egg … but I might be surprised!

The Gift from Serendip

Gianna Pomata

In 1557, a little book came out in Venice under the title *Peregrinaggio di tre giovani figliuoli del re di Serendippo, per opera di M. Christoforo Armeno della persiana nell'italiana lingua trapportato*. Almost nothing is known of this Cristoforo and his life, except for what he says himself in the dedication of his book to a Venetian nobleman. A Christian from the Persian city of Tabriz, Cristoforo arrived in Venice in 1554 and was the grateful recipient of the hospitality the city offered to poor foreigners. Wishing to give something in return for the courtesy received from the learned men of Venice, Cristoforo decided to translate a collection of Persian tales into their language with the hope of "giving them delight." [1]

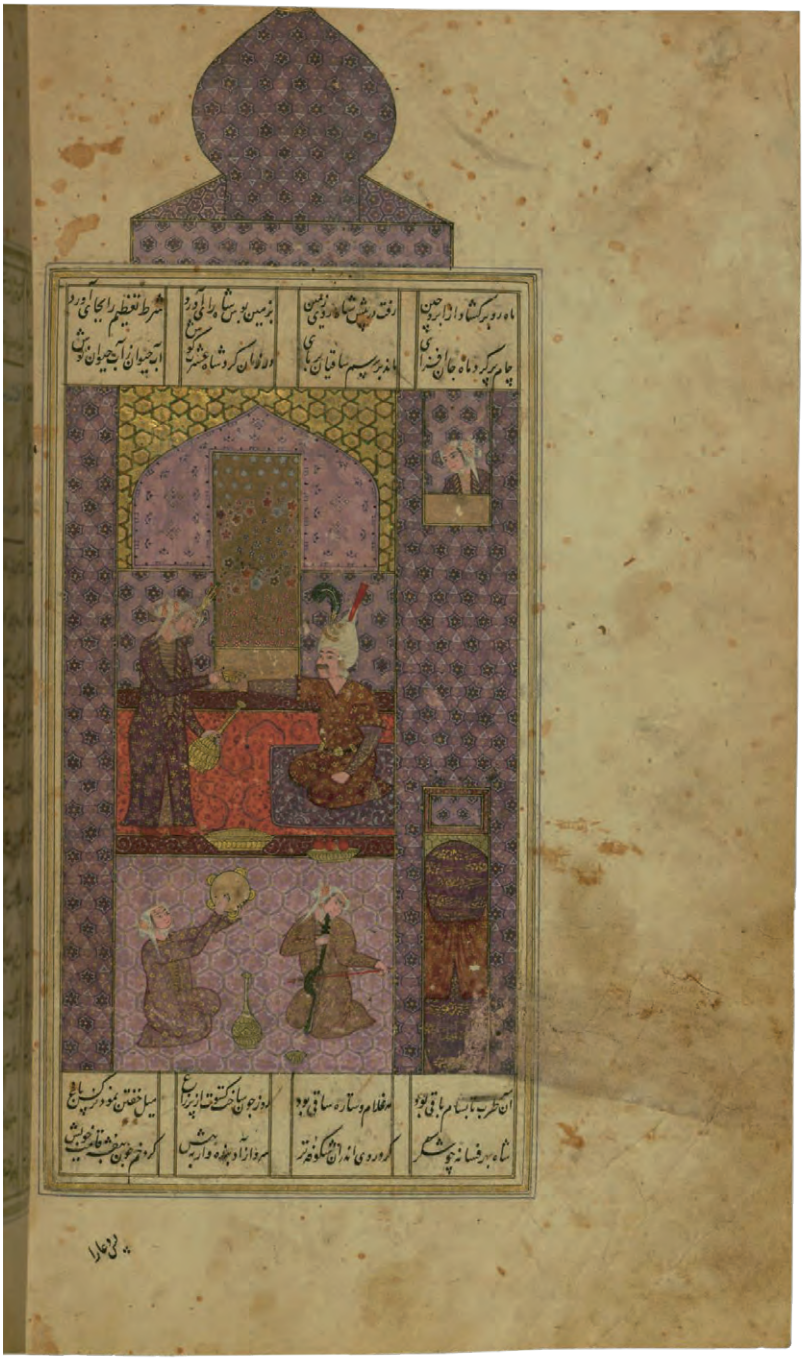
The *Peregrinaggio* was the source of the concept of serendipity—that "pretty bauble of a word" coined by Horace Walpole in 1754 to name the happy circumstance of "making discoveries, by accidents and sagacity, of things one was not in quest of."[2] Much research has been devoted to the vicissitudes of the notion of serendipity in Europe in the centuries after Cristoforo's *Peregrinaggio*. Much less, in comparison, has been done to understand the cultural transfer from Persian to Italian performed by Cristoforo, its context, and its sources. Recent scholarship, however, has identified the main source of the *Peregrinaggio* in the *Hasht-Bihisht* (*The Eight Paradises*, ca. 1302), a novella collection by the Indo-Persian Sufi poet Amir Khusrow.[3] *The Hasht-Bihisht,* which has the distinction of being the first Persian work to be translated and printed in a European language, is a masterpiece of Indo-Persian literature. Strangely enough, it has never been translated in its entirety into English or any other present-day European language. Except for Italian.[4] Thanks to this serendipitous circumstance, I have been able to read it and compare it with Cristoforo's work. What emerges from the comparison?

1 I quote from the modern edition: Cristoforo Armeno, *Peregrinaggio di tre giovani figliuoli del re di Serendippo*, ed. and intro. Renzo Bragantini (Rome: 2000).

2 "Pretty bauble of a word" is the expression used by Lorraine Daston, "Are You Having Fun Today? Review of *The Travels and Adventures of Serendipity* by Robert Merton and Elinor Barber," *London Review of Books* 26, no. 18 (2004): 29.

3 Sunil Sharma, *Amir Khusrow: Poet of Sultans and Sufis* (Oxford: 2005).

4 Amir Khusrow, *Le otto novelle del paradiso*, trans. and postface by Angelo Michele Piemontese (Messina: 1996).



Bahram Gur in the Green Pavilion (left) and *the Blue Pavilion* (right), 1529, ink and pigments on laid paper, scribe: Pir Hussein al-Katib Shirazi, The Walters Art Museum, MS W.622.244B and 254B.

Both the *Hasht-Bihisht* and the *Peregrinaggio* present a sequence of tales embedded in a frame narrative, following a model that was typical of medieval and early modern novella collections East and West. But though the tales are, to a large extent, the same, the framing story is different. In the *Hasht-Bihisht*, the frame concerns the malady of King Bahram, a hero of Persian medieval legends. The malady is attributed to Bahram's obsessive passion for hunting. To cure the king's obsession, seven pavilions are built, each in a different color and each intended to be the residence of a beautiful maiden. Every day, the king is supposed to visit a different pavilion, to be entertained in turn by each pavilion's lady with a story. The storytelling is set in the context of sexual intimacy—a feast of the senses steeped in the brilliant polichromy of the pavilions-paradises.

The intent of the treatment (moving from pavilion to pavilion, from mistress to mistress, from tale to tale) is to wean the king from the hunter's nomadism by luring him to some measure of settled life, its monotony tempered by the daily variation of residence, lover, and story. The frame narrative of *The Eight Paradises* centers on the tensions involved in the transition from the nomadic to the sedentary state and the exciting yet dangerous lure of the hunt—a central theme in premodern Arabic poetry.[5]

In Khusrow's work, the three princes of Serendip appear only once, in the first novella: they are not part of the frame narrative. Cristoforo, in contrast, turned the tale of the three princes, with their uncanny ability to learn from clues, into the frame of his work. In the *Peregrinaggio*, the king's melancholic disease is due not to his obsession with hunting but to the disappearance of his lover, Deliram, and the therapeutic strategy is devised by the three princes with the goal of finding her again. In addition to the pavilion's ladies, they decide to recruit seven *novellatori* from as many cities, hoping they will bring tidings of the lost Deliram. In *The Eight Paradises,* each tale is told by the pavilion's lady, and storytelling is part of the king's sexual entertainment. In the *Peregrinaggio,* the storyteller

5 Jaroslav Stetkevych, *The Hunt in Arabic Poetry: From Heroic to Lyric to Metapoetic* (Notre Dame, IN: 2016).

becomes a separate male figure, endowed with a specific cognitive role: through him, news from all parts of the world can be collected and shared.

In both *The Eight Paradises* and the *Peregrinaggio,* the therapeutic journey is a travel through knowledge acquired from listening to tales. In both, the sequence of stories mimics the wandering of the inquisitive mind "all over the world, wherever there is an enigma, wherever the researcher finds some kind of stratagem," to use Khusrow's own words.[6] Serendipitous sagacity is a theme in both books, but in the *Peregrinaggio* it becomes the central theme.[7] Moreover, and most importantly, the quality of the knowledge pursued is different. The art of detection practiced by the three princes is called by Khusrow "physiognomy"—the ancient Islamic art of *firāsa* whereby one can know hidden things from exterior signs.[8] Cristoforo calls it *arte dell'indovinare, astuzia e sottile avvedimento,* and couples it, over and over again, with *esperienza.*[9] And therein, in this emphasis on experience, lies another significant difference between the two texts. The knowledge that Khusrow celebrates is the *firāsa* of mystical intuition, which was an important feature of Sufi culture. The knowledge highlighted by Cristoforo, in contrast, is another form of *firāsa*: it is that training in guesswork that comes from *fare dell'arte l'esperienza.*[10] In other words, the knowledge pursued in *The Eight Paradises* is sapiential, that in the *Peregrinaggio* experiential.[11] By changing the frame narrative of Khusrow's stories, Cristoforo presented *firāsa* to his Italian readers as experience-based sagac-

6 Khusrow, *Otto novelle*, 210.

7 As noted by Piemontese, Postfazione, in Khusrow, *Otto novelle*, 153.

8 Khusrow, *Otto novelle*, 38, 41. On the *firāsa,* see Youssef Mourad, *La physiognomonie arabe et le "Kitāb Al-Firāsa"de Fakhr Al-Dīn Al-Rāzī* (Paris: 1939).

9 Armeno, *Peregrinaggio*, 25, 92, 97–98, 207.

10 Armeno, *Peregrinaggio*, 98. On the two aspects of the *firāsa*, see Toufic Fahd, "Firāsa," in *Encyclopaedia of Islam,* 2nd ed. (Leiden: 2012). On the mystical acception of *firāsa*, see also Mourad, *La physiognomonie arabe,* 17, 34, 60–61.

11 Bragantini, "Introduzione," in Armeno, *Peregrinaggio,* xvii.

ity rather than mystical wisdom, thus bringing an Eastern rivulet to the "broad river-bed" of Western empiricism.[12]

* * *

In the geographic imagination of the Middle Ages, in Christianity as in Islam, Serendip was the place where Adam fell from paradise and left his first footprint on earth.[13] It was the place of the first clue, reminiscent of the prelapsarian condition, when knowledge and delight were one. A faint but discernible echo of that paradisal unity is in the act of storytelling, which remains the prototype of combining the search for knowledge with the giving and taking of delight. In the reminder of that unity, in a nutshell—the nut of the fairytales, which, when opened, discloses a whole world—lies the gift from Serendip. May the dear friend, to whom this nutshell essay is dedicated, long enjoy serendipity in her quest for knowledge.

12 I borrow the expression "broad river-bed of empiricism" from Daston, "Are You Having Fun Today?," 30.

13 Giovanni de' Marignolli, *Chronicon Bohemorum: Relatio, in Sinica Franciscana*, vol. 1, *Itinera et relationes fratrum Minorum saeculi XIII et XIV,* ed. A. van den Wyngaert (Florence: 1929), 535. See also André Miquel, *La geographie humaine du monde musulman jusqu'au milieu du 11e siècle* (Paris: 1975), 2:78.

Eureka, Overflowing

Theodore M. Porter

Although science of late has had no great success in managing its public relations, almost anyone can appreciate a narrative of science structured as a sequence of discoveries. Surprise fits well into such stories, even if it is not obligatory. It may, like chance, favor the prepared mind. Historians and philosophers of science have been more leery of any focus on discovery. Thomas Kuhn argued in a well-known essay that discovery, so simple in appearance, is complexly structured and difficult to isolate. He instanced the discovery of oxygen, a famous episode of contested priority. A moment's thought makes it clear that merely filling a jar with this gas, which Antoine-Laurent Lavoisier described at first as especially pure air, cannot suffice. Even the recognition of its special chemical properties may fall short. Joseph Priestley's jars were filled with "dephlogisticated air," which escaped with the smoke during combustion and suffocated the little animals forced to breathe it. Soon afterward, Lavoisier came closer to our conceptions, explaining combustion and calcination as the chemical combination of this elemental gas, vital for life, with carbon or iron. However, the name he gave it, oxygen, implied that its defining characteristic was as a principle of acidity. The role of surprise in this story, we should add, depended on the disposition of the chemist. Lavoisier, who planned everything meticulously, despised surprises, quite in contrast to Priestley, who presented himself as incurably curious and utterly fallible.[1]

Natural history, offering so many strange and wonderful forms and mechanisms, seems an exemplary field for scientific surprise. Experimentation, too, has a record of confounding and delighting. Yet even mathematics shows promise. Archimedes's excitement when (as the story goes) he first realized that he could measure any volume by the water it displaced, and in this way determine the density of an irregular object such as a crown, seems to qualify it as a surprising discovery. Two millennia later, Francis Galton recounted a eureka moment in his autobiography: he was rambling on the grounds of

1 Thomas Kuhn, "The Historical Structure of Scientific Discovery," in *The Essential Tension* (Chicago: 1977), 165–177; Charles Gillispie, "The Rationalization of Matter," in *The Edge of Objectivity* (Princeton, NJ: 1960), ch. 6.

Naworth Castle in Cumberland when, seeking refuge from a shower, he suddenly grasped that the laws of heredity should be expressed in statistical units, deviations from an average. This idea "flashed across me," he explains, "in a reddish recess in the rock. I forgot everything else for a moment in my great delight."[2] Yet Galton's cloudburst did not come from out of the blue. He had been brooding.

It may be easier to historicize what people say about surprise than surprise itself. There is a long tradition of moral arguments for science as a submission to facts, which keep us honest. Lorraine Daston has often recited Michael Faraday's line evoking so many appealing thoughts and theories, silently crushed by scientific self-criticism. Karl Pearson's *Grammar of Science*, from which she quotes, invoked Faraday's thought in a section on the imagination, which he described as indispensable for science, even if it could not be allowed to run wild. Criticism, playing the role of natural selection, enabled the creative aesthetic sense to stimulate science without overwhelming it.[3] This seems reasonable enough. Bursts of inspiration may have to be sacrificed on reflection, often with regret; yet can we get by without them? Surprise creates opportunity, whether by disrupting familiar expectations or by opening a new path.

Kuhn insisted on a structure of discovery. Can scientific surprise, which seems so personal and unregulated, be given a structure, and would a theory of the mental spark enhance our historical sense of science? The question is too hard. I will instead proceed with a few reflections on moments of unexpected realizations in the work of history. Each of my four books thus far shifted away from an original plan and left it smelling stale. In every case, there was a recognizable moment when I perceived how the research might expand into domains less trodden by historians of science, yet with some relation still to familiar forms of academic science. I experience it as an open-

2 Francis Galton, *Memories of My Life,* 3rd ed. (London: 1909), 300.

3 Lorraine Daston and Peter Galison, "The Image of Objectivity," *Representations* 40 (1992): 81–128; page 118 and footnote 78 quote Faraday's line from Karl Pearson, *The Grammar of Science* (London: 1892), 38, possibly Raine's first use of this line. The original source is Faraday's lecture "Observations on Mental Education," presented at the Royal Institution on May 6, 1854, with Prince Albert, that German wellspring (according to Lytton Strachey) of earnest Victorianism, in attendance.

ing up of a topic to wider domains and at the same time as a research initiative, once prosaic, now capable of enchanting me with ironies or paradoxes made visible by looking at science from closer to the ground. In contrast to stirring visions of shiny new interpretations, none of which ever seem to go anywhere, the revelation that comes a year or more into a project is always-already linked to a concrete problem linked up with sources. These surprises go beyond what I had been able to imagine. Tracking the unexpected source is now no renunciation but pure seduction. The dull and dry is borne away by irrepressible laughter.

That sense of discovery initiates the happiest months of research, when opportunities seem to open in every direction, and everything I read leads on to further novelties. Of course it can't last. Eventually the work has to be confined within manageable bounds. The surprise, experienced initially as a gold mine ("Eureka" is the motto of California), now seems to depend on blasting deep pits with high-pressure hoses. Not only is there far more relevant material than anyone can possibly read. The historian is now challenged to assemble the pieces into something coherent, with each sentence leading to another and each chapter building on its predecessor. It is a problem not merely of presentation to uninstructed readers but of sifting out for myself of those engaging tidbits that do not advance the narrative. Although some of the "discoveries" in a book arise as revelations, much of it involves an almost endless process of drawing back in the hope of finding some way to advance. I often am surprised by a satisfying argument that finally forces its way to the surface in the fifth draft. And then, after a book leaves my hands, a curiously different book from the one I thought I wrote takes form in the reactions of readers. Once in a while I am startled by an impression that these readers may be right.

Knowledge and (Dis)belief

Jamil Ragep

In the interwar years of 1918 to 1939, a diplomat manqué and a Viennese psychologist decided to vent their frustration with what the world had become, and the imagined catastrophes to come, by writing a book denouncing the person they perceived to be the father of these calamities: Thomas Woodrow Wilson. The diplomat was William C. Bullitt, who had become disillusioned with Wilson's efforts at Versailles and had resigned (or was dismissed) in 1919. The psychologist was Sigmund Freud. The book was essentially completed in 1932, but because of Bullitt's desire not to jeopardize his career, publication did not occur until late in 1966.

The book's publication set off a firestorm. Anna Freud insisted her father could not have written such an ill-tempered book, a sentiment echoed by Eric Erikson and Richard Hofstadter in the *New York Review of Books*. Others, such as historian A. J. P. Taylor, used it as a bludgeon against Freud and psychoanalysis. As it turned out, an examination of Bullitt's papers left no doubt that Freud had been an active and equal collaborator.

A few months after the book appeared, my teenage self was going through the Freud shelves at the Toledo Public Library, determined to read everything he wrote (or at least what was translated). I thus came to peruse Freud and Bullitt's *Thomas Woodrow Wilson, Twenty-Eighth President of the United States*, completely innocent of the controversy and history outlined above. I was appalled; whatever Wilson's faults (and they were many), he certainly didn't deserve the inane analyses on offer. The book caused a crisis: how could a great scientist and humanist, liberator of our innermost secrets and thoughts, be driven to write a work based on what were clearly political motives. Later, Arthur Koestler's *Darkness at Noon* provided a partial answer: if ideology could make one acquiesce in one's own execution, it could certainly drive us to fashion truth as we saw fit.

Science and its history seemed to provide a way out of the many pitfalls of ideological belief: here was a subject that was about unvarnished and transcendent truth, that was the closest we could come to our true, rational selves. Years later, I found myself happily studying the history of mathematics and astronomy of premodern Islam with a mentor who shared and encouraged my devotion to the rationality

and objectivity of science. But a tsunami of counterarguments to this Panglossian optimism was heading our way; science might not be so Weltanschauung-frei as I imagined. And my own research began to uncover ways in which social and religious currents could influence and affect scientific change.

I first became aware of this when studying the eminent religious scholar Abū Ḥāmid al-Ghazālī (d. 1111) and realized that his criticisms of Aristotle and Ibn Sīnā (Avicenna) were not only cogent but in some ways rather "modern" in opening up alternatives to Peripatetic physics. Most scholars had emphasized what they perceived as Ghazālī's antirationality and its implications for the decline of Islamic science, but I and others found that his views opened up interesting avenues. The culmination came with one ʿAlī Qushjī (d. 1474), the son of the falconer at the court of Timerlane's grandson in Samarqand. Unlike Ghazālī, Qushjī was a working scientist whose roots were in the ancient Alexandrian tradition of the mathematical savants: Euclid, Ptolemy, and their siblings. But like Ghazālī, and unlike the Alexandrians, Qushjī was also committed to the Abrahamic God, the "volitional Omnipotent" of Islamic theology, who was not bound by the rules of Greek *physis* or physics. But how could one be a "scientist" studying an orderly universe when one also believes in a God who can upend that order at any time?

Qushjī's solution was to evoke the venerable "pots and pans" argument that "after leaving a house the pots and pans inside do not turn into human scholars who take to investigating the sciences of theology and geometry, despite the fact that the volitional Omnipotent might make it thus in virtue of His will." Lying beneath this assertion is a vast array of arguments and counterarguments regarding God and His creation, His omnipotence and will, and the human capacity to understand them. Qushjī, drawing on several centuries of Islamic philosophy and theology, was able to base his ontology and epistemology on a kind of provisional knowledge: some things are beyond question (such as geometrical theorems), but others, such as the nature of the celestial orbs, remain known only tentatively. But where there is a correspondence between our mental constructs and external reality, there is also a sense of wonder that God could give us

the ability to attain knowledge of the order underlying the universe. Yes, He could change it. But our direct experience, whether with pots and pans or observing the celestial spectacle, somehow allows us to believe that a loving God has provided us with an objective reality, called *nafs al-amr*, that contains both our correctly construed mental constructs and external reality. Shades of Popper's Third World.

But this is still belief. And so, what happens to capitalized Knowledge and Truth? Qushjī could live with provisional knowledge. But could I? Many years after my first encounters with Qushjī, Raine Daston invited me to participate in a research project called "Knowledge and Belief." Both in formal groups and over long, hearty meals in the evenings, my youthful optimism that Truth could win out over the ideological commitments of a Freud or a Rubashov gave way to an acknowledgment that my own knowledge was underlain by belief. But like Qushjī, my belief was (hopefully) based on evidence and a shared human experience that belied my pots and pans turning into scholars. During the last few decades, we have witnessed the catastrophes caused by ideologies based on fanciful beliefs and alternative facts, ideologies far more dangerous than the psychoanalytical malpractice involving Little Tommy Wilson. For this nonbelieving Muslim, the antidote was in the writings of a fifteenth-century believer. No one could have been more surprised.

Making Manuscripts Confess

Sally P. Ragep

I take great comfort these days in reading medieval Islamic scientific manuscripts. The black-on-white confessions from the pens (or mouths) of authors, copyists, marginalia commentators, and others (re)affirm a respect for the written word and remind me of a common humanity of ideas expressed over time and place. The Islamic Scientific Manuscripts Initiative (ISMI) has given me a wonderful opportunity to examine hundreds of texts in the exact mathematical sciences and be privy to the hearts and minds of scholars past. Some two decades ago, Jamil Ragep and I, working in the trenches of research libraries worldwide, conceived of a database; our modest aim then was simply to manage (i.e., not lose) the valuable material we were amassing that was sandwiched within worn bindings of Arabic, Persian, Turkish, and other codices. We proudly watched our baby mature over the years, with much of its nourishment and support coming from its godmother, Raine Daston, and our MPIWG IT family.

One major perk of the ISMI collaborative has been to look beyond the offerings of a few individual texts and manuscripts, interesting in themselves but often unrepresentative of the tradition as a whole, and to view Islamic science as a social endeavor, not just the idiosyncratic outpourings of a few heroic individuals. Now, one would assume that any scientific tradition that stretched over well-nigh a millennium would be viewed as more than a series of solitary ventures; but, surprisingly, the insistence that the fate of Islamic science ultimately rested with a handful of talented, disconnected, and obviously financially resilient individuals still has currency. I'm not sure how adherents of this stance reconcile it with the tens of thousands of extant scientific manuscripts located in repositories worldwide; left unanswered are lingering questions as to who authored, read, and copied these works. Personal accounts affirm that scores of students showed up on the doorsteps of the madrasas and observatories of Marāgha, Samarqand, Constantinople (and countless less showcased locales, such as Bursa, Konya, Merv, and Tabriz) with prior training in the mathematical sciences, this well beyond a rudimentary level. Patronage is often dealt as a trump card to explain (or explain away) bouts of scientific flourishing; Islamic science becomes like Brigadoon, appearing miraculously every century or so. But

though patrons may pay for buildings, instruments, and salaries, they still can't conjure scientists out of thin air.

Having access to a large pool of extant Islamic scientific treatises via ISMI—something inconceivable in a predigital era—has afforded us a means toward understanding the transmission of scientific knowledge within Islamic lands, both diachronically and synchronically. This has led to a number of surprises.

One is how deeply rooted is the tradition of scientific education within Islamic societies. Another surprise is its depth, evidenced by a plethora of original compositions as well as commentaries, supercommentaries, and glosses composed to elucidate the original compositions. (In the fifteenth century alone, there were almost 500 new astronomical works.) Countless readership, ownership, and copyist notes are embedded in the folios of these works. For astronomy, as for other disciplines, a standardized technical vocabulary develops, attesting to the ability to communicate over geography and centuries. Commonplace are unattributed references, puns, quotations—even whole passages—to unnamed works and authors (predecessors and contemporaries alike) with the expectation that any reader worth his salt will recognize them. That so many astronomical works survived through numerous tumultuous upheavals (including the Timurid and Mongol invasions) is testimony to the tradition's tenacity; and this persistence highlights how swiftly texts found safe havens, most likely assisted by well-established scholarly pipelines that disseminated scientific knowledge throughout vast lands.

That the mathematical sciences were taught in Islamic religious institutions on a regular basis is only surprising given the standard narrative. If one depends solely on Islamic biographical dictionaries, where there is rarely an indication of *where* teachers taught scientific texts, one might well conclude that their study was banished to private homes, backrooms, or elsewhere. On the other hand, manuscripts may contain locales, including religious institutions (and ISMI has allowed us to document them), but detecting these demands a careful read of each text, a painstaking and time-consuming task indeed. Another consideration often overlooked is the discussion of scientific theories (and even the inclusion of sample passages from

scientific texts) in other disciplines such as theological works, which of course were studied in Islamic religious institutions. Finally, the *governmental* sanctioning of scientific teaching in religious institutions is something that is easy to document. It is known that once the Ottomans appeared on the scene, theoretical astronomical works were officially taught within their madrasas, and these institutions were dispersed throughout three continents from the fifteenth to the twentieth centuries.

Islamic historical encyclopedias provide lists of specific titles of scientific treatises ranked according to designated levels of proficiency (categorized as beginner, intermediate, or advanced). It is not surprising that modern researchers have paid most attention to a select few advanced works in that these tend to deal with more seductively complex and sophisticated aspects of theoretical astronomy, such as planetary theory and modeling. But consequently, other scientific treatises have been overlooked, characterized as derivative and uncreative. Relegated to a nonunique status (a dime a dozen), it's not uncommon for a library catalogue to describe yet another copy as "même ouvrage," "dasselbe werk," or collectively as "etc."

That a text's value has often been depreciated because of its large number of copies (in some cases hundreds), and its worth often judged without even a quick perusal, is shameful. As a consequence, the extensive pedagogical careers of so many of these texts (in one case inspiring over 60 derivatives spanning seven centuries) has been ignored. Left buried in each copy is a treasure trove of goodies awaiting discovery beyond the rainbow of the text. Downplayed is that collectively these copies evidence a tradition of an Islamic scientific public. Overlooked is that this commentary tradition was being used to introduce new ideas and teaching methods, including those that would later come from European sources. So not surprisingly, attention must be paid. But surprising is that little did we know decades back that our database journey would become a quest to right this unrightable wrong. For among impossible dreams, this is such stuff as research dreams are made of.

Poison in the Archives

Alisha Rankin

The tiny town of Neuenstein in southwest Germany, population 6,500, is not a place you would expect to find either a beautiful castle or a valuable trove of documents. But it has both at once: a marvelous archive housed in an impressive Renaissance palace, a former residence of the counts of Hohenlohe. I spent a glorious week at the Hohenlohe Zentralarchiv (HZA) Neuenstein in the cold January of 2006 while writing my first book on noblewomen-healers. The HZA Neuenstein had several manuscript recipe collections owned by a series of local countesses. I was very pleased with what I found, if not exactly overwhelmed. Like any good archive rat, I had done my catalogue research ahead of time and had a decent idea of the holdings. Still, the manuscripts had some fascinating idiosyncrasies and exciting connections to texts and individuals in other parts of Germany. All in all, I viewed it as a successful archive trip and well worth the trek out to Neuenstein.

Then came the surprise. I was the only person working in the archive that week, and the archivist had been very helpful throughout: letting me take photographs and helping me find the sources I sought. On my last day, as I was paging through a manuscript, he approached me. "If you're interested in the history of medicine in the sixteenth century," he said, "you may want to take a look at an unusual file we have. It's a case in which a criminal was used to test poison." I had a train to catch and was short on time, but it sounded too good to pass up. The file contained records of a criminal trial for theft, accounts of the accused thief's confession under torture, and several letters between the court and Count Wolfgang II of Hohenlohe discussing the possibility of using the prisoner to test an antidote to poison that his mother had recently purchased. I knew that Count Wolfgang was famous for his interest in alchemy, and his mother Anna was one of the women I had come to study. I desperately wanted to examine the file more closely, but I had to get to the train station. In one last act of kindness, the archivist made a copy of the documents for me.

Back in my study in Cambridge, England, where I lived at the time, I examined the file more carefully. The documents described the arrest and criminal trial in December 1580 of a horse thief named Wendel Tümler, who then became caught up in the experimental

Entrance to the archive, castle Hohenlohe Neuenstein, Germany.
Photo: Alisha Rankin.

interests of Count Wolfgang. Rather than hang the criminal as expected, the count wished to use him to test a new antidote to poison called Silesian terra sigillata. Count Wolfgang claimed he had decided such a trial was worthwhile after reading a "Hessian document" that described a previous test of the same antidote on poisoned dogs. My heart started beating faster: I had come across a manuscript in Heidelberg that included a four-page description of an extensive trial using poison on dogs, conducted by the Landgrave Wilhelm IV of Hesse-Kassel in 1580. In the Hohenlohe file, Count Wolfgang appeared to accept the results of this test and wished to see whether the antidote also worked on humans. In a third source, a printed text, I found descriptions of both the Hessian and Hohenlohe poison trials, as well a third trial on dogs in Jülich. I realized that I had accidentally stumbled on the foundation of my next book. I began digging further into German poison antidotes and drew out a rough outline for a book on wonder drugs in the German-speaking world.

A second surprise came after I had moved to Tufts. When I told my PhD advisor, Katy Park, about my new project, she remarked that she had seen a sixteenth-century account of a poison trial on a condemned criminal in the Archivio di Stato in Florence, which sounded remarkably similar to the Tümler case. A year or so later, Bruce Moran recommended that I take a look at the famous herbal written by the Italian physician Pietro Andrea Mattioli because "there's poison all over his book." I took his advice—and I found two accounts of antidote tests on condemned criminals, one directed by Pope Clement VII in 1524. Suddenly, the German book I had imagined took on European proportions. The more I looked, the more cases I found of attempts to test poison antidotes, often on condemned criminals. My book (which I am still finishing) unexpectedly became pan-European, and then global, as I found accounts of poison trials in drug treatises from the New World and Portuguese India.

And that is how my interest in early modern German women healers led me to very unexpected places, thanks to that archivist in the HZA Neuenstein and to Katy and Bruce. The historical phenomenon I found—the poison trial—astonished and fascinated me with the richness and complexity of discussions about religious, ethical,

and experimental concerns and the human-animal divide in drug tests. But although I did not expect a visit to a remote German archive to start me on a journey through pan-European sources in multiple languages, it should come as no surprise that helpful archivists and supportive mentors and colleagues set me on my way. It just goes to show how much the lonely historian relies on the help of others.

Exceedingly Remarkable

Joan Richards

Augustus De Morgan was a very cautious man who did not make statements he could not substantiate. But when he ventured into logic in the mid-1840s, he found himself in territory unfamiliar enough that it could be difficult to be sure he was on solid ground. When his first foray into the subject provoked an accusation of plagiarism from the Scottish philosopher William Hamilton, De Morgan defended his honor to the point of a duel. But then he found a positive message as well. That he and Hamilton had each, independently, seen the need to expand the number of Aristotelian propositions from four to eight struck him as "exceedingly remarkable."[1] His surprise at this unexpected agreement supported De Morgan for a lifetime of logical exploration.

De Morgan was bracingly clear about the central importance of syllogistic logic to all human thinking: "All that is called reasoning, and which cannot be made syllogistic, is not reasoning at all; and all which cannot easily be made syllogistic is obscure."[2] His project was to open up Aristotle's and Kant's formal logic so that it would be adequate to this expansive vision. His challenge lay in explaining how a study that focused on language could be anything but empty. In the second chapter of *Formal Logic* he addressed this problem by explaining that language and words are our essential portal to the real world around us. We think with them.

De Morgan grounded this view of language as central in a form of the Cartesian *cogito ergo sum*: "That our minds, souls, or thinking powers (use what name we may) exist, is the thing of all others of which we are most certain, each for himself."[3] The advantage of this starting point was the certainty of the knowledge it generated; the disadvantage was that if a man "should affirm the whole creation to be a dream of his own mind, he would be absolutely unanswerable." De Morgan found his way out of the trap of this "dreaming man" with

1 Augustus De Morgan, "On the Symbols of Logic, the Theory of the Syllogism, and in Particular of the Copula, and Application of the Theory of Probabilities to Some Questions of Evidence," in *Transactions of the Cambridge Philosophical Society* (1850): 99.

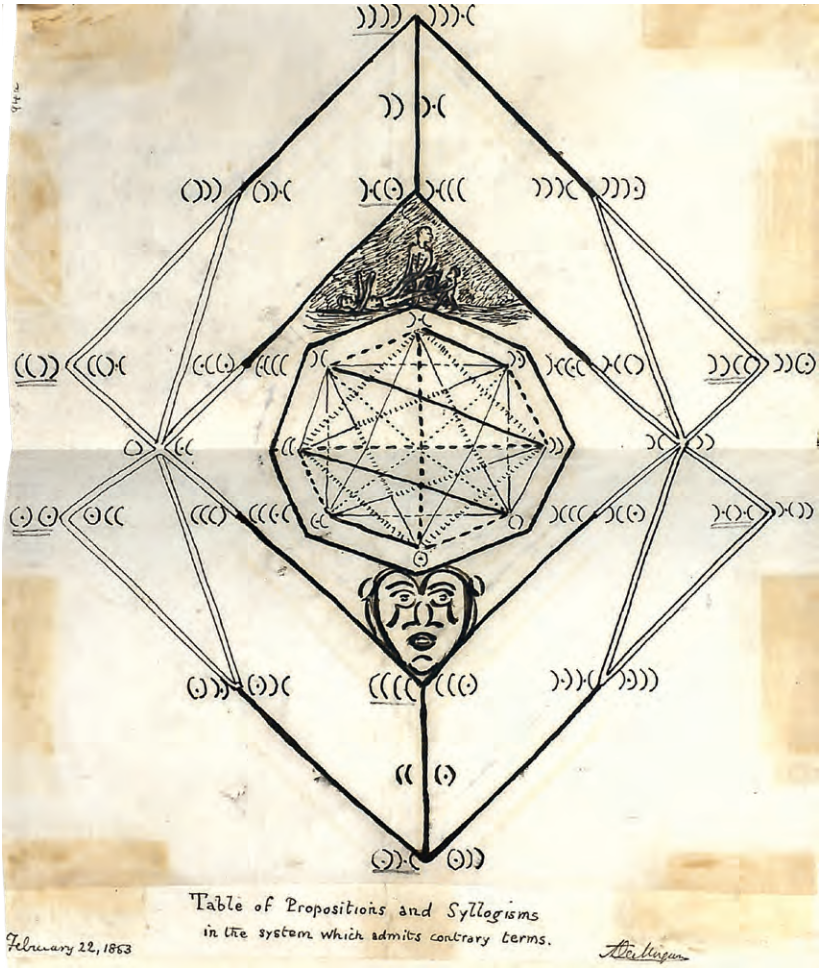
2 {Augustus De Morgan}, *Penny Cyclopedia,* s. v. "Syllogism."

3 This and all following quotations from Augustus De Morgan, *Formal Logic: Or the Calculus of Inference, Necessary and Probable* (London: 1847), 28–31.

the help of other people. What distinguishes the dreaming from a waking man is that "different {waking} minds receive impressions at the same time, which their power of communication enables them to know are similar." As soon as this happens, all are forced to admit that "there must be a *somewhat* independent of those minds, which thus acts upon them all at once, and without any choice of their own. This *somewhat* is what we call an external object." In this construction, it was the "power of communication," that is language, that allowed De Morgan's "sentients" to share their experiences with one another; this was the key to establishing the real existence of the external world.

Even as De Morgan thus answered the challenge of those who found the study of logic to be empty because it focused on language, he faced another question: What is the nature of this "somewhat"? What is the true nature of the world we speak of to one another? In response, he turned to the work of George Berkeley, who maintained "that our impressions of matter are only impressions, communicated by the Creator without any intervening cause of communication." From this Berkelian point of view, the experiences that united all sentient beings, the "somewhat" that constituted external reality, were ideas beamed directly into their minds from a common God.

De Morgan recognized that there was no definitive way to establish the truth of the Berkelian vision, and he surrounded all of his written references to it with caveats. However, his commitment to it comes out in a series of carefully crafted, but never published, images, which he carefully bound into his personal copy of *Formal Logic*. The climax of the series is a sketch of the relations among his eight propositions—symbolized with parentheses and dots—in the logical system that he had developed. The result at first glance may look three dimensional, but on closer examination is not. The result is a figure that from a Euclidean point of view may appear troubled, haunting, and strange, but it is an image of logical, as opposed to geometrical, space. De Morgan was supported in his rendering of it by the agreement about propositions that he and Hamilton had so unexpectedly and unpleasantly stumbled upon a few years earlier.



De Morgan's personal copy of *Formal Logic,* reproduced with permission of the Archives of the Senate House Library, University of London, MS776/1-2.

De Morgan found this final image suggestive enough that he drew it twice. The first is a straightforward diagram that contains just the propositions with a line between them that reflects their relationship to one another. The second is the same with the addition of two little sketches: the heart-shaped face of a calmly alert, supernatural being and an image of the kind of lively human scene a father of seven might be confronting daily. Because of these crude images, this one might seem to be the least serious of the drawings De Morgan bound into his book, but it was more than a passing doodle. It is the only image that he labeled—"Table of Propositions and Syllogisms in the system which admits contrary terms"—and dated—February 22, 1853—and signed, with a flourish. With this titling, De Morgan marked his doodled image as the culmination of months of logical thought.

In De Morgan's final picture, logic framed the relation between God and his reasoning creatures. His little pictures turned his diagram of propositional relations into a Berkelian image in which logic encompassed both human experience and the divine mind. With it, De Morgan had created a divinely saturated logical alternative to the geometrical space of Newton's external world.

The Art of Expectation

Robert J. Richards

When working on a book about Charles Darwin's theory of mind and behavior, I got a very pleasant surprise—of a kind I've never quite experienced again.[1] I knew that Darwin's theory of moral judgment, as he worked it out in the *Descent of Man*, depended on a notion of community selection—natural selection operating on early, proto-human groups, essentially removing the "proto" from the equation. The problem that initially arose for Darwin was threatening: How could altruistic instincts be naturally selected, since moral behavior usually gives the advantage to the recipient and not to the individual exercising the trait. I also knew that Darwin drew his model of community selection from his theory of the evolution of the social insects, especially ants and bees. In *On the Origin of Species*, he had argued that natural selection worked on the entire ant nest or beehive. This application of natural selection would explain how soldier ants and bees might have developed their peculiar instincts to defend the colony even at the cost of their lives. Beehives, for instance, that by chance had more aggressive workers would have the advantage over those that had fewer such workers, and over the course of thousands of generations, the defensive instincts of the workers, now transformed into soldiers, would be honed to such a degree that only a honey-mad bear might brave a theft.

The historiographic issue had pushed me back to Darwin's theory of the evolution of the social insects. I knew that Darwin, at some point in his theorizing, must have recognized that the problem was even more general than that of the solider bees' self-sacrificing behavior. It had been well established in the literature of the period that worker ants and bees were neuters; they could leave no progeny to inherit any instincts or special anatomical traits. In *On the Origin of Species,* Darwin admitted that the problem of the "wonderful instincts" of social insects—for example, "slave-making" behavior in certain species of ant—was "sufficient to overthrow my whole theory."[2] Prior to having arrived at his solution, he had explained in-

1 Robert J. Richards, *Darwin and the Emergence of Evolutionary Theories of Mind and Behavior* (Chicago: 1987).

2 Charles Darwin, *On the Origin of Species* (London: 1859), 207.

stincts in Lamarckian fashion, conceiving them as the result of inherited habit. Only gradually did he seek to apply natural selection in their account.

At some point, the problems must have forcefully struck him. Natural selection gives the individual an advantage because of a fortuitous trait, which then might be passed to progeny. But altruistic behavior favored the recipient of the behavior, not the individual expressing it; and, even more deadly, neuter soldiers can leave no offspring to inherit such traits. Then one day while sifting through Darwin's manuscripts at Cambridge University Library, I came across four pages written in pen and dated June 1848.[3] In this manuscript, Darwin outlined the difficulties exactly and tried several solutions. Among the solutions was the one he adopted in *Origin*, but in the manuscript, he couldn't make it work: by chance all the instincts exhibited by workers in the hive would need to vary simultaneously in the same direction, or so he believed; yet this ran counter to "all analogy." Later Darwin sorted out the difficulty, though mostly by ignoring it. But here, then, in the manuscript was Darwin's clear recognition that I assumed had to exist—and I found it. I was happily surprised by this discovery. In my book, I used the manuscript as a pivot point, from which I could show how Darwin arrived at a solution to the evolution of moral behavior, a solution that many biologists and philosophers still accept. It has not been my fortune, however, to make a historiographic discovery of this kind again. The event, though, has led me to think more generally about discovery in history, both by the scientist and by the historian of science.

Looked at more finely, each advance by a scientist in a project—for example, Darwin's recognizing the similarity between traits of social insects and traits of early human groups—is a discovery, a happy surprise. For the richly imaginative scientist, like Darwin, the surprise might come with little woops of delight. In his *N Notebook*, when he began to construct a theory of conscience that joined reason with instinct, he caught himself in the exuberant flush of

3 DAR 73, "Darwin Manuscripts," Cambridge University Library.

discovery: "Therefore I say grant reason to any animal with social & sexual instincts … he *must* have conscience—this is capital view."[4]

Likewise for the historian, a slight advance in the narrative surprises and glues one to the chair. Even small advances must, after all, be surprises, since each advance begins in the dark. A conjecture is made blindly, which either works or doesn't; if it works, then it's retained, and forward movement now has a new base. Often enough, the happy surprise turns sour as one senses the presumed advance is sliding off into empty air. As I write this sentence, the words come, but not always the right ones, and I must keep pounding the delete key. It's a Darwinian situation. In the terrain of the mind, a word comes skittering forth and is tested against the environment of words already printed and vaguely against the pile of words, one hopes, yet to come. The tentative word may not last, or perhaps it weakly survives only to be undone by later words. When the word appears to work in its conceptual environment, it elicits, at least from this writer, a small surprise and a momentary uplift. For the historian, however, some further art is required. He or she must shape the cumbersome object in a modulated way, to convey to the reader the series of small surprises that will result in a revelation of greater consequence. The artistic task is to formulate sentences that carry both semantic meaning and the music of swelling expectation. Often enough, in this writer's experience, his words have the rhythmic quality of the sound of an L train taking a corner in Chicago.

4 Charles Darwin, *Notebook N* (MS 2–3), in *Charles Darwin's Notebooks, 1836–1844*, ed. Paul Barrett et al. (Ithaca, NY: 1987), 564.

A Manhattan Project

Daniel Rosenberg

There are many kinds of surprise. Some things come out of the blue. Others are a matter of degree. Some are combinatorial: they put familiar elements together in new ways. This last sort of surprise was explored in a kind of Manhattan project in 1933. That year, two decades before he achieved fame for innovations in information processing at IBM, Hans Peter Luhn filed patent for a cocktail recipe guide.[1] (Fig. 1a)

In his career, Luhn would earn more than 80 patents, often clever remixes of prior art. His 1929 Lunometer, which measured thread count, was a marvel of simplicity. A clear acrylic stick printed with fine lines, when laid on fabric, produced a moiré pattern that pointed to a thread-count number on the device's edge. The optical effect was well known; Luhn's insight was to use it as a calculator. His 1958 Keyword-in-Context index, toasted in academia and industry, implemented a concordance system first developed by thirteenth-century French Dominican Hugh of Saint-Cher; yet its application in punch-card computing was both novel and effective.[2]

Though it didn't seem so important at the time, US Patent 2,011,722 proved a base for Luhn's later work.[3] Its function was simple: you select ingredients; it tells you what you can make. On receiving his patent in 1935, after the repeal of Prohibition, Luhn renamed it the Cocktail Oracle and gave it a good slogan: "What you'll get with what you've got."[4]

Tempting as it is to see the Oracle as a diversion for Luhn, his choice of the cocktail as an experimental problem was not frivolous. Because of the formality of its conventions, it offered a neat articulation of a combinatorial—or mixological—information system.

1 Hans P. Luhn. Recipe guide. US Patent 2,011,722, filed September 16, 1933, and issued August 20, 1935.

2 Daniel Rosenberg, "An Archive of Words," in *Science in the Archives: Pasts, Presents, Futures*, ed. Lorraine Daston (Chicago: 2017), 271–310.

3 H. P. Luhn, *H. P. Luhn: Pioneer of Information Science: Selected Works*, ed. Claire K. Schultz (New York: 1968).

4 A copy of the Cocktail Oracle is preserved by H. P. Luhn's son, Christopher Luhn. I am grateful for his assistance.

In cooking, there are many variables: cocktail mixing distills these to just a handful of elements and moves, each significant.[5] Substitute scotch for rye and a Manhattan becomes a Rob Roy. Swap the olive in a Martini for a cocktail onion and you have a Gibson. In the cocktail, distinction is achieved with minimal difference, as in the formula "shaken, not stirred."

The standard Martini requires three ingredients: gin, vermouth, olive. The less vermouth, the drier the Martini. The atomizer has long been a popular tool of vermouth minimization, but over the years enthusiastic dipsophiles have raised the bar higher.[6] Surrealist Luis Buñuel kept his vermouth corked, only "allowing a ray of sunlight to shine through a bottle of Noilly Prat before it hits the bottle of gin."[7] In 1966, the American Standards Association, tongue in cheek, proposed electric light as a reliable alternative.[8] (Fig. 1b)

Luhn's Oracle was a simple device, a stack of acrylic cards printed with a four-by-eight grid, fastened by a spindle. The "ingredient cards" that made up the deck looked like irregular checkerboards. Some squares were transparent. Others were "blackouts." The bottom "key card" gave 32 cocktail names. An opaque square on the ingredient card obscured the name of any cocktail that required that ingredient. As the user selected ingredients—gin, vermouth, and so on—and removed those cards from the deck, cocktail names were revealed.

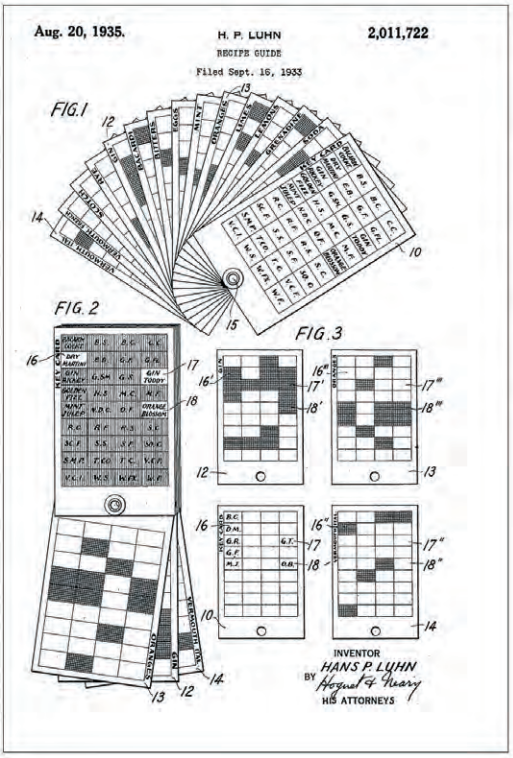
In his patent application, Luhn touted the broad applicability of the "optical coincidence" principle: "It is obvious that there are possible modifications without departing from the spirit of the invention. For example, it is applicable to any recipes for mixing drinks, to recipes for food, to chemical formulae, or to any code by which it is

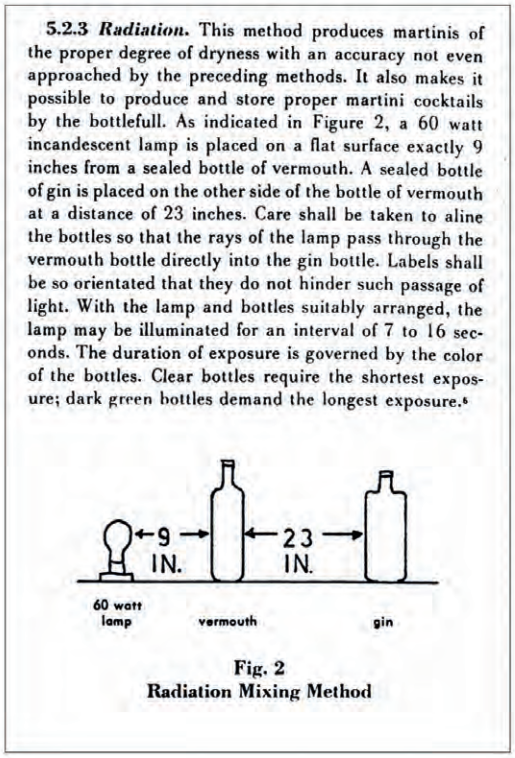
5 On structure in the culinary recipe, see Luce Giard, "The Rules of the Art," in Michel de Certeau, Luce Giard, and Pierre Mayol, *The Practice of Everyday Life,* vol. 2, *Living and Cooking*, trans. Timothy J. Tomasik (Minneapolis: 1998), 215–222.

6 Lowell Edmunds, *Martini, Straight Up: The Classic American Cocktail* (Baltimore: 1998), 90.

7 Luis Buñuel, *My Last Sigh: The Autobiography of Luis Bunuel*, trans. Abigail Israel (New York: 2013), 44.

8 American Standards Association, *Safety Code and Requirements for Dry Martinis* (New York: 1966).





5.2.3 ***Radiation.*** This method produces martinis of the proper degree of dryness with an accuracy not even approached by the preceding methods. It also makes it possible to produce and store proper martini cocktails by the bottlefull. As indicated in Figure 2, a 60 watt incandescent lamp is placed on a flat surface exactly 9 inches from a sealed bottle of vermouth. A sealed bottle of gin is placed on the other side of the bottle of vermouth at a distance of 23 inches. Care shall be taken to aline the bottles so that the rays of the lamp pass through the vermouth bottle directly into the gin bottle. Labels shall be so orientated that they do not hinder such passage of light. With the lamp and bottles suitably arranged, the lamp may be illuminated for an interval of 7 to 16 seconds. The duration of exposure is governed by the color of the bottles. Clear bottles require the shortest exposure; dark green bottles demand the longest exposure.[6]

Fig. 2
Radiation Mixing Method

Fig. 1a (left): Hans P. Luhn, Recipe Guide. US Patent 2,011,722. Fig. 1b (right): Radiation Mixing Method from American Standards Association, Safety Code and Requirements for Dry Martinis, 1966.

desired to ascertain readily different combinations resulting from various designated components." It was to the third of these, chemical formulae, that Luhn applied the principle again at IBM in the 1940s in the photo-electric "Luhn Scanner."

Luhn might well have written his original patent around chemical formulae, but then we would have missed out on his spirited way of mixing ideas, not to mention his Bronx Cocktail, Golden Fizz, New Deal Cocktail, and Rye Cobbler, as well as his old-fashioned descriptions and how-to's. For a taste, here are ingredients and descriptions from Luhn's deck:

Grenadine	If not, pretend you have it and use any other fruit syrup
Lemons	You really should have these
Limes	Pretend you have them and use lemons
Oranges	You can't fake this flavor … try pineapple juice
Mint	If not fresh, forget it and weep
Sugar	Bachelors! Watch this item!
Eggs	Get 'em young and healthy
Bitters	Ground nutmeg and cloves will do in a pinch
Soda	Watch for the bubbles
Bacardi	This is not a soft drink
Gin	What! No gin?
Rye	Good old rye!
Scotch	Don't be stingy with this one
Vermouth, French	Frenchmen can't be wrong!
Vermouth, Ital.	Be sure you know the difference

Wry humor notwithstanding, Luhn's recipe guide deserves its place in the history of information technology. In this respect, the standard history is not wrong but too dilute. The experiments that produced US patent 2,011,722 stirred Luhn's interest in information design. From the Oracle came the scanner and an allegory of invention, with a twist.

Connaître, s'estimer, rire

Sophie Roux

Descartes fait de l'admiration la première des passions et insiste sur sa spécificité. Les autres passions se rapportent à ce qui est bon ou mauvais pour nous ; elle précède toute évaluation, étant suscitée par la surprise que provoque le rare ou l'extraordinaire. Le désir excepté, les passions vont par paires (amour-haine, joie-tristesse, etc.) ; elle n'a pas de contraire. Elles s'accompagnent de mouvements du sang et du cœur ; elle touche seulement le cerveau. Indifférente au bien et au mal, cantonnée au cerveau, l'admiration est la passion cognitive par excellence. Aussi faut-il n'en avoir ni trop, ni trop peu. Les curieux en ont trop, leur attention ne se fixant pas assez longtemps pour connaître ; les hébétés, en ayant trop peu, prêtent attention seulement au déjà connu. Ainsi, l'admiration a trouvé sa place en tant que passion cognitive dans *Wonders and the Order of Nature*.[1]

Mais l'admiration ne serait pas la première des passions s'il s'agissait seulement de modérer les excès des savants. Son développement principal est la générosité, qui est la clef de toute vertu. L'estime de soi étant l'admiration de sa propre grandeur, la générosité est une estime de soi bien fondée, car elle porte sur ce qu'il y a de plus grand en nous, notre liberté de bien agir. Mais, si l'admiration est suscitée par le rare et l'extraordinaire, d'où vient que nous admirons notre liberté ? Notre liberté n'est pas rare : nous sommes libres et la générosité consiste à le savoir. Mais elle est extraordinaire : elle nous fait en quelque façon ressembler à Dieu. Une deuxième face de l'admiration apparaît : la générosité consistant à estimer notre liberté, c'est la passion morale par excellence.[2]

La troisième face de l'admiration cartésienne est l'effet qu'elle produit sur le corps. Étant purement cérébrale, elle ne cause par elle-même aucun mouvement corporel ; toutefois, la surprise qui la caractérise a la force d'augmenter d'autres passions. Ainsi, combinée avec un peu de joie et, parfois, avec un peu de haine, elle fait affluer du sang dans le poumon et en chasse l'air présent, ce qui provoque le

1 René Descartes, *Passions de l'âme*, II, 53, 70–78, in *Œuvres de Descartes*, ed. Charles Adam et Paul Tannery, nouv. ed., 11 vols. (Paris: 1964–1974) (par la suite AT), 11:373, 380–386; Lorraine Daston et Katherine Park, *Wonders and the Order of Nature, 1150–1750* (New York : 1998), 13, 302, 308, 311, 316–317, 320.

2 Descartes, *Passions de l'âme*, III, 149–153, 160, in AT, 11:443–446, 451–453.

rire.[3] Les philosophes avaient depuis longtemps lié l'admiration et le désir de connaître, mais aussi vu dans notre liberté le ressort de la vertu. L'association de l'admiration et du rire est plus énigmatique. Un peu d'histoire peut l'éclairer.

Avant la Renaissance, trois émotions avaient été associées au rire : le mépris de l'indigne (Aristote, Cicéron, Quintilien), l'admiration pour le nouveau (Isḥāq ibn 'Imrān et Avicenne), la joie en face du plaisant enfin (Jean Louis Vivès).[4] Jouant avec ces références, les médecins du milieu du XVIe siècle discutèrent du lien entre l'admiration et le rire. Constatant que nous avons trois réactions face au nouveau, l'admiration, qui suspend l'âme, l'extase, lorsque cette nouveauté est immense, le rire enfin, Girolamo Fracastor lia l'admiration et le rire. L'inattendu suscite l'admiration, l'admiration, la joie, et la joie, le rire ; plus précisément, l'admiration et la joie provoquent deux efforts contraires, l'un de suspension, l'autre d'expansion, qui composent le rire.[5] François Valeriole contesta le lien de l'admiration et du rire : on admire sans rire des phénomènes météorologiques extraordinaires ; on rit devant des bébés sans les admirer ; bref, l'admiration porte, contrairement au rire, sur de grandes choses.[6] Enfin, François Vallès défendit Fracastor. Aux contre-exemples de Valeriole, il répondit qu'admiration et joie doivent être petites pour causer le rire : plus grandes, elles conduisent à l'extase. Surtout, si le rire exprimait la seule joie, il ne serait pas le propre de l'être humain, les bêtes aussi étant joyeuses ; mais nous comprenons qu'il le soit s'il résulte non seulement de la joie (passion de la partie animale de notre âme pour le plaisant), mais de l'admiration (passion de la partie rationnelle de notre âme pour le nouveau).[7]

3 Descartes, *Passions de l'âme*, II, 72–73, III, 124–127, 178, 197, in AT, 11:381–383, 419–422, 465, 476. Voir également AT, 4:305, 409–410.

4 Jean Louis Vivès, *De anima et vita libri tres* (1538) (Zürich : 1563), lib. III, 211–214.

5 Girolamo Fracastor, *De sympathia et antipathia rerum liber unus* (Venise : 1546), cap. 20, 23–26.

6 François Valeriole, *De enarrationum medicinalium libri sex* (Lyon : 1554), lib. III, Enar. 9, 217–219.

7 François Vallès, *Controversiarum medicarum et philosophicarum libri decem* (1556) (Lyon : 1591), lib. V, cap. 9, 596–603.

Cette controverse médicale eut un écho durable. Francisco Suàrez prend le parti de Fracastor et de Vallès et soutient que le rire naît d'une sympathie entre la faculté vitale et la faculté rationnelle de l'âme, la joie étant l'acte de la première, l'admiration l'acte de la seconde[8]. Laurent Joubert défend au contraire la thèse de Valeriole que le rire est indépendant de l'admiration, et ajoute qu'il suppose un certain dégoût.[9] Les Conimbres examinent l'admiration et le rire pour réfuter l'objection que la division entre appétit intellectif et appétit sensitif ne suffit pas. Ils rattachent la première à l'appétit intellectif et expliquent, après Thomas d'Aquin, pourquoi elle cause de la joie alors qu'elle naît d'une certaine ignorance. Ils font du second un effet tantôt de la joie, tantôt du contentement, ce qui est dire qu'il dépend tantôt de la partie supérieure de l'âme, tantôt de sa partie inférieur.[10] Adrien de Montluc argumente pied à pied pour défendre la thèse de Fracastor et Vallès contre celle de Valeriole.[11] Marin Cureau de la Chambre réfute tour à tour les opinions de ceux qui associent le rire à la joie, à l'admiration, ou aux deux à la fois, pour défendre l'idée originale que le rire est une passion sociale.[12] L'enjeu de ces discussions était de donner une description du rire, mais aussi de le situer dans l'économie des facultés. Il est lié à l'admiration, non seulement parce que la surprise provoque le rire, mais parce que, étant le propre de l'être humain, il devait être la manifestation d'une faculté proprement humaine.

Descartes connaissait cette controverse : il évoque le rire « sardonien », c'est-à-dire le rire purement corporel, et l'illustre par une anecdote empruntée à Vivès.[13] En faisant du rire le mouvement corporel que suscite un peu d'admiration, de joie et de haine, il se rangeait

8 Francisco Suàrez, *Partis secundae summae theologiae tomus alter … de anima* (1572), 1621, lib. V, cap. 5, 11–13, on 213.

9 Laurent Joubert, *Traité du ris* (Paris : 1579), 16, 163–166, 238.

10 Conimbres, *Commentarii … in tres libros de anima* (Lyon : 1600), In III, cap. 13, Quaest. I, art. 5–6, 478–481.

11 Adrien de Montluc, » Discours académique du ris «, in *Les jeux de l'inconnu (*Paris : 1630), 7–25.

12 Marin Cureau de la Chambre, *Les charactères des passions* (Paris : 1642), 168, 183–198.

13 Descartes, *Passions de l'âme*, II, 127, in AT, 11: 422, et AT, 4:410.

dans le camp de ceux avaient considéré que, le rire étant le propre de l'être humain, sa genèse supposait l'intervention de la partie rationnelle de l'âme. Cependant, contrairement à eux, Descartes ne divisait pas l'âme en parties. Ainsi le rire se trouva-t-il associé à la passion cognitive et morale par excellence, l'admiration.

Gossamer Threads

Anne Secord

The reader observes as the flier prepares. A steep ascent, a momentary pause, then a sudden launch on a silken thread, which, when coiled and gathered together, acts like a balloon for floating through the air.

When Gilbert White included this observation in his *Natural History of Selborne* (1789), he could have called the flier a balloonist.[1] Four years previously, he had witnessed the earliest Montgolfier flight undertaken in England. The great balloon, appearing in the sky no larger than a tea-urn, had passed over the small parish of Selborne and left White in a state of awe and exhilaration.[2] White understood this aeronautic feat. Just a month earlier, his nephew Edmund and a companion had made a model balloon out of paper and supplied the "buoyant air" by burning a cotton plug of wool soaked with spirits of wine. The experiment failed outdoors, but in the vicarage belonging to Edmund's maternal uncle, despite the propensity of the paper to catch fire, the mini-Montgolfier soared up the stairwell and rested against the ceiling until the fuel was exhausted. White thought this "small exhibition explained the whole balloon affair very well."[3]

But White had not seen a Montgolfier when he observed the flier that shot away on a silken thread. Nonetheless, he recognized that the wingless creature, a tiny spider that had run up his open book before launching itself from the top of the page, must, like the hot-air balloon, possess a locomotive power. He was sure of this because the spider had gone off at considerable velocity in a room where the air was still and with no assistance from White's breath.

This observation caused White to wonder at the locomotive power of spiders, but it was not presented as a wonder. As he pointed out, the phenomenon of spiders ballooning had been noted by Martin Lister a century earlier.[4] Instead, White's observation of his minia-

1 Gilbert White, *The Natural History and Antiquities of Selborne* (London: 1789), Letter 23 to Daines Barrington, June 8, 1775.

2 Rashleigh Holt-White, *The Life and Letters of Gilbert White of Selborne*, 2 vols. (London: 1901), 2:135–136.

3 Entry for September 1, 1784, in *The Journals of Gilbert White, 1751–1793,* ed. Francesca Greenoak, 3 vols. (London: 1986–1989), 3:52.

4 Anne Marie Roos, *Web of Nature: Martin Lister (1639–1712), the First Arachnologist* (Leiden and Boston: 2011), 105–107.

Gossamer at St Leonards-on-Sea nature reserve, East Sussex.
Photograph courtesy of Ross Lawford. © Ross Lawford.

ture flier served as a rational end point to a memory of wonder involving several registers of surprise.

The events of September 21, 1741, were so wondrous and rare that they remained vivid in White's recollection almost 34 years later. On that day, White, an Oxford undergraduate at home in Selborne for the vacation, had set out with his dogs before daybreak to hunt game birds. As dawn broke, he saw that the ground was thickly matted with cobweb. This seemingly most delicate of substances—gossamer—immediately revealed its hidden strength. As the dogs commenced the hunt, noses to the ground, the strong, sticky web covered their eyes. Thus surprised and blinded, they lay down to scrape the webs from their faces with their front paws. With his dogs "hoodwinked," White returned home musing on the "oddness of the occurrence." But the perfect autumn day was just starting its series of surprises.

From nine in the morning to the close of the day, the inhabitants of Selborne experienced a continuous shower of large "flakes or rags" of cobweb. As the flakes twinkled in the sun they drew the attention of even the "most incurious." Past observers of the phenomenon had also been hoodwinked by gossamer, believing it to be the substance of clouds or the finest goose down, even that it represented bits of the Virgin Mary's winding sheet that fell to earth during her Assumption.[5] By 1775, White was confident that nobody doubted that the flakes were produced by swarms of small spiders; instead, what needed explanation was the shower itself. He reported that a learned observer (his father, John White) imagined that the gossamer had been blown, like thistledown, from an elevated meadow, before falling on the fields below. To test this conjecture, White senior had ridden to the top of a hill, which he thought would raise him above the shower, only to discover "to his great astonishment" that the flakes descended in the same manner as on the lower ground.

White described the gossamer shower through a series of responses ranging from confusion and astonishment to intellectual curiosity, all of which reflect aspects of the brief, involuntary emo-

5 Peter Marren and Richard Mabey, *Bugs Britannica* (London: 2010), 111.

tion of surprise: that fleeting suspension of rationality at encountering the unexpected. Surprise itself does not last; it is only the states of mind it gives rise to, such as fear or wonder, that are sustained. This is apparent in White's 1775 account of the 1741 shower, where his rational discourse is twice interrupted by the wondrous spectacle of falling gossamer flakes twinkling in the sun. According to Joseph Addison, the most surprising events are the most memorable.[6]

In his *Natural History*, White supposed that the shower was a consequence of both spiders and gossamer threads becoming entangled in dew, rising up into the atmosphere through evaporation, and the spiders thickening their webs in the air until they were heavy enough to fall back to earth. But understanding why this should happen on one particularly fine autumn day was, he confessed, a matter beyond his skill. Despite his rational discourse, White himself continued to associate the gossamer shower with surprise because it was something he experienced only once. "Every thing that is *new* or *uncommon* raises a Pleasure in the Imagination," Addison claimed, "because it fills the Soul with an agreeable Surprise, gratifies its Curiosity, and gives it an Idea of which it was not before possest."[7] For White, the gossamer shower was not just an arresting sight but the moment he became possessed of the idea of the interconnectedness of natural occurrences. When, a few years later, observing nature became his pleasure, it no longer took a gossamer shower to excite his attention: it was the ordinary, regular workings of nature that would continually surprise his soul.

6 Christopher R. Miller, *Surprise: The Poetics of the Unexpected from Milton to Austen* (Ithaca, NY, and London: 2015), 24.

7 Joseph Addison, "The Pleasures of the Imagination," *The Spectator* no. 412 (June 23, 1712).

Eureka!

Jim Secord

The most common expression of scientific surprise is "Eureka" (Εύρηκα). The colorful story associated with the word, told by Vitruvius about Archimedes two centuries after the latter's death, has had a fascinating career. Archimedes, asked by the king of Syracuse to determine if a golden crown was mixed with silver, found the answer while bathing. Archimedes realized that an object's volume (and hence the crown's density) could be measured by the water it displaced. Leaping out of the bath for joy, he ran naked through the streets shouting, "Eureka, Eureka"—I have found it, I have found it!

That is just about all anyone knows about the history of the word. It was only in the second half of the nineteenth century that "Eureka" began to be used in something close to the way that it is today. Before then, to think of discoveries in science as involving "Eureka" or "Aha" moments was unusual.[1] After Vitruvius's work became widely known among the learned in the fifteenth century, the "Eureka" story featured in accounts of the eccentricities of learned men. In rare cases, Εύρηκα (always in Greek) signaled devotion to the great master of antiquity. In recalling his discovery of the "milky veins" (the lymphatics of the thorax) in 1622, Gaspare Aselli recalled telling the learned men nearby, "I say with Archimedes: *Eureka,* and at the same time I invite them to the spectacle of such an unusual thing." Christiaan Huygens's notes are emblazoned with the word in capital letters. A bemused assistant recalled how Isaac Newton "turn'd himself about, run up y^{e} stairs like another Archimedes, with an εύρηκα, fall to write on his desk standing, without giving himself the leisure to draw a chair to sit down on."[2]

By the eighteenth century, references to Eureka often had this kind of satiric connotation, recognizing (as a standard dictionary put

1 The trend is clear in Google Ngram Viewer for "Eureka."

2 Aselli is quoted and translated in Gianna Pomata, "*Praxis Historialis*: The Uses of *Historia* in Early Modern Medicine," in *Empiricism and Erudition in Early Modern Europe*, ed. G. Pomata and N. G. Siraisi (Cambridge, MA: 2005), 104–146, on 119; for Huygens, see Michael S. Mahoney, "Christian Huygens: The Measurement of Time and of Longitude at Sea," in *Studies on Christiaan Huygens,* ed. H. J. M. Bos et al. (Lisse: 1980), 234–270; and for Newton, see David Brewster, *Memoirs of the Life, Writings, and Discoveries of Sir Isaac Newton* (Edinburgh: 1855), 2:26.

it) "an affected importance annexed to an insignificant discovery."[3] "Eureka" appears in comic poems such as Alexander Thomson's mock-epic *Whist* (1792) and Peter Pindar's *Sir Joseph Banks and the Emperor of Morocco* (1788). The magnitude of the discoveries "Eureka" had come to represent is evident in Henry Fielding's *Joseph Andrews* (1742), when Mr. Adams hits upon a method of paying a bill despite his traveling party's funds having been stolen. The word also had associations with Freemasonry, which traced its heritage back to ancient mathematical wisdom.

The toxic combination of naked enthusiasm and pedantry continued to render "Eureka" an unlikely candidate for regular use in the Romantic era. Yet it does crop up in Lord Byron's *Childe Harold's Pilgrimage* (1812–1818), though only to refer to a sighting of ruins which prove to be a mirage. The word makes a rare positive appearance in the mathematical diary of the 19-year-old Carl Frederick Gauss, who in 1796 wrote, "EYPHKA. $N=\Delta+\Delta+\Delta$," recording his solution of the triangular case of Fermat's polygonal number theorem.[4] Satisfying though this result was, it had perhaps simply taken a frustratingly long time to work out.

How did "Eureka" gain its celebrity? To understand this, we need to look to the emerging culture of reporting inventions associated with the Industrial Revolution. By the 1830s in England, "Eureka" makes occasional appearances as a byword for novelty: a railway engine, a brand of hairbrush, a machine for making Latin verses, an offhand mention in a review of a biography of the chemist Humphry Davy.[5] In America, with its optimistic focus on progress, the word was somewhat more widely employed. When New Yorkers first saw daguerreotypes in 1839, they immediately imagined that the inventor "must have exclaimed in the language of the philosopher of old—'eureka—eureka!'"[6] A steamship was named *Eureka* in 1840, and

3 David Evans Macdonnel, "Heureka," in *A Dictionary of Quotations,* 3rd ed. (London: 1799).

4 G. Waldo Dunnington, with additional material by Jeremy Gray and Fritz-Egbert Dohse, *Carl Friedrich Gauss: Titan of Science* (1955; rprt. New York: 2004), 471.

5 *The Times,* October 27, 1838, 5; *The Times,* July 23, 1843, 10; *The Times,* June 19, 1845; "Life of Sir Humphry Davy," *Journal of the Royal Institution* 1 (1831): 347–360, on 360.

6 "The Daguerrotype," *The New-Yorker,* December 14, 1839, 205.

six years later a journal appeared as *Eureka: A Record of Mechanism, Inventions, Patents, Science and News*. These were occasional references, although characteristic of a growing faith in progress and the power of individual genius. Edgar Allan Poe recognized the trend by calling his cosmological prose-poem *Eureka*.

What made "Eureka" a commonplace was gold. From March 1848, the same month in which Poe's speculations appeared, reports began to leak out that the precious metal had been found in California. Although these never mention Archimedes or his bath, the connection was made late in 1849 by Major Robert Selden Garnett of the United States Army, who was in California from his native Virginia. Garnett had learned Greek at the Norfolk Academy and had studied engineering and drawing both there and at West Point.[7] Clearly a devotee of Archimedes, he designed a state seal featuring the motto "Eureka" above a seated Minerva overlooking San Francisco Bay.[8] California was henceforth the "Eureka" state, and subsequent findings of gold (as in Australia) were indelibly coupled with the word.

The linking of "Eureka" to the century's greatest public sensation provided a wealth of positive associations that advertisers, journalists, inventors, and scientists were eager to exploit. "Eureka" became a keyword of the second industrial revolution, in which scientific and technical innovations went hand in hand—a name for oil wells, mines, engines, guns, household appliances, and clothing. "Eureka" also became retrospectively associated with a range of historic scientific insights, from Newton's apple to Louis Pasteur's discovery of left- and right-handed crystals in the tartrates. Such accounts were part of a conception of discovery that emerged with the mass circulation of print, a notion of epiphany and distracted genius that matched the Archimedean template.

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7 Arthur M. Bergeron Jr., "Robert S. Garnett (1819–1861)," *Encyclopedia Virginia,* Virginia Foundation for the Humanities, last modified June 20, 2014, accessed August 21, 2017, https://www.encyclopediavirginia.org/Garnett_Robert_S_1819–1861. For the Norfolk Academy curriculum, see A. J. Morrison, *The Beginnings of Public Education in Virginia, 1776–1860* (Richmond: 1917), 140.

8 John Ross Browne, *Report of the Debates in the Convention of California* (Washington, DC: 1850), 303–304.

"The Great Seal of California," *Illustrated London News*, January 12, 1850, 21. Reproduced by kind permission of the Syndics of Cambridge University Library, NPR.C.313.

It is no coincidence, then, that scientific discovery is today often thought to proceed by what early-twentieth-century psychologists began to call "Eureka moments."[9] That way of thinking, like so much of the framework still used to understand the workings of science, has its origins in a culture of marketing, commerce, and journalism that began to emerge in the nineteenth century. "Eureka" has become an advertisement for science: in books, museum displays, hands-on science galleries, television documentaries, and internet sites.

Yet, in a sense, the surprise invoked by "Eureka" is of a limited and even predictable sort; after all, Archimedes knew what he was looking for. We might do better to follow Isaac Asimov's apocryphal dictum: "The most exciting phrase in science, the one that heralds new discoveries, is not 'Eureka' (I found it!) but 'That's funny…'"[10]

9 Théodule-Armand Ribot, *Essai sur l'imagination créatrice* (Paris: 1900), 252.

10 Garson O'Toole, "The Most Exciting Phrase in Science Is Not 'Eureka!' but 'That's Funny …'" Quote Investigator, last modified March 2, 2015, accessed August 21, 2017, https://quoteinvestigator.com/2015/03/02/eureka-funny.

An Unexpected Letter

David Sepkoski

On May 1, 1999, I learned of the sudden death of my father, J. John "Jack" Sepkoski, Jr. A professor of paleontology at the University of Chicago, he was a leading practitioner of an approach to the study of evolutionary patterns via quantitative analysis of data from the fossil record. Within a day I was back in Chicago, having the surreal experience of being interviewed over the phone for his *New York Times* obituary.

I knew very little about my father's career, actually. Although growing up I often interacted with his students and colleagues, I had only a vague awareness that he worked with fossils and, more mysteriously, with computers. At the time of his death I was a PhD student in history of science, but I had never read any of his scientific articles or asked him about the details of his research. Busy with my own interests, I suppose I always assumed I had plenty of time for that in the future.

It was with a mixture of pride and regret, then, that I began to realize—as newspaper obituaries and testimonials from colleagues came out—that he had been part of an important scientific movement that changed the way we understand the history of life. To oversimplify somewhat, he and colleagues demonstrated that much of the pattern of life's history has been determined by chance events: major episodes of mass extinction caused by unpredictable events like the asteroid impact that wiped out the dinosaurs (and many other groups) 65 million years ago. As mammals we ourselves are the direct beneficiaries of one of the major surprises in the history of life.

And then came the second surprise. In the summer of 2001, I was asked by my father's colleagues to help figure out what to do with all of the materials in his office. By chance I knew an archivist at the American Philosophical Society (APS), who agreed to go through the office with me to decide what was worth saving. In truth, I had never visited an archive before, and so the weekend we spent sorting through filing cabinets and cardboard boxes was my first experience actually handling historical documents. Of course I couldn't resist pausing now and again to read a letter or flip through an old notebook.

It was purely by accident, though, that I stumbled on a document that changed my career: while I was carrying a stack of yellowed manila folders crammed with miscellaneous papers, a thin sheet of paper slipped free and floated gently to the floor. It was a letter typed on old-fashioned blue airmail paper, and I glanced at it as I picked it up.

The letter was from Stephen Jay Gould, my father's graduate mentor at Harvard, who, as even I knew, was one of the most important evolutionary theorists of the late twentieth century. It was written in what I would come to learn was Gould's characteristic prose style (it began "the Procrustean dimensions of this air-letter assure that the reply will be neither Nietzschean nor Joycean"). It was dated April 1971 (a year before I was born) and was Gould's response to learning, while on sabbatical in Oxford, that my father, a young PhD student, was considering transferring to UC Santa Barbara—in part because the Cambridge winters were long and cold!

I had never known about this decision that might have changed both of our lives, but it was Gould's argument for staying that caught my attention. While he conceded that "there's probably more joy in California," the case he made for staying was worded as prophecy: "There's a revolution going on in ecology and biogeography," he wrote, and "the next great innovator in paleoecology will be the man {!} who successfully learns to understand this revolution and transfer its insights into paleontology." Gould strongly implied that my father had a choice between sunny California and being part of a major intellectual transformation. He stayed at Harvard.

But now I was curious about what Gould meant about this predicted "revolution" and whether my father did indeed play a part in it. I was too far along on my dissertation (on seventeenth-century mathematics) to change topics, but I held onto the letter until I had taken my first job, where I had some money to travel for research. And so my first real archive trip was to the library of the APS to look at my father's papers in more detail, where I found all kinds of evidence that indicated that he had, indeed, been in the center of a remarkable period of intellectual ferment in paleontology. In the process, I also discovered both the joy of archival research and a latent fascination with evolutionary biology. I immediately turned my

attention away from the history of mathematics (in truth, I needed little encouragement) and haven't looked back since.

The chance discovery of Gould's letter was the start of my real career as a historian, but it was also the beginning of a long conversation with my father that I wish I had been able to have while he was still alive. In the process, I have learned about my own history and about the nature of history itself. After all, what makes history different from, say, physics is that the stories we tell (unlike the story of an atom or a projectile in flight) are contingent on chance or unpredictable events. As my father's mentor Stephen Jay Gould put it when discussing the history of life, contingency is "no more nor less than the essence of history." And the essence of contingency is surprise!

A Promenade

Elena Serrano

Consider Goya's oil painting *Spring (The Flower Girls)* from 1786.[1] Dressed as a Spanish lady, the absentminded Flora pauses her promenade to receive the floral gift of a *maja*. Meanwhile, a peasant has tiptoed up behind her. Hiding there, he holds up a rabbit, a symbol of spring, that will startle her when she turns her head. Goya vividly depicts the peasant's delight—sparkling eyes, red cheeks—in anticipating Flora's surprise. With a naughty smile and a finger about to cross his lips, the peasant asks the *maja*, and the viewer, to keep quiet, all thus becoming gleeful coconspirators, excitedly awaiting Flora's reaction to the unexpected.

Here I will focus on the "collective performance of surprise," which greatly depended on watching and being watched, in this case in what was perhaps the most fashionable site for promenading in late-eighteenth-century Spain: the gardens of El Capricho (The Caprice). In doing so, I will highlight how astonishment, gender, and knowledge grew together in the garden.

In 1783, the Duchess of Benavente bought a rural property on the outskirts of Madrid. She designed most of its 150 hectares in the Anglo-Chinese style (also called picturesque)—a supposedly English invention that stood in stark contrast with the grand geometrical French style. A novelty in Spain (except for the royal gardens in Aranjuez), Anglo-Chinese gardens were distinguished not only by serpentine tracks, irregular topography, and babbling brooks but especially by their *follies*: theatrical settings strategically placed here and there. The duchess's guests might unexpectedly bump into a tiny chapel (with a real hermit), a two-floor cottage in the Petit Trianon style, a neoclassical apiary (housing 80 beehives that could be seen through glass walls), a navigable channel leading by gondola from a Chinese quay to a dancing pavilion, a hydraulic machine, a temple of Venus (featuring Bacchus instead), and a column (with Saturn eating his son at the top).

1 "Las floreras o la Primavera," Francisco de Goya y Lucientes, Museo Nacional del Prado, accessed September 3, 2018, https://www.museodelprado.es/coleccion/obra-de-arte/las-floreras-o-la-primavera/a7d9b670-77a0-43bb-b97e-aa04a04711d6.

Francisco de Goya, *Spring (The Flower Girls)*, 1786.
© Museo Nacional del Prado, Madrid.

A promenade through the picturesque garden was carefully designed to inspire a "mouvement admiratif de l'amé," as Denis Diderot defined surprise. This could vary from the "slightest emotion of pleasure" to agitation or terror. Designing an Anglo-Chinese garden required *follies*—and though catalogues offered models for the perfect eremite-house or Chinese pavilion, it was the owner who ultimately created the garden's character. Smells, colors, sounds, even placement of the morning or evening light were all carefully considered to create unforgettable sensual experiences. In The Caprice, amazement was a collaborative effort that included an expert in theater sceneries (*maestro tramoyista*) and Goya himself. In addition to staid pastoral scenes, the duchess bought four shocking works by Goya that included witches and allusions to the Inquisition (*pinturas de brujas)*. She also purchased the first exemplars of his *Los Caprichos,* a collection of engravings that used unexpected visual metaphors to criticize the Spanish upper classes and clerical behavior. Bound in an album, Goya's work resided in the duchess's library for visitors to leaf through.

Sensual experiences were laden with the moral and political. In *Spring,* Goya played with the symbolic and the quotidian: surprise intermingled with visual metaphors, literary references, and political agendas. The two-floor cottage in The Caprice, for instance, was customized with a figure of an old woman spinning. The cottage became the symbol of the ideal peasant house in accordance with actual policies promoted by the enlightened circles of Madrid. In order to stop rural migration toward urban textile production, reformers proposed to return this work to rural women. Moreover, from 1787 onward the duchess herself promoted spinning and other textile production among Madrid's poor women through the women's branch of the Madrid Economic Society.

Scholars have acknowledged the toing and froing between literary and real worlds, always inspiring and reinforcing one another. A promenade through The Caprice afforded upper-class female visitors the opportunity not only to play at farming but also to reenact the "woman philosopher," a successful literary character. Consider, for example, the apiary. Transparent beehives and other instruments of

observation were widely used by literary and real characters alike for admiring the "wonders of nature." In the *Spectacle de la nature*, for instance, the translation of which was freshly edited to much acclaim in Spain during the 1770s, the Countess of Jonval's country house was the setting for her attentive observation of nature. As a fictional country house, The Caprice was home to fruit trees and tree nurseries, a silkworm breeding ground, greenhouses, exotic vegetables, and various agronomic experiments, to mention but a few. Sitting in the apiary, female observers of the hustle and bustle of bees might recall and perhaps reenact not only the countess's study of insects but also her enlightened conversation—always brightened with philosophical and religious reflections—with the other guests in the room. Yet the beehives were placed in a surprising setting: to observe the bees, visitors sat in a luxurious hall decorated with Italian marble floors and columns with Corinthian golden capitals. One can only speculate if the intention was to invoke the lesson of Mandeville's *Fable of Bees*: private vices such as desire for material goods could drive the wealth of society and bring public benefit.

In fact, it was widely thought that fashion-driven feminine behavior could have certain benefits. Mulling over the duchess's Caprice, the secretary of the powerful Royal Academy of Fine Arts (Academia de bellas artes) concluded that for the prosperity of the country the best imaginable fashion among aristocratic women would be a vogue for country houses. Who but the landed gentry could afford to lose an entire harvest in an experimental garden, breed new species, invest in novelties? Thus, he pleaded, "May God grant that the elite gentlewomen bring about, for the benefit of their fatherland, that which has not been conceded to men."[2] The joyful, sensual, collective performance of surprise in *The Caprice* was in fact serious feminine business.

2 Antonio Ponz, *Viaje de España*, 18 vols. (Madrid: 1772–1794), 13:773, preface: "y acaso tendrá Dios dispuesto que las grandes Señoras efectúen en beneficio de su patria lo que no ha sido concedido a tantos hombres."

Upper London

Sally Shuttleworth

In his work on *The Emotions and the Will*, nineteenth-century psychologist Alexander Bain discussed the "emotions of the intellect," and those flashes of identification that can illuminate work in both the arts and the sciences when things lying apart are seen to be linked, and "we are arrested, startled, and excited into a pleasing wonderment."[1] Such modes of "pleasurable surprise," he argues, vary with subject matter, from the sense of enlarged power that can accompany major scientific discoveries to the vaguer yearnings for increased insights, which can lead to a scholar's experience of "elation of mind" or "intellectual bliss." Intellectual bliss is probably too extreme a state to associate with the Upper Reading Room of the Bodleian Library or the perusal of nineteenth-century scientific journals, but startlement and excitement do capture the sensations I experienced on opening up the first volume of the *Asclepiad* (1884–1895),[2] a little known periodical that had the distinction of being penned entirely by one man, medical researcher and public health reformer Benjamin Ward Richardson (1828–1896).

The pleasures of reading scientific periodicals are decidedly mixed: there can be the tedium of toiling through endless tables but also the excitement of the unexpected. In this case what the volume appeared to offer was a microcosm of nineteenth-century medical research, in its practical and cultural contexts, bringing together in unexpected ways diverse aspects of Victorian culture and medicine. The famous general periodicals of the Victorian age, such as the *Fortnightly Review* or the *Nineteenth Century*, are renowned for their interdisciplinary subject mix, with literature, politics, and science intermingling in their pages. Medical periodicals by the later century, however, were more focused and constrained. Not so the *Asclepiad*, which carries an extraordinary range and mixture of material, from an account of the reinterment of the remains of William Harvey (instigated by Richardson) to an article on aneurism of the coeliac axis;

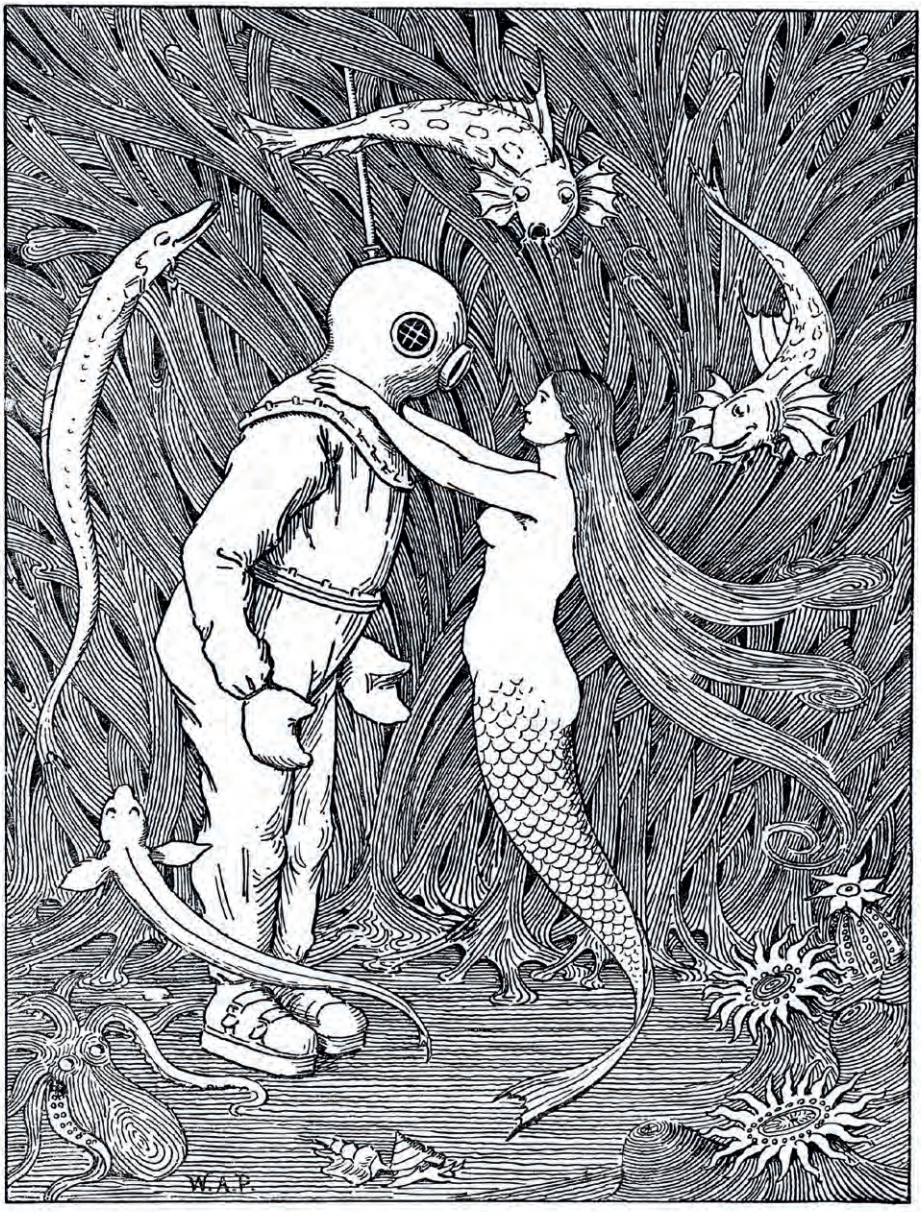
1 Alexander Bain, *The Emotions and the Will,* 3rd ed. (London: 1880), ch. 12, "Emotions of Intellect," 215–219.

2 Benjamin Ward Richardson, ed., *The Asclepiad: A Book of Original Research and Observation in the Science, Art, and Literature of Medicine, Preventive and Curative* 1 (1894). All references in the essay will be to this volume.

and from studies of the possibilities of living in a "factitious atmosphere," as shown by Henry Fleuss's invention of a diving suit, to instructions on how to maintain the temporary preservation of post-mortem specimens. Richardson also published the first of his series of medical biographies, starting interestingly with William Gilbert, the sixteenth-century physician and author of *De magnete* who Richardson labels "The First Electrician." These biographies were subsequently collected as *Disciples of Aesculapius* (1900), making a significant, if idiosyncratic, contribution to the early historiography of medicine.

Richardson's own work was consistently at the interface of medicine, science, and technology, and one can track these intersections in the essays (which draw on his work over the previous two decades): his accounts, for example, of his lectures at the Royal Polytechnic Institution using the great induction coil to measure the effects of electricity on the body or, in another version of testing the limits of the body, the series of measurements he conducted on the American "professional pedestrian" Edward Payson Weston, who walked a startling 5.000 miles in 100 days (resting, of course, on Sundays) and delivered a lecture at the end of each day, without showing (or so it was reported) any visible signs of fatigue. Richardson was constantly testing, pushing to see how far physiological, and indeed psychological, life could be analyzed and measured. In "Felicity as a Sanitary Research," he takes Joseph Priestley (not Jeremy Bentham) as his guide, in an analysis of all the material, social, environmental, and physiological conditions necessary for felicity, offering a call to arms to all his fellow physicians to lead the political battles against slum housing, appalling factory conditions, and environmental pollution. Detailed analysis is mixed with stern missionary fervor: "Can we, scientifically, connect health with happiness? If we cannot we had better never have been born."

Richardson rose to international fame in 1875 with a lecture on his vision of "Hygeia," an ideal city of health. In this issue of the *Asclepiad,* he turns his attention to a call for plans for the reconstruction of the city of London. His essay, "Upper London," is a visionary delight: the roof tops of London are to be leveled, so that they can be



SCENE FROM A SUBMARINE PANTOMIME.
TANTALISING POSITION OF A SUSCEPTIBLE DIVER.

Punch 109 (December 28, 1895): 303.

turned into a series of green walkways or terraces, rather like those springing up in our own cities in recent years: "charged with flowers and trailing evergreens, they would be the empyrean gardens of the great city." There would also be connecting bridges, so that those on foot or on "light noiseless vehicles, like tricycles" could move easily and freely across the city, in a pollution-free environment: such developments, he suggests, would lead to the purification of the air since houses would install the smoke-consuming furnaces designed by Sir Spencer Wells (surgeon to Queen Victoria's household and famous for his ovarian surgery, but also a very active sanitary campaigner). The bridges between the houses would also carry electric cables and street lights: "Imagine the metropolis turned into a fairy land by this adventure of science into the domain of art, and art reciprocating the idea with all her rich resources, and we see in our mind's eye what our children, when we are all of us gone, may really see, and perhaps thank us for proposing for their benefit."

Richardson captures the romance of science but also the idealism and sense of responsibility to the future that lay behind so many public health campaigns in the Victorian era. He notes, in conclusion, that he writes without expectation that his plan will be accomplished in his lifetime but "forseeing it as a necessity and a practicality in the times to come." When Richardson died, one obituary noted that he was the most best-known medical man in England; yet he has largely slipped through the nets of history of science, appearing only in occasional footnotes. That call to the readers of the future resonates, however, across the years, eliciting those flashes of identification identified by Bain that lie at the heart of intellectual pleasure and excitement and also, dare I say it, responsibility.

The Joy of Invention

Otto Sibum

In the early 1830s, Moritz Hermann Jacobi wrote in his diary that his recent invention was "eine Erfindung, die mir viel Spaß macht, weil sie die Not erzeugte." Indeed, he was about to construct an electromagnetic machine in which magnetic force *directly* induced a rotational mechanical force. He wrapped metal wire around cylindrical bars of soft iron. Sixteen bars of equal size were produced; eight of these were mounted at equal distance in a circle on a wooden frame. The other eight bars were positioned opposite to the fixed bars but mounted on an axle so that they were able to rotate. A battery provided the necessary electric current running through the bent wire. The electric current produced in this way effected a magnetic force, which interacted with the field created by the bars positioned opposite. If the magnetic forces were of the same kind, they would repel each other, and the rotating part of the machine would move.

By means of an ingenious method of connecting the different circuits and installing a control mechanism called the "commutator," the magnetic poles were periodically reversed, and a continuous rotation of the bars was possible. This "commutator" was made of a copper disc with wooden sections inserted at regular intervals on its edge. Four of these discs were mounted on the rotating axis. The conducting and nonconducting sections of the discs allowed the reversal of the magnetic poles that made the coils spin. It was the centerpiece of the whole setup. And, after long and stressful trials, much to his surprise, it worked fantastically: "I have advanced, after all my experiments, that magnetism is a force, acting like universal gravitation, purely as some function of space. … The reversion of the poles being brought about instantly, there would thus be an infinitely accelerating velocity. But a system, moveable on an axis and capable of having continued circular motion is the only one which could be susceptible of such a velocity."[1]

Machines had fascinated Moritz Jacobi since his student days. The son of a wealthy Jewish merchant family in Potsdam, he had ini-

1 Moritz Hermann Jacobi, "On the Application of Electro-magnetism to the Moving of Machines," in *The Annals of Electricity, Magnetism, & Chemistry and Guardian of Experimental Science*, vol. 1, *October 1836 to October 1837,* ed. W. Sturgeon, trans. J. H. Lang (London: 1837), 408–415, 419–444.

tially followed his parents' wishes and studied civil engineering as part of *Kameralistik* in Berlin and Göttingen, finishing a degree in architecture. Between 1825 and 1832, he worked as a Prussian civil servant, translated civil engineering books, and finally became a civil engineer (*Baumeister*) in Königsberg, where his younger brother Carl Gustav Jakob Jacobi had been professor of mathematics since 1827. But he did not stay for long. Already by 1835 Moritz Jacobi had been elected professor of civil engineering (*Zivilbaukunst*) at the Russian University of Dorpat.

For Jacobi, every exact investigation of nature based on instrumentation was a human intervention.

> If {man's} emancipation from nature is to be achieved through work, then work, in its universal meaning, first consists, if not in overcoming the fixed categories of time and space, then at least in voluntarily, that is, freely shaping their mutual designations. … I do want to point out that in man's desire to turn nature into one of his organs also lays the principle of the machines which man puts between himself and nature and which should be seen first as a {means of} emancipation from material work, furnishing him with the ability and the leisure to concern himself with higher pursuits and finally to rise to the spiritual level.[2]

Work and machines played a crucial role in his analysis of the human emancipation from nature. Human intelligence had compelled natural forces to behave in such a way that they performed work by themselves. Through his ingenious device, nature's blind actions (agency) had been transformed into purposeful actions through human cunning (*List*). Here Jacobi seems to argue in tune with the Hegelian mode of reasoning.

> One has to put one's own activity into the tool, i. e. to make it self-acting. This happens in the following way … that nature's own activity, the elasticity of a watch spring, water, wind gets used in

2 Moritz Hermann Jacobi, "Von der eigentlichen Bedeutung des Luxus und der Mode" (unpublished lecture manuscript, undated {possibly 1835}), St. Petersburg Academy of Sciences Archive, fond 187/op.1/dele 330, St. Petersburg.

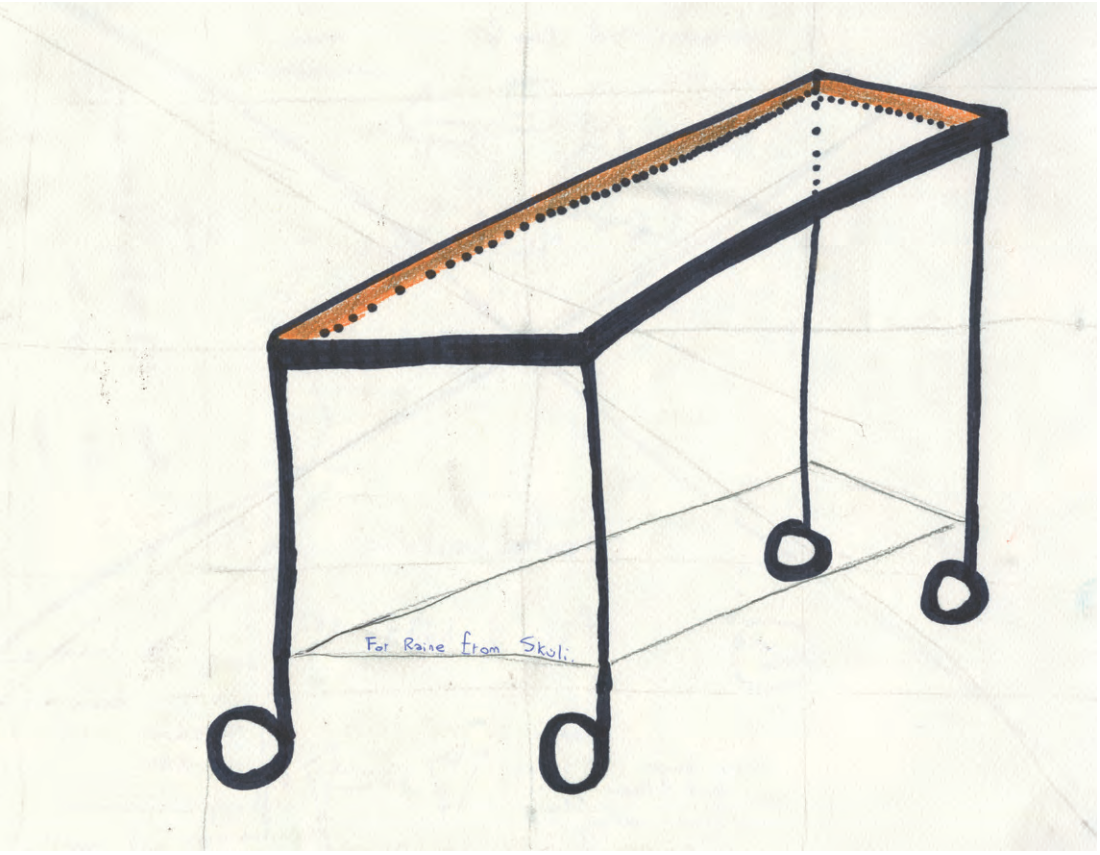
> order to do something very different than what {these agents} wanted to do according to their sensuous state of being, that their blind actions become efficient {*zweckmäßig*}, the contrary to one's self: reasonable behaviour of nature, *laws*, in their external *state of being*. … Here the driving force {Trieb} steps back fully from work. He {man} lets nature score oneself, observes calmly and governs the whole easily: *List*.[3]

Jacobi's electromagnetic machine embodies this way of thinking. His remark about the commutator, "eine Erfindung, die mir viel Spaß macht, weil die Not sie erzeugt hat," now makes much more sense. Being in "Not" did not mean to be in a miserable situation, in despair at the hopelessness of that situation, in need of help—no, it meant to catch the necessity, "die Not-wendigkeit," of turning around the physical constraints that nature provided in such a way that the natural force does something very different from what this agent is meant to do due to its natural state of being. In the flow of the event, man, this observing intelligence, chooses and arranges just those natural elements that suffice to achieve the envisaged goal. The result was far beyond Jacobi's expectations. It was a surprise, indeed, and even fun.

3 G. W. F. Hegel, *Jenenser Realphilosophie II. Die Vorlesungen von 1805/06*, ed. J. Hoffmeister (Leipzig: 1931).

Projective Geometry

Skúli Sigurdsson



Skúli Sigurdsson, Projective Geometry in the Kitchen (2018).
Konstruktion eines nicht kippenden Küchenwagens,
wenn die Bremsen – wie hier abgebildet – an den richtigen
Punkten angebracht wären.

An Excellent Salve for Burns

Pamela Smith and Xiaomeng Liu*

An anonymous resident of sixteenth-century Toulouse, perhaps a goldsmith or foundry worker, set down in writing a remarkable vernacular compilation of practical recipes for diverse art and technical objects. Based on both firsthand experience and hearsay from other workshops, most objects would have fit nicely into a *Kunstkammer*. The instructions in the manuscript's 962 entries introduce a delightfully eclectic range of expertise, encompassing metalcasting and coloring, pigmentmaking and drawing, imitation gemmaking, cannon-casting, treegrafting, landsurveying, papier-mâché masks, and even the composition of "monstrous" preserved animals like winged rats. Amid this cabinet of human artifice, we also find a burn salve recipe—or is it a prayer?—through which spirit is materialized in an ointment.

> *Against burns, excellent*
>
> Heat linseed oil on a light fire, without letting it boil and simmer, but once it is hot put in a quarter as much of the newest wax you can. After all this has melted, let it cool. And once it begins to curdle, stir continuously with a new wooden spatula for as long as it takes you to say 9 *pater nosters*, and while you say them, wash this composition with holy water, stirring all the while. Having said the first 9 *pater nosters*, pour out the first water and put in new, and wash and stir the composition for the time it takes you to say 8 *pater nosters*, and the 3rd time for as long as 7, and thus successively you will add new water, doing the same as above, until the last and single *pater noster* of nine. Then you shall have a soft white ointment, with which you shall smear the burn for 9 days. But do not apply it any longer, since it would cause an overgrowth of flesh. You shall dress your burn twice a day, and each time you shall wash your face with water and wine mixed together, a little tepid, not rubbing but so to say pressing with wet linen, and you shall wipe it similarly with fine linen. And then apply the ointment, over which you can put ivy leaves. This causes hair to regrow and leaves no scar. I was taught this by a powder maker who had almost completely burnt himself but showed no sign of burns (BnF, Ms. Fr. 640, fol. 103r).

Oil-based salves and ointments were widely employed in early modern Europe to cure wounds and relieve swellings and joint pain. Linseed oil and wax are the basis of this salve, both common in cooking, lighting, and all types of industrial processes. Versatile and useful materials, they appear in multiple recipes in the manuscript—mostly for artistic rather than medical purposes. Linseed oil was not usual in medicinal preparations, whereas wax had many healing properties, often deriving from anagogical power, being compared to the light and humanity of Christ: its malleability a metaphor for the Creator's handwork.

For the salve, one part wax was melted in three parts hot linseed oil, then the mixture washed several times in holy water, the process being timed, as was common in craft procedures, by reciting the paternoster. Like wax candles and other material objects—known as sacramentals—that played a role in devotional practices, holy water was a bridge between material and spiritual realms, sometimes being used as a cure-all or to expel evil spirits. The burn salve requires nine iterations of mixing holy water with the salve while reciting the paternoster, nine times at first, then decreasing incrementally by one, 45 times in all. Nine was a significant, sometimes magical number, connected to the Trinity, conveying perfection, and defining the norm for human gestation. The white ointment that results is to be applied to a burn twice a day for nine days, no less, no more. The final covering of ivy leaves makes the beard grow back—a regeneration engendered by this evergreen plant?

The symbols and rituals are obvious, but what did this salve look like? Only recreating the recipe can make this clear. Our reconstruction in the Making and Knowing Lab (www.makingandknowing.org) revealed that bringing the burn salve into physical being turned out to be a surprising process of spiritual materialization.

We heated the one part new yellow beeswax to four parts yellow linseed oil somewhat higher than the melting point of beeswax to about 85°C. On cooling, the mixture began to "curdle," as noted in the recipe. As we did not have time to order holy water on Amazon.com, distilled water sufficed. With some skepticism, we added the water to the curdling mixture. The lab intern, Ludovic Touzé Peiffer, intoned

(Latin being appropriate to a literate sixteenth-century Catholic), "Pater Noster, qui es in caelis, sanctificetur nomen tuum; adveniat regnum tuum; fiat voluntas tua, sicut in caelo, et in terra. Panem nostrum supersubstantialem da nobis hodie; et dimitte nobis debita nostra, sicut et nos dimittimus debitoribus nostris; et ne nos inducas in tentationem; Sed libera nos a malo. Amen." To our surprise, the mixture immediately transformed, becoming whiter, creamier, and lighter with each washing, increasing in volume about five times by the end of 45 paternosters.

The anonymous author-practitioner of Fr. 640 claimed he learned the recipe from a "Pouldrier," a gunpowder maker. Gunpowder making was dangerous work; this maker apparently sustained disfiguring burns of which the author-practitioner saw no trace. Such a salve recipe is perhaps unremarkable—in modern chemical terms, it is an emulsion, commonly employed today to make lotions and ointments. The surprise revealed by reconstructing this recipe (as opposed to simply reading it) was that the process of mixing {holy} water while repeating paternosters caused a tangible "purification" and "inspiriting" of the raw materials. Our reconstruction was of course inauthentic; we could not capture the spiritual significance of the process—we didn't even use holy water—but, even so, the material transformation converged with and made tangible the spiritual process. Was this the secret that healed the gunpowder maker's burns?

* Xiaomeng Liu, a student in the Making and Knowing Lab in spring 2017, wrote an annotation on this entry for the digital critical edition of Ms. Fr. 640 being prepared by the Making and Knowing Project.

African Apemen? Really?

Marianne Sommer

Of all researchers, one might think that paleoanthropologists are among those most often surprised. After all, hardly a day passes without news of the discovery of a curious new hominin; who else, in their daily work, can expect to stumble upon once-living "hobbits"? Indeed, particularly in popular accounts, fossil hunters often report that their discoveries "were a stunning surprise."[1] However, when we peek into the history of the field, things appear to be somewhat different. It seems, rather, that paleoanthropologists can be astonishingly resistant to the unexpected. Let me outline what I mean using the example of the discovery of *australopithecines*, which was closely related to debates about the geographical origin of what was then referred to as the hominid line.

When paleoanthropology came of age in the early twentieth century, many scientists were of the opinion that the hominid origin was somewhere in "the east." This view was supported by biogeographical reasoning and especially by the discovery of *Pithecanthropus erectus* (today *Homo erectus*) in Java: here were the remains of a being that, while smallbrained, had already walked erect. The anatomy of the find was not, however, in accord with the theory that the expansion of the brain preceded the appearance of other human hallmarks. But, for some, the discovery fulfilled Ernst Haeckel's prophecy: Haeckel had assumed that *Pithecanthropi* or *Pithecanthropi alali* had once roamed an eastern cradle of humankind.

That humankind had its beginnings in the east was not a new conjecture, even in the natural history of Haeckel's time. But for Haeckel and others working within a racial-anthropological framework, this was less associated with the biblical narrative than with a preference for Asia—in Haeckel's case especially India—over "the dark continent." It did not, therefore, come as a surprise that the *Pithecanthropus* find corroborated Asian origins. Too much of a surprise would, on the contrary, have been the discovery of African apemen, which was claimed by Raymond Dart, head of the anatomical institute at Witwatersrand University in South Africa, in 1924.

1 Donald C. Johanson and A. Edy Maitland, *Lucy: The Beginning of Humankind* (New York, London, Toronto, Sidney: 1981), 231.

Indeed, experts were so little prepared that they mostly dismissed the first *Australopithecus* remains (the Taung Child) as an unimportant ape. It took decades of hard work, additional bones, and sometimes aggressive negotiations to change the minds of anthropologists worldwide.[2]

For British geologist William Sollas, among other scientists, the development of instruments for precise measurement and numerical comparison was required before he could be properly taken aback by the importance of African apemen. Sollas also suspected other forces at play in the controversy. In 1936, Robert Broom, writing from the institute of paleontology and physical anthropology at the Transvaal Museum, had submitted a description of an adult australopithecine fossil from near Pretoria and identified it as a "missing link." Sollas was upset about the fact that Broom's piece had not yet appeared in *Nature*, while the journal had published opinions of negators such as the great British trio of Grafton Elliot Smith, Arthur Smith Woodward, and Arthur Keith.

Sollas wrote to Broom, "I am surprised that your Taungs has not yet appeared in *Nature*. … Keith may be keeping things back. Keith has great influence on this Scotch periodical. In submitting things I wonder if whether they appear or not depends on personal considerations." Sollas was particularly angry that the "British oracle" of paleoanthropology voiced his strong opinions through the press and did not shy away from open controversy on this platform: " Sir Arthur Keith … is indeed the most arrant humbug and artful climber in the anthropological world. You will probably have read his communication in "Nature" by the time you read this. I am truly astonished. He makes the rashest statements in the face of evidence. Never quotes an author but to misrepresent him, generalises on single observations, and indeed there is scarcely a single crime in which he is not adept. Journalism, my dear boy, journalism pure and simple, and

2 Marianne Sommer, *Bones and Ochre: The Curious Afterlife of the Red Lady of Paviland* (Cambridge, MA: 2007), pt. 2.

backed by all the journalists, poor dears. He has gone up like a rocket, and will come down like the stick."[3]

However, with an increasing number of fossil specimens, Keith eventually agreed that Broom had found what he had thought impossible: an anthropoid with human dentition. Nonetheless, while one could be astounded by what seemed the grossest unscientific behavior, it was more difficult to allow amazement in the presence of strong theoretical stances. The British expert in primate phylogeny, Wilfird Le Gros Clark of Oxford University, still subsumed the australopithecines under the fossil remains of African anthropoid apes in his *Early Forerunners of Man* (1934). He positioned himself against the stochastic view of evolution advocated by the selectionists and followed others in the assumption of evolutionary trends programmed into the germplasm that would lead the evolution of related forms into similar directions. Even at the risk of vitalism, Le Gros Clark thought orthogenesis preferable over pure contingency as shaper of primate evolution. Within a model of parallel evolution, the humanlike traits of *Australopithecus* could be explained without inference to a relatively close phylogenetic relation.

However, during the Second World War, Broom started a voluminous correspondence with Keith and Le Gros Clark despite the slow mail service. Broom sent Le Gros Clark information on all the latest discoveries and casts of the apeman material to the effect that the latter became his mouthpiece at British scientific meetings. At the first Pan-African Congress on Prehistory in Nairobi in 1947, Le Gros Clark presented the insights gained from his studies of the australopithecine material during a short visit to South Africa: "The general conclusion was reached that the *Australopithecinae* must at least be regarded as having a fairly close relationship to the ancestral stock which gave rise to the *Hominidae*."[4] The resemblances had become too numerous and detailed to be explained by parallel evolution, so

3 Sollas to Broom in May and July 1925, in G. H. Findlay, *Dr Robert Broom, F.R.S., Palaeontologist and Physician / 1866–1951. A Biography, Appreciation and Bibliography* (Cape Town: 1972), 53.

4 Wilfrid Le Gros Clark, "Pan-African Congress on Prehistory: Human Palaeontological Section," *Man* 47 (1947): 101.

that the amount of evidence in the end indeed could "astonish the world."[5] As a happy (first) ending of the australopithecine story, Broom's book *Finding the Missing Link* appeared in 1950 and Le Gros Clark's *The Fossil Evidence for Human Evolution* in 1955, both of which advocated the important role of the australopithecines in hominid evolution.[6] It might therefore come as a surprise that, as a survey of British museumgoers reveals, even today a part of the public has problems accepting Africa as "their birthplace."[7]

5 Robert Broom and Gerrit Willem Hendrik Schepers, *The South African Fossil Ape-man: The Autralopithecinae* (Transvaal Museum, Pretoria: 1946), 143.

6 Marianne Sommer, *Evolutionäre Anthropologie zur Einführung* (Hamburg: 2015), 115–123.

7 Monique Scott, "'We Grew Up and Moved On': Visitors to the British Museums Consider Their 'Cradle of Mankind,'" in *Envisioning the Past: Archaeology and the Image*, ed. Sam Smiles and Stephanie Moser (Oxford: 2005).

Son et Lumière

Emma C. Spary

In early modern French history, the term "surprise" was often associated with violence: in politics, it meant the capture of a territory or throne by force of arms. In the 1694 edition of the *Dictionnaire de l'Académie françoise,* the first example of its proper usage was "Il s'est rendu maistre de cette Place par surprise." When the court preacher Bossuet lamented the death of Madame, the king's sister, he remarked that death could come as a "great and terrible" surprise for the residents of the enchanted palace of Versailles, isolated from the less comfortable realities of life in the city and surrounded by wonders. Surprise here was used less in the sense of shocking news than in that of a blow or buffet from fate, a reminder of mortality: "il faut des coups de surprise à nos coeurs enchantés de l'amour du monde."[1]

It could be argued that Versailles was the crucible of an important transformation in surprise. Whereas at first the word had referred to power captured from an unready foe, in the grounds of the king's new château, to which the court definitively removed in 1685, it came to denote intriguing or perplexing experiences: a way to keep courtiers distracted, off balance. In this sense surprise was the very essence of Versailles, from the waterjets that soaked unsuspecting visitors perambulating the gardens to the dazzling spectacles of light and sound orchestrated by high-ranking household servants. The famous fountains were designed by the very same engineers who made the cannon with which the king captured city after city across Europe. Even eating was an endless play of artifice; courtly cuisine was centered on disguise. Voltaire was critical: "As for the cooks, I can't bear the essence of ham, nor the surfeit of morels, mushrooms, pepper and nutmeg, with which they disguise dishes that are very healthy in themselves."[2] Courtly delights were part of a program of defeating or rather deflecting noble opposition, an attempt to prevent any resurgence of *frondisme*. If you like, Versailles was a gigantic machine of the passions, with the monarch as puppetmaster.

1 Jacques-Bénigne Bossuet, "Oraison funebre de Henriette-Anne d'Angleterre, duchesse d'Orléans," *Recueil des Oraisons funebres* (Lyon: 1780), 58.

2 On culinary disguise, see Béatrix Saule, "Tables royales à Versailles, 1682–1789," in *Versailles et les tables royales en Europe XVIIème–XIXème siècles*, ed. Jean-Pierre Babelon (Paris: 1993), 41–68.

Ézéchiel Spanheim, envoy of the elector of Brandenburg, described the king's role as being to "fixer en quelque sorte l'humeur volage et indiscrète des courtisans."[3] Versailles was a hydraulic device not unlike the body itself, where the artful management of fluid economies allowed the exercise of power.

The palace's springs were moved by a series of experts. Early on in Louis XIV's reign, the surprise makers were among the many Italians arriving at court with Cardinal Mazarin: actors, marionettists like the Briocci family from Bologna, acrobats like Filippo del Campo, known as Cardelin, cooks like Vicenzo Pronti. These individuals specialized in different skills of spectacle and illusion. It is perhaps hard to imagine nowadays that marionettes and acting could have caused genuine fear among early modern European populations, but these simulacra of life were held by many to be witchcraft; until the eighteenth century, for example, actors could not be buried in hallowed ground. Excelling at the mastery of the body, actors also commanded a series of increasingly elaborate mechanical skills, brought to court in the so-called machine plays featuring automata, stage lighting and explosions, or special effects like moving scenery, thunderclaps, gods, or ships. As time went by and these well-known figures died, Louis did not replace them. Instead, he co-opted their technical expertise for Versailles: its elaborate waterworks, menagerie, hall of mirrors, and fireworks displays were all, as numerous historians have noted, parts of an attempt at *éblouissement*, a project for amazing, amusing, and shocking the humans present. Unlike touring performers or artisans who moved between courts seeking patronage, Versailles was wholly within the French king's control. Siphoning off the skills of his clients—their ability to produce complex visual, mechanical, and emotional effects—he used these to keep his courtiers and visiting ambassadors in a perpetual state of "surprise": entertained, awed, and confused in equal measure. This new kind of surprise was a conquest from within. Courtly spectacle was characterized by lights and mirrors, by displays at which the brilliant variety of material goods was such that "the eyes could hardly bear their

3 Ézéchiel Spanheim, *Relation de la cour de France en 1690* (Paris: 1882), 3–4.

sparkling diversity."[4] Onlookers were deliberately dazzled, overwhelmed, and kept guessing: What was artifice and what reality?

Yet in the early eighteenth century, surprise became a more suspect enterprise. It now generically referred to any "unexpected object" or sudden emotional shock, but for critics of the Crown its political undertones remained apparent. Fénelon, tutor to the king's grandson, the duc de Bourgogne, who died before inheriting the throne, turned the barrels back onto Louis XIV himself. In *Télémaque*, an idealized account of good rule by a prince who spends an entire lifetime waiting for his father's return, Fénelon acerbically remarked that "les meilleurs rois étaient malheureux en ce qu'ils … faisaient souvent, par la surprise des flatteurs, les maux qu'ils ne voulaient pas."[5] Many at court were anxious about the ability of certain individuals, particularly mistresses, to exercise covert (or more obvious) power over the king's decisions. The notion that one would yield to, or be seduced by, superficial brilliance was already troubling by the reign of Louis XV, great-grandson to the Sun King, when the comte de Caylus described surprise as "toujours le premier mouvement des sots."[6] Concerns about the optical superficiality of high society, the ease with which its attention could be commanded by dazzle and illusion, echoed across the remaining decades of the Old Regime. The mathematician Henri Decremps specialized in disclosing the hidden mechanism of magical spectacles "dont le charme consiste … dans l'erreur & le mensonge."[7] For in reality, there was insufficient water power to run all the fountains at Versailles simultaneously: the king had to write and rewrite itineraries around the gardens for ambassadors to ensure they were properly surprised. The power of Versailles lay in these carefully stage-managed illusions where advanced technology encountered disciplined bodies.

4 *Mercure Galant* 2 (1700): 187.

5 François Salignac de la Mothe-Fénelon, *Les aventures de Télémaque fils d'Ulysse* (Tours: 1851), 59.

6 Anne Claude de Tubières-Grimoard de Pestels de Lévis, comte de Caylus, *Œuvres badines complettes* (Amsterdam: 1787), 9:262.

7 Henri Decremps, *La magie blanche dévoilée ou explication des tours surprennants* (Paris: 1784), x.

Jean Lepautre, "Cinquiéme journée. Feu d'artifice sur le Canal de Versailles," 1674. Bibliothèque nationale de France, Département estampes et photographie, RESERVE FOL-QB-201 (53). Source: gallica.bnf.fr / BnF.

Taming Aids

Claudia Stein

Like a tsunami or a volcanic eruption, AIDS appeared unexpectedly, an unknown that seriously challenged taken-for-granted realities. The twentieth century's two world wars, though unimaginably brutal and devastating, had their logic; they fit predictably into historical patterns. AIDS did not.

It is well known how AIDS surprised the medical profession, how its humanitarian image, cultivated through invincible antibiotic magic bullets, lay in tatters. Public health and epidemiology were revealed to be little more than Cinderella subjects. Shocking at the time, too, was that victims of AIDS did not behave as was expected. Their untreatable suffering and inevitable death could not be pacified by the promises of orthodox medicine.

In the then rising neoliberal regimes where older rhetoric, perceptions, and metaphors of sociability, civic trust, and power were being reworked by new consumer-driven global market models based on individual performance and self-fashioning, AIDS exploded like a star shell. It provoked a reaction to traditional values, while at the same time exposing the bankruptcy, not just of sexual freedom, but also of the new ideals of a neoliberal "fractured society" and its emergent operating values—above all, individual choice and desire. As the literary critic Susan Sontag soon realized, the homophobic reaction to AIDS victims, their demonization as morally depraved threats to heterosexual family life and politics, was also a wider reaction to the new market-driven consumerist model of governance, in which people felt their conventional social identities becoming atomized.

Yet, less well-known is how the surprise of AIDS shook the world of academia. Cutting-edge scholars in the sociology, philosophy, and history of medicine and science in particular had been confidently critiquing the production of scientific knowledge, arguing that it was a sociocultural construction, a process shot through with political, economic, and cultural considerations. Scientific truth was no longer seen as timeless, objective, or universal. This was a view shored up in the late 1970s and early 1980s by social-constructionists and post-structuralists, the latter considering *all* of human reality through the lens of language and its theory. As Michel Foucault and others taught,

the human body and diseases were not what they seemed but rather a complicated discursive construct of power and knowledge. The very experience of disease was therefore not transparent, "true," or "real" but an ever-shifting fabrication. While earlier generations of scholars had hoped to cut through the veil of language, to penetrate its ideologies and metaphors, and thus get at what disease "really" was, poststructuralists undermined the realist search.

The AIDS crisis posed serious intellectual problems to this thinking. How was one to answer the voice of the realist from the back of the conference room: "Are you telling me my child/partner/lover/friend is dying of a sociocultural or linguistic construction?"

It was a question hard to answer, far easier to avoid. Some historians did so by focusing on the sociocultural impact of AIDS, drawing ready analogies with earlier epidemics, notably plague and venereal disease. Others, who were already thinking that social relativism and linguistic reductionism had gone too far, sought to strengthen their hand. Didn't people in the past feel pain, suffering, birth, or death as something "real"? Even those who embraced the crisis of AIDS in postmodernist terms, those who wrote that it provided an "object lesson in the binary hierarchies of language," were forced to pull back. Some came to wonder whether certain realities—such as AIDS—needed to be brutally essentialized in a postmodern world that too easily fragmented and isolated the sorts of experiences which could not be fit into the consumerist market model.[1]

As a PhD student in the 1990s, launching into an investigation of the sixteenth-century French pox (one of the first fatal "surprise" epidemics that hit Europe), I was not fully aware of how AIDS had attenuated the discussion of disease. I only knew that certain methodological routes could no longer be safely traveled. Among them was framing disease in terms only of social-cultural reactions, for these frames ultimately depended upon a conception of disease as timeless and universal, an ahistorical assumption equal to that of retrospective diagnosis. All scholars agreed—and they agreed on little else—that AIDS had unveiled the limits of modernist obsessions

1 Daniel T. Rodgers, *Age of Fracture* (Cambridge, MA: 2011), 162.

with scientific medicine based on reason and its virtues; indeed, it exposed them as myth. Neither could I approach the surprise of French pox in an older sense of a motivational force driving rational scientific medicine, for now the idea of modernity as the ostensible spark that ignited the motor of progress was also regarded as part of the mythmaking. AIDS, as well as my debut into academia, was somewhat beyond "surprise."

But another option emerged: the practice and epistemology of surprise. It was a diversion of sorts from the radical relativism of the "linguistic turn" and essentialism of sociocultural constructionism. In this fast-growing area of scholarship, surprise and related human passions such as wonder, puzzlement, and marvel were transformed from external motivational forces in the production of scientific knowledge into forces inherent within the epistemic preoccupations of early modern scientific practitioners. In this revision, surprise and wonder became emblematic epistemic virtues as intrinsic to the practice of medicine and science in the early modern period as reason and rationality became in modernity. Passions like surprise became productive forces in the very making of knowledge about early modern diseases. The surprise of the French pox did not undermine traditional early modern medical thought and practice, I came to argue. It strengthened them. Early modern contemporaries were far from being paralyzed by the surprise attack of the French pox, as earlier scholarship had argued. In fact, they appropriated and understood the unknown disease precisely through the very uttering that they were surprised by it.

As in early modernity, so in late modernity. Surprising? Looking back, was I, too, not also complicit in the taming of AIDS?

A Kantian Puzzle

Thomas Sturm

Kant's 1798 *Anthropology from a Pragmatic Point of View* disturbs preconceptions about the philosopher. This book resulted from lectures he gave on the "science of man" (*Wissenschaft vom Menschen*) during the very cold Königsberg winters between 1772–1773 and 1795–1796. It is, for Kant, unusually popular in style and content and indeed attracted more students than any of his other courses. Technical philosophical terminology and argumentation are reduced to a minimum. Instead, Kant the anthropologist observes, reflects, and jokes about all things human: many human beings are unhappy since they cannot "abstract" (a young man is unable to propose to a lovely lady because he cannot ignore a spot on her face); we all play roles in society (the priest appears to be serious in public, though with his children he plays as any parent does); courtiers mimic the behavior of the rulers they wish to please, losing all individual character; if a horse had self-consciousness, we would dismount and regard it as member of society; there might be intelligent beings on other planets who are, unlike ourselves, unable to lie, always speaking their minds without any inhibition whatsoever.

Science does not escape Kant's attention either, but not science viewed from a transcendental perspective, with its a priori foundations scrutinized and systematized. Rather, under the heading of special "talents" of cognitive power, Kant looks at scientists themselves, their mental capacities and practices.[1] For instance, what mental powers must a researcher of nature possess to make a significant discovery? Mere luck cannot do the job, and neither can the "logic of the schools." Francis Bacon's *Organon* is recommended as a toolkit for making discoveries by means of experiment. But Kant also remarks that some researchers possess a special gift or "talent," namely "sagacity" (*Sagazität* or *Nachforschungsgabe*), a natural disposition that cannot be explained by rules.

Scientists in possession of this gift find paths to new knowledge as if they were guided by a divining stick (*Wünschelrute*). They can sniff out (*auswittern*) the right direction to go; they cannot teach this intuitive talent but only show it to others. As Reinhard Brandt notes

1 Immanuel Kant, *Gesammelte Schriften*, Akademieausgabe, 7:223–225.

in his 1999 work *Kommentar zu Kants Anthropologie*, the term *Sagazität* is the translation of the Greek ἀγχινοία, which contains at its root νοῦς: the faculty of intuitive insight. Other than this, little is known about the background of Kant's idea. Sagacity is so little considered that you can still write the English Wikipedia entry on it if you would like to: the term appears, but the page is blank. The German entry on *Scharfsinn* claims that *Sagazität* is just *Scharfsinn*, but when it comes to Kant and his predecessors, the topic treated is a broader one, namely "wit" (*Witz*). For Kant, *Witz* is the ability to compare, relate, and connect things that appear to be different. In *Zedler's Universal-Lexicon, Scharfsinnigkeit* is rendered as a translation not of *sagacitas* but of *perspicacitas*.

However, what interests me here is a different problem. What sagacious scientists know, and how they come to know it, must be surprising to those who do not have the power of sagacity. If you simply either have this power or you don't, if you can only display it but not teach it, then untalented others cannot but marvel at the innovative processes and products of sagacious scientists. Or perhaps they think that it is all pretence. Kant, oddly, does not enter into this issue. He simply takes for granted that some scientists possess the power, much as exceptional inventors possess what he calls "originality." However, in his lectures on logic, Kant warns against blindly trusting or following great exemplary minds.

> History of science becomes pragmatic if one simply observes how scholarship is related to human reason, progress, and the things that impede it. It has been noted that great examples retard the sciences for a while, because everyone follows the model and none strive for originality. This happened with Aristotle, Leibniz, {Des}Cartes, and Newton.[2]

When scientists focus too exclusively on "great examples" like Newton, there is the risk that they emulate these models mechanically and thus obstruct progress. A "pragmatic" history of science could help out here, since it tries to study the general conditions that

2 Kant, *Gesammelte Schriften*, Academy Edition, 24:492.

further or impede such progress. Scientists should "strive for originality": for example, they should relate things that have hitherto been treated as unrelated or invent instruments that open new paths for discovery. These claims are in line with another of Kant's famous maxims that we must learn to think for ourselves. But, if scientists can strive for originality, then it must be possible to improve one's own given disposition to originality and, consequently, also one's sagacity.

If and insofar as improvement and learning are possible, this could in turn reduce the surprise or lack of understanding that others experience when faced with the processes and products of sagacity. But this is problematic: Kant cannot have it both ways, declaring sagacity to be an immutable power that cannot be taught, while also claiming that we can intentionally improve it. Some Kant scholars—those who are trained in what Lorraine Daston has called the truly hard science, namely philology—will point out here that I used a logic lecture, produced by a student of Kant's, against a text published by Kant himself, namely the *Anthropology*. So, one might throw the problem out. Even so, it exists: still today, we tend to think of the emergence of certain discoveries as difficult to explain, because, in some cases at least, they seem to be built on tacit abilities. But we also reject the view that some products of scientific research are the result of a mysterious process that we cannot understand or teach. The puzzling topic of sagacity requires further clarification and reflection by historians and philosophers of science.

Chaos and Order

Claudia Swan

Collecting is at once a form of madness and a calling to order. The impulse to amass, to arrange, to hold and behold the sort of array that qualifies as a collection often defies the strictures and the structures that hold such assemblages together. *Wunderkammern* exemplify this in several respects, beginning with the etymological: chambers of mirabilia are containers for fantasy and repositories for the exceptional. The vast assortment of objects housed in early modern collections often adhered to general categories (crystal vessels, aquatic animals, resins and gums, antiquities, ivory lathework, armor), but the overall impression of inventories and other records is pretty chaotic. Were the stringent categories (inscriptions) that Samuel Quiccheberg devised ever actually enforced?[1] It comes as a relief when collectors attest to the challenge of containment and order, as did Ulisse Aldrovandi in 1595, when he enumerated the contents of his collection, which he immodestly called "the eighth wonder of the world."

> Today in my microcosm can be seen more than 18,000 different things, including 7,000 plants in fifteen volumes, dried and pasted, more than 3,000 of which are painted "*al vivo*"... in fourteen armoires, my so-called Pinacotheca. I also have sixty-six chests, divided into 4,500 boxes, where there are 7,000 subterannean items, with various fruits, gums, and other very beautiful things from the Indies, marked with their names, so that they can be found.[2]

Thank goodness for containers and labels. His microcosm, like many others, is a world on the verge of order.

Many descriptions of collections fall back on numbers; in light of the numbers, words fail. This is markedly so in the case of collections of works on paper, where thousands of prints and drawings were

1 Samuel Quiccheberg, *The First Treatise on Museums. Samuel Quiccheberg's Inscriptiones, 1565,* trans. Mark Meadow and Bruce Robertson (Los Angeles: 2013).

2 Ulisse Aldrovandi, *Trattato naturale dell'utilità et eccellenza della lettura dell'historia naturale,* Biblioteca Universitaria de Bologna, ms. Aldrovandi 21, IV, c. 53v. See Lucia Tongiorgi Tomasi, ed., *Immagine e natura: L'immagine naturalistica nei codici e libri a stampa delle Biblioteche Estense e Universitaria,* exh. cat. (Modena: 1984), 131.

Joris Hoefnagel, *Animalia Volatilia et Amphibia (Aier)*, plate LVI, watercolor and gouache with gold leaf on vellum, ca. 1575–1580, 14.3 × 18.4 cm. National Gallery of Art, gift of Mrs. Lessing J. Rosenwald. Courtesy National Gallery of Art, Washington.

kept in hundreds of albums. The Amsterdam lawyer Laurens van der Hem, for example, compiled an extraordinary atlas that, at his death in 1678, consisted of over 20,000 prints and drawings in 192 albums and portfolios. Rembrandt, whose collection was described in a notarial document drawn up during bankruptcy proceedings in 1656, owned numerous *kunstboecken*, or albums that contained prints and drawings of all sorts—most organized by medium and name of

artist. "A book full of sketches by Rembrandt" is followed by "a book of wood prints by Lucas van Leijden" and numerous others containing works by Netherlandish and Italian artists—Pieter Bruegel, Hendrick Goltzius, Raphael, and several others. Item no. 199 "A {book} with drawings by the foremost masters of the entire world" supports what the rest of the list implies: Rembrandt belonged to and collected a canonical microcosm.[3]

Today, large private and institutional collections of prints and drawings are organized by artist—and many of the artists Rembrandt collected still form the backbone of collections of early modern graphic art. Standard curatorial and academic art historical taxonomy adheres to era and geographical region, with artists' names or specific media serving as more particular references. Scholars of the graphic arts who consult institutional collections are accustomed, therefore, to translating their interests into the categories born of centuries of collecting in the shadow of the canon. At times this can result in chance encounters, sidelong glances at works one has not requested but that are stored (as all well-kept freestanding prints and drawings are, in acid-free boxes) alongside works one has—where alphabetical ordering and available space do not coincide and artists share storage space. A request to view works by a given artist may elicit others whose surnames begin with the same or similar letters, depending on the girth of a given artist's work and the size of the boxes in which her work is stored. Every time this happens, a feeling of surprise is inevitable—but getting this close to curatorial housekeeping also feels mildly illicit.

The canon of identified artists exercises a firm grip on curatorial practices and scholarly expectations alike, and it is therefore unsurprising that this canon is exercised in times of crisis. Generally, when works are selected for preservation from destruction, it is also according to the order or criteria of recognition/fame and value. When U-boats approached the East Coast of the United States, 15,000 prized works in the collection of the Metropolitan Museum of Art and addi-

3 Bob van den Boogert, ed., *Rembrandt's Treasures*, exh. cat. (Amsterdam: 1999), "Appendix to Rembrandt's Inventory."

tional works from other local collections were moved under cover of night to a stately home outside Philadelphia—Whitemarsh Hall. The director of the Museum of the City of New York, who did not participate, referred to the repurposed mansion as a "monument hysterique."[4] None of this is especially surprising, although it might lead us to ask whether any effort to preserve physical objects from destruction is a form of madness—as mad perhaps as collecting to begin with.

The order of things inside the Print and Drawings Study Room of the National Gallery of Art in Washington, DC, largely adheres to convention. Works are stored in acid-free boxes arranged according to century, country, and surname. It came, therefore, as a surprise to learn that a number of additional boxes are grouped under the non-arthistorical rubric "WW III." These boxes, labeled in the same calligraphic lettering as the others, contain works selected for preservation should the unthinkable occur. They number fewer than 100 (in a collection of over 100,000 items), and the selection is said to be subject to regular curatorial review. Surprisingly, the works earmarked for preservation in these boxes are neither the priciest nor the most famous. They include a spectacular drawing by Rubens of Pan recumbent, a self-portrait by Rembrandt, a drawing by the Netherlandish artist Hans Bol of skaters on ice, an early example of engraving, and four volumes of exquisite watercolors by Joris Hoefnagel, *The Four Elements* (figure).[5] Unlike works preserved during World War II, each of these is unlikely to be familiar to more than a few scholars each. These are not representative but rather wholly unique works. This alternate canon is a vivid reminder that the relationship between chaos and order—here, the threat of annihilation informs judgment—animates collection practices far and wide, past and present.

4 Calvin Tomkins, "Merchants and Masterpieces: The Story of the Metropolitan Museum of Art (1970)," in *Historical Perspectives on Preventive Conservation,* ed. Sarah Staniforth (Los Angeles: 2013), 155–157, on 157.

5 Ned Martel, "Curator Andrew Robison Decides What Goes into National Gallery's Emergency Box," *The Washington Post*, August 14, 2011.

Purple on the Ruffles

Mary Terrall

Surprise is transient, by definition, but its echoes survive in memory and in writing. It often crops up at pivotal moments in narratives of eighteenth-century scientific investigations. For naturalists, surprising occurrences might have sparked a systematic investigation in the field or in the laboratory; at other times, an experiment or test offered up its own surprises. At a remove of centuries, the historian can vicariously experience these reactions filtered through the medium of ink on paper and occasionally finds herself surprised by the naturalists as well as the objects of their attention.

For my short excursion into the realm of unexpected observations, I turn not to an earthshaking surprise like Galileo's moons or Leeuwenhoek's animalcules but to a rather mundane, if colorful, occurrence of the sort that punctuated the daily efforts of naturalists.[11] The scene plays out on the Atlantic coast in Poitou, in the autumn of 1710, where the consummate observer René-Antoine Ferchault de Réaumur explored the tidepools not far from his provincial estate. Enjoying the ocean air on his annual vacation from the demands of the scientific and academic life in Paris, Réaumur was looking for a particular kind of sea snail, a common whelk known as *Buccinum*. The previous year, his colleague Bernard de Jussieu had brought a specimen from these same shores into the academy's meeting room, where he produced a striking purple color from liquid squeezed from the mollusks. The academicians watched the color develop from pale yellow to an intense purple, a color they interpreted as comparable to the purple dye made in ancient times from the murex, another species of shellfish. Réaumur wanted to further investigate the physics of the gradual color change and hence found himself scanning the shore for whelks. He found plenty of them, but he also noticed masses of unidentified tiny bodies nearby, tightly attached to the rocks. Were they eggs, or perhaps seeds? Though quite familiar with

1 This account and all citations are taken from R.-A. F. de Réaumur, "Découverte d'une nouvelle teinture de pourpre et diverses expériences pour la comparer avec celle que les anciens tiraient de quelques espèces de coquillages que nous trouvons sur nos côtes de l'océan," *Mémoires de l'Académie royale des sciences* 1711 (Paris: 1730), 166–196, on 169–174.

the local marine life, he did not recognize these structures, each one shaped like "an elliptical spheroid, or an elongated ball."

On closer examination, the tiny bodies contained a fluid that seemed similar to the *Buccinum* fluid demonstrated by Jussieu. Perhaps this liquid, squeezed from the mysterious little balls, would also produce color? "In truth, a conjecture could hardly be more tenuously founded, but the experiment necessary to enlighten myself on this point was simple as could be." He plucked some from the rocks where they clung, and "using the first cloth (*linge*), and the least colored, available to me at that moment, I squeezed their juice onto the *manchettes* of my shirt." (These are the ruffled ends, often embellished with lace, of a gentlemen's shirt sleeves.) He could see a pale smear on the linen, with a bit of unremarkable yellow in some places, but otherwise no color. Then other things caught his eye, and he thought no more of his conjecture until, some minutes later, he glanced "by chance" at the ruffle: "I was struck by a pleasant surprise: I saw a very beautiful purple color just where the grains had been crushed." Surprised but hardly immobilized, he quickly gathered up more of the gelatinous grains, careful to choose those with no evident color, and crushed them onto clean sections of his shirt sleeves. Sure enough, as he watched, the color appeared and deepened to purple over the course of two or three minutes.

Réaumur emphasized that he had unexpectedly discovered "a new purple dye that I was not looking for." Reading his retrospective account, I was myself surprised at the casual way he used the ruffles on his sleeves to test the slimy substance. A handkerchief seems a more likely candidate. We might expect a servant to be involved—there were certainly servants present, ready to carry specimens and seawater back to the house. Was their linen perhaps not white enough to serve as test material? Was this simply a spontaneous gesture? In any case, it was the start of a long series of experiments.

"You can well imagine that the curiosity natural to those who love physics did not permit me to leave it at that." Enlisting the servants to help with gathering a large quantity of the little "grains" before the tide came in, he took them back to his study, where he crushed them and applied the liquid to clean pieces of linen. "I was

nearly as surprised as I had been the first time I saw the purple color appear when, having regarded my linen cloths for a very long time, there was no change in their color at all." Indoors, he could not reproduce the color change he had seen on the shore. Later on, he noticed small spots of reddish purple on the wall near the window where the liquid had splashed. By moving the soaked cloths to different locations he was able to get the color to appear, and eventually concluded—another surprise—that the movement of air over the surface initiated the color change. "Who would ever have guessed that a little more or less air circulation could have produced such an effect so quickly?" Ultimately, to cut a rather long story short, he interpreted this result in terms of the agitation of the air acting on the arrangement of the particles of the liquid. By the end of a long chain of experiments, including various chemical tests, the various unexpected effects had been tamed into reproducible results and even a mechanical explanation of sorts.

I should not perhaps have been surprised to find Réaumur smearing snail eggs, or whatever they were, onto the gathered ruffle of his fine linen shirt. (He mentioned that the color never did come out, even after repeated launderings.) The image of the genteel naturalist experimenting on his linen is an engaging one, and the narrative deployed the circumstances and his own surprise to good rhetorical effect. It served not only as the engine driving his subsequent investigation but also as the dramatic crux of the discovery narrative.

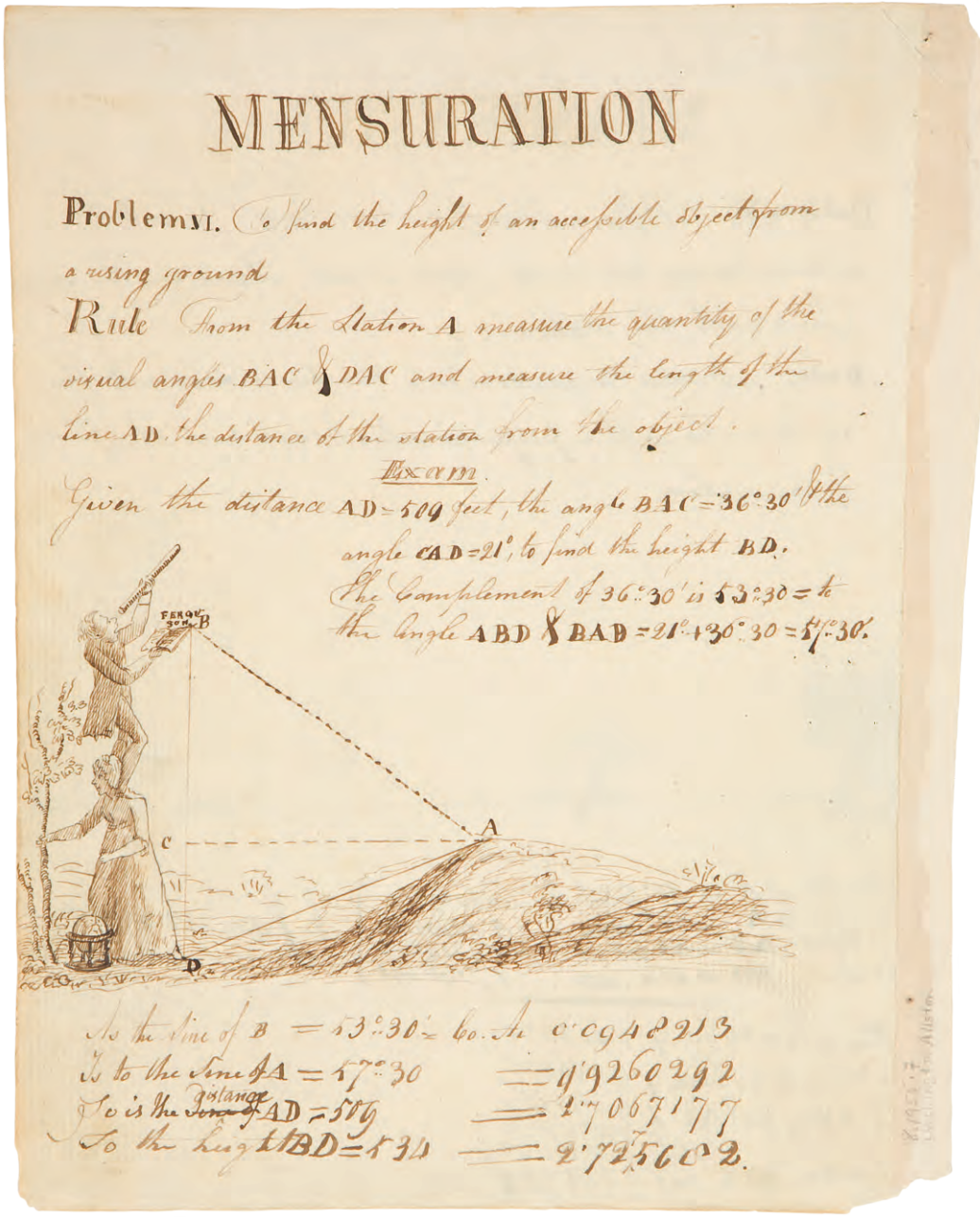
Problem VI

Viktoria Tkaczyk

Washington Allston (1779–1843) is celebrated for being the first American-born Symbolist painter, essayist, and poet. His symbolist style avant la lettre characterizes the second half of his career, when he left the United States, toured through Europe, resided in London for a decade, and finally settled in Cambridgeport, Massachusetts. Allston's opulently colored and highly expressive oil paintings of this period are rich in references to the old masters and in biblical and literary motifs. Among them is his most sophisticated work of art, *The Dead Man Restored to Life by Touching the Bones of the Prophet Elisha* (1811–1814) and the incomplete *Belshazzar's Feast* (1817–1843).

But let us turn to the artist's early years at Harvard College, where he obtained a classical education and searched for new horizons. During his first years at college, Allston—the offspring of a plantation family from Brook Green Domain near Georgetown, South Carolina—mostly filled his letters, notebooks, and manuscripts with drawings that recall the style of pictorial satirist William Hogarth. A series of four of such brown pen-and-ink sketches, produced between 1797 and 1799, is preserved in Harvard's Fogg Museum and was recently considered for the exhibition *The Philosophy Chamber: Art and Science in Harvard's Teaching Cabinet, 1766–1820* at the Harvard Art Museums. The series of caricatures illustrates problems in geometry. One of them, "Problem VI," shows the problem of finding the height of an accessible object from a rising ground. Following mathematical rules, Allston gives an example and solves the problem correctly. Interspersed between his calculations, we find the sketch of a land surveyor who appears to be agreeably surprised by what he sees through his telescope. He is standing unsteadily on the shoulders of a woman. What exactly, the drawing seems to inquire, *is* a rising ground? A grassy hill, a tree, or something that keeps rising, moving, or turning—the earth? What can an observer additionally see from a constantly moving position? Inaccessible, faraway objects? New continents? New worlds?

That surprises arise from changes in position, especially if those positions—or both positions and targets—keep moving, has long since become a truism. Probably the most famous case in point is Galileo Galilei, who suggested to his readers in one of his renowned



Washington Allston, "Mensuration, Problem VI," ca. 1797–1799, ink on paper.
Fogg Art Museum, Harvard University, Washington Allston Trust.

thought experiments that they imagine having themselves shut up "in the main cabin below decks on some large ship, and have with you some flies, butterflies, and other small flying animals." Is there any difference, Galileo asked, between observing the creatures' flight when the ship continues its progress and when it stands still, and if there is a difference, then for whom? For centuries, Galileo's vessel and other famous vehicles have been passing up and down the highways and byways of the history of science: Think of a train that travels at the speed of light (Einstein)! Imagine the sound of a police car's siren as it overtakes its quarry (Mach)! Neither sound, nor time, nor space, nor gravity, nor the shoulders of giants, nor truth, nor even the histories of science themselves remain stable. Time and again, terra firma seems worth trading in for surprise. Going back to Allston's sketch, the "problem" might just be to ask whose shoulders have to bear the weight of those attempts to gain new perspectives.

The Nice Ones Are Sometimes the Worst

John Tresch

I tried to warn the editors of this collection—on no less authority than Adam Smith's—that they are playing a dangerous game. In its substance and delivery, this volume takes monstrous chances with the well-being of its recipient.

Smith's unpublished *History of Astronomy* was actually a treatise on the sentiments' relation to knowledge.[1] He opened with "surprise", whose consequences could be deadly. He cited an anecdote from Livy: "a Roman lady," who believed her son killed in battle, "was sitting alone bemoaning her misfortunes" when that same son, having escaped his captors, "came suddenly into the room to her." In a horrible irony of maternal affection, she cried out "and expired instantly in a transport of joy."

For Smith, the nicer the surprise, the greater the risk. Unhappy surprises are more tame: "Let us suppose the contrary of this to have happened, and that in the midst of domestic festivity and mirth, he had suddenly fallen dead at her feet, is it likely that the effects would have been equally violent? I imagine not." Since Smith describes philosophy "as one of those arts which address themselves to the imagination," his last three words carry weight.

Smith attributed the difference between fatal joy and survivable sadness to the rhythm and trajectory of each. Surprise involves a change between what is expected and what occurs, with a corresponding internal alteration: "Grief comes on slowly and gradually, nor ever rises at once to that height of agony to which it is increased after a little time. But joy comes rushing upon us all at once like a torrent." This sudden change is "more violent and apt to have more fatal effects, than that which is occasioned by a Surprise of grief."

The account may seem odd—indeed, surprising—yet for Smith its truth was confirmed by common sense: "Most men who can take the trouble to recollect, will find that they have heard of more people who died or became distracted with sudden joy, than with sudden

1 Adam Smith, "The Principles Which Lead and Direct Philosophical Enquiries, Illustrated by the History of Astronomy," in *The Glasgow Edition of the Works and Correspondence of Adam Smith,* vol. 3: *Essays on Philosophical Subjects,* ed. W. P. D. Wightman, J. C. Bryce, and I. S. Ross (Oxford: 1983), 33–105.

grief." On reflection, I can't say I know of more people extinguished by happy surprise than by sudden sorrow. But the eighteenth was a sensitive century.

Surprise is often a prelude to the second sentiment Smith examines, wonder, which arises from unusual, singular things that confound established categories, or "small irregularities" in a familiar chain of events. The two sentiments form a chain of their own: "When one accustomed object appears after another, which it does not usually follow … we start and are surprised at feeling it there, and then wonder how it came there." Such irregularities stop the fancy, which moves always ahead toward what is expected; they open "a gap" in our anticipation, forcing us to wonder, in a mental "oscillation" astutely diagnosed as "a nasty hybrid of seasickness and toothache."[2]

As with joyful surprise, too much wonder can end badly. We see this with both astronauts and cardsharps. A man somehow transported to another planet, "where nature was governed by laws quite different," or the observer of a card game whose rules she could not decipher would suffer "confusion and giddiness," which if prolonged would end "in lunacy and distraction."

But even if they don't kill you or drive you mad, surprise and wonder—and their close kin, admiration—might make a pagan out of you (or worse, a Cartesian). Smith imagines a savage "overawed" by "comets, eclipses, thunder, lightning, and other meteors," who therefore "views them with a reverence that approaches to fear." Confronted with such grandeur, the imagination rushes in to provide a "bridge" between was expected and what arrives; this need is "the origin of Polytheism, and of that vulgar superstition which ascribes all the irregular events of nature to the favour or displeasure of intelligent, though invisible beings, to gods, daemons, witches, genii, fairies." It is also what led "Des Cartes" to postulate "invisible effluvia" between bodies.

Notwithstanding Smith's own later belief in an "intelligent, though invisible" hand, guiding selfish actors toward the common

2 Lorraine Daston and Katharine Park, *Wonders and the Order of Nature, 1150–1750* (New York: 1998), 327.

good, his work on the passions was a visible intervention. He offered a venerable balm: "Philosophy, by representing the invisible chains which bind together all these disjointed objects, endeavours to introduce order into this chaos of jarring and discordant appearances, to allay this tumult of the imagination, and to restore it, when it surveys the great revolutions of the universe, to that tone of tranquility and composure, which is both most agreeable in itself, and most suitable to its nature." Smith saw polytheism as the offspring of imagination run wild, of philosophizing without tranquility.

For Auguste Comte, who embraced Smith's analysis, *fetishism*—belief in the intelligence and benevolence of natural objects—preceded polytheism. Yet both forms of religion always existed alongside their more patient sibling, philosophy (or positive science).[3] Comte envisaged a future return to fetishism as a way of encouraging "altruistic" emotions, yet under the authority of a new science, sociology, administered by society's natural directors: historians of science, of course.

Someone once said that philosophy begins in wonder. But for wonder to have a chance, it needs a safe place to play. According to Smith, when "subsistence ceases to be precarious, the curiosity of mankind is increased, and their fears are diminished. The leisure which they then enjoy renders them more attentive to the appearances of nature, more observant of her smallest irregularities, and more desirous to know what is the chain which links them all together." From Smith's analysis, it appears that the ideal conditions for cultivating such sentiments and weaving such chains would be a quiet place, with books, conversation, and large windows, under a benevolent and wise director—and not too far from the U-Bahn. The fewer surprises coming in, the more surprising the work going out (though with minimal fatalities, we hope).

If these words are being read, however, I rest assured. My hyperbolic fears were unfounded. Happily—on the matter of happy surprises, at least—Smith was wrong.

3 Georges Canguilhem, "Histoire des religions et histoire des sciences dans la théorie du fétichisme chez Auguste Comte," in *Études d'histoire et de philosophie des sciences* (Paris: 1994), 81–98.

Disappointment in the Field

Jeremy Vetter

Not everyone likes surprises. Consider, for example, naturalists and scientists in the field. Following the nineteenth-century rise of the laboratory to prominence, the field was increasingly thought of as the messy, complex world outside its walls. One might imagine, given the unpredictability and uncontrollability of the natural worlds studied by field scientists, that the field would be a wonderland of new discoveries. However, in looking more closely at the wide range of primary source notes that I have gathered from published and archival sources from the interior American West during the railroad era, what I have found is a far more ambivalent—even anxious—relationship with the unexpected. Indeed, for many field scientists, surprise was more often synonymous with disappointment.

Why should this be? It seems to me that the key was how field scientists responded to the messy conditions of the field, which often turned the unexpected to disappointment. In a world of epistemically ascendant labs, anyone wishing to justify time and expense for fieldwork endeavored to show that they had some idea what they were looking for—that they were not engaged in the proverbial fishing expedition. This meant knowing about what was likely to be found in advance, even if the exact details remained uncertain: Which geological formations were most promising for rich fossil remains? Which local environments were likely to be fertile ground for collecting plants and animals? Where could the natural world be investigated most profitably, so as to make fieldwork worthwhile, not only to its practitioners but to potential critics in labs and museums? In this context a "surprise" meant, in many cases, that something was *not* found, even though it was anticipated. In a word, disappointment.

Even those who built their careers in the field could be disappointed, such as the Carnegie Museum paleontologist Earl Douglass, best known for leading on-site excavation of rich fossil deposits in Utah, which later became the centerpiece of Dinosaur National Park. On a "day to be remembered" in 1909, when his field crew "took down the first really big specimen," Douglass nevertheless expressed "surprise" to find "only one series of the vertebrae of the neck instead of

two as I supposed."[1] Another highly skilled field man, Vernon Bailey of the US Biological Survey, astonished his colleague E. W. Nelson by failing to find as many elk in the northern part of Yellowstone as had been found at Jackson Hole. Nelson wondered if Bailey had "overlooked some elk" and asked him to make sure he was counting them all, "so that it can not be claimed that an imperfect job has been done."[2] At countless other field sites, still less fortunate field scientists and naturalists found very little or even nothing in the geological formations, environmental conditions, and topographical settings where they expected better, based on their advance planning.

But disappointment was not just a matter of failures of cognitive preparation—of unsuccessful mental roaming over the landscape or of insufficient consultation of maps and other kinds of preexisting stores of knowledge to predict when and where to go. It was also, in practical terms, about justifying investments of time and resources. Fieldwork cost money and devoured the precious time of trained personnel. While mid-nineteenth-century exploring expeditions were often open-ended and opportunistic—especially when accompanying military campaigns or Pacific railroad surveys—a few decades later nearly all fieldwork was carefully planned to maximize returns on time invested and money spent on supplies, railway fare, meals, hotels, camping equipment, horses, and instruments. In this context, too, "surprise" often meant that the payoffs in collecting, observing, or mapping failed to meet expectations. S. F. Emmons of the US Geological Survey's Colorado Division reported in the mid-1880s that "two or three months" anticipated for finishing a map of the Denver Basin were insufficient due in part to "unexpected complication in the structure," which made it impossible to complete the fieldwork in the time allotted.[3] In the annals of field science, unexpectedly low returns on investment of time and money in fieldwork were at least as common as surprisingly rich discoveries.

1 Earl Douglass, Diary 25, December 14, 1909, Earl Douglass Papers, University of Utah.

2 E. W. Nelson to Vernon Bailey, March 31, 1916, Vernon Bailey Papers, American Heritage Center, Laramie, Wyoming.

3 "Report of Mr. S. F. Emmons," *Annual Report of the United States Geological Survey* 7 (1885–1886): 92.

Finally, a third kind of failure of expectation evident in fieldwork may not have been tied to disappointment, but it too transcended the simple positive novelties of field discovery. This was when field researchers received incredulous responses from lay people because their scientific perspective challenged popular beliefs about the natural world. The secretary of agriculture declared in 1889 that careful work by his statistics division in the Rocky Mountain region would "surprise the Eastern States with new views" of what was regarded as part of a "Great American Desert."[4] Likewise, two Bureau of Soils field researchers found that farmers near Billings, Montana, were "not a little surprised" at their chemically informed expertise on alkali soils.[5] Carefully collected field data on climate or soil conditions thus might challenge popular assumptions that were based on more limited or partial experience, failing to confirm what lay people expected, desired, or feared.

It is true that one can also find examples of welcome mismatches of reality and expectation. Earl Douglass once rejoiced at an "unexpected upward turn of the neck" of a fossil dinosaur, which "saved perhaps $500 to $1000 in work and shortened the time" his team would have to spend excavating the specimen.[6] Even with the best cognitive preparation and investment of resources, some things truly were astounding, bringing unexpected delight. But for field scientists who systematically prepared for fieldwork, and who carefully budgeted their time and expenses, surprises could bring disappointment as easily as joy.

4 J. M. Rusk, "Report of the Secretary of Agriculture," *First Report of the Secretary of Agriculture* (1889): 15.

5 Charles A. Jensen and N. P. Neill, "Soil Survey of the Billings Area, Montana," *Field Operations of the Bureau of Soils* 4 (1902): 683.

6 E. Douglass to D. Stewart, October 12, 1909, Earl Douglass Papers, Carnegie Museum of Natural History.

Terrifying Clouds

Marga Vicedo

"Attention, if sudden and close, graduates into surprise; and this into astonishment; and this into stupefied amazement. The latter frame of mind is closely akin to terror." So wrote Charles Darwin in "Surprise—Astonishment—Fear—Horror," chapter 12 of his 1872 book *The Expression of the Emotions in Man and Animals*.[1] Darwin's connection of surprise to fear is startling. But Darwin knew a thing or two about the anxiety provoked by nature's bewildering variety and variability.

One of the ways that humans try to contain the terror brought about by the unexpected is through classifications. Over the centuries, we have devised a variety of categories to organize flowers, animals, faces, stars, and dreams. We have also constructed typologies of causes, explanations, and predictions. And then we've built systems to organize our knowledge about the furniture of the world in catalogues, libraries, archives, and databases.

Lorraine Daston has illuminated the changing ways in which surprises have attracted attention, inspired astonishment, and provoked fear.[2] Consider her work on attempts to classify even the epitome of nature's fuzziness: clouds. As she notes, clouds had served as metaphors of mutability for centuries and thus did not seem to be objects about which scientists could establish reliable generalizations. But she shows how cloud watchers standardized nomenclature and learned "to see in unison." Slowly the giant cotton balls of our infancy were put into boxes: "Nimbus, cirrus, cumulus." Then, scientists created cloud atlases thanks to what Daston calls "remarkable exercises in collectively willed ontology, in ways of seeing, parsing, and naming nature made global by international collaboration."[3]

Now, let me introduce you to a very different "feat of ontological creativity," another way of using clouds for containing the potentially terrifying surprises of our world.

1 Charles Darwin, *The Expression of the Emotions in Man and Animals* (Oxford: Oxford University Press, 1998 [1872]), 278.

2 Lorraine Daston and Katharine Park, *Wonders and the Order of Nature, 1150–1750* (New York: Zone Books, 1998).

3 Lorraine Daston, "Cloud Physiognomy," *Representations* 135 (2016): 52, 45, 53.

At 12 years of age, a girl invented the following system:

Sun with clear sky: 4 doors
Sun with 1 cloud: 3 doors
Sun with 2 clouds: 2 doors
Sun with 3 clouds: 1 door
Sun with 4 clouds: 0 doors

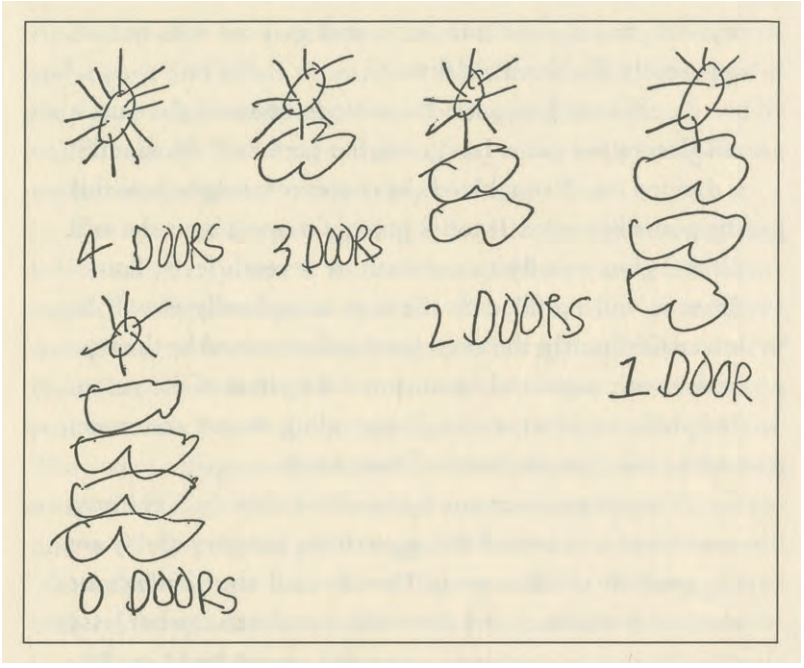
The system includes 29 kinds of days, depending on the presence of clouds and the position of the sun. In summer, she calls "dayhigh" a day with high sun and no clouds. In winter, "daynothing" refers to a clear sky. The system classifies not only days but also the affective consequences of the state of the sky on the classifier: the sun brings happiness to her days, while any cloud will ruin her mood. When she gets up, the girl rushes to look at the sky. Terrifying surprises are always possible. A day could be a "dayhighdarkcloud." Despondency, sadness, and despair will follow. Over the years, she establishes diverse relationships within her system. The different types of days correlate with numbers, flavors, and gum wrappers. For her, number 3 is "rainbow-colored when cloud has color outside looks like rainbow and white inside."[4]

Because of its affective connotations, the system also helps to organize and evaluate other experiences in the girl's life. She assigns four doors and no clouds to hard rock music because it brings her such intense pleasure that she needs to put four doors in between her and the sound to make it bearable. She allocates two clouds and two doors to classical music. For her evening meal, she measures the green juice she pours in her green cup. The amount of juice she'll drink depends on the clouds in the sky that day.

The unique character of this system reveals the remarkable mind of the person who elaborated it. Jessica is autistic. And, as her mother put it, "She is the center of her universe."[5] But neurologist Oliver Sacks reminds us that Jessica's system, though idiosyncratic,

4 Clara Claiborne Park, *Exiting Nirvana: A Daughter's Life with Autism* (Boston: Little, Brown, and Co., 2001), 82.

5 Clara Park, in Oliver Sacks's documentary "Rage for Order" (part of his BBC series *The Mind Traveller*, Rosetta Pictures for the BBC, directed by Christopher Rawlence).



Jessica's clouds-doors system, spring 1970. Clara Claiborne Park, *Exiting Nirvana: A Daughter's Life with Autism* (Boston: 2001), 75.

brings "to mind the elaborate, pseudoscientific systems of numerology and astrology."[6] Indeed, we too have looked to the skies for guidance and have tried to find meaning in the stars.

Is there meaning in Jessica's system? Her father, physicist David Park, and mathematician Philip Youderian analyzed it and pointed out the gap that separates her "from the rest of us."[7] They discovered that Jessica's "obsession" with systems helps her to bring clarity but also excitement into her life: "One need not go beyond her wide swings of emotion as the sun came and went, or the trembling excitement with which she filled her glass in the evening, to see that Elly {Jessica} found her own ways to live a life as rich in excitement and

6 Oliver Sacks, "Foreword," in Park, *Exiting Nirvana*, xi.

7 David Park and Philip Youderian. "Light and Number: Ordering Principles in the World of an Autistic Child," *Journal of Autism and Childhood Schizophrenia* 4 (1974): 321.

happiness as any of us have found."[8] However, looking for what sets her apart, I believe they also found what unites Jessica with "the rest of us."

For sure, her principles of classification are not our principles. Jessica's system is exceptional, not only in its uniqueness but in dispensing with the basic goal of scientific systematizers: to fix referents in order to enable communication, comparison, and thus agreement or debate. Organized around subjective affects, Jessica's system cannot be the basis for scientific knowledge today. As Daston and Peter Galison have shown, in an effort to "hold subjectivity at bay" the modern scientific ideal of objectivity requires emotional detachment.[9] In its uniqueness, Jessica's system reminds us of the great variety of human experiences and the intricate ways of the human mind. But it also reveals that her intentions are the same as those that Daston told us guided the makers of cloud atlases: "to discover order in apparent chaos."[10] Thus, Jessica's system teaches us that containing surprises is not only a goal for apothecaries, cosmologists, archivists, and naturalists. It seems to be a universal human desire as well, a deep, basic need of the human mind.

We all search for principles to order our universes, to assuage the terror of chaotic realities. Like Jessica, we too get up every morning and look through the window, wondering how many clouds the day may bring. It is exciting, and terrifying, to live in a world full of surprises.

8 Park and Youderian, "Light and Number," 322.

9 Lorraine Daston and Peter Galison, *Objectivity* (New York: 2007), 17.

10 Daston, "Cloud Physiognomy," 48.

Rapture, Hope, Wonder

Fernando Vidal

Horror and terror, as Lorraine Daston has shown, long accompanied wonder. Triggered by gross violations of the natural order, these "passions of incredulity" were also "passions of the unnatural."[1] Whether *supra*, *contra,* or *praeter naturam*, miracles always are phenomena of that sort. Nonetheless, since they confirm the existence of a divine cause, they strike with wonder and amazement, not with terror and horror. Does this render them unexpected surprises? What are the cognitive and epistemic ingredients of witnessing such an event? *A Miracle of Saint Joseph of Cupertino*, painted around 1750 by Placido Costanzi (ca. 1702–1759), a successful artist from Naples active in Rome, offers the occasion to briefly explore these questions.[2] The painting, illustrative of the emotional piety and cultivation of wonder that characterized Counter-Reformation religiosity, was commissioned by the Colonna family for a chapel dedicated to Joseph in the church of Santi Apostoli on the occasion of his beatification.

Although the Conventual Franciscan Joseph of Cupertino (1603–1663) performed so many miracles that his life was a "miracle theater," his iconography principally shows him during the spectacular ecstatic flights that made him famous. Costanzi's painting is unusual in combining a miracle with the saint in midair. Suspicious of Joseph's feats, the Inquisition sent him for surveillance to Assisi. It was there that the depicted miracle took place; yet it was not among the ones approved for Joseph's beatification. Asked to cure the young lunatic Baldassare Rossi, Joseph placed his hand on the patient's head, told him to commend himself to God and the Virgin Mary, and then, "non sine ingenti circumstantium stupore," grabbed the boy's hair and rose in the air with his "usual scream, *Oh!*" When they "returned to

1 Lorraine Daston, "Wonder and the Ends of Inquiry," *The Point,* 2014, https://thepointmag.com/2014/examined-life/wonder-ends-inquiry.

2 See Maria Antonia Nocco, catalogue entry no. 61, in *Visioni ed estasi: Capolavori dell'arte europea tra Seicento e Settecento,* ed. Giovanni Morello (Milan: 2003). The Metropolitan Museum of Art owns an oil sketch of Costanzi's painting: http://www.metmuseum.org/art/collection/search/724811.

Placido Costanzi, *A Miracle of Saint Joseph of Cupertino,* ca. 1750, oil on canvas, 250 × 175 cm. Galleria Nazionale d'Arte Antica, Palazzo Barberini, Rome, inv. 2422.

earth," Joseph simply said, "Sta allegremente Cavalier," and bid the boy go home, healed and praising God.[3]

Surrounded by witnesses in awe, Joseph and Baldassare are depicted as leaving or returning; either way, they are portrayed in the "most pregnant" moment, which alone leaves free play to the imagination and from which, Gotthold Ephraim Lessing argued in *Laokoon* (1766), the preceding and subsequent moments are comprehensible. The picture gives an impression of aloofness and stiffness that seems to run counter to the circumstances, but which actually derives from the rules that shape the image and the emotional and cognitive dynamics of the represented action.

As in much seventeenth- and eighteenth-century art, the chief semiotic scaffolding of the painting is a strictly codified *eloquentia corporis*.[4] Bodily positions, hand gestures, and facial expressions contribute to a pictorial choreography that operates as a rhetorical device; postures and attitudes enunciate the passions of the soul. The passions that dominate in *A Miracle* are rapture, hope, and wonder—and surprise binds them together. To understand how, we may rely on Charles Le Brun's influential 1688 lecture on expression.[5] The lecture is noteworthy for its use of René Descartes's *Les Passions de l'âme* (1649) to rationalize visual codes and aesthetic norms that remained current well into the eighteenth century and still framed Costanzi's representational practice.[6]

The facial expressions of the two female figures on the right and the priest behind them most clearly render the sentiment of hope. According to Descartes, the hoping soul is convinced that its desires will be realized; it fears frustration, yet can also incline toward assur-

3 I here draw on Domenico Bernino, *Vita del venerabile padre Fr. Giuseppe da Copertino …* (Venice: 1726), 504 and 74, and *Acta Sanctorum Septembris* (Antwerp: 1755), September 18, 5:1022.

4 Nicole Rouillé, *Peindre et dire les passions: La gestuelle baroque aux XVIIe et XVIIIe siècles* (Paris: 2007).

5 Charles Le Brun, *Conférence de Monsieur le Brun … sur l'Expression generale & particuliere* (Amsterdam and Paris: E. 1698). I here draw on the initial "Conference tenue en l'Academie royale de peinture et sculpture" (1–24) and the subsequent iconographic discussion (beginning with *Admiration* on a new page 1).

6 Jennifer Montagu, *The Expression of the Passions: The Origin and Influence of Charles Le Brun's Conférence sur l'expression génerale et particulière* (New Haven, CT: 1994).

ance. Hence the resulting immobility. As Le Brun notes, since the entire body is "suspended" between fear and confidence, the movements of *esperence* (*sic*) "are more internal than external" and do not give rise to marked expressions.

In a miracle, hope, wonder, and joy are moments in the realization of desire. While the miracle is being accomplished, wonder (as the French *admiration* should be translated in this context) holds sway. Surprise, however, towers so much above all other passions that Baldassare's entire body mimics Cesare Ripa's emblem for *maraviglia* (surprise, *un certo stupore di animo*), which entered his *Iconologia* in the second edition (1603). Moreover, in Le Brun's Cartesian system, wonder is a kind of surprise, and rapture a kind of wonder.

Descartes does not discuss rapture, but the state is vital for religious art. Le Brun writes that rapture (*ravissement*) is wonder caused by an object, such as God's power, which is beyond the reach of the soul's cognitive capacities. (Constanzi visualizes that power as a softly radiant cloud accompanying Joseph's flight.) That is why, in rapture, the body takes over—though mainly to produce the fixedness of the ecstatic gaze. Indeed, says Le Brun, "intent on discovering what the soul cannot know," the eyes stay turned toward heaven. This has a physiological cause. Wonder is a surprise that leads the soul to consider the objects that strike it as "rare and extraordinary." Such surprise (Descartes conjectures about *étonnement*) directs the "spirits," the fluids that animate body and mind, to the cerebral location where the impression of the surprising object is situated, and this prevents them from flowing toward the muscles: "Ce qui fait que le corps demeure immobile comme une statue." With a painter's sensibility and perhaps echoing seventeenth-century discussions on the apparent contradiction of trying to render movement in painting, Le Brun writes, "Le corps devient immobile."

In addition to depicting a great concatenation of passions by way of remarkably static bodies, Costanzi inscribes wonder in the two men on the left and the more distant onlookers. Le Brun maintains that in a state of wonderment, "the heart feels the least agitation," the face undergoes hardly any change, the gaze remains focused on the wondrous object, and the rest of the body is still. In the end,

wonder "only produces a suspension of movement," which allows the soul to consider attentively the object of interest. We may now understand the paradoxical motionlessness of Costanzi's painting as the skillful articulation of wonder as a species of surprise and as a pictorial reminder that, in knowledge as in belief, only those who are prepared for such passions are able to experience them.[7]

7 With thanks to Mechthild Fend, Tatiana Senkevitch, and Claudia Swan for their friendly art-historical guidance.

Ordner „Vermischtes“

Annette Vogt

Die Philosophie- und Wissenschaftshistorikerin Anneliese Maier (1905–1971) formulierte im März 1954 in ihrer „Denkschrift“ für eine geplante aber nicht realisierte Abteilung für Philosophie- und Wissenschaftsgeschichte an der Bibliotheca Hertziana (MPI) in Rom ein Credo:

> Bei mediävistischen Untersuchungen kommt immer etwas heraus, und fast immer etwas Interessantes und Überraschendes, wenn auch nicht immer gerade das, was man gesucht und erhofft hat. Man muss mitnehmen, was sich bietet und was das handschriftliche Material an Entdeckungen schenken will.[1]

Diese Einsicht basierte auf ihrer über 25-jährigen Erfahrung als Wissenschaftshistorikerin und gilt nicht nur für Forschungen zu mittelalterlichen Handschriften. Es gehört zur Logik der Archive, dass man nicht immer gerade das Gesuchte findet. Konsultiert man jedoch Aktenordner, die auf den ersten Blick und laut Findbuch wenig mit der eigenen Fragestellung zu tun haben, bekommt man, mit etwas Finderglück, Entdeckungen geschenkt. In meinem Beitrag möchte ich drei Beispiele aus der Mathematik- bzw. Wissenschaftsgeschichte im 20. Jahrhundert skizzieren. Die Beispiele zeigen, dass Archiv-Bestände, die unter „Vermischtes“ abgelegt waren, für Überraschungen gut sind.

Das erste Beispiel stammt aus dem Projekt zur Geschichte der Berliner Universität, der späteren Humboldt-Universität, zwischen 1945 und 1961. Die Quellenlage für die Jahre bis 1951 war erstaunlich schlecht. Aber es gab einen Ordner „Vermischtes“ im Archiv der HU, „Bestand Verwaltungsdir. 1950, Abt. III, Allg. Verwaltung, 1947–1950, Sgn. 39“, der viele nicht paginierte Blätter enthielt. Mit den Erfahrungen früherer Archiv-Recherchen ging ich sorgsam Blatt für Blatt durch und fand etwas Unerwartetes: den Durchschlag eines Briefes vom Stellvertreter des Brigadegenerals der US Army Frank L. Howley

1 A. Maier, 12.3.1954, in Archiv MPG, II, 1A, PA A. Maier, Bd. 1, S. 4 (Abschrift). Vgl. Annette Vogt, „Anneliese Maier (1905–1971) zwischen der *Bibliotheca Hertziana* und dem *Campo Santo Teutonico*,“ in *Orte der Zuflucht und personeller Netzwerke. Der* Campo Santo Teutonico *und der Vatikan 1933–1955*, hgg. Matheus, Michael und Stefan Heid (Freiburg i. Br., Basel, Wien: 2015), 94–122.

(1903–1993), gez. von Babcook, an den Oberbürgermeister von Berlin-West, Ernst Reuter (1889–1953), vom 25. April 1949.

In dem Brief ging es um die Erlaubnis der US-Militärregierung, die in Dahlem gelegenen Gebäude und Institute für die Belange der Freien Universität zu nutzen, und den Hinweis, dass mit der Nutzung der Gebäude, die juristisch der Humboldt-Universität im sowjetischen Sektor gehörten, keine Übertragung von Eigentumsrechten verbunden war („3. Diese Genehmigung ist nicht als Übertragung eines Rechtstitels auszulegen.“). Dieser kleine Fund zeigte ein interessantes Detail zur Geschichte der feindlichen Schwestern-Universitäten FU und HU während des Kalten Krieges. Die FU plagte mindestens eine so große Raumnot wie die HU. Gleichsam vor der Tür standen mehrere relativ unbeschädigte Institutsgebäude in Dahlem, mit Apparaten und Mitarbeitern, die allerdings der HU gehörten bzw. unterstanden. Nun erlaubten die Amerikaner in dem Schreiben dem Magistrat in Berlin-West, diese Institute in ihre Verwaltung zu übernehmen. Ausdrücklich ging es nur um die Verwaltung. Wie die Kopie des Briefes an die HU gelangte, ist unklar, von dem Wissen, das darin enthalten war, machten die offiziellen Stellen der HU bei der Auseinandersetzung mit der FU keinen Gebrauch, weder vor noch nach 1989.[2]

Die beiden anderen Beispiele gehören zu meinem Forschungsprojekt zur Geschichte der Statistik im 19. und 20. Jahrhundert. Für die Entwicklung der Statistik in Berlin spielte die 1906 gegründete Berliner Handels-Hochschule (ab 1936 Wirtschafts-Hochschule) eine besondere Rolle. Hier wurden innovative Lehrangebote früher als an der Universität oder der Technischen Hochschule angeboten, und die Hochschule, gegründet und finanziert von den Berliner Kaufleuten, den Aeltesten der Kaufmannschaft bzw. der Industrie- und Handels-

2 Vgl. Brief Brigadegeneral Frank L. Howley, gez. von Babcook, an den Oberbürgermeister von Berlin, Ernst Reuter, 25.4.1949, in Archiv HU, Bestand „Verwaltungsdir. 1950, Abt. III, Allg. Verwaltung“, 1947–1950, Sgn. 39, unpaginiert; Colonel Babcook war der Stellvertreter von General Howley; publiziert in Annette Vogt, „Vom Wiederaufbau der Berliner Universität bis zum Universitäts-Jubiläum 1960,“ in *Geschichte der Universität Unter den Linden*, Bd. 3, *Sozialistisches Experiment und Erneuerung in der Demokratie – die Humboldt-Universität zu Berlin, 1945–2010*, ed. Heinz-Elmar Tenorth (Berlin: 2012), 125–250, bes. 181–192.

kammer, verfügte über größere Spielräume als Universität oder TH. Nicht zuletzt deshalb wurde 1929 vorgeschlagen, ein Institut für Statistik zu gründen, das an der Handels-Hochschule angesiedelt und auch für die Studenten der Berliner Universität und der TH zugänglich sein sollte. Im Archiv der HU, wo sich das Archiv der Handels-Hochschule befindet, weil sie 1946 Bestandteil der neuen Wirtschaftswissenschaftlichen Fakultät wurde,[3] sind das „Memorandum“ zur Gründung des Instituts und weitere Schreiben überliefert, aber keine Dokumente, warum es nicht zu der Gründung gekommen war. Akten der Industrie- und Handelskammer, der „Obrigkeit“ der Handels-Hochschule, sind im Landesarchiv Berlin aufbewahrt. In dem umfangreichen Bestand sind zwei Bände (jeweils unpaginiert) die mit „Vermischtes“ betitelt werden könnten: ein Band „Institut für Wirtschaftsstatistik“ und ein Band „Interakademisches Institut“.[4] Hier fand sich die Erklärung, warum es nicht zum geplanten Institut für Statistik gekommen war. Zu den Fundstücken gehörte der Brief des Kurators der Handels-Hochschule, Fritz Demuth (1876–1965), an den Mathematiker Ladislaus von Bortkiewicz (1868–1931) im Mai 1930 mit der streng vertraulichen Bitte um eine Stellungnahme zu dem geplanten Institut sowie die Aktennotiz der Antwort v. Bortkiewicz', dass er und sein Kollege Rudolf Meerwarth (1883–1946) vom Preußischen Statistischen Landesamt die Einrichtung eines solchen Instituts „nicht für erwünscht erachte(n)“.[5] Die Handels-Hochschule hatte sich außerdem bei der Frage des künftigen Direktors dieses Instituts für R. Meerwarth und gegen Ernst Wagemann (1884–1956), Präsident des Statistischen Reichsamtes und Autor des Memorandums, entschieden.[6]

3 Archiv HU, WHB Nr. 529 (24.10.1929–8.10.1930).

4 LA Berlin, A Rep. 200-02-03, Nr. 194 (Januar–Dezember 1929) und LA Berlin, A Rep. 200-02-03, Nr. 82 (1929–1930).

5 Vgl. Brief F. Demuth an L. v. Bortkiewicz, 3.5.1930, und Aktennotiz von F. Demuth, 5.5.1930, in Landesarchiv Berlin, A Rep. 200-02-03, Nr. 82, unpaginiert. Vgl. Wolfgang K. Haerdle und Annette Vogt, „B. Ladislaus von Bortkiewicz – Statistician, Economist and a European Intellectual,“ *International Statistical Review* 83, no. 1 (2015): 17–35.

6 Vgl. Briefe von Franz Eulenburg an F. Demuth, 20.6.1930 und 28.6.1930, in LA Berlin, A Rep. 200-02-03, Nr. 82, unpaginiert. Franz Eulenburg (1867–1943) war zu dieser Zeit Rektor der Handel-Hochschule Berlin.

10 Jahre später erfolgte unter NS-Bedingungen die Gründung eines „interakademischen“ Instituts, des „Berliner Hochschulinstituts für Versicherungs-Wissenschaft an der Wirtschaftshochschule“, offen für Studenten der Universität, der TH und der Wirtschafts-Hochschule. An der Handels-Hochschule hatte Alfred Manes (1877–1963), einer der Begründer der modernen Versicherungswissenschaft, bis zu seiner Vertreibung 1933 ein entsprechendes Institut geleitet. Im Landesarchiv Berlin gibt es den Ordner „Vermischtes: Sachliche Angelegenheiten, Räume etc., Personalien und Allgemeines“, in dem sich Dokumente zur Anstellung von Mitarbeitern in dem am 19. Januar 1939 eröffneten Institut befinden.[7] Zum Institut für Versicherungs-Wissenschaft gehörte eine kleine mathematische Abteilung unter Alfred Klose (1895–1953), Nachfolger des von den Nazis vertriebenen Richard von Mises (1883–1953). Bei A. Klose hatte 1939 der ehemals russische, nun staatenlose Wassilij (Wassily) Höffding (Hoeffding) (1914–1991) promoviert, den er 1940 als wissenschaftliche Hilfskraft einstellte.[8] Wassily Hoeffding, der nach der Kapitulation NS-Deutschlands in die USA emigrierte, arbeitete von 1947 bis zu seiner Emeritierung 1979 an der University of North Carolina, Chapel Hill und wurde ein international anerkannter Statistiker, einer der Begründer der „nonparametric statistics“, „the science of analyzing data without making unnecessarily restrictive assumptions about their origin.“[9]
Die Beispiele zeigen, „man muss mitnehmen, was sich bietet“ und in Archiven nicht nur die Akten-Bestände einsehen, die einen unmittelbaren Bezug zur Forschungsfrage haben, denn in den Ordnern „Vermischtes“ bekommt man manchmal schöne Entdeckungen geschenkt.

7 LA Berlin, Rep. 200-02-03, Nr. 237.

8 Vgl. „Einstellungsregistratur“ 23.12.1940, in Landesarchiv Berlin, Rep. 200-02-03, Nr. 237, unpaginiert.

9 Nicholas I. Fisher und Willem R. van Zwet, „Wassily Hoeffding (1914–1991)” in *National Academy of Sciences: Biographical Memoirs* (Washington, DC: 2005), 86:2–21, auf 3.

In the Freiberg Mines

Andre Wakefield

It must have been the fall of 1996. I had already spent a remarkable summer in Berlin hanging around the onetime Czechoslovakian Embassy in former East Germany, a Cold War spaceship building perched near the edge of no-man's-land, now housing the brand-new Max Planck Institute for the History of Science. Berlin was chaotic then, with cranes on every horizon singing the promises of many futures. Imagine my shock when I headed directly from Berlin to Göttingen that fall. Where Berlin was raucous, Göttingen was predictable. Not that predictability is always a bad thing. It's often good for research, when you know that you can retrieve a certain book or that the library and archives will open at a certain hour. And so it was in Göttingen, which welcomed me with its signature and not unpleasant mix of boredom and anticipation, something I regularly experienced as I sat comfortably ensconced in my little pinewood *Kabine* in the Göttingen State and University Library (SUB), daydreaming about Berlin techno bunkers, surrounded by the smells of old vellum and fine paper, overlooking the far end of Weender Strasse, and reading endless heaps of cameralist literature from the seventeenth and eighteenth centuries.

Cameralist texts, if you read enough of them, start to feel a little like Göttingen: comfortable and predictable. You notice patterns. The writers articulate the same thoughts, about the same things. You have your responsible *Hausväter*, your happy and industrious *Volk*, your good princes, and your thriving farms. It was a strange wonderland I lived in during those halcyon days of 1996. That happy world of eighteenth-century cameralists seemed reflected all around, inside my well-ordered little *Kabine*, itself situated inside a well-ordered library. Even the *Mensa* felt cameralist, with its abundant and affordable *Eintopf* and *Knödel*. Albion Small, my University of Chicago predecessor, seemed prescient at that time, having seen in those early cameralists the harbingers of a well-ordered future.[1] Not only that, but my dissertation proposal had it all figured out: I would "reconstruct the Cameralist dream of a unified science of order," Foucauldian style. I would read some books, visit some archives, bang

1 Albion Small, *The Cameralists: The Pioneers of German Social Polity* (Chicago: 1909).

out some chapters. After a year of quality time in that cozy *Kabine*, it would all but write itself. *Kein problem*.

Imagine my surprise and dismay as that plan slowly crumbled during that fall and winter. As I kept reading, my well-ordered proposal came to seem more of an impediment than a support. It boxed me in. I was stuck, with nothing new or interesting to say. And that cozy *Kabine* in the SUB started to lose its luster, feeling more like a cell than a refuge.

We all discover what we expect to find, but it is harder and more rewarding to seek unanticipated things. The former teaches us what we already know; the latter makes for interesting history. In that sense, my theme is not so much about surprise in the history of science as it is about serendipity. Horace Walpole coined the word in 1754.[2] Unlike surprise, which takes one unawares and off guard, serendipity is something you can cultivate and encourage. One can develop a talent for serendipitous discoveries. It is something that the best historians do—whether it involves a certain kind of openness, a gift for following hunches, or a talent for seeing unorthodox connections.

Kant famously wrote that Hume had awoken him from his dogmatic slumber.[3] My case was much less grandiose or dramatic: let's just say that miner-archivist Hans Hofmann flat-out woke me up when I arrived in Freiberg early in 1997. After wallowing in my self-constructed cameralist mess in that Göttingen *Kabine,* I headed to the little mining town of Freiberg, in Sachsen, on a hunch. One of the patterns I had noted in those hundreds of cameralist texts was simple: mines everywhere. But there was very little written about them in the secondary literature. Soon enough, Hofmann had convinced me to don an old East German army uniform and go spelunking in the mines under Freiberg. It was there that I became acutely aware of my limitations, of how much more there was to interpret and understand; it was there that I first got a glimmer of a world that

2 Horace Walpole, cited in Robert Friedel, "Serendipity Is No Accident," *Kenyon Review* 23, no. 2 (2001): 36–47.

3 Immanuel Kant, *Prolegomena to Any Future Metaphysics,* ed. and trans. Gary Hatfield (Cambridge: 1997), 10.

cameralist texts had ignored, that what I had been reading was but one side of a much richer and deeper story. It was, as Walpole might have said, a moment of accidental sagacity.

Hans Hofmann had a big booming Saxon voice, both underground and in the archive, which could be a little jarring if you were used to the vibe in the Library of Congress or in my *Kabine* in Göttingen. "Glückauf Herr Wakefield!" he used to bellow, when I came in for the morning's research, as if we were part of a miner's crew. When we did head underground, it blew my mind. Not here the well-ordered shafts and adits of camerlist imaginings. Instead, a dizzying array of markings, dead ends, crawl spaces, flooded adits, and rotting timbers. As we walked, ducked and eventually crawled from the mine shafts of the nineteenth century all the way back to their sixteenth-century predecessors, the tunnels and shafts narrowed and constricted as if you were being squeezed by the sheer weight of time. My stupid assumptions, gleaned from reading too many books, and then conflation of those textual descriptions with some kind of imagined lived reality rapidly fell away. In their place came new questions. How did the mine foremen possibly exercise oversight down here? How could a *Berghauptmann*, perched safely above ground in his *Kammer*, really hope to organize and arrange every facet of work? Neat Foucauldian frameworks came crashing down. Those questions eventually led me to abandon the strictures and structure of my original thesis altogether. It was a liberating day; it made me rethink not only how I would write about the topic but also how I approached history.

Just Cause for Wonder

Cecelia Watson

The Principles of Psychology is as much a performance as it is a book. The hero of the drama is the Good Conventional Scientist, and the actor starring in that role is William James. Despite detesting "brass-instrument" psychology, James dutifully produced and reproduced experiments and (so he claimed) avoided explanations that veered too close to the "metaphysical." "I have kept close to the point of view of natural science throughout the book," James promises piously.[1] (Some readers, returning to this line after reading the entire book, might admire how judiciously chosen is the word "close.")

Part of this act of willing himself strictly scientific is James's attitude toward surprise. Surprise is the emotion that results from a mistake or misperception. We are surprised when our knowledge is inadequate. We become unsurprised when we hit upon the right theory and articulate a law. Accordingly, most accounts of "surprises" in the *Principles* are stories of errors in perception or judgment. Consider, for instance, the man surprised by his terrier's apparent ingenuity.

> A friend of the writer gave as a proof of the almost human intelligence of his dog that he took him one day down to his boat on the shore, but found the boat full of dirt and water. He remembered that the sponge was up at the house, a third of a mile distant; but, disliking to go back himself, he made various gestures of wiping out the boat and so forth, saying to his terrier, "Sponge, sponge; go fetch the sponge." But he had little expectation of a result, since the dog had never received the slightest training with the boat or the sponge. Nevertheless, off he trotted to the house, and, to his owner's great surprise and admiration, brought the sponge in his jaws. Sagacious as this was, it required nothing but ordinary contiguous association of ideas. The terrier was only exceptional in the minuteness of his spontaneous observation. … If the reader will take the trouble to analyze the best dog and elephant stories he knows, he will find that, in most cases, this simple contiguous calling up of one whole by another is quite sufficient to explain the phenomena.

1 For all citations see William James, *The Principles of Psychology* (New York: 1950), 1:v; 2:349; 2:494–495; 2:475–476; 2:502.

The best surprises spark curiosity, joy, and (if one is the owner of a clever terrier) pride. But when we chase after the surprise, we find that as soon as we grasp it and pull it close enough to scrutinize it, it vanishes, and with it evaporate all the pleasurable feelings it brought. The extraordinary, properly viewed, reveals itself to be ordinary after all. So it goes, at least, in the model of surprise in which surprise is a balloon and science a struck match. James dutifully plays bubble burster through most of the *Principles.* In place of surprise and its constant companion, wonder, James swaps in their supposed opposite: knowledge. We are surprised, James notes, when our bodies respond with reflex action when presented with a mental or visual stimulus: "It is just cause for wonder, as our chapter on Instinct has shown us, that such bodily consequences should follow such mental antecedents." But wonder yields to understanding: "We explain the mystery *tant bien que mal* by our evolutionary theories, saying that lucky variations and heredity have generally brought it about that this particular pair of terms should have grown into a uniform sequence."

Understanding's tendency to snuff out surprise has ramifications for ordinary life, James saw. Wisdom and professional accomplishment were yoked to a world-weary wonderlessness worthy of Ecclesiastes because surprise, along with the other emotions, was governed by a general principle: "*They blunt themselves by repetition more rapidly than any other sort of feeling,*" James proclaimed.

> The oftener we meet an object, the more definitely we think and behave about it; and the less is the organic perturbation to which it gives rise. The first time we saw it we could perhaps neither act nor think at all, and had no reaction but organic perturbation. The emotions of startled surprise, wonder, or curiosity were the result. Now we look on with absolutely no emotion. This tendency to economy in the nerve-paths through which our sensations and ideas discharge, is the basis of all growth in efficiency, readiness, and skill. Where would the general, the surgeon, the presiding chairman, be, if their nerve-currents kept running down into their viscera, instead of keeping up amid their convolutions? But what they gain for practice by this law, they lose, it

> must be confessed, for feeling. For the world-worn and experienced man, the sense of pleasure which he gets from the free and powerful flow of thoughts, overcoming obstacles as they arise, is the only compensation for that freshness of the heart which he once enjoyed.

There is some pleasure in accomplishment, then; but accomplishment, as it is described in this passage, *precludes* surprise. (James, ever fretful about the perils of professionalizing, perhaps spoke from painful experience.)

But the reader damned to discouragement by one passage in the *Principles* can be almost assured of finding salvation on some other, contradictory page of the book. Buried in a seemingly mundane passage about lifting boxes with unknown contents, James offers an alternate conception of the relationship between advancing knowledge and surprise: "*Surprise* can only come from getting a sensation which differs from the one we expect. But the truth is that when we know the objects well, the very slightest difference from the expected weight will surprise us, or at least attract our notice." Here, there is hope that surprise might signal something more sophisticated than naive mistake or mere absence of knowledge. The kind of surprise James describes in this passage arises from *deep* knowledge. A surprise, in this understanding of it, is both a source of pleasurable emotion *and* a new piece of knowledge. It may after all be the mark of the truly probing and generous thinker that she finds the line between surprise and knowledge faint and sees, all around her, just cause for wonder.

Perfect Color

Kelley Wilder

At the other end of the rope my lab partner flexed her wrist up and down, and then, with more force, her forearm from the elbow. I did the same, awkwardly, against her rhythm, up and down until a single wave emerged from our competing waves. “Congratulations,” said the teacher, “you’ve created a standing wave.” At 15, it didn’t interest me much. If only he’d told us then that color photography could be made out of these waves alone, I’d have paid more attention.

While the 1839 articles and reports about the invention of photography were hyperbolic in their praise and incredulity of the new image-making automaton, that single elusive element of full, natural color hovered in the background. It seemed churlish to ask the daguerreotype and photogenic drawing to be *even more* perfect. And yet, there were rumours. Hushed reports of Louis Daguerre’s first attempts to fix the image of the camera obscura with phosphorous were accompanied by Edmond Becquerel’s astounding modification of the Daguerreotype and publications on full-color photographs in 1848. But Becquerel’s heliochromes were still susceptible to light. Shrouded in near darkness, they were viewed by the light of a single candle at the 1855 Exposition Universelle in Paris. Today, the last remaining plates are kept in the dark, rarely available for inspection. Mystery and secrecy, darkness and caution surrounded the full-color photograph.

So much more thrilling, then, was Gabriel Lippmann’s announcement on the February 2, 1891, that he had fixed the color spectrum permanently on a photographic plate of his own devising. In the tiny 4 × 4 cm square (later 6.5 × 9 cm) the panchromatic emulsion recorded spectra, or blue skies, green foliage, and beds of red flowers, but only for the observer looking at the correct angle. Look at the wrong angle and the colors change, or a darkness covers the plate. Imagine the sensation. A small block sits on your table in the archive. It is covered in a rough, off-white cloth, with a hinged opening and a tab to pull it. You pull back the door and look, cocking your head first one way, then another. Then suddenly, perhaps in the bottom corner, you catch a flash of red. You move, but too quickly, it is lost. You move again, and this time, blue appears in the upper left-hand side. Finally, after adjusting your eye and your body to gather together these inci-

dent rays, blocks of color emerge. Shapes eventually resolve into Versailles and its gardens (George Eastman Museum) on what looks like a sunny day, in perfect color. The light from a nineteenth century sun never looked brighter.

Lippmann's foray into Fourier mathematics, optics, and the resolving power of ultra-fine emulsions did not go unnoticed. His research galvanized similar-minded experimenters across Europe. Among the most famous of these are the Lumière brothers, August and Louis. Not only did the Lumière factory produce some of the finest emulsions in Europe, they were already deeply involved with the scientific establishment, altering photography almost beyond recognition in order to supply scientists with designer photographic plates. Louis Lumière was able to replicate the Lippmann plates and create a portrait in 1893 by improving the speed of the plates. It was the same laboratory that would later develop the commercially successful Autochrome plate and released it to market in 1907, albeit colored by a very different method.

The Lippmann plates depended on the agency of light in a way that recalled the sense of early wonder and disbelief in photography itself. In 1844, William Henry Fox Talbot, on finding some misunderstanding about the manufacture of the images in *Pencil of Nature,* inserted a "Notice to Readers" in the fascicles. It read "The plates of the present work are impressed by the agency of Light alone, without any aid from the artist's pencil. They are the sun-pictures themselves, and not, as some persons have imagined, engravings in imitation." Lippmann plates, with their promise of perfect color, were never commercially viable for color photography. But they brought about a revolution in imaging science that lives on in the formation of present day holograms.

Angle of Attack

Benjamin Wilson

In his unfinished masterpiece *Vom Kriege*, the Prussian military theorist Carl von Clausewitz wrote that, in war, "surprise lies at the root of all operations without exception."[1] In 1812, he had resigned his post with the Prussian military to assist Tsar Alexander I's effort to halt Napoleon's eastward march. Clausewitz observed as the once-mighty French armies were dissipated and reversed by a combination of Russian tactics and unforgiving Russian territory. Years later, writing his book at the Kriegsakademie in Berlin, he described the experience of approaching the firing line, where "shot is falling like hail, and the thunder of our own guns adds to the din. The air is filled with hissing bullets that sound like a sharp crack if they pass close to one's head." Muskets and cannons had increased the lethal reach of infantry and artillery, but they had not altered war's traditional rhythms. Soldiers still met on the field of battle, commanded by generals who plotted their advances and retreats. Napoleon's misfortune convinced Clausewitz that defensive campaigns were superior to the offense, because "it is easier to hold ground than to take it." The advantage of surprise, he concluded, belonged as much to defense as to attack.

On July, 16, 1945, an explosion generated by splitting plutonium atoms shattered the predawn darkness over a southern New Mexican desert known as the Jornada del Muerto—the journey of the dead man. Three weeks later, the world learned what one such explosion, delivered by surprise, could wreak on an entire city and its people. "The pattern of the use of atomic weapons was set at Hiroshima," said J. Robert Oppenheimer, who had directed the scientific project that made the weapons a reality. "They are weapons of aggression, of surprise and of terror. If they are ever used again, it may well be by the thousands, or perhaps by the tens of thousands."[2] The pacifist philosopher Bertrand Russell agreed. "If war comes," he wrote in

1 Carl von Clausewitz, *On War*, trans. Michael Howard and Peter Paret (Princeton, NJ: 1976), 198. The book was first published posthumously, in three German volumes, between 1832 and 1834. For the following citations in this paragraph, see ibid., 113 and 357.

2 "J. Robert Oppenheimer, 'Address to the American Philosophical Society, 16 November 1945,'" American Rhetoric, last modified November 12, 2017, accessed April 11, 2018, http://www.americanrhetoric.com/speeches/robertoppenheimeratomicbomb.htm.

1946, "it will begin with a surprise attack in the style of Pearl Harbor. The aggressor will hope for a knock-out blow so severe as to make retaliation impossible."[3]

Physicists soon discovered that by fusing light atomic nuclei together, rather than cleaving heavy ones apart, they could boost explosive yields by a factor of 1,000 or more and make warheads portable enough to travel on rockets to the other side of the globe in 30 minutes. Dwight Eisenhower stood before the United Nations in December 1953 and warned that merely possessing nuclear weapons was "no preventive, of itself, against the fearful material damage and toll of human lives that would be inflicted by surprise aggression."[4] As the Cold War deepened, the president was not alone in fearing a nuclear Pearl Harbor.

December 7, 1941: the template of military surprise in the American imagination. Many believed it had been a preventable disaster. In 1940, US cryptanalysts had cracked the code protecting secret communications between Tokyo and its foreign embassies, and radio traffic provided a decent picture of the whereabouts of the Japanese fleet. Still, American military and political leaders had been unprepared. To most analysts, Pearl Harbor was a stunning failure of intelligence analysis. But not to everyone. At the offices of the RAND Corporation in the early 1950s, Roberta Wohlstetter began to dig into the available documents. In her judgment, the positive signals of an imminent attack were mingled with disconfirming evidence and ambient noise. Anticipation was theory laden: without a prior belief that the Japanese were likely to strike, the data alone would never have revealed it.[5] This disturbing thought shaped the work of Roberta's husband, Albert, who joined RAND's economics division in 1951. He developed the theory that the Soviet Union was hell-bent on ex-

3 Bertrand Russell, "The Atomic Bomb and the Prevention of War," *Bulletin of the Atomic Scientists* (October 1, 1946): 19–21, on 19.

4 "Address by Mr. Dwight D. Eisenhower, President of the United States of America, to the 470th Plenary Meeting of the United Nations General Assembly, 8 December 1953," International Atomic Energy Agency, accessed April 11, 2018, https://www.iaea.org/about/history/atoms-for-peace-speech.

5 Roberta Wohlstetter, *Pearl Harbor: Warning and Decision* (Stanford, CA: 1962).

Early warning radars of the Ballistic Missile Early Warning System, near Anderson, Alaska. Library of Congress (http://www.loc.gov/item/ak0486).

ploiting any vulnerability. In a series of influential studies, he argued relentlessly that US nuclear forces needed better protection, the better to ride out an attack and retaliate. If America's best guarantee of security wasn't intelligence, then it was deterrence.[6]

The view of deterrence held by most strategic thinkers was this: that beginning or averting nuclear war would come down to a decision, to strike or not. Yet, what if the verge of war were less like leaping into the pool or staying out and more like inching along its slip-

6 For an unclassified summary of these findings and arguments, see Albert Wohlstetter, "The Delicate Balance of Terror," *Foreign Affairs* 37, no. 2 (1959): 211–234.

pery ledge? This idea occurred to the economist-turned-strategist Thomas Schelling in early 1958. Neither superpower would deliberately choose a war it knew to be suicidal, he thought; but each might fear surprise attack more than nuclear war itself. Fearful of being struck first, each would grow more likely to attack to beat the enemy's first strike. In this nervous atmosphere, a technical glitch or a misinterpreted blip on a radar screen could unleash a mistaken retaliation, commencing a war that no one, strictly speaking, had chosen. In Schelling's view, the solution to this conundrum was, fortunately, just as automatic. His model of "the reciprocal fear of surprise attack" bore an uncanny mathematical resemblance to the Keynesian macroeconomic models he had once analyzed as a graduate student. (The likeness was no accident.) Nuclear deterrence—much like aggregate employment, inflation, and the national income—would settle into a dynamic equilibrium. As long as each side could assure the other's destruction, every minute of every day, the superpower nuclear confrontation would remain "stable."[7]

"War," wrote Clausewitz, "is not merely an act of policy but a true political instrument, a continuation of political intercourse, carried on with other means."[8] Armies clashed when violence had become the best, or only, way of securing the political aims of the state. For the Cold War superpowers, nuclear weapons ripped politics and potential destruction cosmically out of alignment. Surprise, once a sharp instrument of statecraft, became an apocalyptic risk. Paradoxically, it also inspired the notion that the shadow of annihilation could be the guardian of stability. Analysts still cling to this idea, waking each day to find the world not yet aflame, filled with confidence, or with troubled hope, that the unexpected will never happen.

7 See esp. chs. 9 and 10 of Thomas C. Schelling, *The Strategy of Conflict* (Cambridge, MA: 1960), 207–229 and 230–254.

8 Clausewitz, *On War*, 87.

Don't Look Now

Catherine Wilson

The miracles of the Old and New Testament encompassed a number of good surprises and a few bad ones. Eve's openness to a new taste experience and to acquiring knowledge and wisdom brought about the worst surprise of all: expulsion from the Garden, hard labor, pain, and death. Thereafter, Christian tradition offered further warnings against sampling the sensory world and investigating the unknown. It was not that more bad surprises might follow but rather that making amends for that original curiosity came through obedience to God and the mercy of God's grace; everything else was not only not necessary but a hindrance. St. Augustine, who admitted to being interested in women, music, animals, pictures, food, perfumes, and ingenious products of human manufacture, strongly condemned curiosity in Book 10 of his *Confessions*.[1] John Calvin cited St. Paul in condemning "intruding into those things which he hath not seen" and "foolish curiosity in the investigation of things that are obscure, and even hidden from and transcending our mind."[2] The nature and composition of eternally burning hellfire is a topic "left to the disputations of foolish curiosity."[3]

English sermons published between 1650 and 1700 contain many references to curiosity, all unfavorable. The term appears in a distinctive semantic field accompanied by the terms "conceit," "pride," "vanity," "ostentation," "impertinence," "anger," "covetousness," "idleness," "drunkenness," and "gluttony." Curiosity is wanton, sinful, saucy, and useless. Woe to him who seeks to "satisfy" or "gratify" curiosity. William Sherlock, in a sermon on "the danger of corrupting the faith by philosophy" reminds us that we do not need to know "how Corn, or Fruit, or Herbs grow" to be nourished by them, nor what the nature of matter is. Nor do we need to investigate how

1 St. Augustine, *Confessions*, trans. William Watts, 2 vols. (Cambridge: 1912), 165–175.

2 John Calvin, *Commentaries on the Epistles of St. Paul the Apostle to the Galatians, Ephesians, Philippians and Colossians*, trans. T. H. L. Parker, ed. David W. Torrance and Thomas F. Torrance (Edinburgh and London: 1965), 339–340.

3 John Calvin, *Commentaries on the Epistles of Paul to the Philippians, Colossians, and Thessalonians*, trans. John Pringle (Edinburgh: 1851), 197.

God can lack a cause or be everywhere at once.[4] The Platonist John Norris declared to Lady Masham, "The Principal care and concern of Man both because of his *own interest*, and out of compliance with the *Designs* of God, ought to be to Live a good and regular Life, to accomplish the *Moral* part of his Nature, to subdue his Passions, to rectifie his Love, to study Purity of Heart and Life, in one word, to *perfect Holiness in the fear of God*."[5]

People listened to such sermons every week for their entire lives and read the published versions. How could a scientific culture requiring curious individuals, willing to invest time and resources, have emerged in this climate of hostility? Yet the journal books of the early Royal Society detail curiosity-driven and seemingly pointless investigations, offering a random selection of thoughts and visual presentations on clothes, varnish, shipping, trees, sulphur, the chameleon, quicksilver. Robert Hooke's *Micrographia* of 1665 was one of the most sought-after publications of its era. Evidently, populations as well as individual minds can compartmentalize. The theologians fulminated, the experimentalists carried on with their work, and ordinary human beings went on being interested in animals, pictures, clothes, and romantic adventures, while probably wondering about real talking serpents, the Trinity, and whether a person could actually walk on water or rise from the dead.[6]

Robert Boyle stands out as transforming, singlehandedly, the semantic field of the term "curiosity." Curiosity is deemed "just" and "worthy of a Rational Creature" and taken as a legitimate motive to action. The *New Experiments* of 1660 refer to Pascal's "commendable curiosity" and his own nephew's "inbred curiosity and love of experimental learning." Boyle announces frequently his desire to "gratify" and "satisfy" his readers' curiosity and to "entertain" them

4 William Sherlock, *The Danger of Corrupting the Faith by Philosophy: a Sermon Preach'd Before the Right Honble, the Lord Mayor and Court of Aldermen at Guildhall-Chappel on Sunday, April 25* (London: 1697), 21.

5 John Norris, *Reflections Upon the Conduct of Human Life With Reference to the Study of Learning and Knowledge: in a Letter to the Excellent Lady, the Lady Masham* (London: 1690), 124, 130–131.

6 Keith Thomas, *The Ends of Life: Roads to Fulfillment in Early Modern England* (Oxford: 2009), 110–131, 198–225.

with philosophical subjects.[7] The contrast between scripture's ability to "Quicken Obedience" and its ability to "Satisfie our Curiosity" began to tilt toward the latter.[8]

As well as avoiding wading into points of theology and dogma—and avoiding Thomas Hobbes, the materialist who mocked religion—the experimental philosophers mediated and reconciled. They created a counter-rhetoric in which enquiry into obscure and hidden things was explicitly or implicitly praised and encouraged as a morally positive and useful trait, as leading to what Francis Bacon called the "improvement of man's estate."[9] They pretended that they were recovering epistemological capacities lost in the Fall, preparing for the Second Coming, all in a divinely approved manner. Yet there were threats—naturalism, mortalism—in the corpsuculo-mechanical philosophy to which Boyle and his experimenting and observing associates subscribed. There was accordingly confrontation as well as compartmentalization, and Boyle, especially sensitive to these problems, oscillated between rapture and dejection over his scientific vocation.

One significant advantage the experimentalists had in making their case was that admiration for the "curiously wrought," for the products of human craftsmanship and care (*cura*), was too deeply rooted in human nature for Augustinian injunctions to have full effect. The surprise presented by the newly invented telescope was a pitted and dented moon which, for Galileo, demolished the very idea of the incorruptibility and superiority of the heavens.[10] Had God really made it and set it up there, in the realm of angels? The telescope promised such unwelcome surprises that—according to legend and testimony—certain of the clergy refused even to look. But the surprise presented by the microscope was the geometrical complexity, perfection, and intricacy of the microworld: the orna-

7 Robert Boyle, *Works of the Honourable Robert Boyle*, ed. Thomas Birch, 5 vols. (London: 1744), 1: 10, 4, 142.

8 Robert Boyle, *Some Motives and Incentives to the Love of God Pathetically Discours'd of, in a Letter to a Friend* (London: 1659), 165.

9 Thomas Hobbes, *Leviathan*, ed. Richard Tuck (Cambridge: 1996).

10 Galileo Galilei, *Sidereus Nuncius or the Sidereal Messenger*, trans. and ed. Albert Van Helden (Chicago: 1989), 41–49.

mentation of insects, the lacy individuality of every snowflake. Here, there was a place for God's care and majesty, in compensation for what astronomy had taken away. And here, as with Boyle's colorful chemical experiments, luxury and beauty could be uncovered, revealed, and enjoyed without drawing down accusations of venality and concupiscence; without shame.

Scientific instruments, objects themselves so curiously wrought, drove and still drive the sciences, giving us new surprises. In the early modern period, it was particularly the revelations of optical instruments that both ruptured and mended that rift, never fully maintained nor fully closed, between theology and the interpretation of nature.

Sauerstoffküsse

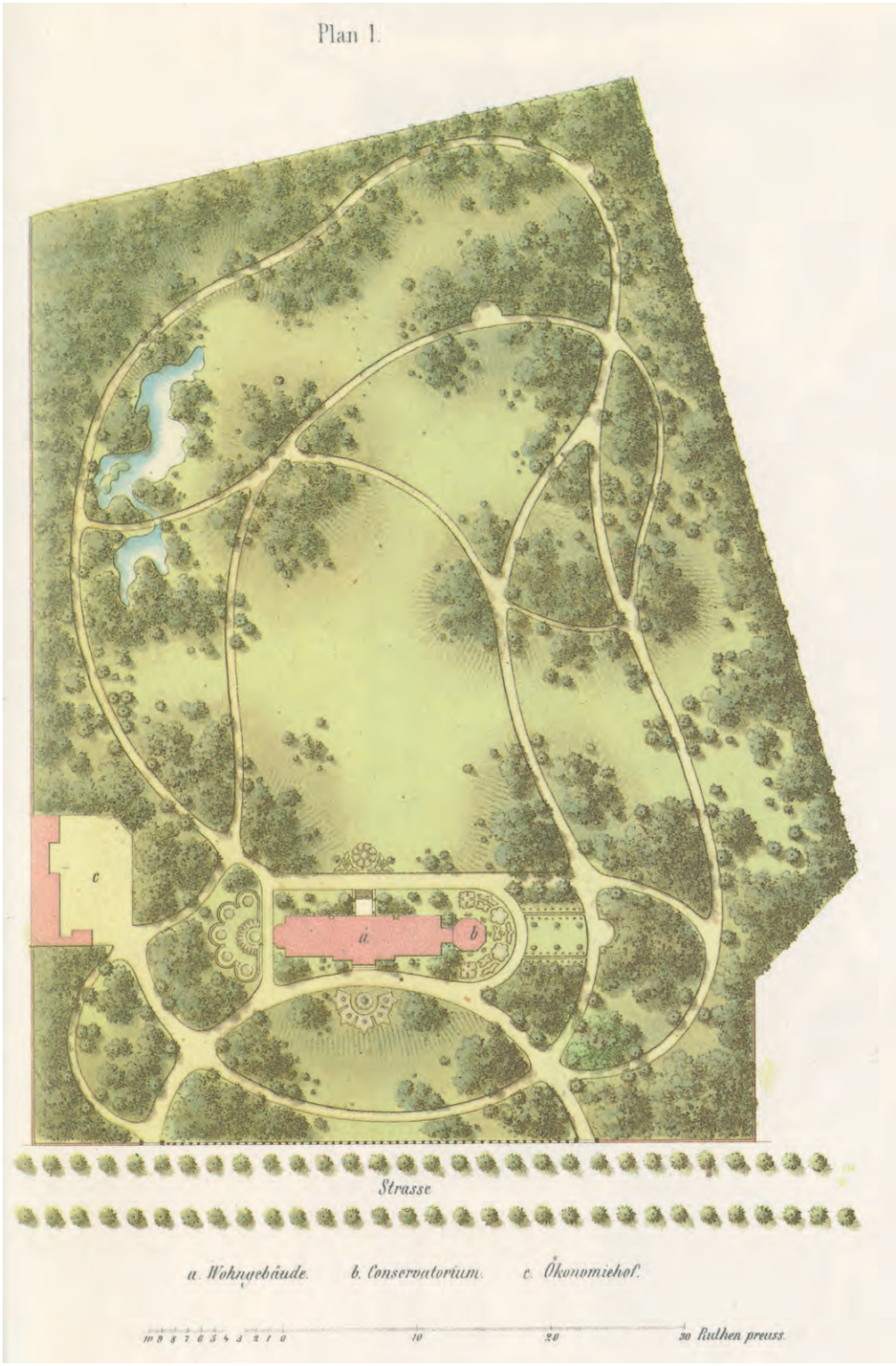
M. Norton Wise

There are some creations that embody in their very concept the idea of surprise. One of these is the landscape garden, or English landscape garden, in reference to its eighteenth-century roots. By contrast with the baroque style, called absolutist and epitomized by Versailles, the English style aimed to express naturalistic freedom in both nature and society. Nature's own forms would replace geometry: no spherically clipped trees, no rectangular hedges, no sensual leveling. Diversity of color and texture would take priority over the line. Thus the gently winding path rather than the broad straight promenade figured as the hallmark of the landscape garden.

Such a path might pass along a stream, itself meandering or tumbling over rocks; it might continue through shrubs or around tree groups, over a bridge, or up a hill. A strolling visitor would always have a sense of expectation, never knowing or predicting what might appear just around the next curve. Indeed, what might appear could be a completely unnatural folly: a statue of Venus, a Greek temple, or a Chinese pagoda, acting as an exotic contrast to trees and shrubs.

These characteristic features of surprise in the landscape garden may suggest why for many years it has served me as a methodological epitome or talisman for writing history, whether of science or of the garden itself (with Elaine Wise). Other aspects are less obvious. Paths never cross at right angles; they diverge as alternative choices that open up different perspectives, different vistas, either within the garden or onto a distant landscape. And there are no apparent boundaries. In the ideal of the country estate, looking out from the manor house, across the nearby pleasure ground, and into the surrounding landscape, one has a sense of continual transition, from a domestic scene of flowerbeds and herbaceous borders to a meadow with occasional trees in the middle distance and on into the countryside of forests and hills. Open vistas inspire the freedom to imagine, to invent, to wander unconstrained.

Of course, all of this sense of naturalistic freedom is in fact the product of carefully designed, excavated, planted, pruned, and nurtured artificiality. As in historical writing, the garden's cultivated form assists its explorers in discovering the ordering ideas that assist



Layout of paths in a very small (15 acre) landscape garden. Gustav Mayer, *Lehrbuch der schönen Gartenkunst* (Berlin: 1860), plate 18.

understanding. And it encourages humility in the face of nature's variety, maintaining the sense of expectation and surprise around the corner.

Another aspect of landscape gardens runs deeper and will bring me closer to a concrete example. Gardens themselves are historical objects. Their paths through history continually open up unanticipated vistas as they change in meaning with period and place. Imported from England to Prussian Berlin following the Wars of Liberation from Napoleon, they took on a variety of forms over the nineteenth century. Beginning as scenes of royal display, they acquired new identities with new contexts of ownership and purpose. One of the most surprising of those forms in the context of Berlin is the *Volksgarten* (garden of the people). It makes a striking contrast to the more famous gardens of the royal family centered around Potsdam, such as Sanssouci, Babelsberg, or the Pfaueninsel. No great fountains, no imposing follies in the form of statues and Chinese teahouses, and no profusion of exotic plants celebrate wealth and status in the *Volksgarten*. It emerged in Berlin only after 1840 in association with Prussia's late industrialization and the population explosion in the city. It was intended to provide a place of recuperation for the workers who now streamed in and out of the factories of the North and East beyond the walls of the city. In that local context, such basic conceptions as the difference between work time and one's own time, or free time, took on a new and fervently defended significance for wage laborers. Free time, free air, and fresh air (*Freizeit, freie Luft, frische Luft*) became closely identified with each other and with the winding paths and greenery of the *Volksgarten*. The children's playground entered the garden for the first time. The history of the landscape garden, moving through this new time and setting, quite surprisingly becomes a social history of industrialization and class identity.

One such *Volksgarten* is Humboldthain. Named in honor of the great explorer who opened up the landscape and vegetation of the Americas to European view, it also honored, in the view of the working classes, that singular member of the Prussian court whom they

most clearly recognized as their hero. The new historical meaning of this people's garden has been captured in an eloquent portrayal from 1893.

"Humboldthain is a wonderful creation" said Wilhelm Bölsche in a series of probing vignettes drawn to evoke the distinct character of different districts of Berlin, each possessing "almost its own linguistic and ethnographic originality." In Humboldthain he found "one of the most beautiful oases of the city." But this oasis lay in the far north of Berlin, "where the sky is so grey," painted with a dark brush by surrounding railroad lines, factories, smokestacks, and tenements.

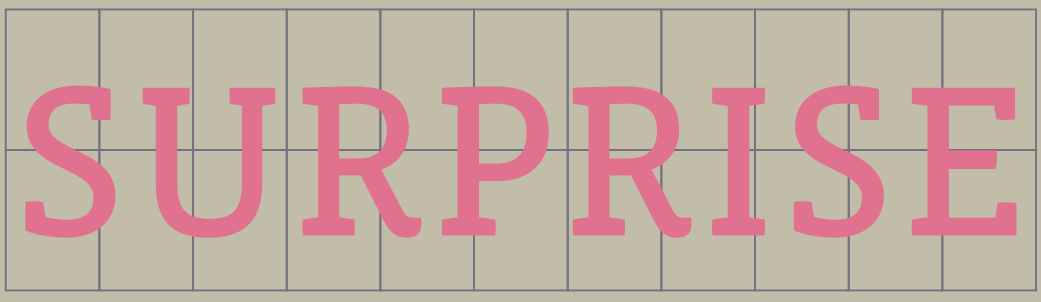
> It is the sky of Berlin North, of the factory north, by day a smoke cloud and by night a reddish brown cloud of fire. … Whoever enters behind these signs of the heavens, turns forever in the same spot, with thousands together trapped in the wheelwork of the machines, compressed, churned, mangled.

Thus Humboldthain presented a distressing contrast.

> At many hours it is completely empty; the plants then rule alone. For them everything goes on; the colorfully blooming bushes and the broad exquisite meadows gleam in unfading party dress. … But noontime comes, and now the whistles of the factories shrill. Out of the airless factory rooms comes the humanity of Berlin North: hollow-faced workers who consume their lunch on the benches, grimy factory girls, tired schoolchildren trudging home. The contrast is bitter. Now there rolls by a ring-line train in its deep trench and hurls its smoke into the white scented clusters of the gold-green acacias. One feels somewhat faint in this so well-intended oasis, whose *Sauerstoffküsse* (kisses of oxygen) are profaned by hundreds of sooty chimney-snouts with the full brutality of our big-city fight for existence.[1]

Sauerstoffküsse: what an engaging surprise in the *Volksgarten*.

1 Wilhelm Bölsche, "Berlin nach der Windrose," in *Berliner Pflaster. Illustrierte Schilderungen aus dem Berliner Leben*, ed. M. Reymond and L. Manzel (Berlin: 1893), 265–288, on 266, 267, 269.


SURPRISE

Gadi Algazi, Elena Aronova, Maria Avxentevskaya, Monika Baár, Bruno Belhoste, Etienne S. Benson, Dan Bouk, Marie-Noëlle Bourguet, Martin Brody, Joan Cadden, Mary Baine Campbell, Lino Camprubí, John Carson, Karine Chemla, John R. R. Christie, Angela N. H. Creager, Rohini Devasher, Emmanuel Didier, Matthias Dörries, Anna Echterhölter, Paul Erickson, Fa-ti Fan, Rivka Feldhay, Sebastian Felten, Mechthild Fend, Erna Fiorentini with Vincenzo Fiorentini, Markus Friedrich, Yulia Frumer, Claire Gantet, Cathy Gere, Donatella Germanese, Hannah Ginsborg, Catherine Goldstein, Michael D. Gordin, Nils Güttler, Michael Hagner, Anke te Heesen, Florence Hsia, Hansun Hsiung, Lily Huang, Myles W. Jackson, Vladimir Janković, Sonam Kachru, Judy Kaplan, Doris Kaufmann, Stefanie Klamm, Cynthia Klestinec, Charlotte Klonk, Fabian Kraemer, Katja Krause, Richard L. Kremer, B. Harun Küçük, Sachiko Kusukawa, Nicolas Langlitz, Philipp N. Lehmann, Daryn Lehoux, Rebecca Lemov, Elaine Leong, Elizabeth Lunbeck, Abigail Lustig, Christoph Lüthy, Harro Maas, Andreas Mayer, J. Andrew Mendelsohn, Minakshi Menon, Erika Lorraine Milam, Gregg Mitman, Glenn W. Most, Staffan Müller-Wille, András Németh, Christine von Oertzen, Brian W. Ogilvie, Katharine Park, Gianna Pomata, Theodore M. Porter, Jamil Ragep, Sally P. Ragep, Alisha Rankin, Joan Richards, Robert J. Richards, Daniel Rosenberg, Sophie Roux, Anne Secord, Jim Secord, David Sepkoski, Elena Serrano, Sally Shuttleworth, Otto Sibum, Skúli Sigurdsson, Pamela Smith and Xiaomeng Liu, Marianne Sommer, Emma C. Spary, Claudia Stein, Thomas Sturm, Claudia Swan, Mary Terrall, Viktoria Tkaczyk, John Tresch, Jeremy Vetter, Marga Vicedo, Fernando Vidal, Annette Vogt, Andre Wakefield, Cecelia Watson, Kelley Wilder, Benjamin Wilson, Catherine Wilson, M. Norton Wise