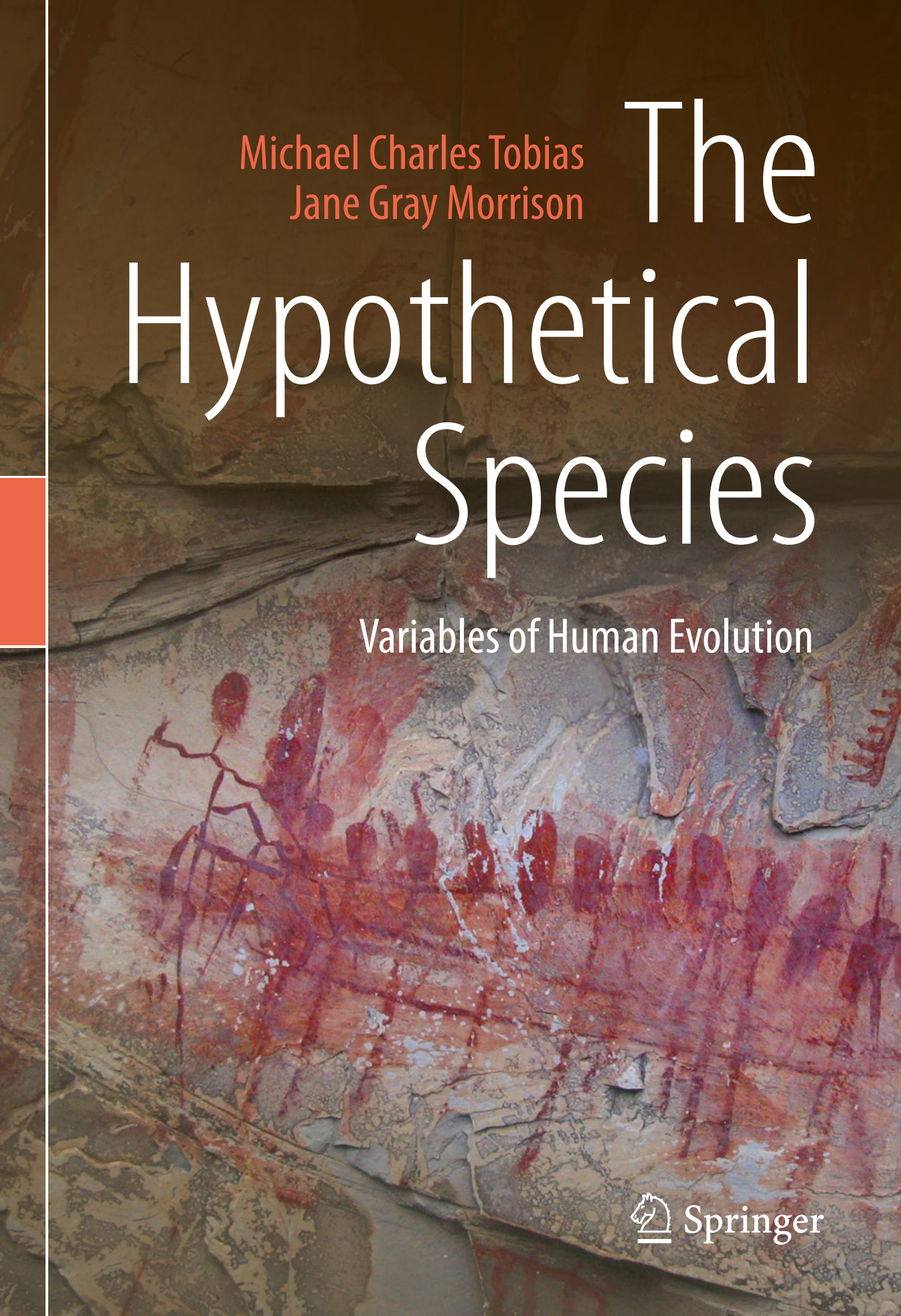

Michael Charles Tobias
Jane Gray Morrison

The Hypothetical Species

Variables of Human Evolution

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Foreword

At this very moment, in the name of taxonomy, literally thousands of people across the world are documenting, describing, sequencing, and analyzing more and more data using bigger and faster computers and storing it in the vastness of an enormous magical space called a cloud. If we turned back the clock to the Victorian era, we would find a scramble for demonstrating national pride by shooting, stuffing, mounting, and amassing the greatest number of specimens representing the world's biodiversity in museum collections. All of the collecting and killing was in the name of producing a classification system for retrieving information from the rich biodiversity of colonies. Darwin and Audubon were personally conflicted between their ethics and methodologies. Today, we have technology and data analyses that present organisms to taxonomists as tiny tubes of nucleic acid to be subjected to sequencing and analysis. But such highly efficient modalities can too readily sever specialists from their very humanity by their goals to produce the most robust databases and run the most rigorous analyses. Now, more than ever, we need to embrace postmodern approaches to produce a new taxonomy that is not just predictive, allowing us to retrieve information, but is commensurate with the Anthropocene.

The interdisciplinary approach showcased in *The Hypothetical Species: Variables of Human Evolution* by Michael Charles Tobias and Jane Gray Morrison illuminates the peril into which *Homo sapiens* places all species by maintaining obsolete philosophies in our pursuits of the "perfect" taxonomy. The authors remind scientists that our tenacious obsession with systematic excellence, at the expense of balance, is intended as a stark reminder that such endeavors have erected blinders. The scientific Royal We continues to overshadow and smother the miraculous inner lives of our kindred neighboring species. Tobias and Morrison explicitly and strongly encourage the reader to recognize that this emotional default position is destroying the world.

As has been the case with their other tomes, Tobias and Morrison continue to emphasize that our future depends on a compassionate understanding of both ourselves and other species. We phylogenetically analyze data and elucidate the relationships organisms share as complex branching patterns. Somehow, we forget that our own lineage, the great apes, lacks the evolutionary potential to propel our clade into a wave of significant evolutionary diversity. You would think that one species, occupying one of the thinnest branches in the tree of life, would recognize how perilous its own position is. You would also think that we would have the greatest compassion for those Others we share a common ancestry with. That is not the case. Our activities are threatening approximately two-thirds of

nonhuman primates with extinction within 20 years. Can compassion tip the balance in saving primates, those Others closest to us? Dian Fossey was chided for being too compassionate and too close to her study subjects. However, her brand of "active conservation," and the framework she established for monitoring and protecting mountain gorillas, has been practiced for more than 50 years. This year, mountain gorillas were removed from being "critically endangered" to "endangered." Would that have happened had Fossey not crossed the imposed rules of science which emphatically opposed becoming empathetic and compassionate toward one's study subject? Ironically, from the perches in the Virungas, in 1994, these apes were overlooking a genocide. Almost 25 years later, they are part of a thriving African nation being shaped, at least, to some degree, by the power of ethical suasion practiced by our species. The lives of Rwandans and mountain gorillas now form a binary orbiting realm of survival.

One of the questions that Tobias and Morrison nudge the reader into pondering is whether we are a suicidal species. We are certainly potentially so, whereby the action of one individual, with the resources to push a button, can destroy our entire species and much of the biosphere. At the same time, we are also modifying the environment to the extent that we will actually push that button, unless we find the tipping point for compassion drift from our species to the Others. We are altering the environment and providing a new set of conditions for the next dominant species. And we have managed to decrease biodiversity to the extent that we may have killed off the very next species that could replace us.

We know what carrying capacity is, and we adjust and play with it to increase our life expectancies and cram more carnivorously inclined individuals into larger and larger populations. *No* other organism has evolved this ability. As but one species, we exploit, and/or destroy countless other life forms while altering the earth's landscape to increase our carrying capacity. It is most assuredly a no-win strategy. Noting the clear records of geological time, we should be aware of the fact that organisms committed evolutionary suicide by altering the entire atmosphere. Those primordial species that changed the Earth's atmosphere developed photosynthesis to accommodate their energy needs. That resulted in the first mass extinction that was biologically triggered. Today, we are doing the same thing as a species, perpetuating our reliance on fossil fuels to meet our energy needs. As we continue down that road, we set the stage for another mass extinction.

Is there hope for us to circumvent the Anthropocene? Hope is what fuels every environmental conservationist. Our understanding of evolution and ecology provides us with the ability to synthetically think about the way our planet operates: when microbes, plants, and animals function together as communities and intertwine with the atmosphere, hydrosphere, and lithosphere to permit energy flow and nutrient cycling. In essence, our world depends on relationships more than any single entity. If we can shift our obsession with our own survival and well-being and, instead, focus on the rights of the earth's functions not to be crippled by our actions, we might just discover our greatest hope for our own, and the Other's, survival.

Tobias and Morrison move us closer to that way of thinking in *The Hypothetical Species: Variables of Human Evolution*. This book is a follow-up to two of the authors' previous works, *Anthrozoology: Embracing Co-existence in the Anthropocene*, as well as *The Theoretical Individual: Imagination, Ethics and the Future of Humanity*. Our evolutionary self-confidence and lack of communion with the world around us has brought us to this juncture in geologic time. Do we continue to subject the Others, and the intricate web of connections present on Earth, to the same legacy we created for ourselves? This is the final question Tobias and Morrison want the reader to ponder after they close the book.

Florissantia quilchenensis **(Mathewes & Brooke) Manchester. These 49 million year old flowers from Republic, WA, represent a member of the Sterculiaceae (Chocolate Family). This extinct genus was likely an understory species in the forests of British Columbia to Colorado during the Eocene-Oligocene. (Both images were taken by M.L. DeVore)**

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Contents

Introduction

1

Abstract

In this chapter we examine the goal of confronting and elaborating upon the outlines of evolutionary theory within a framework that collaborates in the invention of an all-inclusive construct, namely, the survival of a compassionate, sustainable humanity. Examples of its neural network and biological infrastructure are taken from some fundamental ecological case studies, such as the primordial mutualisms displayed by the tiny wasps and fig trees, as well as numbers theories and probability distribution concepts.

When Philosophy Confronts Trillions of Particulars

Immanuel Kant, in his *Prolegomena to Any Future Metaphysic* (1783), suggested that a transcendental apperception was the way in which nature could be manifested in human consciousness (and by implication, in the consciousness of nature herself: biodiversity as self-conscious) (Fig. 1.1). Starting from that parameter, all human sovereignty is ceded to an entirely Other focal point of biological content, a very different planet than that which we have always supposed. Reconciling the complex rules of such a dramatically liberated nature, liberated from us, as a human personage might construe this elemental bifurcation, relying upon our most attenuated sensory experiences of the natural world, was the essence of what Kant called *Understanding*. What can it mean, amid so many travails expended in the act of trying to acquire knowledge, data, and predictability? Many qualifying layers accrete over time upon the exoskeleton of contemplations: deep understanding, cross-fertilizing fruition, metanoia, speculative fructification, lasting epiphany, ecological shock, and transformative experience. From Gilgamesh to James Joyce (as but one random span of cognitive emblems), the wilderness symbology in our sciences strikes of a complete parallel to what is real.

Those parallel data sets comprise a near infinity of personal baggage of the mind, minds that may well be monasteries teeming with fellow cenobites each exhibiting the mark of satori, revelation, and some manner of transcendence from A to B – from nowhere to nowhere else. These are, by other names, communities, cities, and human aggrandizement. Such connections are meant to serve as a prelude not to the mechanical but, rather, to metaphysics, a poetry of subjective cases which demonstrate distinct advantages over the natural sciences they cautiously analyze. Metaphysics, like poetry, are the soft tissue that eludes fossil evidence. This is philosophy that can envision a pure escape from the dictatorial present tense, whether according to the rubrics of historical Utopias or in

M. C. Tobias, J. G. Morrison, *The Hypothetical Species*,
https://doi.org/10.1007/978-3-030-11319-3_1

Fig. 1.1 Biodiversity as Self-Conscious: 5,000-Year Old Petroglyph, Werehpai Cave, Tiriyó Indian Territory, Southern Suriname. (© M.C.Tobias)

the very dialectics, converging fact and fiction in great works of art and in the euphoria's attendant upon scientific breakthroughs.

Our goal here henceforth is to understand that agency of great energy expenditure known as humanity, whose presence on Earth poses no less than a current nightmare requiring urgent understanding, reappraisal, and rectification in every possible realm where physical contact has resulted and will continue to inflict widespread biochemical damage.

If we measure our alleged knowledge of the natural worlds in us and around us by way of some metric that has the added proof-positives of peer review, what we are really doing is fundamental confirmation bias, a practice that we will explore in-depth throughout this work. Confirming what we think we know simply drags out a battle between humble efforts and all-expansive imperialism. To break up this sinister monopoly embodied in human evolution requires an insistence upon ignorance that tracks and correlates across every intellectual domain that has to date claimed knowledge for itself. But, in fact, our knowledge is a likely ruse developed over time to ceaselessly certify and codify our appetites. What we *really* know is plenty little. This is a certainty we can rely upon as we pay witness in this generation, and those before us, to one ecological crash after another.

Let a first principle be established, albeit ensconced in as many approbations as misgivings. A closed rubric in the history of natural science makes it the responsibility of a researcher to fill in the blanks. Humboldt, Jefferson, Buffon, Darwin, and Linnaeus before them had laid down a conceptual framework that for two centuries effectively rebutted challenge. The genius of the binomial nomenclature is its welcoming of anomalies, easily accommodated within the evolutionary theories we have been led to firmly believe encompass the description and understanding of each and every organism. If Latin is the most successful human language, at least until English speaking all but eclipsed it, so too the overall compendiums of evolution have stunned generations who seem to recognize in the Darwinian order something wholly a priori by nature, granting it the second nature acceptance that is tantamount to faith; maxims (however agnostic) that bind moral orders with an unflexing rationale enabling the assimilation of everything: trillions of particulars.

We are interested in *feeling* the roots of humanity's present ecological crisis, a compulsion (unrelenting masochism that mirrors our predicament) to grasp the peril in which our own kind has plunged the entire biosphere. There is nothing preordained or given in this treatise. Rather, we seek through the *process* of its many enquiries an unblushing series of elucidations. Through a rigorous interdisciplinary exploration, it is our goal to make meaningful acquaintances and connections, to encounter that which is known and unknown, and to posit possibilities

Fig. 1.2 A way forward for a species: a young Bhutanese Monk. (© J.G.Morrison)

and assert certain commonalities of experience that suggest new interpretations. The title itself should suffice to incite some sense of both computational biology and evolutionary speculation, both at the heart of our goal, which is to see a way forward for a species that has invoked grave doubts as to its future (Fig. 1.2). By extrapolating data and illuminations from the history of astrogeophysics and cosmology, we hope to rethink and refresh perspectives whose ecological excesses may be evolutionarily tied to cellular clocks and seemingly implacable laws. This approach to human evolution and the Anthropocene is more than a little willing to concede that all of the traditional wagers, optics, mechanisms, calibrations, extrapolations, and the very numbers are far off base, let alone enshrining anything regular or established to offer, in the realms of either lateral or vertical experiment; linear or exponential computations of thought.

The feverish dyad that concerns us most – raw exogenous data versus endogenous and intuitive familiarities – underscores a mighty existential melancholy, on the one hand, namely, the scientific collapse before the sixth extinction spasm. Conversely, less draconian, steely machinations on an abacus, or simply in the abstractions of serious contemplation, yield a more favorable picture of human and associated other biological beings, as co-dependents within a marvelously petite and teeming trial, 4.1 billion years in the making.

There is little rationale defending breakdown but every conceivable reason to focus upon breakthrough. Narrowing the intimations of those bifurcative words (breakdown/breakthrough) is a methodically grueling but essential element of paleotaxonomy.

In an earlier work,[1] the authors posed a possibility that is a matter of observed logic of plausibility borne out time and again: that the one might influence the many, from a worker bee to a malevolent powermonger to a great artist (Beethoven's Ninth; the Ghent Altarpiece by the Van Eyck brothers; Edison and the lightbulb; Susan B. Anthony and her peers; Salk and the polio vaccine). Homer, Mahavira, Alexander the Great, Ptolemy, Leonardo, and Mahatma Gandhi, each impacts others the way a lone particle might theoretically be the one to tip the scales in favor of gravity, or strong interactions, of the weak or nuclear force or electromagnetism. As with each of the 56 signatories to the Declaration of Independence,[2] the incipient aphorism "every vote counts" brings into an assured confluence a testable plurality – from civic societies to quantum mechanics – which mirrors that collective of noumena (Imanuel Kant's noumenon, *something*

[1] See *The Theoretical Individual*, by Michael Charles Tobias/Jane Gray Morrison, Springer, New York, 2017.

[2] "Signers of the Declaration of Independence," http://www.ushistory.org/declaration/signers/index.html, Accessed August 29, 2018.

Fig. 1.3 The equivalent sub-atomic particles of biology: alpine meadow in the rockies. (© M.C.Tobias)

conceived)[3] within the life sciences. Our goal is to search for those connected dots that might suggest a biologically sustainable quotient for an as yet biodiversity-rich planet and for the future of our species.

The equivalent subatomic particles of biology (Fig. 1.3) – all the equivalent elementary building blocks of atoms, but viewed in larger configurations – *units*, such as molecules, cells, and genes – leave original traces, an edifice given to philosophical probity; itineraries of mathematical probability about which this book, in part deals. That would encompass natural selection, hybridization, new and/or extinct species, and notions of re-evolution, atavism, all those twisting traits that inform their own hereditary substance, despite the odds, thereby nurturing novel mixtures of life, however cantankerous and solitary, at times, that excite the neural networks throughout the entire geography of sensate substance by way of ecosystem dynamics, some old, others concurrent, all imagined. This latter conceit presents a most tantalizing riddle: no one, whether an Aristotle or Shakespeare, *knows* what is actually happening throughout the myriad pathways of life. The concept, often phrased vacuously, that knowledge is power is simply not possible, because knowledge is a fiction that merely tempts the cusp of truth or, as Pope Inncent X is said to have uttered, when first viewing his completed portrait by Diego Velásquez (c. 1650, domiciled in a cosy nook at the Galleria Doria Pamphilj in Rome), *too much truth*.

Those mystery units, measures, and the very definitions themselves connote different entities, presuppositions, and a holistic Weltanschauung of variables abetting and confounding evolution – from many millennia before Darwin. These include all those aboriginal cosmologies, the Jain Jivas, the Hindu Atman, and soul or spirit, to all those countless ways by which our species has

[3]"Kant: Sensibility, Intuition and Noumenon," S. C. Hickman, Southern Lights, September 12, 2015, https://socialecologies.wordpress.com/2015/09/12/kant-sensibility-intuition-and-noumenon, Accessed August 19, 2018.

attempted to classify and characterize both material presence and essence. We have done so as a function of self-definition – the perennial naming of names[4] – but also because we are obsessed with weights and measures, distances and extents, peripheries, horizons, and reasons which, by one comparison after another, motivate us to live, to be ourselves, to share in the world of others, and, by hopeful implication, to become more empathetic. Numbers exert an astonishing array of nuances in our evolutionary self-interest and behavioral roles, because we relentlessly wonder and seek out simulacra, mirror images, in our quest to understand the world around us. Everyone knows this. But if we cross out the verb, *know*, what then?

All of the components of denominated objects, subjects, ideas, and objective and subjective categories absorb our interest. Everything our senses grasp and involuntary nervous systems calibrate excites our consideration. The world in us and around us, so many of whose excitations, glints, fibers, and contents we have subjected to scrutiny: this is all the restive fodder for our future natures, about which – it must be emphasized now, at the beginning – we know nothing.

By analysis human beings prompt both philosophical and reflex actions. The meaning of a tree, of a particular kind of tree, will vary in every respect from culture to culture and throughout time. Geography dictates as much about the biology of a tree species, as does its interpreted utility to humans. And when we try to assess the tree's meaning, we are at once confronted by the proliferation of floristic properties, other dependent species, relationships, and what the tree provides them, or us. Take one celebrated example, the Bodhi or peepal (pipal) tree in India (Fig. 1.4), one of that country's five most sacred trees (or panca-vrksa).[5] An Indian ethnobotanist describes it according to its Latin and Hindi names and assigns known curative properties, portions of the tree that may be utilized by humans, and basic botanical qualities, as such: "A medium sized, glabrous tree. Leaves: 10–15 × 10–12 cm, ovate-round, entire, coriaceous, shining, apex long tailed. Fruit: receptacles sessile, paired, smooth, depressed, globose, dark purple when ripe."[6]

The genus *Ficus* contains over 2000 species, though some botanists disagree, suggesting more like 600 species. A first hint at vast discrepancies that continue throughout the human descriptions of the biological world, a maze of definitions, and species uncertainties.

The family Moraceae, also known as the mulberry family, contains at least 38 genera. That number, as well, is not absolute.[7] But then, the overall number of tree species in the world is only estimated at "60,065"[8] of which pantropical species alone vary between "~40,000 and ~53,000."[9] Every one of these estimated three trillion individual living trees[10] has (we all *appreciate* from varied experiences) a distinctive personality; life history; on average 200,000 leaves; at least, on average, half-million 50-micron-wide

[4] See *The Naming Of Names – The Search For Order In The World Of Plants*, by Anna Pavord, Bloomsbury Publishing, New York, N.Y., 2005, particularly Chapters I and XIV.

[5] See https://www.esamskriti.com/e/Culture/Indian-Culture/Sacred-Trees-Of-The-Hindus-1.aspx, Accessed July 22, 2018.

[6] See Ethnobotanical Leaflets: 10: 329–335. 2006, Abstract, "Panca Ksira Vrksa (Ficus Species Used in Ayurvedic Medicine)," by Dr. Amrit Pal Singh, BAMS; PGDMB; MD (Alternative Medicine), Herbal Consultant, India –Swift Ltd., Chandigarh, December 19, 2006, https://opensiuc.lib.siu.edu/cgi/viewcontent.cgi?referer=https://www.google.com/&httpsredir=1&article=1243&context=ebl, Accessed July 22, 2018.

[7] See *The Oxford Encyclopedia Of Trees Of The World*, Consultant Editor: Bayard Hora, Oxford University Press, New York, 1981, pp. 155–157.

[8] "How many tree species are there in the world?" April 4, 2017, n.a., https://www.bgci.org/news-and-events/news/1400, Accessed July 22, 2018.

[9] See "An estimate of the number of tropical tree species," J. W. Ferry Slik, Víctor Arroyo-Rodríguez, Shin-Ichiro Aiba, Patricia Alvarez-Loayza, et.al., PNAS June 16, 2015. 112 (24) 7472–7477, June 1, 2015. https://doi.org/10.1073/pnas.1423147112, Edited by James H. Brown, University of New Mexico, Albuquerque, NM, and approved April 10, 2015 (received for review December 6, 2014, PNAS, Proceedings of the National Academy of Sciences of the United States of America, http://www.pnas.org/content/112/24/7472, Accessed July 22, 2018.

[10] *Science & Environment, "Earth's trees number 'three trillion'," By Jonathan Amos, BBC Science Correspondent, 3 September 2015, https://www.bbc.com/news/science-environment-34134366, Accessed July 23, 2018.

Fig. 1.4 A small temple beneath the Bodhi Tree, Bodh Gaya, c. 1810. (© British Library)

cells beneath the bark; and other co-dependents whose numbers cannot adequately be ascertained, given the worlds-within-worlds that make a single tree, a shrub, and a flower. And the same would go for deadwood. The trillions of fungi that utilize and live with trees are equally astonishing. A single 1500-year-old *Armillaria bulbosa* fungus discovered by James Anderson in 1992 in Michigan is thought to weigh "22,000 pounds" and covers "15 hectares," making it one of the largest organisms on the planet.[11] At the time of the *Armillaria* discovery, there were an estimated 1.5 million species of fungi on Earth. But by 2011, the number had been reversed by botanists to an estimated "5.1 million species" of fungi.[12] Many of them live on trees. Countless others inhabit the soil. Plant pathologists and medical mycologists study them with an eye to fungal diseases that can cause infections – like *Candida*, a fungal yeast species, one of 1500 known fungi-yeast organisms that are hundreds-of-millions of years old. Yeast happens to be one of the most biologically studied types of organisms in the laboratory. Two other fungal species found teeming throughout soils globally, *Cryptococcus neoformans* and *Cryptococcus gattii*, have been implicated as defining, opportunistic players in a number of potentially lethal

[11] https://nature.berkeley.edu/garbelotto/downloads/humongousfungus1992.pdf; See "The Secrets of the 'Humongous Fungus,'" by Sarah Zhang, October 30, 2017, The Atlantic, Science, https://www.theatlantic.com/science/archive/2017/10/humongous-fungus-genome/544265, Accessed July 23, 2018.

[12] AM J Bot. 2011 Mar;98(3):426–38. doi: https://doi.org/10.3732/ajb.1000298. Epub 2011 Mar 2. "The fungi: 1, 2, 3 ... 5.1 million species?" Blackwell M, PUBMED, https://www.ncbi.nlm.nih.gov/pubmed/21613136, Accessed July 23, 2018.

Fig. 1.5 A stone buddha in from a Kyoto Monastery Garden. (© M.C. Tobias)

human diseases, from meningitis to AIDS. In Greek, *Cryptococcus* refers to a "hidden sphere," in part, because the parent organism relies on its airborne propagules to assist in metamorphosis.

In 2009 researchers discovered from within a decaying hollow portion of a peepal tree in New Delhi "a novel anamorphic Cryptococcus species…."[13] As with plasmids and bacteria, this particular new strain may be harmless to humans but has been deposited methodically in the CBS-KNAW Collection in Utrecht, the Netherlands,[14] which, according to its website, offers a "comprehensive coverage of the culturable biodiversity of the fungal Kingdom (over 100,000 strains), while the prokaryotes are represented by unique collections of bacterial mutants, hosts suitable for DNA research, genetically engineered plasmids, broad-host-range plasmids and phages."[15] The biosafety involved in the transferring of such genetic materials is overseen by the Convention on Biological Diversity ("CBD")[16] and a European Union protocol under the Common Access to Biotechnological Resources and Information program ("CABRI").[17]

Which leads us back to trees, a peepal (fig) tree specifically, just one out of those three trillion or so other individuals. While Hindus associate every part of this one with the deities of Creation (Vishnu, Brahman, and others), the Buddhists of India believe that in the village of Bodh, in the District of Gaya, Bihar state, where this tree in question continues to prosper, Prince Siddhartha Gautama, later called Buddha, was himself enlightened sitting beneath its branches in meditation (Fig. 1.5). Mendicants retreating into a forest solitude for the remainder of their days was one of the most proximate of philosophical traditions across India for millennia.[18] Today, this famed Enlightenment tree can easily be visited at the Mahabodhi temple complex and is a place of important pilgrimage for the devout, or curious, from throughout the world.[19] While the current

[13] Antonie van Leeuwenhoek, March 2010, Volume 97, Issue 3, pp. 253–259, "*Cryptococcus randhawai* sp. nov., a novel anamorphic basidiomycetous yeast isolated from tree trunk hollow of *Ficus religiosa* (peepal tree) from New Delhi, India," by Zia U. Khan, Suhail Ahmad, Ferry Hagen, Jack W. Fell, Tusharantak Kowshik, Rachel Chandy,Teun Boekhout, First Online: 20 December 2009, Springer Link, https://link.springer.com/article/10.1007/s10482-009-9406-8, Accessed July 22, 2018.

[14] http://www.westerdijkinstitute.nl/collections/.

[15] http://www.westerdijkinstitute.nl/Collections/#MoreInfomation.

[16] https://www.cbd.int/.

[17] www.cabri.org.

[18] See *The Exile In The Forest*, by Vishwa Chander Ohri, Lalit Kala Akademi, India, Bombay, 1983; See also, *Remarkable Trees Of The World*, by Thomas Pakenham, W. W. Norton & Company, New York, 2002, pp. 94–97.

[19] See "Tales by Trees – A Brief Guide to the Sacred Trees

tree (*Ficus religiosa*) is said to be a descendant of the original one, legend has it that a shoot of the original tree was taken to what is today Sri Lanka in the third century BC by the daughter of the Emperor Asoka where the local emperor planted it at a monastery in Anuradhapura. That tree flourishes today.[20] This Enlightenment tree is classed alongside giant weeping banyans, found from Australia to Asia, Common *Ficus* in Mediterranean countries, the *Ficus sycomorus* mentioned in Luke 19:4 (in ancient Jericho, "Zacchaeus climbed a sycamore-tree to see Jesus as he passed by,"[21] not to be confused with the *Acer pseudo-platanus*, the North American sycamore). Naturalists and ethicists, both, have waxed poetic about the Bo (the Buddha or Enlightenment) tree, its powers over human consciousness and its "inflorescence" (or syconium) comprising "a fleshy cup formed from the flower stem; and within that cup hundreds of flowers [which] open inward."

And all of this lascivious enticement doted upon and fertilized by a specific wasp, or two.[22] Buddha's own contemplative hours become blurred in a natural history thriller that takes to flight. It turns out, writes Colin Tudge, that the very specialized Bo tree fertilizing wasp(s) may indeed be coming from entirely different neighborhoods. They are different species meeting at the same Buddha tree, possibly mating, hybridizing, and, potentially – according to recent DNA research – encouraging the fig trees to hybridize as well "as we have already seen in willow, hawthorns, poplars, and many others…."[23]

The fig-wasp phenomenon encompasses molecular systematic research at a level that continues to astonish every multidisciplinary component of the biological sciences, accounting for a superfamily of wasps, the non-pollinating Chalcidoidea, which (to make it more confusing) includes a hypercritical family of *pollinating* fig wasps known as the Agaonidae.[24] They both live out their early life cycles in the fruits of figs, the former being parasites and the later mutualists. The full communion of wasps attends to one of the three fig flowers – the short ones. Nearly 90 million years, in this specific intimacy, of coevolution and what is called co-cladogenesis, coadaptation, intense co-selectivity, and host transitions all of which have led to a community of bio-phenomena of which the fig-wasp interdependent relationships appear to be almost globally emblematic, pillars of hybridization and speciation.[25]

While some 900 Agaonidae species have been identified,[26] estimates on their Chalcidoidea superfamily diversity have ranged from 22,000 to 100,000 to a theoretical number of 500,000 tiny wasp taxa. Those are extraordinary levels of uncertainty, but they should not be surprising, either. As we will probe and ponder, what we don't know about the natural is almost everything.[27] Like the astonishing worlds of fungi, tiny wasps and figs speak to something crucial within the biological sciences, as well as humanity's assiduous attempts to understand them. Those multitudinal ambassadors of plant and insect also convey largely unopened telegrams. We suspect, but do not know, that they are speaking such realms as might help us to prepare for our own journeys. Their 90 million years versus our 300,000. So startling is their intimacy – wasps

of India," by Jyoti Jennings Roth, February 8, 2016, https://www.talesbytrees.com/a-brief-guide-to-the-sacred-trees-of-india/, Accessed July 22, 2018.

[20] See https://www.buddhanet.net/e-learning/buddhist-world/bodgaya.htm, Accessed July 22, 2018.

[21] See M.G. Easton, M.A., D.D., *Illustrated Bible Dictionary*, Third Edition, published by Thomas Nelson & Sons, London, 1897.

[22] See *The Tree – A Natural History Of What Trees Are, How They Lie, And Why They Matter*, by Colin Tudge, Crown Publishers New York, 2006, pp. 191–192.

[23] ibid., Tudge, p. 338.

[24] Natural History Museum, Universal Chalcidoidea Database, Notes on families, http://www.nhm.ac.uk/our-science/data/chalcidoids/agaonidae.html

[25] See Boucek, Z. 1988. Australasian Chalcidoidea (Hymenoptera): a biosystematic revision of genera of 14 families, with a reclassification of species. C.A.B. International, Wallingford, England. 832 pp.

[26] https://www.britannica.com/animal/fig-wasp.

[27] See "Phylogenetic relationships, historical biogeography and character evolution of fig-pollinating wasps," by Carlos A. Machado, Emmanuelle Jousselin, Finn Kjellberg, Stephen G. Compton, Edward Allen Herre, Published 7 April 2001.doi: https://doi.org/10.1098/rspb.2000.1418, Proceedings of the Royal Society B: Biological Sciences. *268 (1468): 685–94,* http://rspb.royalsocietypublishing.org/content/268/1468/685*, The Royal Society Publishing).*

Fig. 1.6 Newly discovered fungal species, Bialowieza National Park. (© M.C. Tobias)

and figs – that, by comparison, our own greatest love affairs have scarcely felt the first touch to one's lips. We are beginners; no matter how passionate and true our commitments, our alleged cleverness amounts to mere novitiation.

Similarly, like the fig wasps and their hybridizing mysteries, fungi also reproduce within as yet ungrasped realms of pure enigma (Fig. 1.6). In fact, says biologist David George Haskell, "The fungi exhibit such a wide array of reproductive methods that most attempts at unifying explanations have foundered."[28]

Sycamores of the Bible, fiddle leaf figs – hothouse favorites – and even rubber trees across India, all share at common theme which is the wasp that fertilizes the nearly undecipherable flower that opens within the so-called ostiole of the tree.[29]

Creative evolution, form/function, function/form, nature/nurture, and nurture/nature: These dialectics are constant metamorphoses that engage every conceivable biorhythm and relationship. Equally involved at a pace likely contingent upon Others, the human conscience and its formation of thought occur within this fabulist botanical verse, the getting of wisdom, fertility, and morphology by way of the co-engenderment of individuals converging upon the phenomenon of community within evolution. Of groups, vast intricacies, parts, and pieces of life are swept together, bio-typhoons. The resulting landscapes that our aesthetic dalliance glances over are actually the mental and organic offspring of this deep resonance that creates its own perceptions, needs, and dependencies and has the time frame – hundreds-of-millions of years – to experiment with chaos and elegance, both at the same moment, under the astonishing eye of the same choreographer. In the case of minute fig wasps, their long ovipositor offers one of the obvious great form/function creations. But why in insects and fish and not, for example, among gorillas? Why not?[30] And why do the wasps themselves comprise wingless males and horizon-thirsty, free-flying females who think nothing of dispersing at great distances? Their "obligate symbioses" that "involve vertical transmission of symbionts to [a] host offspring"[31] is certainly one of the great preludes in the lexicons of natural history. A riveting tale, caressed on a moonless night in Verona, of primeval mutualism. And

[28] *The Forest, A Year's Watch in Nature*, by David George Haskell, Viking New York, 2012, p. 136.

[29] *Stirling Macoboy's What Tree Is That?*, Crescent Books, A Kevin Weddon Production, Wedding Publishing, Sydney, Australia, 1979, p. 134; See also, "The Queen of Trees: Mutual Dependence," PBS, http://www.pbs.org/wnet/nature/the-queen-of-trees-video-mutual-dependence/1359/, Accessed July 23, 2018.

[30] See https://www.britannica.com/animal/fig-wasp.

[31] "Obligate mutualism within a host drives the extreme specialization of a fig wasp genome," by Jin-Hua Xiao, et al., Genome Biology, 2013, 14:R141, https://doi.org/10.1186/gb-2013-14-12-r141, © Xiao et al.; licensee BioMed Central Ltd. 2013, 20 December 2013," Genome Biology, https://genomebiology.biomedcentral.com/articles/10.1186/gb-2013-14-12-r141, Accessed July 24, 2018.

forever after held peacefully on a bed of roses. Obligate symbiosis is quintessentially about waxing poetic.

With each question and discovery, the imaginative formations in humans, as we must assume in every other species, are paradoxically exposed or yield open windows upon yet bigger and more perplexing obscurities. Further research, still, dwarfs whatever is known to that point, at every juncture of inflection and nuance of the scientific discipline trying to make sense of primeval mechanisms favoring offspring. Such has been the history of humanity's intellectual immersion into Nature. We keep recognizing a stark lesson: there is much more to the evolutionary thrust than expediency or all the footnotes in the world. Sidelines we never considered are equally critical. As we are inclined to worship trees, so, too, shall we worship the wasps.

And There Is Linnaeus

And there is Linnaeus naming animals and plants. The names, the languages, and predilections are mentored by phenomena that are frequently the very creations of our own making, of course, adding thickness of habit, stubbornness of appellation, and precedent to outreach again and again within the biosphere we think we know but certainly knows us. While he was likely in error when it came to his belief that swallows hibernated in muddy lake bottoms or that there were precisely 58 plants in the Garden of Eden which would all cross-fertilize to eventually populate the world we know today (Fig. 1.7), species all named by Adam (1: Moses, 2:19), Linnaeus had an incipient grasp of human psychology to the extent that he embraced the phrase, "Nomina si nescis, perit et cognition

Fig. 1.7 "Paradise," Jan Brueghel the Elder, circa 1606, anonymous collection. (© M.C. Tobias)

rerum" – Without names no Knowledge"[32] – and "If we do not know the names of things, the knowledge of them is lost too."[33]

Whatever the actual number of plants gracing the lives of one Adam and his companion, Eve – which we will never know nor understand – it is clear, and was so for Linnaeus, religious by nature, that plants and animals propel the gift of morals, intelligence, communications, and purity of beauty that is their contagion. Names are abstract constructs of expediency to which we lend our fleeting summation in the declaration of a word about them. Linnaeus was as much a fancier of linguistics as he was a practical mechanic. His system, when weighed against its targets, feels in our time (for all of its efficiency) more like a theatrical presentation in Latin, some lazy Giorgionesque fête champètre or luminist George Inness meadow beneath a coming storm, all fitted into a perpetually propagative Utopia. But behind the rapturous mask of those fruitions is a tutored, sentient soirée, the haunt of mythopoetics as were enshrined in the mind and work of Charles Darwin's eccentric grandfather, the brilliant Erasmus who cast his spell in his book, *The Temple of Nature or the Origin of Society*, published in 1803. He, in turn, gave intoxicating fodder to the Belgian humanist Maurice Maeterlinck's *L'Intelligence des fleurs*, 1907. Such works of love instill in us the uncanny realization that what Linnaeus really accomplished was not so much a system, as a proclamation of animal and plant rights within the religious and scientific framework of evolution. That massive crossing over of species dating to a generic Garden, in fact, continues its fertility pageants every second. The resulting individuals, whole populations, inform our convoluted appraisals of life around us, leaving traces moment-by-moment within the annals of applied ethics and conservation biology (Fig. 1.8).

Evolutionary Hybridism

Such crossings (e.g., fertilizations) comprise a global, holy, exquisite, ever unpredictable mechanism in nature that obviously touches something profound within our mammalian circuitry, insisting upon "the offspring of genetically dissimilar parents or stock."[34] Every generative occurrence is another ecological iteration defining the growth of all known biomes, whilst also challenging our conceptions of the origins and identification of each individual and their fate. Hamlet, Vivaldi, the entire population of Iberian wolves and Cuban tree frogs pass before us; we see the destiny of whole civilizations propped up upon a floating ark of genetic communiqués, decade after decade, and these quiet echoes, fossilized memories, and fated lives give us to understand some portion of the intangible. Like a visit to the old Jewish cemetery in Prague, the biosphere is a metaphysic, not a fluid truth. More poetry than physics.

Science staggers and gasps before its self-propelled languages of computation and empirical surprise after surprise. No one caught out in the ecstatic whorls of eco-dynamics can sit back upon a cold calculus in response. In the case of the aforementioned wasps, for example, there is plenty of evidence to support both horizontal and vertical gene transfer involving life cycle changes that come about through bacteria living on the traveling circus which is each separate wasp, lending equal insights (to date) as to the roles of both bacteria and viruses, as well. This viral dimension adds a third-party candidate in the ever-transmutational enigmas inherent to coop-

[32] See "The legacy of Linnaeus," by Magnus Lidén, Uppsala University Resource Centre >The Legay of Linnaeus, Volume 4, Number 1, January 2007, …/resources/article/0565/ www.bgci.org.

[33] Carl Linnaeus, *Philosophia botanica*. Stockholm: L. Salvius, 1751, cited in "Linnaean sources and concepts of orchids," Charlie Jarvis and Phillip Cribb, Ann. Bot. 2009 Aug: 104[3]: 365–376. Published online 2009 Jan 30. doi: https://doi.org/10.1093/aob/mcp005, PMCID: PMC2720649, PMID: 19182221, © The Author, 2009, Published by Oxford University Press on behalf of the Annals of Botany Company.

[34] For basic definition see https://www.thefreedictionary.com/hybridism, Accessed July 24, 2018.

Fig. 1.8 *Coryanthes Maculata* (South American orchid). (Illustration by E.J. Detmold, in *Hours of Gladness*, by M. Maeterlinck, Translated by A. Teixeira De Mattos, George Allen & Co., London, 1912, p.84. © M.C. Tobias)

erative fruition between species.[35] The juxtaposition of art and science, in the mulling over of molecular biology, poses challenges because somewhere amid the analysis of social insects and plant communities, a human heart, echoes in the brain, become attached. We see a face in each wasp. We recognize the utter magnificence of those daily rounds to which it is committed, and all the other organisms which are part of its evolutionary odyssey. We become emotionally involved; its languages and teleology enter our living rooms, bedrooms, sleep in our minds at night and rouse us in the daylight. Huge military-like expeditions have been goaded on by nothing more palpable than a grain of pollen, a fog encincturing a rarely seen mountain in the desert, or a certain ground orchid that blooms but once in a century. Those who would solo across all the oceans of the world do so knowing that their own bodies are more than 70% water. These reciprocities are core to scientific mindsets.

Hence, the genesis of animal rights takes hold of similitudes throughout biology and the concomitant arousals of long-lost cousins in our midsts. Our penchant to meet them, speak with them, and to go there, within evolutionary biol-

[35] See, Front. Microbiol., 15 February 2016 | https://doi.org/10.3389/fmicb.2016.00136, "Multiple Horizontal Transfers of Bacteriophage WO and Host Wolbachia in Fig Wasps in a Closed Community," Ningxin Wang, Sisi Jia, Heng Xu, Yong Liu and Dawei Huang, Shandong Provincial Key Laboratory for Biology of Vegetable Diseases and Insect Pests, College of Plant Protection, Shandong Agricultural University, Tai'an, China Key Laboratory of Zoological Systematics and Evolution, Institute of Zoology, Chinese Academy of Sciences, Beijing, China.

Fig. 1.9 Carl Linnaeus, after Alexander Roslin's Painting. (© commons.wikimedia.org)

ogy strikes of a most challenging campaign, particularly in view of the hundreds-of-billions of individuals whose rights are at stake. We find it very hard to see how such gigantic numbers can be part of a sane human life, but they must. It takes a most tenacious general conviction, a universal ethic overtly embraced, to step over the abyss and to give in to beauty and compassion where the rush of the life sciences so counter-easily stampede. Linnaeus' own personal life, beginning with his exceptional diaries marking a 3000 mile journey in Lapland from May 12 to September 10, 1732 (Linnaeus was 25 at the time), emblemizes the struggle to work through the logistics of naming the world out of love and the endless curiosities of youth in full blush.[36] "Linnea… A plant of Lapland, lowly, insignificant, disregarded, flowering but for a brief space -from Linnaeus who resembles it" (Carl Linnaeus) (Fig. 1.9).[37]

[36] See "The Linnaean Correspondence," in Carl Linnaeus, 1707–1778: A Bicentenary Guide to the Career and Achievements of Linnaeus and the Collections of the Linnaean Society. Commemorative catalogue, by Gavin D. R. Bridson and William T. Stearn, London, 1978.

[37] See *The Travelling Naturalists*, by Clare Lloyd, Croom Helm, London, 1985, p. 12.

In one of the truly exceptional works of late twentieth century science and philosophy, Marvin Minsky's *The Society Of Mind*,[38] the author points out that all such numbers (numeric representations, counted collaboratives, minions throughout time) as have already been introduced, are "part of a huge network"[39] that fit within a "frame," a notion he first developed in his 1974 essay, "A Framework for Representing Knowledge."[40] Minsky argues that "As scientists, we like to make our theories as delicate and fragile as possible. We like to arrange things so that if the slightest thing goes wrong, everything will collapse at once!"[41] Of course, the fragility of a theory (or a line from Shakespeare, a mere acoustic glance off Mozart's "Lacrimosa" fragment from his D-minor Requiem) is quite different from the robust application of an infinite number of hypotheses to test any one theory.

Infinity-to-one: As if to say, any question regarding *nature* will be accented, contextualized, and reaffirmed. It will segue with fine-tuning by way of all the subsequent hypotheses that need not be formalized within the strict rubrics of a scientific theory.

Fragile versus robust. One example can be gleaned in the work carried out on the topic of "natural soil-vegetation systems."[42] While we learn many fascinating pieces of trivia from the accumulation of such research, we have to always ask ourselves: What have we really come to *understand*? If we attempt to step back from the human perspective, is there any perspective at all? Or do all measurements collapse, all mean-

[38] Simon And Schuster, New York, 1985/1986.

[39] ibid., p.192.

[40] ibid., p.259.

[41] ibid., p.193.

[42] See AGU100, Advancing Earth and Space Science, Papers, Water Resources Research, An Agu Journal, "Ecological optimality in water-limited natural soil-vegetation systems: 1. Theory and hypothesis," by Peeter S. Eagleson, April 1982, https://doi.org/10.1029/WR018i002p00325, https://agupubs.onlinelibrary.wiley.com/journal/19447973, Accessed July 24, 2018; See also, "Difference Between Hypothesis and Theory," September 2, 2016 By Surbhi S, Key Differences, https://keydifferences.com/difference-between-hypothesis-and-theory.html, Accessed July 24, 2018.

Fig. 1.10 Jane Gray Morison and Burro Friend. (© M.C. Tobias)

ing vanish the instant we get *outside* of ourselves? The question is the salient one. At the core of transcendental experiences throughout the history of religion, anthropology, and, presumably, within all of the fields of astronomy and cosmology, there is a transport between Self and the Other (Fig. 1.10). It is a reversible dialogue, the conversants equating the odds of actual contact in an area ecologically referred to as the hybrid zone, or a biological margin, an ecotone. These areas are spatial and contain information that is never steadfast. There is movement within that grid, measured according to the goal of any one design, with its control versus experimental groups, core areas and mirror monitoring areas, for example. These dualities driving empiricism are extraordinarily relevant to one kind of logic, but not necessarily to another.

Applying theory and hypothesis to numbers, or any representation of a measurement, involves questions and perpetually redesignated, or newly understood, answers. Certainty and uncertainty, stasis and distribution, randomness and stolidity, predictive or pre-emptive causation, and unknown probability: Each of these characteristics of *something* enter into our minds as we read the textbooks offered through our species' ever-changing lenses that are focused upon drawing distinctions, opining on what we believe to be specific relationships, and suggesting methodologies and fine details to better assist in grasping that which we have already, in some sense, figured out, to paraphrase Pascal (whether we are right or wrong). Just as numbers invoke and represent ideas, one can easily test this correlation in humans as a defining characteristic of the difference between theories and hypotheses. When we think, principally, of zero, one, two, and three, we easily and almost by definition conjure up ideas, pictures, and pictorial associations in our mind. When we add or subtract one plus two, the same happens. Multiplication becomes more obscure, division even more so. But what is clear is that about three, the numbers start to recede, and as size and complication mount, our ability to connect dots and see through to pictures or invoke memories blurs. We quickly lose the ability to *identify* with an individual picture; grains of sand become first the sparkling cliché image in one's palm but then turn into a seashore, the entire beach (Fig. 1.11).

All of this pertains to natural history in a most beguiling and headstrong manner. The numbers go from conserving charismatic megafauna – individual wild beings that arouse our fascination and hopefully empathy – to only vague interest in a class of organisms, to actual indifference. Ultimately, the larger the numbers, the more intellectually abstract do the concepts corresponding to them become. Equally clear, the remoteness and/or diminutive size of organisms tends to invite little mental opportunism by our species. A case in point: a small flash flood in the mountains above Tesuque, New Mexico, in mid-August 1977 and the recovery of stream invertebrates following that incident are events that

Fig. 1.11 A Rookery at the Farallon Islands National Wildlife Refuge, California. (© M.C. Tobias)

would have been utterly lost in time. Except that at least one scientist cared enough about the small creatures involved to document their plight.

In the immediate aftermath, 94% of the river sediment-dwelling organisms were gone. Even after 2 years, Manuel Molles, Jr., discovered that the benthic species compositions remained altered. Molles, Jr., describes how earthworms "showed no clear effect from the flood or its aftermath" and true flies did fine; aquatic mayflies, stoneflies, and caddisflies "recovered at intermediate rates," while beetles "recovered most slowly."[43] Such research is more than merely thrilling: it utterly redeems the nature of science, of human beings in general, by showing a sense of curiosity that is mingled with compassion and much hard work. Imagine the interplay of obsession, concern, presumption, hypothesis, and theory based upon instinct, intuition, and then actual empirical evidence that goes into such a research paper. Consider the many approaches to discovering, measuring, and then assessing and reassessing the data; of synthesizing it and coming up with numbers to represent it, within a range of estimation versus precision where confidence in the research can bring it down to express percentages. That requires a comprehensive understanding of the entire research area, its ecosystems, and 10,000 accomplices within the complex topography of ecotonics.

Pythagoras plays upon the mind. So does Zeus and Leto's son, Apollo, whose music persists throughout all of the Phrygian and Lydian modes of behavior and melody, such are the enduring biological principles that seem to propel a human interest in such matters. The lyrical. But this kind of research – grueling, meticulous, and largely

[43] See The Southwestern Naturalist, Vol. 30, No. 2, May 31, 1985, "Recovery of a Stream Invertebrate Community from a Flash Flood in Tesuque Creek, New Mexico," by Manuel C. Molles, Jr., *The Southwestern Naturalist,* Vol. 30, No. 2 (May 31, 1985), pp. 279–287, Published by: Southwestern Association of Naturalists, doi: https://doi.org/10.2307/3670741, Stable URL: https://www.jstor.org/stable/3670741, https://www.jstor.org/stable/3670741?seq=1#page_scan_tab_contents, Accessed July 26, 2018.

ignored – also requires an understanding of the pragmatic, an entire field of invertebrate recoveries (in Molles, Jr.'s case, a knowledge of "Oligochaeta," "Diptera," "Ephemeroptera," "Plecoptera," "Trichoptera," and "Coleoptera").[44]

And it must be added that we have a very personal interest in this particular research because we experienced a major flash flood this very week above our own domicile along that exact same creek in the Sangre des Cristos Mountains at the southern reach of the Rockies. It was a shocking surge of revelations, all our designs and complacencies riven in a dark thunderous extravaganza. We evacuated. The aftermaths were too extraordinary. Grasses and everything else within 200 ft of the river had been flattened as if by trucks whose job it was to scrape the Earth. Then we noticed that all three of the Western wood pewees (*Contopus sordidulus*) who had been nesting outside our kitchen since Spring, catching insects with fantastic speed, coming to the windows when we knocked, were gone, along with hundreds of shrubs and trees. The hail and lightning and forces all around them in the dark was – as it was for us – too much.[45] Did the pewees migrate to South America early or attempt another nest? We'll never know. But the crows were also gone, and we realized the jays and magpies had deserted the area some 2 days prior, before all the lightning began.

The same week as the flood, in a phone conversation with Dr. Molles just days before his 70th birthday,[46] we learned that he and his wife – who lived in La Veta Colorado, 175 miles north of us – were cleaning up after a disastrous wall of water had swept down the mountain above them on the same day the Tesuque flash flood occurred. Just a few weeks before the flood (which took out their water system, ironically), they had endured the massive Spring Creek Fire, one of the largest in Colorado's history, which left the baked soils above them utterly hydrophobic, thus accelerating the raging torrents.[47] But in an incredibly upbeat moment, Dr. Molles reminisced about how, as a child, he had seen a documentary on Albert Schweitzer and recalled Schweitzer on camera asking the interviewer not to harm an ant wandering across the table at Schweitzer's home above the Ogooué River in the village of Lambaréné, French Equatorial Africal, now Gabon. From that time on, said Molles, who grew up on a farm in Merced County California, "reverence for life" was a principal impetus in all of his work. We concluded our conversation on the topic of specimens, and he concurred, in so many words, that the taking of specimens was not something he could sanction, down to the smallest insect.

Different Measures of the World

What is generally clear is that historically, our intricately woven, culturally strewn species values and envisions numeric perspectives, measurements, and sizes, cherishing the day and other characteristics defining life, very differently from place to place, century upon century. It is no clear pathway from inches and pounds to living individuals. But at the genetic level, which quickly translates into those very organisms and their subsequent quantification by way of, for example, bionomial classification, phylogenetic trees of life, ancestral ties, and evolution herself, all of their life metrics, can be viewed in a rudimentary sense. That composition endures in the guise of general biological numbers phenomenon. It is something deeply woven into the human consciousness as we approach, mingle with, and ask questions about life. Those life-fostering numerics are also equally spelled out in some

[44] ibid., Manuel C. Molles, Jr., From Abstract. Little wonder, that Molles, nearly 30 years after publication of this particular essay, received one of the most important awards that can be given out to ecologists in the U.S., the Eugene P. Odum Award for Excellence in Ecology Education by the Ecological Society of America. See https://news.unm.edu/news/molles-receives-eugene-p-odum-award, Accessed July 26, 2018.

[45] The flood hit our home, and those of many of our neighbors sometime after 7:30 pm on Monday night, July 23rd, 2018.

[46] Private phone conversation, July 28th, 2018.

[47] https://www.denverpost.com/2018/07/09/colorado-wildfire-update-monday-fires/, Accessed July 28, 2018.

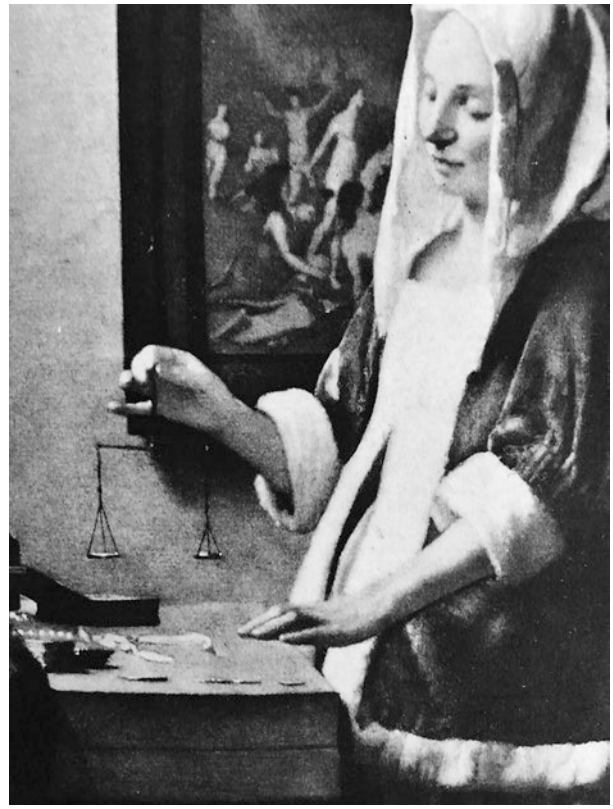

Fig. 1.12 "Woman Holding a Balance," (by Johannes Vermeer, 1662–1663, Plate #36, p. 61, from *Jan Vermeer De Delft*, by Gustave Vanzype, G. Van Oest & Co., Editeures, Bruxelles et Paris, 1921, © M.C.Tobias)

common currency, which, for lack of any better qualification, we can simply label "unit." How we measure it takes on curious diversity. Even humanity's approach to the value and differentiation of measurements is quite fascinating and not a little instructive (Fig. 1.12).

There is, and it stands out, Clause 35 of the "Magna Carta" in which King John agreed to a "single measure of wine throughout our whole realm"[48] to the Système International d'Unités, the General Conference on Weights and Measures, and FOCS 1, the Swiss atomic clock which started ticking in 2004 and is said to have an "uncertainty" one second every 30 million years.[49] Then there is that entire body of human daily experience dependent upon or devoted to measures now deemed obsolete. From the *Bahar* (a measure of mass, once, in the land of Oman) to the former Bengali *passeree*, a weight equivalent of roughly 10.3 lbs. The British used to have a measure for a bun generously smothered with butter and cheese, while the *lachter*, or Berglachter, depending on the region in Germany, was long ago utilized as a standard measure by miners indicating the amount of coal or some mineral a man with outstretched arms could hold. A *Guz* was a Mughal yard. A *sthène* (from the mysterious Greek, *sthenos*) was some obscure, now unknown, force of which there have been countless such powers, pressures, volumes, distances, and suspicious or alluring horizons.[50] *Abucco*, or 196.44 g of gold or silver in Myanmar,

[48] See https://www.bl.uk/magna-carta/articles/the-clauses-of-magna-carta, Accessed July 21, 2018.

[49] See compnetworking.about.com, Accessed July 21, 2018.

[50] See Donald Fenna, "m. t. s. system". *A Dictionary Of Weights, Measures, and Units*, Oxford University Press, Oxford, UK, A Dictionary Of Weights, Measures, and Units. Oxford, England: Oxford University Press, 2002, p. 190. See also, David Herlihy, *Medieval Households*, Harvard University Press, Cambridge, Mass., 2009.

Fig. 1.13 Japanese dreams in a coin fountain, Kyoto. (© J.G.Morrison)

is no longer the standard,[51] and *shaku-kan*, a system for measuring all sorts of things, including cups of rice, is today only employed on a few islands far to the southwest of Japan's mainland. The old Warsaw System went out of favor on January 1, 1819 (1 Polish *ell* or *łokieć* being equal to 1/3 of a fathom), and the *gur-cube* or gun_2 – the amount of a fully laden burro trundling water or cooking oil or grains – has not been utilized (that anyone knows) since the last hours of early Dynastic Sumer (ca. 2300 BCE).[52]

But then, how many of us still have to pause, sometimes without closure, on all those annoying equivalencies: ounces, pounds, centimeters, yards, etc.? And while we still refer to ship loads, we do so casually, ignoring the fact it actually once meant something precise: in the UK, 949,760 lbs of coal, or 20 keels.[53]

Such numeric characterizations, if they are to have meaning for humans, presumably require a human context, an accessible logic, Minsky's "framework" (Fig. 1.13). But what if we have no way to envision a context? What if the numbers and their represented targets have the equivalent of an absolute zero exchange function with a human context? This could be a frequency outside our anatomical range, or the simple limit, the precise distribution circumference that states: this tree meets all of the average criteria for trees everywhere and thereby hosts "about forty species of insect."[54] It is the exceptions that strain our credulity, falling outside averages, requiring extrapolations that expand or accelerate time, distance, quantity, and qualia in a possibly nonlinear distribution polarity. Within that distance of unknown, abstract zones become the norm, wherein all is speculation based upon that which cannot be known within the ascertainable. Two profound exceptions are Yasuní National Park, with tens-of-thousands of insect species living on a single tree, and the unknown ratios of sexuality to asexuality among, say, endophytic fungi in Bialowieza's ancient forests across northeastern Poland and southwestern Belarus.

[51] See Bruno Kish, *Scales and Weights*, Yale University Press, 1966, p.237.

[52] François Cardarelli, *Encyclopedia of Scientific Units, Weights and Measures. Their SI Equivalences and Origins*, Springer Science and Business Media, London/Berlin, 2003.

[53] Cardarelli, ibid., p. 48.

[54] See *The Global Forest*, by Diana Beresford-Kroeger, Penguin Group USA, Viking Publishers, New York, 2010, p. 28.

Whichever age of human consciousness is focusing upon a certain property, quantity, or quality, the distribution potential will always be far in excess of our prime numbers and experimental theaters. Part of this horizon fraction, as we might describe it – what might be beyond what we can prove – is predicated on a subjectivity whose many forms of bias may never equal our odds of true understanding. We suspect, but cannot know, that the functional areas of a mammal's cerebral cortex tune that organism's bias – the biasphere – just as they probably operate on those endless forces of persuasion guiding a sponge or a fruit fly. We simply have little or no way of knowing. Long-finned pilot whales – the mammal with the most number of cerebral cortex neurons – cannot be proved to have greater gregarious qualities than, say, a naked mole rat or the *Trichoplax adhaerens*, the last of the Placozoa phylum,[55] flat animals, multicellular, capable of both sexual and asexual division, often cited as the simplest of all organisms, yet globally distributed, without even so much as an outline. *Trichoplax adhaerens* are perfect organisms about which nothing was known prior to their discovery in 1883 by a German zoologist, Franz Eilhard Schulze (1840–1921). Schulze also loved deep-ocean floor Xenophyophores (bearer of foreign bodies, in Greek).[56] He adored sea sponges, particularly the Antarctic and northern Pacific Hexactineliae that became celebrities following Ernst Haeckel's colorful portraitures (Fig. 1.14) of them published for general readers in the wake of the Challenger Expeditions (1873–1876).[57] Their bright color beauty was not unlike the first color lithographs of plants published in seed catalogues following the Civil War.[58] Schulze was President of the Deutsche Zoologische Gesellschaff. There have been at least 14 other *famous* male individuals with the last name of Schulze. If, as Linnaeus would have us believe, they were all a member of the Schulze species (the Genus varying between August, Edmond, Johann, etc.), we should be left to contemplate a peculiar conundrum, which is, in fact, precisely the problem with humans naming everything in the world.

The Problem with Proofs

The point of these divagations is the pivotal role that language and its antecedents in mind play upon the resourcefulness of the human imagination and its craving to unearth secrets, join numbers into formulae, and resolve ever greater hypotheses and theorems that purport to describe the Cosmos. All those descriptions are subjective, no matter how rigorous the methodologies of proof. There is no way Planck's Constant[59] should equal 6.62607004 × 10–34 m^2 kg/s, short of an abundance of presumptions, presuppositions, attitudes, perspectives, historical accretions, and outright prejudice (against specific – though we cannot as yet say – numeric coefficients?) that conform to various inclinations and intolerance, the confirmation of previous confirmations predicated ("Tolstoy Syndrome," "Confirmation Bias") on an eerily emergent willingness to confirm, standpoint, and spin. History is all gossip, Dante allegedly quipped. More recently, the BBC has lent considerable energy to analyzing the origins and functionality in social settings of gossip.[60]

[55] Animal Diversity Web, ADW, http://animaldiversity.org/accounts/Placozoa/, Accessed August 20, 2018.

[56] Universität Rostock, http://cpr.uni-rostock.de/metadata/cpr_person_00002470, Accessed August 20, 2018.

[57] NOAA, "Ocean Explorer," https://oceanexplorer.noaa.gov/explorations/03mountains/background/challenger/challenger.html, Accessed August 20, 2018.

[58] See *American Eden - David Hosack, Botany, and Medicine in the Garden of the Early Republic*, Liveright Publication Corporation, A Division of W. W. Norton & Company, New York, 2018, p. 2.

[59] Quantum Physics/The Cosmos, "Planck's Constant: The Number That Rules Technology, Reality, and Life," By James Stein on Mon, 24 Oct 2011, The Nature of Reality, PBS, http://www.pbs.org/wgbh/nova/blogs/physics/2011/10/plancks-constant/, Accessed August 20, 2018.

[60] BBC –Earth, "What Gave Rise To Gossip?" by Melissa Hogenboom, 27 February, http://www.bbc.com/earth/story/20150227-where-did-gossiping-come-from, Accessed May 30, 2018; See also, McAndrew, Frank T., "The Science of Gossip: Why we can't stop ourselves". Scientific American, October 2008. See also, Sommerfeld RD, Krambeck HJ, Semmann D, Milinski M. (2007). Gossip as an alternative for direct observation in games of

Fig. 1.14 Ernst Haeckel's Mysterious Marine Aesthetics. (© Wikimedia.commons)

There have been taxonomic and evolutionary studies of gossip.[61] Gossip in science, however, resists the breakdown of declamation. Science presumes to stamp order on chaos and regularize and formalize notions of logic, origin, even futurism with a language tied to mathematics and physics that is considered core. There are no subatomic particles named gossip, no organisms biologically singled out for their penchants to gossip. (Stone chats, a gorgeous group of highly dignified birds, Genus *Saxicola*, actually seem to be less chatty than most avians.)[62]

Indeed, while we may assume that all species engage in patter and chatter, we actually know nothing about it. One way to test the plumb line, that horizon fraction within human language, is to focus within a large garrulous party scene, hundreds of people in an acoustically hot venue all around you. Most *Homo sapiens* will be incapable of understanding a single word emanating from the gathering. Recognizable content materi-

indirect reciprocity. Proc Natl Acad Sci U S A. 104[44]:17435–40. PMID 17947384, Accessed May 30, 2018.

[61] Foster, E.K. [2004]. Research on gossip: Taxonomy, methods, and future directions. Review of General Psychology, 8 [2], 78–99; Dunbar, R. [2004]. Gossip in evolutionary perspective. Review of General Psychology, 8[2], 100–110.

[62] "European Stone chat," https://www.british-birdsongs.uk/european-stonechat/, Accessed, August 20, 2018.