

## REFERENCES

### Chapter 1

1. *As the Hamilton Daily Times reported on August 16<sup>th</sup> 1913...*

‘\$500 Dollar Flea Caught.’ in *Hamilton Daily Times*, (1913, August 16). No. 191

2. *Fleas have spring-loaded legs that let them jump over 100 times their own height.*

‘Flea's jump analysed by scientists’ in *The Telegraph*. (2011, Feb 12). Retrieved from: <https://www.telegraph.co.uk/news/science/science-news/8315495/Fleas-jump-analysed-by-scientists.html>

Rothschild, Dame Miriam. ‘How and why fleas jump so high’. Natural Histories on *BBC Radio 4*. Retrieved from: <https://www.bbc.co.uk/programmes/p0371wn4>

3. *The story was good. Good enough to fend off the curious—but it also wasn't true.*

‘Fleadom or death: Reviving the glorious flea circus’ in *New Scientist*. (2012, December 18). Retrieved from: <https://www.newscientist.com/article/mg21628961-900-fleadom-or-death-reviving-the-glorious-flea-circus/>

4. *In fact, whole new species have been discovered in this way.*

‘BBC Inside Science’ on *BBC Radio 4*. (2014, June 26). <https://player.fm/series/bbc-inside-science-1301268/longitude-prize-winner-solar-cells-new-species-fiji-fisherwomen-physics-questions>

5. *“Depicted with the anatomical precision of a rhinoceros” as Oxford historian Allan Chapman wrote*

Chapman, Allen. England's Leonardo: Robert Hooke (1635-1703) and the art of experiment in Restoration England. This lecture is from Proceedings of the Royal Institution of Great Britain, 67, 239 - 275 (1996). Retrieved from: <http://www.roberthooke.org.uk/leonardo.htm>

9. *Hooke's notoriously difficult personality made him unpopular with fellow academics.*

Devine, Miranda. ‘Standing on shoulders of giants’. *The Sydney Morning Herald*. (2009, October 24). Retrieved from: <https://www.smh.com.au/politics/federal/standing-on-shoulders-of-giants-20091023-hda5.html>

10. *Van Leeuwenhoek is thought to have made some instruments that could magnify objects up to 500 times.*

Crow, James Mitchell. 'Zeros to heroes: Tall tales or the truth of tiny life?' in New Scientist. (2010, September 8) Retrieved from: <https://www.newscientist.com/article/mg20727771-800-zeros-to-heroes-tall-tales-or-the-truth-of-tiny-life/>

11. *"I then most always saw, with great wonder, that in the said matter there were many very little living animalcules, very prettily a-moving. The biggest sort...had a very strong and swift motion, and shot through the water (or spittle) like a pike does through the water. The second sort...oft-times spun round like a top...and these were far more in number."*

Gest, Howard. "The Discovery of Microorganisms by Robert Hooke and Antoni Van Leeuwenhoek, Fellows of the Royal Society." Notes and Records of the Royal Society of London, vol. 58, no. 2, 2004, pp. 187–201. JSTOR, JSTOR, [www.jstor.org/stable/4142050](http://www.jstor.org/stable/4142050).

12. *Oral bacteria are prolific: "There are 20 billion bacteria in your mouth and they reproduce every five hours. If you go 24 hours without brushing, those 20 billion become 100 billion!"*

Landers, Bill. 'Oral bacteria: How many? How fast?' in RDH magazine. Vol 29:7 (2009, July 1). Retrieved from: <https://www.rdhmag.com/articles/print/volume-29/issue-7/columns/the-landers-file/oral-bacteria-how-many-how-fast.html>

13. *"I have here sent the Testimonials of eight credible persons; some of which affirm they have seen 10000, others 30000, others 45000 little living creatures, in a quantity of water as big as a grain of Millet..."*

Hooke, Robert. 'A Letter of the Ingenious and Inquisitive Mr. Leeuwenhoeck of Delft, sent to the Secretary of the Royal Society, October 5. 1677.' In *Lectures and collections made by Robert Hooke*. University of Michigan's Early English Books Online. Retrieved from: <https://quod.lib.umich.edu/e/eebo/A44321.0001.001/1:8?rgn=div1;view=fulltext>

14. *To us, reality may appear human-sized, but in truth, 95% of all animal species are smaller than the human thumb.*

Micrarium exhibition. University College London. Retrieved from: <https://www.ucl.ac.uk/culture/grant-museum-zoology/micrarium>

15. *"The flea has killed millions around the world...and is, indissolubly, connected with the history of Black Death. This disease in man is, in fact, caused--as demonstrated by Yersin and Simond--by the triad: bacterium (Yersinia pestis)/rat/flea (Xenopsylla cheopis)."*

Amici, Roncalli R. 'The history of the flea in art and literature.' *Parassitologia*. 2004 Jun; 46(1-2):15-8. Retrieved from: <https://www.ncbi.nlm.nih.gov/pubmed/15305680>

16. *As one commenter wrote online: "There are those creatures that serve no purpose whatsoever. Fleas are such an example. They don't pollinate any flowers, nor do they prey on any destructive or harmful insects. Instead, they siphon the blood of unsuspecting animals and people all the while passing harmful organisms into their bloodstream!"*

Anon commenter. ‘Do fleas have a purpose?’ AnswerDrive. Retrieved from: <https://answersdrive.com/why-are-flies-important-to-the-ecosystem-4632919>

17. *While pesticide manufacturers have argued that the world will face food shortages without pesticides, scientists have found that the claim is overstated, and that the majority of farms would increase productivity if they lowered their use of pesticides.*

Carrington, Damian. ‘High risk of food shortages without pesticides, says chemical giant’, in *The Guardian*. (2018, June 17). Retrieved from:

<https://www.theguardian.com/environment/2018/jun/17/high-risk-food-shortages-pesticides-chemical-giant>

Monbiot, George. ‘Insectageddon: farming is more catastrophic than climate breakdown.’ *The Guardian*. (2017, October 20). Retrieved from:

<https://www.theguardian.com/commentisfree/2017/oct/20/insectageddon-farming-catastrophe-climate-breakdown-insect-populations>

18. *Scientists tell us we are witnessing a catastrophic collapse of insect populations. A German study, found that on protected nature reserves insect numbers had plummeted by 80%. Worldwide, Rodolfo Dirzo, a Stanford University ecologist has documented a 45% decline in insect populations over the last four decades. And on the International Union for Conservation of Nature [IUCN] Red List, of the 3,623 invertebrates being tracked, 42% are currently under the threat extinction.*

Yong, Ed. ‘Insects Are In Serious Trouble: In western Germany, populations of flying insects have fallen by around 80 percent in the last three decades.’ in *The Atlantic*. (2017, Oct 19).

Retrieved from: [https://www.theatlantic.com/science/archive/2017/10/oh-no/543390/?utm\\_source=twb](https://www.theatlantic.com/science/archive/2017/10/oh-no/543390/?utm_source=twb)

Schwägerl, Christian. ‘What’s Causing the Sharp Decline in Insects, and Why It Matters’ in *Yale Environment 360*. Yale School of Forestry & Environmental Studies. (2016, July 6).

Retrieved from: [https://e360.yale.edu/features/insect\\_numbers\\_declining\\_why\\_it\\_matters](https://e360.yale.edu/features/insect_numbers_declining_why_it_matters)

19. *As British biologist Dave Goulson warns us, we “are currently on course for ecological Armageddon. If we lose the insects, then everything is going to collapse.”*

McKie, Robin. ‘Where have all our insects gone?’ in *The Guardian*. (2018, June 17). Retrieved from:

<https://www.theguardian.com/environment/2018/jun/17/where-have-insects-gone-climate-change-population-decline>

20. *“Most of the fruits and vegetables we like to eat, and also things like coffee and chocolate, we wouldn’t have without insects...”*

Deutsche Welle interview with Dave Goulson. 'We cannot survive without insects', in *DW*. (2018, June 22). Retrieved from: <https://www.dw.com/en/we-cannot-survive-without-insects/a-44297313>

21. *Already birds that feed on these insects have begun to disappear.*

Agence France-Presse. 'Catastrophe' as France's bird population collapses due to pesticides', *The Guardian*. (2018, March 21). Retrieved from: [https://www.theguardian.com/world/2018/mar/21/catastrophe-as-frances-bird-population-collapses-due-to-pesticides?CMP=Share\\_iOSApp\\_Other](https://www.theguardian.com/world/2018/mar/21/catastrophe-as-frances-bird-population-collapses-due-to-pesticides?CMP=Share_iOSApp_Other)

22. *Pulex irritans has not gone extinct. It can still be found in Greece, Iran, Madagascar, and even Arizona.*

Ziegler, Michelle. 'The Promiscuous Human Flea' in *Contagions*. (2016, September 27). Retrieved from: <https://contagions.wordpress.com/2016/09/27/the-promiscuous-human-flea/>

23. *As Professor Tomlin noted: "I have offers from all over the world to take my show, but you're afraid of one thing, when you get out of the country can you get fleas?"*

Wiseman, Richard. 'Staging a flea circus,' in *Flea-Circus.com*. Retrieved from: <https://www.noonco.com/flea/history.htm>

24. *Age appears to be a factor, as babies have fewer mites.*

Thoemmes, Megan S., Fergus, Daniel J., Urban, Julie, Trautwein, Michelle & Dunn, Robert R. 'Ubiquity and Diversity of Human-Associated Demodex Mites' in *PLOS One*. (2014, August 27). Retrieved from: <https://doi.org/10.1371/journal.pone.0106265>

25. *moving at a rate of eight to sixteen millimetres per hour*

Rather PA, Hassan I. Human Demodex Mite: The Versatile Mite of Dermatological Importance. *Indian Journal of Dermatology*. 2014;59(1):60-66. doi:10.4103/0019-5154.123498.

26. *Taking swabs from 60 subjects' bellybuttons, researchers working on the "Bellybutton Biodiversity project" found a veritable zoo of bacteria - a total of 2368 unique species - each one a distinct life form, over half of which were previously unknown to science.*

Hulcr, J., Latimer, A. M., Henley, J. B., Rountree, N. R.\*\*, Fierer, N., Lucky, A., Lowman, M. D., Dunn RR 2012. A jungle in there: bacteria in belly buttons are highly diverse, but predictable. *PLoS ONE* 7(11): e47712. doi:10.1371/journal.pone.0047712

27. *One person's bellybutton even housed a bacterium only known to exist in Japanese soil, even though he had never once stepped foot in Japan.*

Murphy, Carrie. 'Your Bellybutton Is Basically Its Own Ecosystem'. in *Alloy*. (2012, November 14). Retrieved from: <http://www.alloy.com/well-being/bellybutton-bacteria/>

28. *Nathan Wolfe has observed, we are sampling a safari of microbial species from around the world: "Dust from deserts in China..."*

Wolfe, Nathan. 'Small, small world.' In *National Geographic*. (2013, January). 140  
Retrieved from: <https://www.nationalgeographic.com/magazine/2013/01/microbe-gallery/>

29. *Air samples collected by scientists at Lawrence Berkeley National Laboratory found as many as 1800 distinct bacterial species in the air that we breathe.*

Wolfe, Nathan. 'Small, small world.' In *National Geographic*. (2013, January). 138  
Retrieved from: <https://www.nationalgeographic.com/magazine/2013/01/microbe-gallery/>

30. *Yale University engineers have found that a person's "mere presence" in a vacant room adds about 37 million bacteria to the mix..."*

Gershon, Eric. 'With you in the room, bacteria counts spike'. *Yale News*. (2012, March 28).  
Retrieved from: <https://news.yale.edu/2012/03/28/you-room-bacteria-counts-spike>

31. *An average the human body has 30 trillion human cells, and about 39 trillion cells that are made up of bacteria, meaning we are only slightly outnumbered by a ratio of 1.3:1.*

Abbott, Alison. 'Scientists bust myth that our bodies have more bacteria than human cells'. In *Nature*. (2016, January 8) Retrieved from: <https://www.nature.com/news/scientists-bust-myth-that-our-bodies-have-more-bacteria-than-human-cells-1.19136>

32. *There are almost 2 billion species of bacteria, the vast majority of which are harmless to human beings.*

Tetro, Jason. *The Germ Code: How to stop worrying and love the microbes*. Doubleday Canada, 2013, p 23.

33. *Relatively but not entirely. There is bacteria in the placenta. "Scientists have spotted bacteria in amniotic fluid, blood in the umbilical cord, the membrane that surrounds the fetus and even babies' first poop."*

Sanders, Laura. 'Baby's first bacteria arrive sooner than we thought' in *ScienceNews*. (2014, May 28). Retrieved from: <https://www.sciencenews.org/blog/growth-curve/baby%E2%80%99s-first-bacteria-arrive-sooner-we-thought>

34. *A species known as Bacteroides fragilis for instance, is found in abundance in the guts of most mammals, including 70-80% of humans.*

Ackerman, Jennifer. 'The Ultimate Social Network.' *Scientific American*, Jun 2012, Vol. 306, Issue 6.

35. *Along with disease-fighting, we also rely on bacteria to help us to perform survival vital tasks — like eat. If you're a fan of pasta, pies or french fries, then Bacterioides thetaiotaomicron is the species that you can pat your belly to thank.*

Ackerman, Jennifer. 'The Ultimate Social Network.' *Scientific American*, Jun 2012, Vol. 306, Issue 6.

36. *Today, one particular species does this brilliantly. Described as "the most important microbe you've never heard of," Prochlorococcus is responsible for manufacturing a full 20 percent of the oxygen we breathe.*

Earle, Sylvia. TIL: 20% of Our Oxygen Comes From a Bacteria. *National Geographic*. Retrieved from: <https://video.nationalgeographic.com/video/til/160322-sciex-sylvia-earle-oxygen-bacteria>

37. *So far only .0001% of microbial species are known to science.*

Bakalar, Nicholas. 'Earth May Be Home to a Trillion Species of Microbes' in *New York Times*. (2016, May 23). Retrieved from: <https://www.nytimes.com/2016/05/24/science/one-trillion-microbes-on-earth.html>

38. *Our planet is surrounded by a literal bubble of bacteria.*

Warren, Stephanie. 'Bacteria Live At 33,000 Feet' in *Popular Science*. (2013, June 19). Retrieved from: <https://www.popsci.com/science/article/2013-06/bacteria-33000-feet>

39. *size is arguably the most important attribute of an animal's existence.*

Bartholomew, G. A. A Matter of Size. cit in *Scaling in Biology*. New York, New York: Oxford University Press, 2000, p.1

40. *Small animals tend to live shorter lives.*

Baggaley, Kate. 'Look to large bodies to understand long life spans' *Popular Science*. (2018, March 19). Retrieved from: <https://www.popsci.com/why-do-bigger-animals-live-longer-than-small-ones>

41. *...hundreds of thousands of single-celled bacteria could fit in the same space.*

Wong, Joyce. 'Diameter of a Bacterium'. *The Physics Factbook*. (2006) Retrieved from: <https://hypertextbook.com/facts/2001/JoyceWong.shtml>

42. *The largest recorded ape primate in the fossil record was Gigantopithecus blacki a three-metre-tall ape. It was doomed by its size in a different manner, however. During the Ice Age, the food supply became insufficient to support the giant ape.*

Strauss, Mark. 'The Largest Ape That Ever Lived Was Doomed By Its Size'. *National Geographic*. (2016, January 5). Retrieved from:  
<http://news.nationalgeographic.com/2016/01/160106-science-evolution-apes-giant/>

43. *"Who does not know that a horse falling from a height of three or four cubits will break his bones, while a dog falling from the same height or a cat from a height of eight or ten cubits will suffer no injury?"*

Galileo Galilei, *Dialogues Concerning Two New Sciences*. (1638) Retrieved from Online Library of Liberty: <http://oll.libertyfund.org/titles/galilei-dialogues-concerning-two-new-sciences>

44. For more on size I direct the reader to Haldane's paper 'On Being the Right Size.'

Haldane, J.S. 'On Being the Right Size' (1928) Retrieved from:  
<https://irl.cs.ucla.edu/papers/right-size.html>

45. *Another factor that scientists believe may affect how marine animals grow to be big in water has to do with loss of heat.*

Yong, Ed. 'Why Whales Got So Big'. *The Atlantic*. (2018, April 4). Retrieved from:  
[https://www.theatlantic.com/science/archive/2018/04/why-whales-got-so-big/557213/?utm\\_source=twb](https://www.theatlantic.com/science/archive/2018/04/why-whales-got-so-big/557213/?utm_source=twb)

46. *this was the age of giants. In this ancient world, mushrooms rose up to the height of houses*

Schultz, Colin. 'Long Before Trees Overtook the Land, Earth Was Covered by Giant Mushrooms'. *Smithsonian.com*. (2013, July 17). Retrieved from:  
<https://www.smithsonianmag.com/smart-news/long-before-trees-overtook-the-land-earth-was-covered-by-giant-mushrooms-13709647/>

47. *Kirkpatrick Sale describes the problem, like this: "If an earthworm were ten times bigger, its weight would be a thousand times greater..."*

Sale, Kirkpatrick. *Human Scale*. Gabriola Island, BC: New Catalyst Books. 2007. p 60

48. *Having a larger volume to surface area also meant that the oxygen amount would still be relative to body size, so the animals wouldn't die from oxygen toxicity either.*

Than, Ker. 'Why Giant Bugs Once Roamed the Earth'. *National Geographic News*. (2011, August 9). Retrieved from. <https://news.nationalgeographic.com/news/2011/08/110808-ancient-insects-bugs-giants-oxygen-animals-science/>

49. *Generally speaking however, over the last 500 million years, the trend has been toward animals getting larger. Marine animals in particular, have increased in size, over 150 fold.*

Than, Ker. 'Animals tend to evolve toward larger sizes over time, Stanford study finds'. *Stanford News*. (2015, February 19). Retrieved from: <http://news.stanford.edu/2015/02/19/body-size-evolution-021915/>

50. *As always, there are exceptions. For instance, climate change is making wolf spiders bigger.*

Machemer, Theresa. 'Climate Change Makes Spiders Bigger—And That's a Good Thing.' *National Geographic*. (2018, July 23). Retrieved from: <https://www.nationalgeographic.com/animals/2018/07/wolf-spider-arctic-climate-change-news/>

51. *Around the world, species in every category - fish, bird, amphibian, reptile and mammal - have been found decreasing in size, and one key culprit appears to be the heat.*

Nicholls, Henry. 'Withering heights: Why animals are shrinking'. *New Scientist*. (2013, February 6) Retrieved from: <https://www.newscientist.com/article/mg21729032-500-withering-heights-why-animals-are-shrinking/>

52. *To avoid overheating, chamois goats now spend more of their days resting rather than foraging, and as a result, in just a few decades, the new generations of chamois are 25 percent smaller, and are dwarfs by comparison.*

Howard, Brian Clark. 'Mountain Goats Are Shrinking—A Lot—Because of Global Warming'. *National Geographic*. (2014, October 24). Retrieved from: <https://news.nationalgeographic.com/news/2014/10/141022-chamois-mountain-goats-shrinking-climate-change-global-warming/>

Douglass, Michelle. 'When animals shrink to miniature form. *BBC Earth*. (2015, October 27) Retrieved from: <http://www.bbc.com/earth/story/20151021-when-animals-shrink-to-miniature-form>

53. *Scientists studying six hundred species of fish say that big size changes are coming, and that by 2050 fish will have shrunk by as much as a quarter.*

Cheung, William W. L., Sarmiento, Jorge L., Dunne, John, Frölicher, Thomas L., Lam, Vicky W. Y., Palomares, M. L. Deng, Watson, Reg, Pauly, Daniel. Shrinking of fishes exacerbates impacts of global ocean changes on marine ecosystems. *Nature Climate Change* volume 3, pages 254–258 (2013). Retrieved from: <https://www.nature.com/articles/nclimate1691>

54. *Looking at commercial whaling data over four decades, researchers documented that sperm whales shrank substantially...*

Whiting, Natalie. 'Shrinking whales study could lead to early warning system for endangered species'. *ABC News*. (2017, June 22). Retrieved from: <http://www.abc.net.au/news/2017-06-23/whales-shrinking-before-population-collapse-researchers-find/8643616>

55. *This allows researchers to measure commercially selected breeds, like the 2005 Ross 308 Broiler against older genetic strains*

Zuidhof et al. "Growth, efficiency, and yield of commercial broilers from 1957, 1978, and 2005."

*Poultry Science*, Advanced Access, (2014) doi: 10.3382/ps.2014-04291, Figure 1) Retrieved from: <https://www.ncbi.nlm.nih.gov/pubmed/25260522>

56. *The average consumption of both red meat and poultry in 1960 was 75.3 kilograms, in 2017 it was projected at 98.8.*

'Per Capita Consumption of Poultry and Livestock, 1965 to Estimated 2018, in Pounds.'

*National Chicken Council*. Retrieved from: <http://www.nationalchickencouncil.org/about-the-industry/statistics/per-capita-consumption-of-poultry-and-livestock-1965-to-estimated-2012-in-pounds/>

57. *In industrialized countries, where is food abundant, we've grown taller by four inches, or 10 centimetres.*

Dougherty, Michael J. 'Why are we getting taller as a species?' *Scientific American*. Retrieved from: <https://www.scientificamerican.com/article/why-are-we-getting-taller/>

58. *In total, 2.2 billion people worldwide are classified as overweight or obese*

Ferris, Robert. 'More than 2 billion people are overweight or obese worldwide, says study'. *CNBC*. (2017, June 12). Retrieved from: <https://www.cnbc.com/2017/06/12/more-than-2-billion-people-are-overweight-or-obese-worldwide-says-study.html>

59. *The first published observations using a microscope were in Galileo's Apiarium in 1625. He first observed the flea with a microscope in 1624.*

Grens, Kerry. 'Apiarium, 1625'. *The Scientist*. (2015, March 1). Retrieved from: <https://www.the-scientist.com/foundations/apiarium-1625-35869>

Amici, Roncalli R. 'The history of the flea in art and literature.' *Parassitologia*. 2004 Jun; 46(1-2):15-8.

Retrieved from: <https://www.ncbi.nlm.nih.gov/pubmed/15305680>

60. *There are three people associated with the invention of the telescope as two patents were filed within weeks of each other. Zacharias Janssen is often also cited as an inventor. Early telescopes were very simple, they were made of two pieces of glass held apart to magnify distant objects.*

Cox, Lauren. 'Who Invented the Telescope?' *Space.com*. (2017, December 20). Retrieved from: <https://www.space.com/21950-who-invented-the-telescope.html>

61. *In 1609, he created a device that he named the occholino, or "little eye," a microscope that could magnify up to thirty times ten times more than Janssen's design.*

Zacharias Janssen. *Science, Optics and You. Pioneers in Optics*. Retrieved from: <https://micro.magnet.fsu.edu/optics/timeline/people/janssen.html>

62. On a clear night, a person with good eyesight can detect the flicker of a single candle flame  
29 2.76 kilometres away.

'How Far Can the Human Eye See a Candle Flame?' *MIT Technology Review*. (2015, July 31). Retrieved from: <https://www.technologyreview.com/s/539826/how-far-can-the-human-eye-see-a-candle-flame/>

63. *Our ability to detect light is so powerful, that scientists recently discovered that, up close, we can even detect the faintest glimmer from the light of a single photon.*

Smith, Belinda. 'Humans can see a single photon at a time.' *Cosmos Magazine*. (2016, July 20). Retrieved from: <https://cosmosmagazine.com/biology/humans-can-detect-a-single-photon-at-a-time>

64. *The ancient Mizar test has been found to be the modern tested equivalent of 20/20 acuity.*

Bohigian, GM., 'An ancient eye test--using the stars.' *Surv Ophthalmol*. 2008 Sep-Oct;53(5):536-9. Retrieved from: <https://www.ncbi.nlm.nih.gov/pubmed/18929764>

65. *Galileo too, had entrepreneurial designs for his telescope which he pitched to the Venetians: "The power of my cannocchiale [telescope] to show distant objects as clearly as if they were near should give us an inestimable advantage in any military action on land or sea..."*

'The First Telescope.' *Science Clarified*. Retrieved from: <http://www.scienceclarified.com/scitech/Telescopes/The-First-Telescope.html>

66. *The seven axioms of heliocentrism are: "(1) There is no one center in the universe; (2) The Earth's center is not the center of the universe; (3) The center of the universe is near the sun; (4) The distance from the Earth to the sun is imperceptible compared with the distance to the stars; (5) The rotation of the Earth accounts for the apparent daily rotation of the stars; (6) The apparent annual cycle of movements of the sun is caused by the Earth revolving round it. (7) The apparent retrograde motion of the planets is caused by the motion of the Earth from which one observes."*

Source: Shaer, Matthew. 'How Nicolaus Copernicus rewrote the rules of the solar system'. *The Christian Science Monitor*. (2013, February 19). Retrieved from:

<https://www.csmonitor.com/Technology/2013/0219/How-Nicolaus-Copernicus-rewrote-the-rules-of-the-solar-system>

67. *They trained the Hubble Ultra Deep Field telescope on a patch next to the moon...*

Plait, Phil. 'A Hundred Billion Galaxies' in Bad Astronomy. *Slate*. (2016, April 7). Retrieved from:

[http://www.slate.com/blogs/bad\\_astronomy/2016/04/07/hubble\\_image\\_of\\_galaxies\\_in\\_sculptor\\_implies\\_100\\_billion\\_galaxies\\_in\\_the.html](http://www.slate.com/blogs/bad_astronomy/2016/04/07/hubble_image_of_galaxies_in_sculptor_implies_100_billion_galaxies_in_the.html)

68. *Using new techniques, researchers have re-imaged the data and calculated that some galaxies may be nearly twice as big as previously thought.*

Williams, Matt. 'Astronomers Process Hubble's Deepest Image to get Even More Data, and Show that Some Galaxies are Twice as big as Previously Believed.' *Universe Today*. (2019, January 31). Retrieved from: <https://www.universetoday.com/141379/astronomers-process-hubbles-deepest-image-to-get-even-more-data-and-show-that-some-galaxies-are-twice-as-big-as-previously-believed/>

69. *"The faintest galaxies are one ten-billionth the brightness of what the human eye can see."*

'Hubble Goes to the eXtreme to Assemble Farthest-Ever View of the Universe'. *NASA*. (2012, September 25). Retrieved from: [https://www.nasa.gov/mission\\_pages/hubble/science/xdf.html](https://www.nasa.gov/mission_pages/hubble/science/xdf.html)

70. *"We are very bad at scale. The things that live in the soil are too small to care about; climate change is too large to imagine."*

Macdonald, Helen. *H is for Hawk*. Toronto, Ontario: Hamish Hamilton, 2014.

71. *The number in football fields is just as mind-numbing and hard to fathom: 60,720,000 football fields.*

'How Many Acres is a Football Field?' [Stack.com](http://www.stack.com/a/how-many-acres-is-a-football-field). Retrieved from: <http://www.stack.com/a/how-many-acres-is-a-football-field>

72. *What the team found, was that whether the number of oil-slicked birds was 2000, 20,000 or 200,000 the financial offer of help was about the same.*

Desvousges, William H., Johnson, F. Reed, Dunford, Richard W., Boyle, Kevin J., Hudson, Sara P., and Wilson, K. Nicole. 'Measuring nonuse damages using contingent valuation'. RTI Press. (1992, January). Retrieved from: <https://www.rti.org/rti-press-publication/measuring-nonuse-damages-using-contingent-valuation/fulltext.pdf>

73. *As Carl Sagan has noted: "Common sense works fine for the universe we're used to, for time scales of decades..."*

Sagan, Carl. *Conversations with Carl Sagan*. Ed. Tom Head. Jackson, Miss: University Press of Mississippi, 2006. p. 61

74. *Galileo was so controversial it took 350 years for the Catholic Church to officially concede, in 1992, that he and Copernicus were right.*

75. “In the long run my observations have convinced me that some men, reasoning preposterously, first establish some conclusion in their minds which, either because of its being their own...”

Galileo Galilei, *Dialogues Concerning Two New Sciences*. (1638) Retrieved from Online Library of Liberty: <http://oll.libertyfund.org/titles/galilei-dialogues-concerning-two-new-sciences>

76. *Today, it is on display at Florence’s Galileo Museum.*

‘Galileo's fingers to be displayed in Florence science museum’. *The Guardian*. (2010, June 8). Retrieved from: <https://www.theguardian.com/culture/2010/jun/08/galileo-fingers-museum-florence>

## Chapter 2

1. *“The flame is...merely a hot gas. Like any source of light, it emits photons or tiny packets of waves of electromagnetic energy...”*

Lanza, Robert & Berman, Bob. *Biocentrism: How Life and consciousness are the Keys to Understanding the True Nature of the Universe*. Dallas, TX: Benbella Books, 2010. p20-21.

2. *In a 1955 letter he wrote: “It is basic for physics that one assumes a real world existing independently from any act of perception. But this we do not know.” [original emphasis]*

Einstein, Albert. Letter to M. Laserna. (1955, January 8). Cit in Laurikainen K V, Montonen Claus. *Foundations Of Modern Physics 1992 - Proceedings Of The Symposium*. Helsinki Finland. (1992, June-August)

3. *Sixty-five billion solar neutrinos pass through one square centimetre perpendicular to the sun per second.*

Keen, James. ‘Nobel Neutrinos’. *Scitable by Nature Education*. (2015, October 6). Retrieved from: [https://www.nature.com/scitable/blog/pop/nobel\\_neutrinos](https://www.nature.com/scitable/blog/pop/nobel_neutrinos)

4. The image created by the neutrinos is called a neutrino-graph.

Personal communication. Professor Janet Conrad. Laboratory for Nuclear Science. Massachusetts Institute of Technology.

5. Lord Londesborough, *At Home, 144 Piccadilly. A Mummy From Thebes to be unrolled at half-past Two — Formal invitation, 1850*

Wisseman, Sarah U. *The Virtual Mummy*. Urbana & Chicago: University of Illinois Press, 2003. p.2

6. *As French aristocrat Abbot Ferdinand de Géramb wrote in 1833: “it would be hardly respectable, on one’s return from Egypt, to present oneself without a mummy in one hand and a crocodile in the other.”*

Nikolaidou, Dimitra. ‘Victorian Party People Unrolled Mummies For Fun’. *Atlas Obscura*. (2016, February 23). Retrieved from: <http://www.atlasobscura.com/articles/victorian-party-people-unrolled-mummies-for-fun>

7. *as one author noted, X-rays became like the iPhones of the 1890s.*

Thompson, Helen. ‘CT scans show first X-rayed mummy in new light’. *ScienceNews*. (2016, October 5). Retrieved from: <https://www.sciencenews.org/article/ct-scans-show-first-x-rayed-mummy-new-light>

8. *only months after the X-ray’s debut, that physicist Walter Koenig scanned the mummy of an Egyptian child, pioneering a non-invasive way to examine human remains, preserving them for posterity.*

Zesch S, Panzer S, Rosendahl W, Nance JW, Schönberg SO, Henzler T. From first to latest imaging technology: Revisiting the first mummy investigated with X-ray in 1896 by using dual-source computed tomography. *European Journal of Radiology Open*. 2016;3:172-181. Retrieved from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4968187/>

9. *At fun-fairs and carnivals, “bone portraits” became a new attraction...*

Gurley, La Verne Tolley & Callaway, William J. *Introduction to Radiologic Technology*. Maryland Heights, MO: Elsevier Mosby. p60-1.

10. *X-rays revealed that a lifetime spent bound in tight hourglass corsets had bent their ribs and crushed their organs.*

The images from *Le Corset* (1908) by O’Followell. *Wikimedia*. Retrieved from: [https://commons.wikimedia.org/wiki/Le\\_Corset\\_%281908%29](https://commons.wikimedia.org/wiki/Le_Corset_%281908%29)

11. *over 75 studios across the US. The women coming in for hair removal on their upper lips, were subjected to up to 20 doses of radiation.*

‘Tricho System: In the early 1920's the Tricho System used x-rays to remove superfluous hair.’ in *Museum of Quackery*. Retrieved from: <http://www.museumofquackery.com/ephemera/tricho.htm>

12. *As with any boom, for a while, the X-ray business was a free-for-all, and anyone, whether they were a builder, pharmacist, or wine-dealer could open up their own lab, and be considered competent enough to read a radiograph.*

Munich, Adam. 'A brief history of the X-Ray.' (2012, December 29). Retrieved from: <http://adammunich.com/a-brief-history-of-the-x-ray/>

13. *The X-ray craze began to fall out of favour as more and more reports came in of non-deliberate hair loss, blisters, swelling and burns, as well as cancer, and even death.*

Sansare K, Khanna V, Karjodkar F. Early victims of X-rays: a tribute and current perception. *Dentomaxillofacial Radiology*. 2011;40(2):123-125. Retrieved from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3520298/>

14. *DNA itself was first imaged using X-rays.*

'DNA: X-ray diffraction from fibrous DNA tipped off Watson, Crick to double helix' in *Chemical and Engineering News*. (2014, August 11) Retrieved from: <http://cen.xraycrystals.org/dna.html>

15. *For all of us then, the very force that keeps us alive, began as a spectacular death in a solar system.*

Thaller, Michelle. 'We Are Dead Stars'. *TEDxBaltimore*. (2016, February 3). Retrieved from: <https://www.youtube.com/watch?v=YAV96XSdMQo>

16. *Our own sun fuses approximately 620 million metric tons of hydrogen into helium every second.*

'Sun.' *National Geographic Encyclopedia*. Retrieved from: <https://www.nationalgeographic.org/encyclopedia/sun/>

17. *The astute reader will have noticed that we skipped from helium to carbon - and that the lighter elements of lithium, beryllium, and boron should be in between. These elements are cosmically created in a different fashion, when a heavier element is hit by cosmic rays.*

Siegel, Ethan. 'The Only Three Heavy Elements In The Universe That Aren't Made In Stars'. *Forbes*. (2015, July 1). Retrieved from: <https://www.forbes.com/sites/ethansiegel/2015/07/01/the-only-three-heavy-elements-in-the-universe-that-arent-made-in-stars/#7b0e253f39e6>

18. *Iron cannot release energy by fusion because it requires a larger input of energy than it releases.*

'Q: Why does iron kill stars?' *Ask a Mathematician / Ask a Physicist*. (2013, November 22). Retrieved from: <http://www.askamathematician.com/2013/11/q-why-does-iron-kill-stars/>

26. It is from this stellar explosion that the primary elements in the periodic table are made. ‘Supernova Explosions’. *Las Cumbres Observatory*. Retrieved from: <https://lco.global/spacebook/supernova/>

19. *Some elements, like gold, are made from the explosive collision of neutron stars.*

Achenbach, Joel. ‘Origin of gold is likely in rare neutron-star collisions’ *Washington Post*. (2013, July 17. Retrieved from: [https://www.washingtonpost.com/national/health-science/origin-of-gold-found-in-rare-neutron-star-collisions/2013/07/17/a158bd46-eef2-11e2-bed3-b9b6fe264871\\_story.html](https://www.washingtonpost.com/national/health-science/origin-of-gold-found-in-rare-neutron-star-collisions/2013/07/17/a158bd46-eef2-11e2-bed3-b9b6fe264871_story.html)

20. *The process is known as “intergalactic transfer”, and astrophysicists at Northwestern University have calculated that approximated half of the matter that makes up our bodies, is not even from the Milky Way’.*

Fellman, Megan. ‘Milky Way’s origins are not what they seem: Study reveals that half of matter around us likely comes from far-flung galaxies’. *Northwestern Now*. (2017, July 26). Retrieved from: <https://news.northwestern.edu/stories/2017/july/milky-way-origin-matter-galaxy/>

21. *Caleb Scharf writes in Zoomable Universe: “In simple terms, we all condensed...”*

Schar, Caleb. *The Zoomable Universe: An Epic Tour through Cosmic Scale, from Almost Everything to Nearly Nothing*. New York: Farrar, Straus & Girous. Ebook: loc 357, loc 350

22. *Locked up in glaciers, it rests for longer, from thousands to hundreds of thousands of years.*

‘The Water Cycle’. *UCAR Center for Science Education*. Retrieved from: <https://scied.ucar.edu/longcontent/water-cycle>

23. *and the dinosaurs that roamed as giants, over the last 230 to 65 million years.*

Schrijver, Karel & Schrijver Iris. *Living with the stars: How the human Body is connected to the life cycles of the earth, the planets, and the stars*. Oxford, UK: Oxford University Press. p. 146-7

24. *Clench created an “After Life” garden...*

Seaman, Callie, Flinders, Bryn, Eijkel, Bryn, Heeren, Ron M. A., Bricklebank, Neil, and Clench. Malcolm R. “‘Afterlife Experiment’: Use of MALDI-MS and SIMS Imaging for the Study of the Nitrogen Cycle within Plants’. *Analytical Chemistry*. 2014, 86, 10071–10077

25. *Sitka spruce trees growing by the salmon riverbanks take around eighty years to reach 50 cm in thickness; their salmon-less counterparts in the interior however, take more than three times that long to grow, requiring on average, three centuries.*

Baron, Nancy. 'Salmon Trees.' *Hakai Magazine*. (2015, April 22) Retrieved from: <https://www.hakaimagazine.com/features/salmon-trees/>

26. *After death, for every kilogram of dry body mass, the average human body releases 32g of nitrogen, 10g of phosphorous, 4g of potassium and 1g of magnesium into the soil of a grave site.*

Hansford, Dave. 'Game over: We all hope our lives will have meaning. But for the agents of biochemistry, our deaths are just another job number.' *New Zealand Geographic*. Retrieved from: <https://www.nzgeo.com/stories/game-over/>

27. *even 16 kilometres away, observers felt like they were "standing directly in front of a roaring fireplace."*

Williams, Calum. 'Beginnings of the atomic age: the 70th anniversary of the first nuclear bomb'. *Extreme Tech*. (2015, July 20) Retrieved from: <https://www.extremetech.com/extreme/210282-beginning-the-atomic-age-70th-anniversary-of-the-first-nuclear-bomb>

28. *When DNA replicates, 30% is carbon.*

Frisén, Jonas. 'New Cells in Old Bodies.' Karolinska Institutet. (2011, November). Retrieved from: <https://www.youtube.com/watch?v=W60TDem8vuI>

29. *As the bomb-pulse radiocarbon decreases by 1 percent per year, by 2030 the bomb pulse will die out. That's because organisms born after this time will no longer have any significant spikes of the bomb pulse traces, and so their cells will not be able to be timed. That is, unless we set off more bombs.*

'Elements.' *RadioLab* podcast. (2015, August 23). Retrieved from: <https://www.wnycstudios.org/story/elements>

30. *And while it is true that you lose, on average, about 50 billion cells a day...*

Reed JC. Apoptosis and Cancer. In: Kufe DW, Pollock RE, Weichselbaum RR, et al., editors. *Holland-Frei Cancer Medicine*. 6th edition. Hamilton (ON): BC Decker; 2003. Chapter 4. Retrieved from: <https://www.ncbi.nlm.nih.gov/books/NBK12580/>

31. *you will still have about half of the original heart that you were born with.*

Bergmann O, Bhardwaj RD, Bernard S, et al. Evidence for cardiomyocyte renewal in humans. *Science* (New York, NY). 2009;324(5923):98-102. Retrieved from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2991140/>

31. *Her cells contained more carbon-14 from the bomb pulse. The last cells were formed in the other sister's body in 1989, meaning she must have lived alongside her dead sister's decomposing body before dying herself the following year.*

Grimm, David. 'The Mushroom Cloud's Silver Lining'. *Science*. Vol 321. (2008, September 12).

32. *Lanza and Berman write in Biocentrism: "entire religions (three of the four branches of Buddhism, Zen, and the mainstream Advaita Vedānta..."*

Lanza, Robert & Berman, Bob. *Biocentrism: How Life and consciousness are the Keys to Understanding the True Nature of the Universe*. Dallas, TX: Benbella Books, 2010. p34

33. *A flower, he explains, cannot exist as an isolated thing, because it is intimately connected to everything around it: "Looking into a flower, you can see that the flower is made of many elements..."*

Thich Nhat Hanh, 'The Island of Self: The Three Dharma Seals.' 1998. Cit in. 'Inter-Being: Awakening from the Illusion of Separateness.' Retrieved from: <https://creativesystemsthinking.wordpress.com/2015/04/30/inter-being-awakening-from-the-illusion-of-separateness/>

34. *As NASA astronomer Dr Michelle Thaller has observed, in reality, "we are dead stars, looking back up at the sky"*

Thaller, Michelle. 'We Are Dead Stars'. *TEDxBaltimore*. (2016, February 3). Retrieved from: <https://www.youtube.com/watch?v=YAV96XSdMQo>

### Chapter 3

1. *The chimpanzees had come to the spot, just as he had, to simply sit and watch the beauty of the sunset.*

Teleki, Geza. 'They Are Us.' In Cavalierie, Paola & Singer, Peter (eds.), *The Great Ape Project* New York: St. Martin's Griffin, 1993, pp. 296-302

2. *"the civilization of a city can be measured by this."*

Cirinna, Monica. *Il Messaggero*. Cit in. 'Rome bans 'cruel' goldfish bowls'. *CBC News*. (2005, October 26). Retrieved from: <https://www.cbc.ca/news/world/rome-bans-cruel-goldfish-bowls-1.556045>

3. *This special ability gave researchers at the University of Oxford and the University of Queensland an idea: they wanted to see if the fish's accuracy and keen eyesight could be used in another way.*

University of Oxford. "Fish can recognize human faces, study shows." *ScienceDaily*, (2015, June 7). Retrieved from: <http://www.sciencedaily.com/releases/2016/06/160607080356.htm>

4. *The study has since been updated to include 3D renderings of faces. It was found that “the fish were able to continue to recognize that image even when the face was rotated by 30, 60, and 90 degrees, from a frontal view to a profile.”*

Bittel, Jason. ‘Water-spitting fish can identify and remember human faces’. National Geographic. (2018, October 18). Retrieved from: <https://www.nationalgeographic.com/animals/2018/10/archerfish-animal-cognition-intelligence-human-faces-news/?user.testname=lazyloading:1>

5. *The pigeons were amazingly accurate, making a correct identification, even on new images, at a rate of 85 percent.*

Stetka, Bret. ‘Using Pigeons to Diagnose Cancer’. *Scientific American*. (2015, December 1). Retrieved from: <https://www.scientificamerican.com/article/using-pigeons-to-diagnose-cancer/>

6. *“This is what makes the elephant, the bat, the dolphin, the octopus, and the star-nosed mole so intriguing...”*

Waal, Frans. *Are We Smart Enough to Know How Smart Animals Are*. New York, NY: W.W. Norton & Company, 2016. p238

7. *Our eyesight, for example, is limited to a mere .0035% of the electromagnetic spectrum.*

Yomna Abdelrahman, Albrecht Schmidt, Pascal Knierim. Snake view: exploring thermal imaging as a vision extender in mountains. UbiComp/ISWC Adjunct. (2017). DOI:10.1145/3123024.3124450

8. *As Phil Morrison writes in the foreward of Super Vision: “Go in one direction from the visible portion of the electromagnetic spectrum, and the last bit of violet fades out...”*

Amato, Ivan. *Super Vision: A new view of nature*. New York, NY: Harry N. Abrams, 2003. p18

9. *In this way, a viper can “see” a warm-blooded mouse in the dark.*

‘Snakes’ heat vision enables accurate attacks on prey’. [phys.org](http://phys.org). (2006, August 31). Retrieved from: <https://phys.org/news/2006-08-snakes-vision-enables-accurate-prey.html>

10. *While previous studies have made this suggestion, a new study scrutinizes the finding. For now, more research is required.*

Lind, Olle; Mitkus, Mindaugas; Olsson, Peter Olsson & Kelber, Almut. Ultraviolet sensitivity and colour vision in raptor foraging. *Journal of Experimental Biology* 2013 216: 1819-1826. Retrieved from: <http://jeb.biologists.org/content/216/10/1819.long>

11. *Bees can see form the 600 to 300 nm range. How do we know what a bee can see? “We can find out whether an animal can see light of a particular wavelength by testing whether that light*

*will travel through the lens of its eye. The lenses of healthy humans block ultraviolet light, so we cannot see it. But for other species, seeing ultraviolet can make it easier to see in dim light.”*

Baraniuk, Chris. ‘How do we know what animals can see, hear and smell?’ *BBC Earth*. (2015, October 19). Retrieved from: <http://www.bbc.com/earth/story/20151019-how-do-we-know-what-animals-can-see-hear-and-smell>

12. *eagles have 20/5 vision*

Wolchover, Natalie. ‘What If Humans Had Eagle Vision?’ *Live Science*. (2012, February 24). Retrieved from: <https://www.livescience.com/18658-humans-eagle-vision.html>

13. *That said, comparatively speaking, on tests of human visual acuity, we can see detail very well compared to most species. Researchers who studied six hundred animal species found that human sight is about seven times sharper than a cat’s, forty to sixty sharper than that of a rat or a goldfish, and hundreds of times sharper than a fly’s or a mosquito’s.*

Duke University. ‘Details that look sharp to people may be blurry to their pets’. [phys.org](http://phys.org). (2018, May 30). Retrieved from: <https://phys.org/news/2018-05-sharp-people-blurry-pets.html>

14. *the beetles were navigating by looking up at the Milky Way.*

Dell’Amore, Christine. ‘Dung Beetles Navigate Via the Milky Way, First Known in Animal Kingdom’. *National Geographic*. (2013, January 24). Retrieved from: <https://blog.nationalgeographic.org/2013/01/24/dung-beetles-navigate-via-the-milky-way-first-known-in-animal-kingdom/>

15. *dragonflies see at 300 frames per second.*

‘Eyes see 300 images per second’. *Ask Nature*. (2018, October 14). Retrieved from: <https://asknature.org/strategy/eyes-see-300-images-per-second/>

16. *Concetta Antico, a tetrachromat has described it as “seeing colors in other colors.”*

Robson, David. ‘The women with superhuman vision’. *BBC Future*. (2014, September 5). Retrieved from: <http://www.bbc.com/future/story/20140905-the-women-with-super-human-vision>

17. *The aphakics were brought in to send in alerts when they saw the UV rays, which were invisible to everyone else.*

Hambling, David. ‘Let the light shine in’. *The Guardian*. (2002, May 30). Retrieved from: <https://www.theguardian.com/science/2002/may/30/medicalscience.research>

See also:

Signaling by Invisible Rays United States Naval Institute Proceedings, Volume 46, pages 1366-1368 both infra-red and ultraviolet, were used during the war. The article explains how professor R. W. Wood further developed such ultraviolet ship signaling technology for France. Devices had a range of up to 6 miles.

In *The Military Engineer*, Volume 23, there is a heading "Germany, Heerestechnik, November 1930, Work Done during the War on Direct-Ray Telephony", after which it refers to an article "Ultra-violet or Ultra-red Rays" by Leo Lowenstein.

18. *What he saw was confounding: from "the dune line to the water line," the entire beach was glowing a bright orange.*

Denuccio, Kyle. The Toxic Gulf: The uncalculated aftermath of the deepwater horizon oil spill'. *Surfer*. (2012, July 18). Retrieved from: <https://www.surfer.com/features/the-toxic-gulf/>

19. *Scientists would later discover that the combination of the oil and dispersant made it 52 times more toxic.*

Main, Douglas. 'Dispersant Makes Oil 52 Times More Toxic'. *Live Science*. (2012, November 30). Retrieved from: <https://www.livescience.com/25159-oil-dispersant-increases-toxicity.html>

20. *"The entire [cleanup] operation has been geared around making things invisible..."*

Denuccio, Kyle. The Toxic Gulf: The uncalculated aftermath of the deepwater horizon oil spill'. *Surfer*. (2012, July 18). Retrieved from: <https://www.surfer.com/features/the-toxic-gulf/>

21. *In his notes, he wrote: "Thus with a pair of scissors I removed completely the eye-balls in a bat..."*

Dijkgraaf, Sven. Spallanzani's Unpublished Experiments on the Sensory Basis of Object Perception in Bats'. *Isis*, Vol. 51, No. 1 (Mar., 1960), pp. 9-20. Published by: The University of Chicago Press on behalf of The History of Science Society.

22. *Researchers at Kewalo Basin Marine Mammal Laboratory in Hawaii put a dolphin named Elele to the test...*

Altom, Helen. 'Dolphins' sonar found to rival eyesight: Hawaii experiments show they can sense shapes acoustically'. *Star Bulletin*. (2002, July 5). Retrieved from: <http://archives.starbulletin.com/2002/07/05/news/story4.html>

23. *Researchers studying Kish's brain activity using MRI*

Thaler, Lore, Arnott, Stephen R., and Goodale, Melvyn A. Neural Correlates of Natural Human Echolocation in Early and Late Blind Echolocation Experts. *PLOS One*. (2011, May 25). Retrieved from: <https://doi.org/10.1371/journal.pone.0020162>

24. *Untrained bees, only 'scored' by chance 30% of the time.*

Loukola, Olli J., Perry, Clint J., Coscos, Louie, & Chittka, Lars. Bumblebees show cognitive flexibility by improving on an observed complex behavior. *Science*. (2017, February 24). 833-836. Retrieved from: <http://science.sciencemag.org/content/355/6327/833>

25. *Pridmore had an accuracy of only 33%, while Ayumu was correct 90% of the time.*

'Chimps with Photographic Memories'. *Neuroanthropology*. (2008, December 10). Retrieved from: <https://neuroanthropology.net/2008/12/10/chimps-with-photographic-memories/>

26. *"What color?" Kathy said: "Gray. You're a gray parrot, Alex."*

Pepperberg, Irene. *Alex & Me: How a Scientist and a Parrot Discovered a Hidden World of Animal Intelligence--and Formed a Deep Bond in the Process*. New York, NY: Harper Collins, 2009. p.97

27. *The first time she saw a zebra, for example, she described it as a "white tiger"...*

Pepperberg, Irene. *Alex & Me: How a Scientist and a Parrot Discovered a Hidden World of Animal Intelligence--and Formed a Deep Bond in the Process*. New York, NY: Harper Collins, 2009. p.83

28. *the first ape to learn ASL: "About 50 years ago, on a pond in Oklahoma*

Linden, Eugene. 'How Koko the gorilla and a chimp named Washoe changed the way humans view their relationship with animals'. *LA Times*. (2018, July 8). Retrieved from: <http://www.latimes.com/opinion/op-ed/la-oe-linden-koko-washoe-animal-sentience-20180708-story.html>

29. *In Norway, scientists came up with a clever way to do this by training horses to communicate with symbols.*

Mejdell, Cecilie M. et al. Horses can learn to use symbols to communicate their preferences. *Applied Animal Behaviour Science*, Volume 184, 66 - 73. Retrieved from: [https://www.appliedanimalbehaviour.com/article/S0168-1591\(16\)30219-2/fulltext](https://www.appliedanimalbehaviour.com/article/S0168-1591(16)30219-2/fulltext)

30. *Asked to carry the TV set outdoors, Kanzi got up, looked around, spotted the TV set and then immediately carried it outside.*

Savage-Rimbaugh, Sue. 'Kanzi and Novel Sentences'. Iowa Primate LearningSanctuary. (2009, January 9). Retrieved from: <https://www.youtube.com/watch?v=2Dhc2zePJFE>

31. *Rachel Nuwer has observed, in trying to "force apes to learn our language, we may have may blinded ourselves to theirs."*

Nuwer, Rachel. 'To Communicate With Apes, We Must Do It On Their Terms'. *NOVA Next*. (2018, April 25). Retrieved from: <http://www.pbs.org/wgbh/nova/next/nature/to-communicate-with-apes-we-must-do-it-on-their-terms/>

32. *Barks for 'human', 'hawk', 'coyote' and 'dog' all have signature acoustic sonograms with differing wavelengths and amplitudes.*

Prairie Dogs: America's Meerkats - Language. (2011, May 8). Retrieved from: <https://www.youtube.com/watch?v=y1kXCh496U0>

Jabr, Ferris. 'Can Prairie Dogs Talk?' *New York Times*. (2017, May 12). Retrieved from: <https://www.nytimes.com/2017/05/12/magazine/can-prairie-dogs-talk.html>

Slobodchikov, C. N., Paseka, C. N. & Verdolin, Jennifer L. Prairie dog alarm calls encode labels about predator colours. *Anim Cogn* (2009) 12: 435. <https://doi.org/10.1007/s10071-008-0203-y>

33. *Robert Seyfarth has done similar work with Vervet monkeys*

Seyfarth, Robert. 'Can Monkeys Talk?'. *Richard Dawkins Foundation for Reason & Science*. (2010, May 18). Retrieved from: <https://www.youtube.com/watch?v=3lsF83rHKFc>

34. *The prairie dogs seemed unable to tell the difference between a square and a circle.*

Slobodchikoff, C.N.; Briggs, William R.; Dennis, Patricia A; Hodge, Anne-Marie C. Size and shape information serve as labels in the alarm calls of Gunnison's prairie dogs *Cynomys gunnisoni*. *Current Zoology*. (2012) 58 (5): 741–748.

35. *His 1976 book The Question of Animal Awareness was later called "The Satanic Verses of animal cognition" by one of his critics.*

Griffin, Donald R. In *The History of Neuroscience in Autobiography*, Volume 2. (ed.) Larry R. Squire. San Diego, CA: Academic Press. p89

36. *"a dog screams when its body is hurt, its vocalization is not the expression of pain..."*

Esteban & Rivas, Titus. 'The question of animal awareness and the culture of science. Science and the Human-Animal Relationship'. Netherlands Universities Institute for Coordination of Research in Social Sciences. Amsterdam, Netherlands. (1992, March). Retrieved from: <http://txtxs.nl/artikel.asp?artid=701>

37. *For the primatologist Frans de Waal, this type of thinking is a form of neo-creationism, like a decapitated theory of evolution. As he writes, it "accepts evolution but only half of it..."*

Waal, Frans. *Are We Smart Enough to Know How Smart Animals Are*. New York, NY: W.W. Norton & Company, 2016. p122

38. Thomas Nagel famously noted this in his essay called, “What Is It Like To Be A Bat? ”: “Even without the benefit of philosophical reflection...”

Nagel, Thomas. “What Is It Like To Be A Bat?” *The Philosophical Review* LXXXIII, 4 (October 1974): 435-50. Retrieved from <http://www.philosopher.eu/others-writings/nagel-what-is-it-like-to-be-a-bat/>

39. Together, they declared that: “Convergent evidence indicates that non-human animals have the neuroanatomical...”

‘Cambridge Declaration on Consciousness.’ Churchill College, University of Cambridge. (2012, July 7). Retrieved from: <http://fcmconference.org/img/CambridgeDeclarationOnConsciousness.pdf>

#### Chapter 4

1. The remaining 40% was skeletal muscle.

deShazo, Richard D. et al. The Autopsy of Chicken Nuggets Reads “Chicken Little”. *The American Journal of Medicine* , Volume 126 , Issue 11 , 1018 - 101. Retrieved from: [https://www.amjmed.com/article/S0002-9343\(13\)00396-3/fulltext](https://www.amjmed.com/article/S0002-9343(13)00396-3/fulltext)

2. As deShazo explained in an interview: “You can actually vibrate that stuff off, and you get these chicken leftovers...”

Hamblin, James. ‘Look Inside a Chicken Nugget’. *The Atlantic*. (2013, October 21). Retrieved from: <https://www.theatlantic.com/health/archive/2013/10/look-inside-a-chicken-nugget/280720/>

3. In the food industry, the most common “restructured meat” is *filet mignon*.

Philpott, Tom. ‘Is “Meat Glue” As Gross As It Sounds?’ *Mother Jones*. (2012, May 7). Retrieved from: <https://www.motherjones.com/food/2012/05/meat-glue-gross-it-sounds/>

4. Examining 30 cookbooks by prominent chefs, Ike Sharpless published a study entitled, ‘*Making the Animals on the Plate Visible: Anglophone Celebrity Chef Cookbooks Ranked by Sentient Animal Deaths.*’

Brehaut, Laura. ‘Mario Batali kills more than five animals per recipe according to the ‘animal kill index.’ *National Post*. (2018, April, 6). Retrieved from: <https://nationalpost.com/life/food/mario-batali-kills-more-than-five-animals-per-recipe-according-to-the-animal-kill-index>

5. According to the *Hong Kong Free Press*, the forty-year-old meat had been “pumped full of chemical additives to keep them looking fresh.”

Kilpatrick, Ryan. '40-year-old 'zombie meat' smuggled through Hong Kong'. Hong Kong Free Press. (2015, June 24). Retrieved from: <https://www.hongkongfp.com/2015/06/24/40-year-old-zombie-meat-smuggled-into-hong-kong/>

6. *imported fish is often gassed with carbon monoxide to prevent the flesh from discolouring during transit.*

Moskin, Julia. 'Tuna's Red Glare? It Could Be Carbon Monoxide'. *New York Times*. (2004, October, 6). Retrieved from: [https://www.nytimes.com/2004/10/06/dining/tunas-red-glare-it-could-be-carbon-monoxide.html?\\_r=1&mtrref=undefined](https://www.nytimes.com/2004/10/06/dining/tunas-red-glare-it-could-be-carbon-monoxide.html?_r=1&mtrref=undefined)

7. *"the industry's color reference standard for the visual judging and comparison of degrees of pigmentation in salmon flesh perceived by the human eye."*

The DSM SalmoFan. DSM. Retrieved from: [https://www.dsm.com/markets/anh/en\\_US/products/products-solutions/products\\_solutions\\_tools/Products\\_solutions\\_tools\\_salmon.html](https://www.dsm.com/markets/anh/en_US/products/products-solutions/products_solutions_tools/Products_solutions_tools_salmon.html)

8. *astaxanthin color additives, which are synthetic caretenoids made from petrochemicals*

'Dr. Mercola explains what you need to know about natural versus synthetic astaxanthin'. *Algae World News*. (2016, June 5). Retrieved from: <http://news.algaeworld.org/2016/06/mercola-need-know-natural-versus-synthetic-astaxanthin/>

9. *To cater to the different geographic desires, egg farmers who want the perfect "golden hue" can add CAROPHYLL® red and CAROPHYLL® yellow to the feed.*

The DSM YolkFan. DSM. Retrieved from: <https://www.dsm.com/corporate/media/informationcenter-news/2016/03/2016-03-02-dsm-launches-new-egg-yolk-pigmentation-guidelines-and-yolkfan.html>

10. *"hundreds of scientists experimented with coating meats and fish in antibiotic solutions, misting the drugs onto fruits and vegetables and mixing them into milk."*

McKenna, Marilyn. *Big Chicken*. Washington, DC: National Geographic. Ebook: loc 1030

11. *While it sounds repulsive, it is actually safe to eat chorine-washed chicken.*

Dawson, Simon. 'Chlorine-washed chicken Q&A: food safety expert explains why US poultry is banned in the EU'. *The Conversation*. (2017, August 2). Retrieved from: <https://theconversation.com/chlorine-washed-chicken-qanda-food-safety-expert-explains-why-us-poultry-is-banned-in-the-eu-81921>

12. *most people (79% according to one survey) will pick up and eat food that's been dropped on the floor.*

Collier, Hatty. 'Scientist speaks out in favor of the '5-second rule' for dropped food'. *Evening Standard*. (2017, March 15). Retrieved from: <https://www.businessinsider.com/scientists-confirm-the-5-second-rule-for-dropped-food-is-real-2017-3>

13. "Not knowing, that's fine. Ignorance is easy. Knowing can be hard but at least it is real, it is the truth. The worst is when you don't want to know because then it must be something very bad."

Heffernan, Margaret. *Wilfull Blindness: Why we ignore the obvious at our peril*. New York: Walker Publishing: 2011. p916

14. As James Pearce notes in his essay, *A Brave New Jungle*: "Perhaps the most insightful way to illustrate the intensification..."

James I. Pearce, *A Brave New Jungle: Factory Farming and Advocacy in the Twenty-First Century*, 21 Duke Environmental Law & Policy Forum. (2011, Spring). 433-467. Retrieved from: <https://scholarship.law.duke.edu/delpf/vol21/iss2/9>

15. *the animals we eat are routinely fed garbage and other animals' feces.*

Rankins, Darrell. Feeding Broiler Litter to Beef Cattle. In. Alabama A&M and Auburn Universities. (2000, May) Retrieved from: <http://www.aces.edu/pubs/docs/A/ANR-0557/ANR-0557.pdf>

16. *Facts like the majority of bacon comes from pigs that were put in a gas chamber*

'If this is the 'best', what is the worst?' [AnimalsAustralia.org](http://AnimalsAustralia.org). Video retrieved from: <https://animalsaustralia.org/features/not-so-humane-slaughter/>

O'Brien, Zoie. 'Bringing home the bacon has never been crueller': Shoppers buying 'high welfare' pork have been 'misled' for 15 years after Government failed to act on its own advice on co2 slaughters'. *Mail Online*. (2018, August 4). Retrieved from: <https://www.dailymail.co.uk/news/article-6016465/Pigs-die-kicking-screaming-packaged-high-welfare-meat-products.html>

17. *steaks on supermarket shelves that came from a steer that was skinned alive*

Warrick, Jo. 'They Die Piece by Piece.' *The Washington Post*. (2001, April 10). Retrieved from: [https://www.washingtonpost.com/archive/politics/2001/04/10/they-die-piece-by-piece/f172dd3c-0383-49f8-b6d8-347e04b68da1/?utm\\_term=.0a8d3615dfb9](https://www.washingtonpost.com/archive/politics/2001/04/10/they-die-piece-by-piece/f172dd3c-0383-49f8-b6d8-347e04b68da1/?utm_term=.0a8d3615dfb9)

18. *E.O. Wilson called this 'biophilia' or "the urge to affiliate with other forms of life."*

Wilson, Edward O. *Biophilia*. Harvard, MA: Harvard University Press. 1984.

19. "To deny the reality...of what we can never describe or understand is the crudest form of cognitive dissonance."

Nagel, Thomas. "What Is It Like To Be A Bat?" *The Philosophical Review* LXXXIII, 4 (October 1974): 435-50. Retrieved from <http://www.philosopher.eu/others-writings/nagel-what-is-it-like-to-be-a-bat/>

20. *Claire Coombs, a research technician at the Ontario Ministry of Agriculture, Food and Rural Affairs put this to the test...*

Coombs, Claire. 'How active is your soil? Try the underwear test.' Ontario Ministry of Agriculture, Food & Rural Affairs. (2015, September 23). Retrieved from: <http://www.omafra.gov.on.ca/english/crops/hort/news/hortmatt/2015/22hrt15a2.htm>

21. *It's been said that "civilizations rise and fall on the quality of their soil"*

Wits University. 'Civilizations rise and fall on the quality of their soil'. *Science Daily*. (2013, November 4). Retrieved from: <https://www.sciencedaily.com/releases/2013/11/131104035245.htm>

22. *Nafeed Ahmed writes: "Over the past 40 years, about 2 billion hectares of soil - equivalent to 15% of the Earth's paland area..."*

Ahmed, Nafeed. 'Peak soil: industrial civilisation is on the verge of eating itself'. *The Guardian*. (2013, June 7). Retrieved from: <https://www.theguardian.com/environment/earth-insight/2013/jun/07/peak-soil-industrial-civilisation-eating-itself>

Searchinger, Tim et al. 'The Great Balancing Act'. *World Resources Institute*. (2013). Retrieved from: [http://pdf.wri.org/great\\_balancing\\_act.pdf](http://pdf.wri.org/great_balancing_act.pdf)

23. *According to the Food and Agriculture Organization of the United Nations, 25 percent of the world's land is degraded, but in areas like sub-Saharan Africa, Southern America, Southeast Asia and Northern Europe soil quality restraints affect more than half the land usage.*

'Fast facts: The State of the World's Land and Water Resources' *United Nations Food and Agriculture Organization*. Retrieved from: [http://www.fao.org/fileadmin/user\\_upload/newsroom/docs/en-solaw-facts\\_1.pdf](http://www.fao.org/fileadmin/user_upload/newsroom/docs/en-solaw-facts_1.pdf)

24. *we only have 60 harvests left.*

Arsenault, Chris. 'Only 60 Years of Farming Left If Soil Degradation Continues'. *Scientific American*. Retrieved from: <https://www.scientificamerican.com/article/only-60-years-of-farming-left-if-soil-degradation-continues/>

26. *the renowned Svalbard seed vault for example, currently contains 890,000 samples and has room for 4.5 million crop varieties.*

Svalbard Global Seed Vault. Crop Trust. Retrieved from: <https://www.croptrust.org/our-work/svalbard-global-seed-vault/>

26. *globally, only 12 plant species and five animal species comprise three-quarters of all our food.*

Corby, Stephen. 'Global food security: are we running out of time?' *In the Black*. (2018, August 1). Retrieved from: <https://www.intheblack.com/articles/2018/08/01/global-food-security-running-out-of-time>

27. *a new, deadlier strain of Panama disease has spread from Asia to Africa and India, and is en route to Central America.*

Fleming, Nic. 'Science's search for a super banana.' *The Guardian*. (2018, August 5). Retrieved from: <https://www.theguardian.com/science/2018/aug/05/science-search-for-a-super-banana-panama-disease-gm-gene-editing>

28. *In the deforested Amazon, 80% of the soy grown becomes animal feed. The cleared land is also used for pasture for beef cattle. Exotic animals like jaguars, sloths, and anteaters are disappearing in the region, as over 700,000 hectares of their forest home was cleared between 2011 and 2015.*

Smithers, Rebecca. 'Vast animal-feed crops to satisfy our meat needs are destroying planet'. *The Guardian*. (2017, October 5) Retrieved from: [https://www.theguardian.com/environment/2017/oct/05/vast-animal-feed-crops-meat-needs-destroying-planet?CMP=tw\\_t\\_a-environment\\_b-gdneco](https://www.theguardian.com/environment/2017/oct/05/vast-animal-feed-crops-meat-needs-destroying-planet?CMP=tw_t_a-environment_b-gdneco)

Nelsen, Arthur. 'Burger King animal feed sourced from deforested lands in Brazil and Bolivia'. *The Guardian*. (2017, August 21). Retrieved from: <https://amp.theguardian.com/environment/2017/mar/01/burger-king-animal-feed-sourced-from-deforested-lands-in-brazil-and-bolivia>

29. *for 95% of dairy cows and 90% of pigs, life starts not in the twinkle of an eye, but in a petri dish.*

'Swine mating practices.' United States Department of Agriculture. (2002, September).

Retrieved from:

[https://www.aphis.usda.gov/animal\\_health/nahms/swine/downloads/swine2000/Swine2000\\_is\\_Mating.pdf](https://www.aphis.usda.gov/animal_health/nahms/swine/downloads/swine2000/Swine2000_is_Mating.pdf)

Morrel, Jane M. 'Artificial Insemination: Current and Future Trends'. Swedish University of Agricultural Sciences, Uppsala, Sweden. (2011, April 10). Retrieved from: <https://www.intechopen.com/books/artificial-insemination-in-farm-animals/artificial-insemination-current-and-future-trends>

30. *In artificial insemination centres, the bulls go through this collection process two to three days a week, and ejaculate is collected on those days two to three times.*

Rouge, Melissa. 'Semen Collection from Bulls'. Colorado State University. (2002, September 2). Retrieved from: <http://www.vivo.colostate.edu/hbooks/pathphys/reprod/semeneval/bull.html>

31. *There is variability in price. At the low end bull sperm can go for \$5-15 per straw, at the high end with Wagyu bulls the price can be \$2000 per straw.*

Mintz, Corey. 'The Need for Seed'. *Globe and Mail*. (2017, January 31). Retrieved from: <https://beta.theglobeandmail.com/life/food-and-wine/food-trends/the-ontario-farmer-whose-business-is-wagyu-semen/article33850236/?ref=http://www.theglobeandmail.com&>

32. *At the elite level, one 'star' bull alone can bring in over \$7 million annually and sire over 500,000 offspring.*

Jokinen, Tom. 'Canada's Bull Semen Boom'. *The Walrus*. (2016, September 22). Retrieved from: <https://thewalrus.ca/money-shot/>

32. *Obituaries are even written for famed bulls.*

'Holstein breeding Comestar Leader dies' cit in *Cow Talk*. cit in: <http://bcowtalk.runboard.com/t1206>

33. *"a cow produces no milk unless she's recently given birth"*

Jokinen, Tom. 'Canada's Bull Semen Boom'. *The Walrus*. (2016, September 22). Retrieved from: <https://thewalrus.ca/money-shot/>

34. *This "jizz biz" is not only domestic, but an international business.*

Mallen, Leah. Personal Communication. 2017.

35. *US even exported \$2 million of bull sperm to Iran*

Yanofsky, David. 'The US has sent nearly \$2 million worth of bull sperm to Iran this year'. *Quartz*. (2013, June 5). Retrieved from: <https://qz.com/91152/the-us-has-sent-nearly-2-million-worth-of-bull-sperm-to-iran-this-year/>

36. *Genomix host semen and embryo auctions*

McCarthy, Marty. 'Semen and embryos the 'future' of bull sales, as first genetic-based sale held in Rockhampton'. *ABC News*. (2015, May 6). Retrieved from: <http://www.abc.net.au/news/rural/2015-05-07/first-full-semen-embryo-sale-held-at-beef-week-australia/6450832>

37. *in recent years there have even been barnyard break-ins...*

‘Thief steals \$70,000 of bull semen from farm’ *The Canadian Press*. (2015, April 9) Retrieved from: <https://www.msn.com/en-ca/lifestyle/whats-hot/thief-steals-dollar70000-of-bull-semen-from-farm/vi-AAaE7CT>

38. *Housed in Fort Collins, Colorado the National Animal Germplasm Program (NAGP) is like a genetic Noah’s Ark*

‘The Livestock Sperm Bank’. *Freakonomics blog*. (2013, August 16). Retrieved from: <http://freakonomics.com/2013/08/16/the-livestock-sperm-bank/>

39. *Today, his genes can be found in 14% of all Holstein cows.*

Zhang, Sarah. ‘The Dairy Industry Lost \$420 Million From a Flaw in a Single Bull’. *The Atlantic*. (2016, October 31). Retrieved from: <https://www.theatlantic.com/health/archive/2016/10/the-dairy-industry-lost-420-million-from-a-flaw-in-a-single-bull/505616/>

40. *"computer assisted semen assessment systems"*

White, Arthur. ‘Canadian Bulls Are Swinging Dicks on the International Semen Market.’ *VICE*. (2015, March 27). Retrieved from: [https://www.vice.com/en\\_us/article/avywna/canadian-bulls-are-swinging-dicks-on-the-international-jizz-market-792](https://www.vice.com/en_us/article/avywna/canadian-bulls-are-swinging-dicks-on-the-international-jizz-market-792)

41. *“Our way of working with this problem has been careful to favor the middle ground. Seed taken from the herd is looked at what it looks like and how it smells. Any deviation in color, composition or smell is interpreted as abnormal and the item is rejected.”*

‘Seed quality’. Finnpig. Retrieved from: <http://www.finnpig.fi/keinosiemennys/siemenen-laatu/>

42. *“We test by ALL the senses: see, touch, smell, taste...”*

Estabrook-Russett, Sabrina. ‘Farm Confessional: I Was a Pig Semen Catcher’. *Modern Farmer*. (2014, March 12). Retrieved from: <https://modernfarmer.com/2014/03/farm-confessional-pig-semen-catcher/>

43. *“Semex’s Robot Ready™ sires...”*

‘Semex Launches Revolutionary Robot Ready™ Sires’. Semex. (2011, December 7). Retrieved from: <http://www.semex.com/i?news=list&id=1323294485>

44. *The rate grows yearly by a factor of ten*

‘Pig Reproduction’. Zaleski, Halina M. Department of Human Nutrition, Food and Animal Sciences College of Tropical Agriculture and Human Resources, University of Hawai‘i at Mānoa. Retrieved from: <http://www2.hawaii.edu/~halina/201/pigb.pdf> (2018)

’48. Today with selective breeding, the rate has increased to 25-30 piglets

45. *The high birth rate in pigs is leading to an increased mortality rate for the sows, as the litter rate has been “linked to a troubling rise in prolapse – the collapse of the animal’s rectum, vagina, or uterus”.*

Civil Eats. ‘We’ve bred them to their limit’: death rates surge for female pigs in the US’. The Guardian. (2018, October 1). Retrieved from: <https://www.theguardian.com/environment/2018/oct/01/death-rates-surge-female-pigs-us>

46. *According to data from the UNFCCC, “If cattle were a country, they would rank third in greenhouse gas emissions.*

Gates, Bill. ‘Climate change and the 75% problem’. *Gates Notes*. (2018, October 17). Retrieved from: <https://www.gatesnotes.com/Energy/My-plan-for-fighting-climate-change>

47. *“almost every vertebrate animal on earth is either a human or a farm animal.”*

Musser, George. #WSFBrisbane. (2016, March 17). Twitter: <https://twitter.com/gmusser/status/710447727688036352>

48. *we will need to support not only 120 million tonnes of additional human beings, but 400 million additional tonnes of farmed animals.*

Monbiot, George. ‘There’s a population crisis all right. But probably not the one you think.’ *The Guardian*. (2015, November 19). Retrieved from: <https://www.theguardian.com/commentisfree/2015/nov/19/population-crisis-farm-animals-laying-waste-to-planet>

49. *The water of content of the average cumulus cloud for instance, is about 1.1 million pounds of water, or the weight of a hundred elephants.*

Soniak, Matt. ‘How Much Does a Cloud Weigh?’. *Mental Floss*. (2013, April 4). Retrieved from: <http://mentalfloss.com/article/49786/how-much-does-cloud-weigh>

50. *“runoff from snowpack alone provides 60 to 80 percent of the annual water supply for 70 million people...”*

Struzik, Ed. ‘Loss of Snowpack and Glaciers In Rockies Poses Water Threat’. *Yale Environment 360*. (2014, July 10). Retrieved from: [https://e360.yale.edu/features/loss\\_of\\_snowpack\\_and\\_glaciers\\_in\\_rockies\\_poses\\_water\\_threat](https://e360.yale.edu/features/loss_of_snowpack_and_glaciers_in_rockies_poses_water_threat)

51. *“In some regions, the vast majority of water feeding high-mountain rivers comes from rain and snowmelt, not melting glaciers.” Some regions however, are dependent upon glacial run-off.*

Ives, Mike. ‘Melting Glaciers May Worsen Northwest China’s Water Woes’. *Yale Environment 360*. (2012, July 26). Retrieved from:  
[https://e360.yale.edu/features/melting\\_glaciers\\_may\\_worsen\\_china\\_water\\_woes\\_tarim\\_river](https://e360.yale.edu/features/melting_glaciers_may_worsen_china_water_woes_tarim_river)

More than one-sixth of the Earth's population relies on glaciers and seasonal snow packs for their water supply: Barnett, T.P., Adam, J.C. & Lettenmaier, D.P. ‘Potential impacts of a warming climate on water availability in snow-dominated regions’. *Nature* volume 438, (2005, November 17), p303–309. Retrieved from: <https://www.nature.com/articles/nature04141>

52. *“We should be uneasy. The loss of these frozen reservoirs of water will have a huge impact, as the glaciers provide seasonal flows to nearly every major river system in Asia.”*

Breashears, David. ‘Tracking the Himalaya’s Melting Glaciers’. *Yale Environment 360*. (2010, July 15). Retrieved from: <https://e360.yale.edu/features/tracking-the-himalaya-s-melting-glaciers>

53. *The report “showed mounting concern by global political and business leaders that water shortages could spark unrest across the world.”*

Halverson, Nathan. ‘We’re running out of water, and the world’s powers are very worried’. *The Centre for Investigative Reporting*. (2016, April 11). Retrieved from:  
<https://www.revealnews.org/article/were-running-out-of-water-and-the-worlds-powers-are-very-worried/>

54. *“To live off surface water is to live off your paycheck...”*

Choy, Janny and McGhee, Geoff. ‘Groundwater: Ignore It, and It Might Go Away’. *Stanford Woods Institute for the Environment*. (2014, July 31). Retrieved from:  
<http://waterinthewest.stanford.edu/groundwater/overview/index.html>

55. *This “groundwater blindspot”*

McGraw, Seamus. ‘Water Crisis in the Making: Antiquated Texas Laws Meet a Hotter Climate’. *Climate Liability News*. (2018, July 26). Retrieved from:  
<https://www.climateliabilitynews.org/2018/07/26/water-crisis-texas/>

56. *NASA’s GRACE FO mission uses two satellites in the same orbit that follow each other.*

Arizona State University. ‘Scientists use satellites to measure vital underground water resources’. *Science Daily*. (2018, July 19). Retrieved from:  
<https://www.sciencedaily.com/releases/2018/07/180719112217.htm>

57. *Human beings use about about 4,600km<sup>3</sup> of water every year.*

Kirk, Ashley. 'Cities in the face of drought'. *The Telegraph*. (2018, August 8). Retrieved from: <https://www.telegraph.co.uk/news/cities-in-the-face-of-drought/>

58. *A 2017 study by scientists at Michigan State University found that water is about to get a lot more expensive.*

Mack, Elizabeth A. & Wrase, Sarah. A Burgeoning Crisis? A Nationwide Assessment of the Geography of Water Affordability in the United States. *PLOS One*. (2017, January 11) Retrieved from: <https://doi.org/10.1371/journal.pone.0169488>

59. *The cities that plan to use buildings and infrastructure to collect rainwater now will be the ones with drinking water in the years ahead.*

Sampathkumar, Yaraswini. 'This idea helped rescue a city of 3.8 million from a water crisis'. [eco-business.com](http://eco-business.com) (2018, July 12). Retrieved from: <https://www.eco-business.com/news/this-idea-helped-rescue-a-city-of-38-million-from-a-water-crisis/>

60. *in Virginia, where "....each morning at 5 o'clock a flying boat carrying a pilot, radio operator and fish spotter leaves the station to aid fishing craft."*

Mondor, Colleen. 'With fish spotting, aviation's relationship with fishing turned contentious'. Anchorage Daily News. (2016, September 28). Retrieved from: <https://www.adn.com/bush-pilot/article/aviations-long-relationship-fishing-became-contentious-fish-spotting/2015/03/28/>

61. *92% of fishing vessels that used aircraft had greater catch success.*

Loomis, David K, Salz, Ronald J., Field, Barry. 'An Analysis of Spotter Plane Use in the ABT Fishery'. National Marine Fisheries Service. (1999, May 4). p25. Retrieved from: <https://www.umass.edu/hd/research/tuna.pdf>

62. *"Twenty years ago, we used to see the tuna swimming under our boats in schools that went on for two miles..."*

Bird, Winifred. 'In Japan, a David vs Goliath Battle to Preserve Bluefin Tuna'. *Yale Environment 360*. (2016, January 21). Retrieved from: [https://e360.yale.edu/features/in\\_japan\\_a\\_david\\_versus\\_goliath\\_battle\\_to\\_preserve\\_bluefin\\_tuna](https://e360.yale.edu/features/in_japan_a_david_versus_goliath_battle_to_preserve_bluefin_tuna)

63. *According to the U.N., "nearly 90% of the world's marine fish stocks are now fully exploited, overexploited..."*

Kituyi, Mukhisa & Thomson, Peter. '90% of fish stocks are used up – fisheries subsidies must stop'. *World Economic Forum*. (2018, July 13). Retrieved from: <https://www.weforum.org/agenda/2018/07/fish-stocks-are-used-up-fisheries-subsidies-must-stop/>

64. *"bloody lesions, eye damage, deformed organs, plagues of flesh-eating sea lice"*

Edwards, Rob. 'Horror photos of farmed salmon spark legal threat'. *The Ferret*. (2018, June 27). Retrieved from: <https://thoferret.scot/pictures-diseases-farmed-fish/>

65. "the mortality rate on Scottish salmon farms is 26.7%"

Scottish Salmon Watch. Homepage. Retrieved from: <https://scottishsalmonwatch.org/>

66. *The film Grinding Nemo, documents trawlers netting up to 50 different species in the parks.*

Grinding Nemo. Ecologist Film Unit / Ecostorm. (2012, November 16). Retrieved from: <https://www.journeyman.tv/film/5687/grinding-nemo-hd>

67. *One of these is anchoveta, a species of anchovy, which have fed Peruvians for thousands of years.*

Streich, Lily. 'The Fish that Smells like Money'. *Hakai Magazine*. (2017, May 17). Retrieved from: <https://www.hakaimagazine.com/news/fish-smells-money/>

68. *In Senegal, monster trawlers have slashed the fish biomass from 1 million tonnes to 400,000 tons.*

Wickens, Jim. 'How vital fish stocks in Africa are being stolen from human mouths to feed pigs and chickens on Western factory farms'. *The Independent*. (2016, September 17). Retrieved from: <https://www.independent.co.uk/news/world/africa/how-vital-fish-stocks-in-africa-are-being-stolen-from-human-mouths-to-feed-pigs-and-chickens-on-a7234636.html>

69. *In the 1960's, 80% of chickens were sold to the public as the whole, recognizable animal.*

McKenna, Marilyn. *Big Chicken*. Washington, DC: *National Geographic*. Ebook: loc 909

70. *today, almost 60 billion chickens are slaughtered every single year.*

Carrington, Damien. 'How the domestic chicken rose to define the Anthropocene'. *The Guardian*. (2016, August 31). Retrieved from: <https://www.theguardian.com/environment/2016/aug/31/domestic-chicken-anthropocene-humanity-influenced-epoch>

71. *Modern robotic de-boning machines can process one bird in 2.5 seconds*

'Humans No Match for RoboButcher in \$23B Poultry Industry'. *Robotics Business Review*. (2012, May 21). Retrieved from: [https://www.roboticsbusinessreview.com/agriculture/humans\\_no\\_match\\_for\\_robotbutcher\\_in\\_23\\_b\\_poultry\\_industry/](https://www.roboticsbusinessreview.com/agriculture/humans_no_match_for_robotbutcher_in_23_b_poultry_industry/)

72. *line speeds at 175 to 200 bpm or birds per minute*

'Poultry-processing line speeds back in the spotlight'. *Safety & Health Magazine*. (2017, July 5). Retrieved from: <https://www.safetyandhealthmagazine.com/articles/15894-poultry-processing-line-speeds-back-in-the-spotlight>

73. *worker amputations happen on average twice a week.*

Wasley, Andrew, Cook, Christopher D., and Jones, Natalie. 'Two amputations a week: the cost of working in a US meat plant'. *The Guardian*. (2018, July 5). Retrieved from: <https://www.theguardian.com/environment/2018/jul/05/amputations-serious-injuries-us-meat-industry-plant>

74. *In Iowa, for example, livestock are sold by "animal units" not by headcount and are measured by weight according the equivalent of standard-sized cattle. A hog, then, is considered to be 0.4 of an animal unit.*

Genoways, Ted. *The Chain: Farm, Factory and the Fate of Our Food*. New York, NY: Harper Collins. p.215

75. *As Ted Genoways writes in The Chain, the whole model is "carried out with the exactitude of a factory..."*

Ibid. p.107

76. *In the 1940's, rendered animal parts could be found in around 75 commercial products.*

Bonah, Christian, Cantor, David and Dörries, Mathias (Eds.) *Meat, Medicine and Human Health in the Twentieth Century*. New York, NY: Routledge. p65.

78. *purchasing meat meal "from rendering plants known to accept euthanized shelter animals."*

Barth, Brian. 'Something's Rotten in the Pet Food Industry'. *Modern Farmer*. (2016, September 20). Retrieved from: <https://modernfarmer.com/2016/09/pet-food/>

79. *in the U.S. anywhere from 700,000 to a million birds a year are still conscious and boiled alive in the scalders.*

Kristof, Nicholas. 'To Kill a Chicken'. *New York Times*. (2015, March 15) Retrieved from: <https://www.nytimes.com/2015/03/15/opinion/sunday/nicholas-kristof-to-kill-a-chicken.html>

Foer, Jonathan Safran. *Eating Animals*. New York, NY: Little, Brown & Company. 2009.

80. *As George Monbiot writes, "What madness of our times will revolt our descendants?..."*

Monbiot, George. 'Goodbye – and good riddance – to livestock farming'. *The Guardian*. (2017, October, 4) Retrieved from: <https://www.theguardian.com/commentisfree/2017/oct/04/livestock-farming-artificial-meat-industry-animals>

## Chapter 5

### 1. a sudden 3,000 megawatt increase or the equivalent of 1.2 million kettles

'England run could trigger record power surge'. *Capital Business*. 2010, June 11. Retrieved from: <https://www.capitalfm.co.ke/business/2010/06/england-run-could-trigger-record-power-surge/>

2. *But they did not expect what the BBC had programmed next: a nature documentary featuring baby pandas.*

Whistler, Simon. 'Does the UK Really Experience Massive Power Surges When Soap Operas Finish from People Making Tea'. *Today I Found Out*. (2017, June 28). Retrieved from: <https://www.youtube.com/watch?v=8dUTEzwZYZ0>

3. *Gretchen Bakke writes in The Grid, the power is: "so fresh, that less than a minute ago, if you live in wind farm territory, that electricity was a fast-moving gust of air."*

Bakke, Gretchen. *The Grid: The Fraying Wires Between Americans and our Energy Future*. New York, NY: Bloomsbury. 2016. p5

4. *As Thomas Hughes writes in Networks of Power: "Londoners who could afford electricity toasted their bread in the morning with one kind..."*

Thomas P. Hughes, *Networks of Power: Electrification in Western Society, 1880-1930*. Baltimore: Johns Hopkins University Press, 1983.

5. *In the 1890's, Chicago alone had forty-five different electrical utility companies and had dedicated DC power lines at 100, 110, 220, 500, 600, 1,200 and 2,000 volts for each.*

Bakke, Gretchen. *The Grid: The Fraying Wires Between Americans and our Energy Future*. New York, NY: Bloomsbury. 2016. p 50

6. *leaving the nation with a 10 million kilowatt power shortfall.*

Murphy, Zoe. 'Japan earthquake: Living with blackouts'. *BBC*. (2011, March 15). Retrieved from: <https://www.bbc.com/news/world-asia-pacific-12731696>

7. *As NBC News reported "one of the world's most technologically advanced societies was transformed overnight into one of the Third World hardship."*

Huus, Kari. 'Millions in Japanese cold struggle without electricity, heat.' *NBC News*. (2011, March 15). Retrieved from: [http://www.nbcnews.com/id/42079799/ns/world\\_news-disaster\\_in\\_japan/t/millions-japanese-cold-struggle-without-electricity-heat/](http://www.nbcnews.com/id/42079799/ns/world_news-disaster_in_japan/t/millions-japanese-cold-struggle-without-electricity-heat/)

8. *As John C. Inglis, Former Deputy Director of the National Security Agency (NSA) stated: "I don't think paralysis [of the electrical grid] is more likely by cyberattack than by natural disaster."*

John C. Inglis. cit in: *Cyber Squirrel 1*. Retrieved from: <https://cybersquirrel1.com/>

9. *leading to over \$6 billion dollars in lost business revenue, and a dip in America's GDP.*

Anderson, Patrick L. & Geckil, Ilhan K. 'Northeast Blackout Likely to Reduce US Earnings by \$6.4 Billion'. *Anderson Economic Group Working Paper*. (2003, August 19). Retrieved from: <http://www.andersoneconomicgroup.com/Portals/0/upload/Doc544.pdf>

10. *As Bakke notes, the average outage in the United States is 120 minutes and growing year by year; in other nations it's ten minutes and shrinking.*

Bakke, Gretchen. *The Grid: The Fraying Wires Between Americans and our Energy Future*. New York, NY: Bloomsbury. 2016. p xiv

11. *In the town of Albertville, 1500 people currently have their homes powered by cheese.*

Farand, Chloe. 'French power station turning cheese into electricity for 1,500 inhabitants in Albertville'. *The Independent*. (2015, December 20). Retrieved from: <https://www.independent.co.uk/news/world/europe/french-power-station-turning-cheese-into-electricity-for-1500-inhabitants-in-albertville-a6780656.html>

12. *running one amp of current through it, what you're not seeing is the equivalent of 6 quintillion electrons zipping through a single point in the wire every second...*

Porter, Harry H. *About Electricity and Power*. (2008, July 16). Retrieved from <http://web.cecs.pdx.edu/~harry/musings/AboutElectricity.pdf>

13. *Astrophysicist Adam Frank worked out another calculation, breaking down how much "pedal power" it would take to create electricity for the average home.*

Frank, Adam. 'Can You Power A House With A Bicycle?' *Skunk Bear*. (2016, December 8). Retrieved from: <https://www.youtube.com/watch?v=xbUxt2x4InE>

14. *A building filled with 18,000 lithium battery packs...*

Fialka, John. 'World's Largest Storage Battery Will Power Los Angeles'. *Scientific American*. (2016, July 7). Retrieved from: <https://www.scientificamerican.com/article/world-s-largest-storage-battery-will-power-los-angeles/>

15. *The battery kicked in within milliseconds, pumping 7.3 megawatts into the the grid, much faster than a nearby coal generator.*

Parkinson, Giles. 'Tesla big battery outsmarts lumbering coal units after Loy Yang trips'. *Renew Economy*. (2017, December 19). Retrieved from: <https://reneweconomy.com.au/tesla-big-battery-outsmarts-lumbering-coal-units-after-loy-yang-trips-70003/>

16. *According to the U.S. Geological survey, the Salar contains 5.4 million metric tons of lithium.*

Haddock, Eitan. 'Salt 'n Power: A First Look at the Lithium Flats of Bolivia'. *Scientific American*. (2010, March 18). Retrieved from: <https://www.scientificamerican.com/article/lithium-flats-of-bolivia/>

17. *Lithium is also mined from hard rock pegmatite. This is a more traditional type of mining, sourcing the metal from ore, and is common in Australia and parts of China.*

'About Lithium'. *International Lithium Corp*. Retrieved from: <https://www.internationallithium.com/about-lithium/>

18. *For high end electric cars like the Tesla Model S Sedan, the amount is 63 kilograms of lithium carbonate, or the equivalent of about 10,000 cell phones.*

Yang, Stephanie & Mukherji, Biman. 'Tesla Shakes Up Market for Lithium, Other Metals'. *Wall Street Journal*. (2016, May 5). Retrieved from: <https://www.wsj.com/articles/how-lithium-defied-the-global-commodities-rout-1462450790>

19. Now, consider that Earth's area is over five hundred *trillion* square metres.

Williams, Matt. 'What is the Surface Area of the Earth?' *Universe Today*. (2017, February 10). Retrieved from: <https://www.universetoday.com/25756/surface-area-of-the-earth/>

20. *According to The Guardian newspaper, even Europe, where solar power is most prevalent, the sun only provides 4% of electricity.*

Vaughan, Adam. 'Solar power growth leaps by 50% worldwide thanks to US and China'. *The Guardian*. (2017, March 7). Retrieved from: <https://www.theguardian.com/environment/2017/mar/07/solar-power-growth-worldwide-us-china-uk-europe>

21. *by 1850, there were over 10,000 windmills dotting the countryside.*

Endedijk, L and others. Molens, De Nieuwe Stockhuyzen. Wanders. 2007. cit in 'Windmill'. *Wikipedia*. Retrieved from [https://en.wikipedia.org/wiki/Windmill#cite\\_note-Stockhuyzen-28](https://en.wikipedia.org/wiki/Windmill#cite_note-Stockhuyzen-28)

22. *As Gretchen Bakke writes: "You can't just turn the wind down..."*

Bakke, Gretchen. *The Grid: The Fraying Wires Between Americans and our Energy Future*. New York, NY: Bloomsbury. 2016. p11

23. *The steam powers the turbines, that generate electricity and hot water for 21,000 nearby households.*

‘Pioneering Renewable Energy’. *Iceland Geothermal*. (2017, June 19). Retrieved from: <http://icelandgeothermal.com/>

24. *World Energy Council estimating that in the future, the number could be as high as 8%.*

Worland, Justin. ‘A Solution to Our Clean Energy Problem May Lie Right Beneath Our Feet’. *Time*. (2017, July 25). Retrieved from: <http://time.com/4844086/geothermal-energy-iceland-deep-drilling-project/>

25. *Today, Niagara Falls churns out almost 2 million kilowatts of power on the Canadian side, and 2.4 kilowatts of power on the US side.*

‘Hydro Power Niagara Falls’. *Info Niagra*. Retrieved from: [http://www.infoniagara.com/attractions/hydro\\_power/index.aspx](http://www.infoniagara.com/attractions/hydro_power/index.aspx)

26. *During the opening of the Niagara Falls Power Company, he declared: “We have many a monument of past ages; we have the palaces and pyramids...”*

Brown, Kalee. ‘How Nikola Tesla Harnessed The Power Of Niagara Falls’. *Collective Evolution*. (2017, April 2). Retrieved from: <https://www.collective-evolution.com/2017/04/02/how-nikola-tesla-harnessed-the-power-of-niagara-falls/>

27. *there was a 50-70% decline in four species of carp...*

Robb, Drew. ‘Hydropower's fish-friendly turbines’. *Renewable Energy Focus*. (2011, July 8). Retrieved from: <http://www.renewableenergyfocus.com/view/19183/hydropowers-fish-friendly-turbines/>

28. *Like a giant pneumatic tube, a vacuum at the base of the dam sucks up the fish shooting them up over 100 feet.*

Dzieza, Josh. ‘Behold, the fish cannon’. *The Verge*. (2014, August 11). Retrieved from: <https://www.theverge.com/2014/8/11/5983681/whooshh-innovations-wants-to-whooshh-your-fish-to-safety>

29. *a human walking in would be killed in a minute.*

McCurry, Justin. ‘Dying robots and failing hope: Fukushima clean-up falters six years after tsunami’. *The Guardian*. (2017, March 9). Retrieved from:

<https://www.theguardian.com/world/2017/mar/09/fukushima-nuclear-cleanup-falters-six-years-after-tsunami>

30. *Today, 11% of the world's electricity needs come from nuclear power.*

‘Tracking Progress: Nuclear power’. *International Energy Agency*. (2017, May 16). Retrieved from: <https://www.iea.org/etp/tracking2017/nuclearpower/>

31. *In Japan, 97,000 people have yet to return to their homes.*

Hamilton, Bevan. ‘Fukushima 5 years later: 2011 disaster by the numbers’. *CBC*. (2016, March 10). Retrieved from: <https://www.cbc.ca/news/world/5-years-after-fukushima-by-the-numbers-1.3480914>

32. *He writes: “three large spoonfuls of crude oil contain about the same amount of energy as eight hours of human manual labour...”*

Homer-Dixon, Thomas. *The Upside of Down: Catastrophe, Creativity, and the Renewal of Civilization*. Washington, DC: Island Press. Ebook: loc 923

33. *By 2020, the number is expected to increase to approximately 100 million barrels per day.*

‘Daily demand for crude oil worldwide from 2006 to 2019 (in million barrels)’. [statistic.com](https://www.statista.com/statistics/271823/daily-global-crude-oil-demand-since-2006/)  
Retrieved from: <https://www.statista.com/statistics/271823/daily-global-crude-oil-demand-since-2006/>

34. *In World War I, the average American division used 4,000 horsepower.*

Yergin, Daniel. *The Prize: The Epic Quest for Oil, Money & Power*. New York, NY: Free Press. Ebook: loc 1316

35. *“indispensable material for laying runways, making toluene...”*

Miller, Keith. ‘How Important Was Oil in World War II?’. *History News Network*. The George Washington University. Retrieved from: <https://historynewsnetwork.org/article/339>

36. *Oil price spikes can have a huge impact on the military, costing billions of dollars for every \$10 dollars that a barrel goes up. Because of this, the military is also spearheading the use of green and solar technologies.*

‘The U.S. Military and Oil’. Union of Concerned Scientists. Retrieved from: [https://www.ucsusa.org/clean\\_vehicles/smart-transportation-solutions/us-military-oil-use.html](https://www.ucsusa.org/clean_vehicles/smart-transportation-solutions/us-military-oil-use.html)

37. *Since 1973, it's been estimated that up to 50% of all interstate wars, have been linked to oil.*

Colgan, Jeff D. 'Oil, Conflict, and U.S. National Interests', *Policy Brief - Quarterly Journal: International Security*. Harvard Kennedy School, Belfer Centre for Science and International Affairs. (2013, October). Retrieved from: <https://www.belfercenter.org/publication/oil-conflict-and-us-national-interests>

38. Why is there such a spectacular abundance of oil—some 60 to 70 percent of the world's supply—in this particular region?

Stow, Dorrik. *Vanished Ocean: How Tethys Reshaped the World*. Oxford, UK: Oxford University Press. Ebook: p261

39. *The critical point, as geologist and oceanographer Dorrik Stow, argues in Vanished Ocean, is that warm water holds less oxygen.*

Ibid. p 294

40. *If you take two open soda cans and leave one at room temperature and put the other in the fridge, the colder one will be fizzier, as it can hold more dissolved gas. The same holds true of ocean water. Colder water can “hang on” to oxygen, while warmer waters release it into the atmosphere.*

Nace, Trevor. 'Oceans Are Losing Oxygen, Just As They Did 94 Million Years Ago'. *Forbes*. (2017, August 10). Retrieved from: <https://www.forbes.com/sites/trevornace/2017/08/10/oceans-losing-oxygen-94-million-years-ago/#609799867235>

41. *Researchers say there were between two and seven large oceanic anoxic events in the mid-Cretaceous.*

Leckie, Mark R., Bralower, Timothy J., Cashman, Richard. Oceanic anoxic events and plankton evolution: Biotic response to tectonic forcing during the mid-Cretaceous. *Paleoceanography*, (2002). Vol. 17, No. 3. Retrieved from: <http://www.geo.umass.edu/faculty/leckie/Leckie%20et%20al.%202002.pdf>

42. *University of Alberta scientists have evidence to suggest that underwater volcanism may have been responsible for a mass extinction event 93 million years ago which led to the formation of major oil reserves.*

University of Alberta. 'Volcanic Eruptions May Have Wiped Out Ocean Life 94 Million Years Ago'. *Science Daily*. (2008, July 18). Retrieved from: <https://www.sciencedaily.com/releases/2008/07/080717095027.htm>

It was this large scale magmatic activity, they say, that triggered the OAE2 93.5 million years ago: Turgeon, Steven C & Creaser, Robert A. Cretaceous Anoxic Event 2 triggered by a massive magmatic episode. *Nature*. (2008, July). 454(7202):323-6. DOI: 10.1038/nature07076

43. *Today, the average tank of gas holds more than 1000 tons of ancient life.*

Ruvinsky, Jessica. 'Fill 'Er Up With Plankton'. *Science Magazine*. (2003, October 14). Retrieved from: <http://www.sciencemag.org/news/2003/10/fill-er-plankton>

44. *A jaw-dropping twenty three metric tons of prehistoric life goes into every litre of gasoline.*

University of Utah. 'Bad Mileage: 98 tons of plants per gallon'. *Eureka Alert*. (2003, October 26). Retrieved from: [https://www.eurekaalert.org/pub\\_releases/2003-10/uou-bm9102603.php](https://www.eurekaalert.org/pub_releases/2003-10/uou-bm9102603.php)

45. "Every *day*, [emphasis mine] people are using the fossil fuel equivalent of all the plant matter that grows on land and in the oceans over the course of a whole year."

Ibid.

45. *A gallon (4 litres) of gasoline contains thirty-one million calories.*

Layton, Julia. 'How Calories Work'. *How Stuff Works*. Retrieved from: <https://health.howstuffworks.com/wellness/diet-fitness/weight-loss/calorie1.htm>

46. *Sunlight causes the bloom of over 5.5 billion metric tons of phytoplankton every year. These single-celled protists, which capture the sun's energy, are the primary producers of the food chain, capturing the sun's energy. Their cumulative death over millions of years captured and stored this energy, essentially making oil what it is: a massive natural battery.*

Stow, Dorrik. *Vanished Ocean: How Tethys Reshaped the World*. Oxford, UK: Oxford University Press. Ebook: p284

47. "oil forms from organic matter that is either 'cooked' deep within the earth for long periods of time at low temperatures..."

'What is Oil?' *San Joaquin Valley Geology*. (2015, October 16). Retrieved from: <http://www.sjvgeology.org/oil/oil.html>

48. Geochemist Martin Fowler has suggested that the levels of anoxia in the Cretaceous would be more like what we see in the Dead Sea.

Fowler, Martin. Personal Communication. (2017, February 28).

49. "Already naturally low in oxygen, these regions keep growing, spreading horizontally and vertically. Included are vast portions of the eastern Pacific, almost all of the Bay of Bengal, and an area of the Atlantic off West Africa as broad as the United States..."

Welch, Craig. 'Oceans Are Losing Oxygen—and Becoming More Hostile to Life'. *National Geographic*. (2015, March 13). Retrieved from: <https://news.nationalgeographic.com/2015/03/150313-oceans-marine-life-climate-change-acidification-oxygen-fish/>

50. *Scientists studying sailfish off the coast of Central America, found that they were no longer venturing below a horizontal band of a few hundred feet.*

ibid.

51. *His superhuman powers include: flight, X-ray vision, super strength, speed, heat vision, freezing breath...*

‘Superman's Powers and Abilities’. *Wikipedia*. (Accessed: 2017, Dec 1). Retrieved from: [https://en.wikipedia.org/wiki/Powers\\_and\\_abilities\\_of\\_Superman](https://en.wikipedia.org/wiki/Powers_and_abilities_of_Superman)

52. *As Geoffrey West writes: “[We] require homes, heating, lighting, automobiles...”*

West, Geoffrey. *Scale: The Universal Laws of Growth, Innovation, Sustainability, and the Pace of Life, in Organisms, Cities, Economies, and Companies*. New York, NY: Penguin Press. Ebook: p 12.

53. *Together, all of us use approximately 150 trillion kilowatt hours of power per year.*

Ibid. p233-4

54. *As M. Sanjayan a senior scientist at Conservation International explains: “right now there is CO2 pouring out of tailpipes...”*

Sanjayan, M. ‘Why humans are so bad at thinking about climate change’. *Vox Climate Lab S1, E1*. (2017, April 19). Retrieved from: [https://www.youtube.com/watch?time\\_continue=1&v=DkZ7BJQupVA](https://www.youtube.com/watch?time_continue=1&v=DkZ7BJQupVA)

55. *The last time there was this much CO2 in the air, was over 800,000 years ago.* World Meteorological Organization. ‘Greenhouse gas concentrations surge to new record’. *Science News*. (2017, October 30). Retrieved from: <https://www.sciencedaily.com/releases/2017/10/171030141900.htm>

56. *equivalent of dropping 400,000 Hiroshima bombs every, single, day.* Romm, Joe. ‘Earth’s Rate Of Global Warming Is 400,000 Hiroshima Bombs A Day’. *ThinkProgress*. (2013, December 22) Retrieved from: <https://thinkprogress.org/earths-rate-of-global-warming-is-400-000-hiroshima-bombs-a-day-44689384fef9/>

## Chapter 6

1. *Littering the lunar surface are 181,000 kilograms of forgotten trash.* Garber, Megan. ‘The Trash We've Left on the Moon’. *The Atlantic*. (2012, December 19). Retrieved from: <https://www.theatlantic.com/technology/archive/2012/12/the-trash-weve-left-on-the-moon/266465/>

2. *the evidence of our brief stays on moon will break down and be gone in about ten to a hundred million years.*

Chow, Denise. 'On the Moon, Flags & Footprints of Apollo Astronauts Won't Last Forever'. [space.com](https://www.space.com/12846-apollo-moon-landing-sites-flags-footprints.html). (2011, September 6). Retrieved from: <https://www.space.com/12846-apollo-moon-landing-sites-flags-footprints.html>

3. *It completes a full revolution around our planet every 132.7 minutes.*

'VANGUARD 1'. [N2YO.com](https://www.n2yo.com/satellite/?s=5) Retrieved from: <https://www.n2yo.com/satellite/?s=5>

4. *Along with over 1,700 active satellites*

'UCS Satellite Database'. *Union of Concerned Scientists*. Retrieved from: [https://www.ucsusa.org/nuclear-weapons/space-weapons/satellite-database#.VF\\_jIIPF8Wg](https://www.ucsusa.org/nuclear-weapons/space-weapons/satellite-database#.VF_jIIPF8Wg)

5. *impact would have the energy equivalent of an exploding hand grenade...*

Marc, Jenny & Scott, Katy. 'Satellite catcher' will use magnets to clean up space junk'. *CNN*. (2017, June 20). Retrieved from: <https://www.cnn.com/2017/06/13/tech/space-sweepers-astrocale-japan/index.html>

6. *From 1971-2016, over 260 spacecraft were dumped at Point Nemo.*

Mosher, Dave. 'A spacecraft graveyard exists in the middle of the ocean — here's what's down there'. *Business Insider*. (2017, October 22). Retrieved from: <https://www.businessinsider.com/spacecraft-cemetery-point-nemo-google-maps-2017-10>

7. *That's the equivalent of over 4,500 Eiffel Towers.*

'U.N. warns 'e-waste' surging to equivalent of 4,500 Eiffel Towers amid scant recycling'. *The Japan Times*. (2017, December 14). Retrieved from: <https://www.japantimes.co.jp/news/2017/12/14/business/u-n-warns-e-waste-surging-equivalent-4500-eiffel-towers-amid-scant-recycling/>

8. *"a single person's 102-ton trash legacy will require the equivalent of 1,100 graves."*

Humes, Edward. *Garbology: Our Dirty Love Affair with Trash*. New York, NY: Avery. Ebook: p4

9. *a mere 5% of the raw materials from the manufacturing, packaging, and transportation process*

Royte, Elizabeth. *Garbage Land: On the Secret Trail of Trash*. New York, NY: Little, Brown and Company. 2005. Ebook: p219

10. *11 million tons of solid waste per day, by the end of the century.*

Hoornweg, Daniel, Bhada-Tata, Perinaz & Kennedy, Chris. 'Environment: Waste production must peak this century'. *Nature*. (2013, October 30). Retrieved from: <https://www.nature.com/news/environment-waste-production-must-peak-this-century-1.14032>

11. *rise of human excrement: "In 10,000 BCE there were about a million people on the planet.*

Waltner-Toews, David. *The Origin of Feces: What excrement tells us about evolution, ecology, and a sustainable society*. Toronto, ON: ECW Press, 2013. p.23

12. *stoop was a way for people to get up above the mess*

Royte, Elizabeth. *Garbage Land: On the Secret Trail of Trash*. New York, NY: Little, Brown and Company. 2005. Ebook: p.1

13. *horse waste (the latter of which piled up at a rate of 1,000 metric tons of manure and 227,000 litres of urine every day).*

Humes, Edward. *Garbology: Our Dirty Love Affair with Trash*. New York, NY: Avery. Ebook: p.37

14. *with an average of one ton of waste digested by 75 pigs a day.*

Ibid. p.38

15. *a fence that was built to keep the hogs at bay*

Ku, Catherine. 'History of NYC Streets: Wall Street Wall Almost "Destroyed" by Pigs'. *Untapped Cities*. (2013, July 31). Retrieved from: <https://untappedcities.com/2013/07/31/history-of-nyc-streets-wall-street-wall-almost-destroyed-by-pigs/>

16. *the appalling street-side filth: "François, King of France by the Grace of God..."*

Laporte, Dominique. *History of Shit*. Cambridge, Mass: A Documents Book, 2003. p.4

17. *"In 1832, 20,000 people died of cholera in Paris alone."*

Rockefeller, Abby A. 'Civilization & Sludge: Notes on the History of the Management of Human Excreta'. *Current World Leaders*, Volume 39, No. 6. Retrieved from: <http://www.ejnet.org/sludge/excretahistory.html>

18. *The French switched over to a method that the Chinese had been using for thousands of years.*

‘Tracking Down the Roots of our Sanitary Sewers.’ *Sewer History*. Retrieved from: [http://www.sewerhistory.org/chronos/middle\\_ages.htm](http://www.sewerhistory.org/chronos/middle_ages.htm)

19. *For thousands of years, 90% of human manure was recycled and accounted for a third of the country’s fertilizer.*

Waltner-Toews, David. *The Origin of Feces: What excrement tells us about evolution, ecology, and a sustainable society*. Toronto, ON: ECW Press, 2013. p. 91

20. *“10kg of nitrogen, phosphorus and potassium compounds, [these are] the three main nutrients plants need to grow.”*

‘A great waste’. *South China Morning Post*. (2013, May 5). Retrieved from: <https://www.scmp.com/magazines/post-magazine/article/1227444/great-waste>

21. *As David Waltner-Toews writes: “the seventeenth-century city of Edo...”*

Waltner-Toews, David. *The Origin of Feces: What excrement tells us about evolution, ecology, and a sustainable society*. Toronto, ON: ECW Press, 2013. p. 91

22. *“Human night soil is essentially the residue of what people eat after they have absorbed necessary nutrients. The night soil of a population that ate a lot of fish and meat generally contained more nitrogen and phosphate...”*

Tajima, Kayo. ‘The Marketing of Urban Human Waste in the Early Modern Edo/Tokyo Metropolitan Area’. *Environnement urbain : cartographie d’un concept*. Vol 1. (2007). Retrieved from: <https://journals.openedition.org/eue/1039?lang=en>

23. *the price of shimogoe depended on demand, but at its height rose up to 140 mon*  
Ibid.

24. *For perspective, in 1805, a hundred copper mon could buy a good lunch of mushrooms, pickles, rice and soup.*

Craig, Teruko. Translator of *Musui’s Story*. cit in: Ask Historians. Reddit. retrieved from: [https://www.reddit.com/r/AskHistorians/comments/2ax1p0/how\\_much\\_was\\_one\\_ryo\\_during\\_the\\_late\\_edo\\_period/](https://www.reddit.com/r/AskHistorians/comments/2ax1p0/how_much_was_one_ryo_during_the_late_edo_period/)

25. *“If a given quantity of land sown without manure, yields three times...”*

Mapes, James Jay. *Working Farmer, Volumes 1-2*. New York: Kingman & Cross, Clinton Hall. p168

26. *Bird poop brings 3.8 million metric tons of nitrogen out of the sea each year. The nitrogen comes from dissolved gases in the air that mix with the water, and are broken into fixed nitrogen. During the 1800s this process was largely done by cyanobacteria.*

Perkins, Sid. 'Bird poop brings 3.8 million metric tons of nitrogen out of the sea each year'. *Science* magazine. (2018, January 23). Retrieved from: <http://www.sciencemag.org/news/2018/01/bird-poop-brings-38-million-metric-tons-nitrogen-out-sea-each-year>

27. "acre for acre...the most valuable real estate on earth."

Hager, Thomas. *The Alchemy of Air: A Jewish Genius, a Doomed Tycoon, and the Scientific Discovery That Fed the World by Fueled the Rise of Hitler*. New York, NY: Broadway Books. 2008. Ebook: p.64

28. *As stated in Section 1: Whenever any citizen of the United States discovers a deposit of guano...*

Matthews, Matthews. 'This 1856 law makes it legal to seize islands for America if they have lots of bird crap'. *Vox*. (2014, July 31). Retrieved from: <https://www.vox.com/2014/7/31/5951731/bird-shit-imperialism>

29. "England and all civilised nations stand in deadly peril..."

Crookes, Sir William. Presidential Address to the British Association for the Advancement of Science 1898. *Chemical News*, 1898. 78, 125.

30. *Today, approximately 90 million to 120 million metric tons of nitrogen in our food system comes from natural processes, such as nitrogen-fixing bacteria and lightning strikes.*

'Dead water'. *The Economist*. (2008, May 15). Retrieved from: <https://www.economist.com/science-and-technology/2008/05/15/dead-water>

31. *To put it in perspective, in 2010, the U.S. produced more than 33.79 million tons of food waste.*

Minter, Adam. *Junkyard Planet: Travels in the Billion-Dollar Trash Trade*. New York, NY: Bloomsbury Press. 2013. Ebook: loc 3426

32. *In the U.S. alone, it works out to all of the offshore oil and gas reserves, being drilled for nothing.*

'US food waste worth more than offshore drilling'. *New Scientist*. (2010, July 28). Retrieved from: <https://www.newscientist.com/article/mg20727712.700-us-food-waste-worth-more-than-offshore-drilling/>

33. "Worldwide about 80 percent of nitrogen harvested in crops and grass goes to feed livestock instead of feeding people directly. Much of that nitrogen winds up in their manure and then

*gases off as it sits in giant open lagoons near intensive animal production centers or when it is spread onto fields without being properly mixed into the soil.”*

Mingle, Jonathan. ‘A Dangerous Fixation’. *Slate*. (2013, March 12). Retrieved from: [http://www.slate.com/articles/health\\_and\\_science/the\\_efficient\\_planet/2013/03/nitrogen\\_fixation\\_anniversary\\_modern\\_agriculture\\_needs\\_to\\_use\\_fertilizer.html](http://www.slate.com/articles/health_and_science/the_efficient_planet/2013/03/nitrogen_fixation_anniversary_modern_agriculture_needs_to_use_fertilizer.html)

33. *You can have too much of a good thing. The process is a like overfeeding fish. We’ve artificially added twice as much nitrogen and three times as much phosphorous as would occur in a natural system.*

Patel, Jugal K. & Parshina-Kottas, Yuliya. ‘Miles of Algae Covering Lake Erie’. *New York Times*. (2017, October 3). Retrieved from: <https://www.nytimes.com/interactive/2017/10/03/science/earth/lake-erie.html>

34. *The Haber-Bosch process alone uses up almost 2% of the world’s energy supply.*

Jacobs, Jake. ‘Water and air are all you need to make ammonia—one of world's most important chemicals’. [phys.org](http://phys.org). (2014, August 8). Retrieved from: <https://phys.org/news/2014-08-air-ammoniaone-world-important-chemicals.html>

35. *11.7 million vehicles were ordered off the roads*

Lau, Mimi. ‘How leaders and an army of staff turned Beijing's grey into 'Apec blue’’. *South China Morning Post*. (2014, November 18). Retrieved from: <https://www.scmp.com/news/china/article/1642445/how-leaders-and-army-staff-turned-beijings-grey-apec-blue>

36. *Political blue sky days are 4.8 per cent lower than average levels, but readings in the 4 days afterwards are 8.2 per cent higher.*

Jing, Li. ‘How China’s quick blue-sky fixes make pollution worse’. *South China Morning Post*. (2016, December 9). Retrieved from: <https://www.scmp.com/news/china/policies-politics/article/2053023/how-chinas-quick-blue-sky-fixes-make-pollution-worse>

37. *“Serious aggravation of heart or lung disease and premature mortality.”*

‘Pollutant-Specific Health Effects Statements for the Air Quality Index (AQI)’. *Department of Energy & Environmental Protection*. Retrieved from: [https://www.ct.gov/deep/cwp/view.asp?a=2684&q=321784&deepNav\\_GID=1619](https://www.ct.gov/deep/cwp/view.asp?a=2684&q=321784&deepNav_GID=1619)

38. *“chemical-tasting, eye watering.”*

Kaiman, Jonathan. ‘Chinese struggle through 'airpocalypse' smog’. *The Guardian*. (2013, February 16). Retrieved from: <https://www.theguardian.com/world/2013/feb/16/chinese-struggle-through-airpocalypse-smog>

39. *in high-income countries, that percentage nearly halved to 56 percent.*

‘Air pollution levels rising in many of the world’s poorest cities’. *World Health Organization*. (2016, May 12). Retrieved from: <http://www.who.int/en/news-room/detail/12-05-2016-air-pollution-levels-rising-in-many-of-the-world-s-poorest-cities>

40. *incinerated particles have been strongly linked to lung cancer.*

‘China sees sharp rise in lung cancer, air pollution possible cause’. *Press TV*. (2017, August 11). Retrieved from: <https://www.presstv.com/detail/2017/08/11/531372/china-lung-cancer>

41. *over 800,000 lung cancer patients a year, by 2020.*

Jenkins, Nash. ‘China to Have Over 800,000 Lung Cancer Patients a Year by 2020, State Media Says’. *Time*. (2015, December 1). Retrieved from: <http://time.com/4130476/china-smoking-pollution-lung-cancer/>

42. *people who die from AIDS is about a third that number, or 940,000.*

‘Global HIV & AIDS statistics — 2018 fact sheet’. *UN AIDS*. Retrieved from: <http://www.unaids.org/en/resources/fact-sheet>

43. *the pollution we produce on an annual basis is staggering.*

‘Scientists categorize Earth as a ‘toxic planet’’. [phys.org](https://phys.org). (2017, February 7). Retrieved from: <https://phys.org/news/2017-02-scientists-categorize-earth-toxic-planet.html>

44. *“Industrial toxins are now routinely found in new-born babies, in mother's milk, in the food chain...”*

Ibid.

45. *By the end of 2017, China was responsible for 28% of global emissions*

‘Global carbon dioxide emissions projected to rise after three stable years’. [phys.org](https://phys.org) (2017, November 13). Retrieved from: <https://phys.org/news/2017-11-global-carbon-dioxide-emissions-stable.html>

46. *equivalent in tonnage of forty-one Mount Everests.*

Hansen, Christopher. ‘The Mighty Neutron Star.’ *Helix*. Northwestern University. (2014, February 26). Retrieved from: <https://helix.northwestern.edu/blog/2014/02/mighty-neutron-star>

47 *“Most plastics are based on the carbon atom...The carbon atom can link to other atoms with up to four chemical bonds...”*

‘How Plastics Are Made’. *American Chemistry Council*. Retrieved from: <https://plastics.americanchemistry.com/How-Plastics-Are-Made/>

48. *“Plastic has gone so fast from zero to omnipresent...”*

Humes, Edward. *Garbology: Our Dirty Love Affair with Trash*. New York, NY: Avery. Ebook: p123

49. *we have made over 9 billion tons of plastic.*

Ferris, Robert. ‘The world has made more than 9 billion tons of plastic, says new study’. *CNBC*. (2017, July 19). Retrieved from: <https://www.cnbc.com/2017/07/19/the-world-has-made-more-than-9-billion-tons-of-plastic-says-new-study.html>

50. *only a small amount of petroleum - approximately 5% - goes into plastic production.*

‘Plastic Production’. [petroleum.co.uk](http://www.petroleum.co.uk). Retrieved from: <http://www.petroleum.co.uk/plastic-production>

51. *“our society has reached a point where the effort necessary to extract oil from the ground, ship it to a refinery, turn it into plastic...”*

Carlini, Giulia. ‘I have always thought that if my plastic were recycled, it would do no harm. But that is just half of the story.’ Center for International Environmental Law. (2017, July 8). Retrieved from: <https://www.ciel.org/always-thought-plastic-recycled-no-harm-just-half-story/>

52. *An August 1955 issue of Life magazine contained a vision of the new American family. The article title was “Throwaway Living.”*

Cosgrove, Ben. ‘“Throwaway Living”: When Tossing Out Everything Was All the Rage’. *Time*. (2014, May 15). Retrieved from: <http://time.com/3879873/throwaway-living-when-tossing-it-all-was-all-the-rage/>

53. *traditional plastic production still goes up every year and is expected to grow up to 40 percent more in the next decade.*

Taylor, Matthew. ‘\$180bn investment in plastic factories feeds global packaging binge’. *The Guardian*. (2017, December 26). Retrieved from: <https://www.theguardian.com/environment/2017/dec/26/180bn-investment-in-plastic-factories-feeds-global-packaging-binge>

54. *There are some species that are able to biodegrade plastic. The recently discovered bacterial species Ideonella sakainesis for instance, secretes an enzyme that under the right heat conditions can break down plastic bottles.*

Netburn, Deborah. 'Newly discovered bacteria can eat plastic bottles'. *Los Angeles Times*. (2016, March 11). Retrieved from: <http://www.latimes.com/science/sciencenow/la-sci-sn-bacteria-eat-plastic-20160310-story.html>

55. *by 2050, it's been estimated there will be more plastic in the ocean by weight than there are fish swimming in the sea.*

Wearden, Graeme. 'More plastic than fish in the sea by 2050, says Ellen MacArthur'. *The Guardian*. (2016, January 19). Retrieved from: <https://www.theguardian.com/business/2016/jan/19/more-plastic-than-fish-in-the-sea-by-2050-warns-ellen-macarthur>

56. *one in four fish had plastic in their guts*

Rochman, Chelsea M; Tahir, Akbar; Williams, Susan L; Baxa, Dolores V; Lam, Rosalyn; Miller, Jeffrey T; Teh, Foo-Ching; Werorilangi, Shinta; Teh, Swee J. Anthropogenic debris in seafood: Plastic debris and fibers from textiles in fish and bivalves sold for human consumption. *Scientific Reports* volume 5, Article number: 14340 (2015). Retrieved from: <https://www.nature.com/articles/srep14340>

57. *83 percent of Dublin Bay prawns or scampi, contained plastic fibres.*

'Health alert over plastic fibres found in scampi'. *The Times*. (2011, April 26). Retrieved from: <https://www.thetimes.co.uk/article/health-alert-over-plastic-fibres-found-in-scampi-2kb9t2lh5kw>

58. *83 percent of tap water samples overall, were polluted with plastic.*

Carrington, Damian. 'Plastic fibres found in tap water around the world, study reveals'. *The Guardian*. (2017, September 6). Retrieved from: <https://www.theguardian.com/environment/2017/sep/06/plastic-fibres-found-tap-water-around-world-study-reveals>

59. *billions of people around the world are eating and drinking invisible plastic.*

'Microplastics discovered in human stools across the globe in 'first study of its kind''. *EurekaAlert*. (2018, October 22). Retrieved from: [https://www.eurekaalert.org/pub\\_releases/2018-10/sh-mdi101518.php](https://www.eurekaalert.org/pub_releases/2018-10/sh-mdi101518.php)

60. *"Look at one of your fingernails. Carbon makes up half of its mass, and roughly one in eight of those carbon atoms..."*

Stager, Curt. 'You Are Made of Waste'. *Nautilus*. (2013, November 7). Retrieved from:

<http://nautil.us/issue/7/waste/you-are-made-of-waste>

61. *In 2010, China's primary shipments to the United States were computer and electronic equipment.*

Humes, Edward. *Garbology: Our Dirty Love Affair with Trash*. New York, NY: Avery. Ebook: p11

62. *"a little more than \$8 billion worth of bundled old newspaper, crushed cardboard..."*

Ibid.

63. *By 2016, China had become the world's largest net importer of garbage, taking in forty-five million metric tons of scrap metal, waste paper, and plastic from around the world each year, valued at \$18 billion.*

'Why China is sick of foreign garbage'. *The Economist*. (2017, August 21). Retrieved from: <https://www.economist.com/the-economist-explains/2017/08/21/why-china-is-sick-of-foreign-garbage>

64. *"China's getting rich, and as you get rich, you throw away more stuff..."*

'Wasted': What happens when China no longer wants our trash?' *CBC Radio*. (2018, January 12). Retrieved from: <https://www.cbc.ca/radio/day6/episode-372-china-s-waste-ban-syrian-cuisine-oprah2020-the-colour-of-2018-letterman-returns-and-more-1.4479480/wasted-what-happens-when-china-no-longer-wants-our-trash-1.4479601>

65. *As a bonus, the net CO<sub>2</sub> emissions from burning the waste is also negative.*

Carlström, Vilhelm. 'Foreign media reports Sweden has run out of garbage and is forced to import - here's what's really going on'. *Business Insider*. (2016, December 14). Retrieved from: <https://nordic.businessinsider.com/foreign-media-reports-sweden-has-run-out-of-garbage-and-is-forced-to-import---heres-whats-really-going-on-2016-12/>

66. *"Precious metals such as gold could find their way into the sewers courtesy of mining, electroplating, electronics and jewelry manufacturing, or industrial and automotive catalyts."*

Cornwall, Warren. 'Sewage sludge could contain millions of dollars worth of gold'. *Science Magazine*. (2015, January 16). Retrieved from: <http://www.sciencemag.org/news/2015/01/sewage-sludge-could-contain-millions-dollars-worth-gold>

67. *1 million people produces \$13 million dollars of metals in the wastewater annually.*

Westerhoof, Paul et. al. 'Characterization, Recovery Opportunities, and Valuation of Metals in Municipal Sludges from U.S. Wastewater Treatment Plants Nationwide'. *Environ. Sci. Technol.*, 2015, 49 (16), pp 9479–9488. Retrieved from: <https://pubs.acs.org/doi/abs/10.1021/es505329q>

68. *In comparison, at the Suwa facility, 1,890 grams—almost two kilograms—of gold can be recovered from every metric ton of ash from incinerated sludge.*

Demetriou, Danielle. 'Japan's sewers paved with gold'. *The Telegraph*. (2009, February 2). Retrieved from: <https://www.telegraph.co.uk/news/worldnews/asia/japan/4429197/Japan-sewers-paved-with-gold.html>

69. *A recent UN report suggests that human waste collected for energy has the potential value of \$9.5 billion dollars per year.*

Schuster-Wallace C.J., Wild C., and Metcalfe C. A Research Brief Assessing the Global Wealth in Waste. United Nations University Institute for Water, Environment and Health. (2015). Retrieved from: <http://inweh.unu.edu/wp-content/uploads/2016/01/Valuing-Human-Waste-an-as-Energy-Resource-Web.pdf>

70. *According to the World Health Organization, combining urine and feces, a single human being produces 4.5 kg of nitrogen every year.*

Kluger, Jeffrey. 'How Poop Can Be Worth \$9.5 Billion'. *Time*. (2015, November 3). Retrieved from: <http://time.com/4098127/human-waste-energy-recycling/>

## Chapter 7

1. *It was Hawaiian Airlines Flight 446, performing its regular scheduled duty.*

Buckley, Julia. "Time travel' flights take off in 2018 and land in 2017, due to time differences'. *The Independent*. (2018, January 1). Retrieved from: <https://www.independent.co.uk/travel/news-and-advice/flights-take-off-2018-land-2017-time-travel-auckland-hawaii-air-new-zealand-hawaiian-airways-taipei-a8136491.html>

2. *Because of this, certain countries are in fact two days apart instead of just one.*

'Three Dates at the Same Time'. [timeanddate.com](http://timeanddate.com) Retrieved from: <https://www.timeanddate.com/time/dateline.html>

3. *As Dava Sobel, the author of Longitude notes: "One degree of longitude equals four minutes of time the world over..."*

Sobel, Dava. *Longitude: The True Story of a Lone Genius Who Solved the Greatest Scientific Problem of His Time*. New York, NY: Bloomsbury. 1995. Ebook: p.4-5

4. *And so, a working flower clock, as poet Tom Clark imagines it, would contain a garden that looks something like this...*

Lines excerpted from “Linnaeus’ Flower Clock” by Tom Clark, from his collection *Fractured Karma*, published by Black Sparrow Press. Copyright Tom Clark 1990. cit in. ‘Linnaeus’ Flower Clock’. *Los Angeles Times*. (1990, June 17). Retrieved from: [http://articles.latimes.com/1990-06-17/books/bk-176\\_1\\_linnaeus-flower-clock](http://articles.latimes.com/1990-06-17/books/bk-176_1_linnaeus-flower-clock)

5. *For example, “the green chaffinch (“the earliest riser among all the feathered tribes”) sings from 1 to 2 a.m...”*

cit. in: Foer, Joshua. ‘A Minor History Of / Time without Clocks’. *Cabinet Magazine*. (2008, Spring). Retrieved from: <http://www.cabinetmagazine.org/issues/29/foer.php>

Dresser, C. *The Art of Decorative Design*. London: Day & Son, 1862. Digitized by the Internet Archive. Retrieved from: <https://archive.org/details/albumofnineteent00unse/page/192>  
p.192

6. *“This wooden device consisted of a series of connected small same-sized boxes. Each box held a different fragrance of incense...”*

Levine, Robert. *A Geography of Time: the temporal misadventures of a social psychologist, or how every culture keeps time just a little bit differently*. New York, NY: Basic Books, 1997. p 56

7. *One of the best-known studies to examine how animals experience time was done by scientists Max Renner and Karl von Frisch in 1955.*

Simon, Seymour & Brett, Jan. *The Secret Clocks: Time Senses of Living Things*. Mineola, New York: Dover Publications. p15-21

8. *As an article in National Geographic notes: “The worms are fried in oil or baked into a loaf with coconut milk and onions.*

Muller, Karin. ‘Samoa Palolo Spawns Annual Fiesta’. *National Geographic*. (2004, October 29). Retrieved from:  
[https://news.nationalgeographic.com/news/2004/10/1029\\_041029\\_palolo\\_worms.html](https://news.nationalgeographic.com/news/2004/10/1029_041029_palolo_worms.html)

9. *neurobiologist Kristin Tessmar- Raible has found evidence of a biological lunar clock.*

Jabr, Ferris. ‘How Moonlight Sets Nature’s Rhythms’. *Hakai Magazine*. (2017, June 21). Retrieved from: Retrieved from: <https://www.smithsonianmag.com/science-nature/how-moonlight-sets-nature-rhythms-180963778/>

10. *Harvard University researchers found that the average internal clock runs on a cycle of 24 hours and 11 minutes.*

Cromie, William J. 'Human Biological Clock Set Back an Hour'. *The Harvard Gazette*. (1999, July 15). Retrieved from: <https://news.harvard.edu/gazette/story/1999/07/human-biological-clock-set-back-an-hour/>

11. "I believe that when you are surrounded by night—the cave was completely dark, with just a light bulb—your memory does not capture the time..."

Foer, Joshua & Siffre, Michael. 'Caveman: An Interview with Michel Siffre'. *Cabinet Magazine*. (2008, Summer). Retrieved from: <http://www.cabinetmagazine.org/issues/30/foer.php>

12. "In Madagascar time might be measured by "a rice-cooking" (about half an hour) or "the frying of a locust" (a moment)."

cit in. Thompson, E.P. 'Time, Work-Discipline, and Industrial Capitalism'. *Past & Present*, Oxford University Press. (1967, December). No. 38. p58

13. "In January 1906, several thousand cotton-mill workers rioted on the outskirts of Bombay."

Beacock, Ian P. 'A Brief History of (Modern) Time'. *The Atlantic*. (2015, December 22). Retrieved from: <https://www.theatlantic.com/technology/archive/2015/12/the-creation-of-modern-time/421419/>

14. *Today, the world's most precise atomic clock, will only lose 1 second every 90 billion years.*

Emspak, Jesse. 'World's Most Precise Clock Powered by Supercold Strontium Atoms'. *Live Science*. (2017, October 5). Retrieved from: <https://www.livescience.com/60612-most-precise-clock-powered-by-strontium-atoms.html>

15. "In 1967 an international consortium defined a second as: "the duration of 9,192,631,770 periods of the radiation corresponding..."

Buonomano, Dean. *Your Brain is a Time Machine: The Neuroscience and Physics of Time*. New York, NY: W.W. Norton & Company. Ebook: loc: 2061.

16. *According to Tokyo-based reporter Jake Adelstein, her sudden passing was one of thousands of deaths from suspected overwork that take place in Japan every year.*

Adelstein, Jake. 'Japan Is Literally Working Itself To Death: How Can It Stop?'. *Forbes*. (2017, October 30). Retrieved from: <https://www.forbes.com/sites/adelsteinjake/2017/10/30/japan-is-literally-working-itself-to-death-how-can-it-stop/#1d6405532f14>

17. *This is not a situation unique to Japan. Charles Czeisler, a professor of sleep medicine at Harvard Medical School has documented sleep deprivation in hospital interns who are at times scheduled to work twenty-four to thirty-four hour shifts.*

Cromie, William J. 'Overworked interns prone to medical errors'. *The Harvard Gazette*. (2004, October, 28). Retrieved from: <https://news.harvard.edu/gazette/story/2004/10/overworked-interns-prone-to-medical-errors/>

18. *"The gods confound the man who first found out / How to distinguish hours."*

cit in. Levine, Robert. *A Geography of Time: the temporal misadventures of a social psychologist, or how every culture keeps time just a little bit differently*. New York, NY: Basic Books, 1997. p72

19. *the average hunter-gatherer adult only worked 3-5 hours each day, or 20 hours per week.*

Sahlins, M. 'The Original Affluent Society'. *Stone Age Economics*. Chigago, IL: Aldine Atherton. 2005

20. *Daniel Bell writes that "industrialization did not arise with the introduction of factories, it "arose out of the measurement of work."*

cit. in Marcus, Herbert. *One-Dimensional Man*. Boston, MA: Beacon Press. p29

21. *idea of overtime came from European cloth makers in the 1300s.*

Bausum, Dolores. *Threading Time: A Cultural History of Threadwork*. Fort Worth, TX: TCU Press. p77

22. *In fourteenth-century England, peasants worked around 150 days per year.*

Parramore, Lynn Stuart. 'Why a medieval peasant got more vacation time than you'. *Reuters*. (2013, August 29). Retrieved from: <http://blogs.reuters.com/great-debate/2013/08/29/why-a-medieval-peasant-got-more-vacation-time-than-you/>

23. *as Peter Stabel notes, we began to see the emergence of the term "clock des ouvriers" or "bell of the workers."*

Stabel, Peter. 'Labour Time, Guild Time? Working Hours in the Cloth Industry of Medieval Flanders and Artois (Thirteenth-Fourteenth Centuries)'. *TSEG / Low Countries Journal of Social and Economic History*. 11 (4): 27–53. Retrieved from: <http://doi.org/10.18352/tseg.167>

24. *As historian Jacques Le Goff notes, this temporal transformation marked a crisis: "in the cloth manufacturing cities, the town was burdened with a new time, the time of the cloth makers."*

Le Goff, Jacques. *Time, Work, and Culture in the Middle Ages*. Chicago, IL: University of Chicago Press, 1980. p46

25. *A survey of 1,018 full-time U.S. employees found that 41 percent of people prefer having time to money. That said, only 30.3 percent of people surveyed were willing to give up their present salaries for a better schedule.*

Berman, Robby. 'Survey reveals the ideal American work schedule'. *Big Think*. (2018, September 18). Retrieved from: <https://bigthink.com/technology-innovation/how-hard-do-americans-work>

26. *In 1755 he wrote: "the Scholars here are obliged to rise betimes and to observe Hours with great Punctuality"*.

J. Clayton. *Friendly Advice to the Poor* (Manchester, 1755) p19, 42-43 cit in. Thompson, E.P. 'Time, Work-Discipline, and Industrial Capitalism'. *Past & Present*, Oxford University Press. (1967, December). No. 38., p.84

27. *"Children marched from place to place and sat in assigned stations. Bells rang to announce changes of time..."*

Toffler, Alvin. *Future Shock*. New York, NY: Bantam Books. 1971, p400.

28. *"This service must be calculated after all deductions for being at taverns, alehouses..."*

cit in. 'Time, Work-Discipline, and Industrial Capitalism'. *Past & Present*, Oxford University Press. (1967, December). No. 38., p.81

29. *In Germany, as Ian Beacock writes, "travellers had to clarify whether departures were according to Berlin, Munich, Stuttgart, Karlsruhe, Ludwigshafen, or Frankfurt time."*

Beacock, Ian P. 'A Brief History of (Modern) Time'. *The Atlantic*. (2015, December 22). Retrieved from: <https://www.theatlantic.com/technology/archive/2015/12/the-creation-of-modern-time/421419/>

30. *he promised to sell a more exact time than what Langley was offering (which was off by one to two seconds)*

Bartky, Ian R. *Selling the True Time: Nineteenth-century Timekeeping in America*. Stanford, CA: Stanford University Press, 2000. p.118

31. *"Any service which will train these persons into habits of accuracy and punctuality, which will affect all employers."*

cit. in Levine, Robert. *A Geography of Time: the temporal misadventures of a social psychologist, or how every culture keeps time just a little bit differently*. New York, NY: Basic Books, 1997. p.66

32. *the brochure heralded: “gives military precision, and teaches practicality, promptness and precision wherever adopted...”*

cit in. Baker, Ronald J. *Measure What Matters to Customers: Using Key Predictive Indicators (KPIs)*. Hoboken, NJ: John Wiley & Sons. 2006. p42

35. As Robert Levine writes, watchmakers started marketing the idea that it was important to “keep a watch on everybody”.

Levine, Robert. *A Geography of Time: the temporal misadventures of a social psychologist, or how every culture keeps time just a little bit differently*. New York, NY: Basic Books, 1997. p.69

33. *“In all these ways - by the division of labour; the supervision of labour; fines...”*

Thompson, E.P. ‘Time, Work-Discipline, and Industrial Capitalism’. *Past & Present*, Oxford University Press. (1967, December). No. 38., p.90

34. *Garment workers in Bangladesh are some of the lowest-paid workers in the world. On average, a monthly salary is \$68, which is significantly below a living wage. Workers often work seven-day weeks, with overtime amounting to fourteen to sixteen hour work days.*

‘Sweatshops in Bangladesh’. *War on Want*. Retrieved from: <https://waronwant.org/sweatshops-bangladesh>

35. That same shirt in the Middle Ages, historian Eve Fisher argues, would have cost thousands.

Fisher, Eve. ‘The \$3500 Shirt - A History Lesson in Economics’. *SleuthSayers*. (2013, June 6). Retrieved from: <https://www.sleuthsayers.org/2013/06/the-3500-shirt-history-lesson-in.html>

36. *“Open and close file drawer, no selection = .04 minutes; desk, open centre drawer = .026 minutes; close centre drawer = .027 minutes”*

Goatly, Andrew. *Washing the Brain: Metaphor and Hidden Ideology*. Amsterdam, Netherlands: John Benjamins Publishing. 2007, p67

37. *“25% to 30% of all clerical workers found themselves being supervised by computer in electronic sweatshops doing boring...”*

Ibid. p140

38. *“The workday typically lasts 12 hours on the assembly line...”*

Kamenetz, Anya. ‘A Day In The Life Of An iPhone Factory Worker’. *Fast Company*. (2013, July 29). Retrieved from: <https://www.fastcompany.com/3014988/a-day-in-the-life-of-an-iphone-factory-worker>

39. *Amazon warehouses in the UK, an undercover investigation revealed that 74 percent of workers were afraid to use the toilet.*

Liao, Shannon. 'Amazon warehouse workers skip bathroom breaks to keep their jobs, says report'. *The Verge*. (2018, April 16). Retrieved from: <https://www.theverge.com/2018/4/16/17243026/amazon-warehouse-jobs-worker-conditions-bathroom-breaks>

40. *At Centrelink, a call centre in Australia, employees punch in an ID code each time they want to use the bathroom.*

Marcus, Caroline. 'Centrelink workers timed on the toilet'. *The Daily Telegraph*. (2011, September 3). Retrieved from: <https://www.dailytelegraph.com.au/business/work/centrelink-workers-timed-on-the-toilet/news-story/7dfff3c19f93a174c511c3c2c21f63d3>

41. "Workers urinate and defecate while standing on the line; they wear diapers to work..."

'No Relief: Denial of Bathroom Breaks in the Poultry Industry: Oxfam Report. *Oxfam America*. 2016. Retrieved from: [https://www.oxfamamerica.org/static/media/files/No\\_Relief\\_Embargo.pdf](https://www.oxfamamerica.org/static/media/files/No_Relief_Embargo.pdf)

42. *High-frequency trades now account for 50 to 70 percent of stock market volume.*

Cheng, Evelyn. 'Just 10% of trading is regular stock picking, JPMorgan estimates'. *CNBC*. (2017, June 13). Retrieved from: <https://www.cnbc.com/2017/06/13/death-of-the-human-investor-just-10-percent-of-trading-is-regular-stock-picking-jpmorgan-estimates.html>

43. *Jeremy Rifkin calls "computime"*

Rifkin, J. *Time Wars: The Primary Conflict in Human History*. New York, NY: Simon & Schuster, 1987.

44. *The human brain needs thirteen milliseconds to process an image, and it takes between one hundred and four hundred milliseconds to blink an eye. A high frequency trade travelling round-trip from Chicago to New Jersey takes only 13 milliseconds. That means 30 trades can take place in the blink of an eye.*

Tovey, Alan. 'High-frequency trading: when milliseconds mean millions'. *The Telegraph*. (2014, April 2). Retrieved from: <https://www.telegraph.co.uk/finance/newsbysector/banksandfinance/10736960/High-frequency-trading-when-milliseconds-mean-millions.html>

45. *In 2018, billionaire Jeff Bezos made \$8.96 million an hour, even when he slept.*

Hoffower, Hillary. 'We did the math to calculate how much money Jeff Bezos makes in a year, month, week, day, hour, minute, and second'. *Business Insider*. (2018, October 6). Retrieved from: <https://www.businessinsider.com/what-amazon-ceo-jeff-bezos-makes-every-day-hour-minute-2018-10>

46. *in India's traditional caste system—the dirty work of cleaning up latrines earns about forty-six rupees a day, which, given an eight-hour day, is about five cents an hour.*

George, Rose. 'A Brief History of Class and Waste in India'. *Long Reads*. (2014, January 28). Retrieved from: <https://longreads.com/2014/01/28/a-brief-history-of-class-and-waste-in-india/>

47. *“An hour sitting with a nice girl on a park bench passes like a minute, but a minute sitting on a hot stove seems like an hour. That's relativity.”*

'Relativity: A Hot Stove and A Pretty Girl'. *Quote Investigator*. (2014, November 24). Retrieved from: <https://quoteinvestigator.com/2014/11/24/hot-stove/>

48. *For civilian GPS, these time signals allow us to measure the latitude, longitude, and altitude of something like your cell phone in a shopping mall down to an accuracy of 4.9 metres.*

'What is the government's commitment to GPS accuracy?'. [GPS.gov](http://www.gps.gov). Retrieved from: <https://www.gps.gov/systems/gps/performance/accuracy/>

49. *Without calibration, the atomic clocks housed in the satellites would run ahead by 45 microseconds each day.*

Pogge, Richard W. 'Real-World Relativity: The GPS Navigation System'. *Astronomy Department, Ohio State University*. Retrieved from: <http://www.astronomy.ohio-state.edu/~pogge/Ast162/Unit5/gps.html>

50. According to Richard Pogge, Professor of Astronomy at Ohio State University, after just two minutes, spatial positions would be totally off.

Ibid.

51. *Some physicists, for instance, have suggested that the “universe is timeless”.*

'Does Time Exist, or Is It Merely the Numerical Order of Change?'. *Futurism*. (2014, May 26). Retrieved from: <https://futurism.com/papers-suggest-that-time-is-a-numerical-order-of-change/>

52. *As Stephen Hawking says, this is “the time that we feel passing, the time in which we grow older.”*

Hawking, Stephen. 'God, The Universe and Everything Else' (1988). *The Science Foundation*. Retrieved from: <https://www.youtube.com/watch?v=HKQQAv5svkk>

53. *“This might suggest that the so-called imaginary time is really the real time, and that what we call real time is just a figment of our imaginations.”*

Hawking, Stephen. *A Brief History of Time*. New York, NY: Bantam Books, 2017. p144

54. *“This...leaves open a pivotal question:*

Greene, Brian. *The Fabric of the Cosmos: Space, time, and the texture of reality*. New York: Vintage Books. 2004, p 140-1

55. *Even our idea of “now” operates on delay. According to scientists, the psychological present is only three seconds long and “our consciousness lags 80 milliseconds behind actual events.” According to neuroscientist David Eagleman, “When you think an event occurs it has already happened.”*

Musser, George. ‘Time on the Brain: How You Are Always Living In the Past, and Other Quirks of Perception’. *Scientific American*. (2011, September 15). Retrieved from: <https://blogs.scientificamerican.com/observations/time-on-the-brain-how-you-are-always-living-in-the-past-and-other-quirks-of-perception/>

56. *“Imagine visiting yourself in the future...”*

*Freedom 55* commercial. Retrieved from: <https://www.youtube.com/watch?v=ZQezUN-e0go>

57. *A Sun Life Financial survey found that only 28% of Canadians believed retirement at age 65 was even feasible.*

‘Freedom 55, 60, 65... and counting?’ *EBT*. (2015). Retrieved from: <https://ebtca.com/freedom-55-60-65-and-counting/>

58. *“Is Freedom 75 boomers’ new goal?”*

Rasbach, Noreen. ‘Is Freedom 75 boomers' new goal?’ *The Globe and Mail*. (2011, January 24). Retrieved from: <https://www.theglobeandmail.com/globe-investor/personal-finance/household-finances/is-freedom-75-boomers-new-goal/article611101/>

59. *“Freedom 85: Staying in the workforce.”*

‘Freedom 85: Staying in the workforce’. *CBC*. (2017, April 11). Retrieved from: <https://www.cbc.ca/news/thenational/freedom-85-staying-in-the-workforce-1.4066767>

60. *“there is a joke in China that you can tell the ‘it’ colour of the season...”*

Webber, Kathleen. ‘How Fast Fashion Is Killing Rivers Worldwide’. *EcoWatch*. (2017, March 22). Retrieved from: <https://www.ecowatch.com/fast-fashion-riverblue-2318389169.html>

61. *This hot summer-like day in 2018 wasn’t taking place in June, it was February.*

‘Central Park Heat Breaks 88-Year Record as Temperatures Soar Into 70s’. *NBC New York*. (2018, February 21). Retrieved from: <https://www.nbcnewyork.com/news/local/NYC-Weather-Record-High-Temperatures-Heat-Wave-Winter-Storm-Team-4-474678743.html>

62. *In 2016, over six hundred plant species bloomed early.*

Doughty, Eleanor. 'Over 600 species of plants are flowering early, according to major survey'. *Telegraph*. (2016, January 26). Retrieved from: <https://www.telegraph.co.uk/gardening/problem-solving/over-600-species-of-plants-are-flowering-early-according-to-major/>

63. *In 2010 and 2012, plants on the east coast of the United States, were flowering earlier.*

Dell'amore, Christine. 'Earliest Blooms Recorded in U.S. Due to Global Warming'. *National Geographic*. (2013, January 17). Retrieved from: <https://news.nationalgeographic.com/news/2013/01/130116-spring-earlier-global-warming-plants-trees-blooming-science/>

64. *"The growing mismatch means fewer birds are likely to survive."*

Carrington, Damian. 'Climate change is disrupting flower pollination, research shows'. *Guardian*. (2014, November 6). Retrieved from: <https://www.theguardian.com/environment/2014/nov/06/climate-change-is-disrupting-flower-pollination-research-shows>

65. *"Suspected mismatches have occurred between sea birds and fish, such as puffins..."*

Ibid.

66. *Instead, as Bertrand Richard notes, faced with "Climate chaos, stock market panics, food scares..."*

cit in Virilio, Paul. *The Administration of Fear*. Los Angeles, CA: Semiotext[e]. 2012, p 7

67. *On January 25, 2018, in an open letter addressed to leaders and citizens of the world, the scientists announced that we are now highly vulnerable to catastrophe, and the clock ticked a minute closer to our end. It now reads two minutes to midnight.*

'It is now two minutes to midnight'. 2018 Doomsday Clock Statement. *Bulletin of the Atomic Scientists*. (2018). Retrieved from: <https://thebulletin.org/2018-doomsday-clock-statement/>

## Chapter 8

1. *In England, you can go for a walk through Madonna's private estate.*

'Right to Roam'. *99% Invisible*. Ep. 313. (2018, June 26). Retrieved from: <https://99percentinvisible.org/episode/right-to-roam/>

2. *we are subject to "the extreme self-restraint that ownership imposes on us, as we restrict ourselves to the spaces..."*

Rudmin, Floyd Webster. *The Science of Ownership*. Retrieved from: <https://thescienceofownership.org/facesvoices/featured/436-2/>

3. *For human beings, “intimate space” is the first bubble that surrounds us; it extends approximately 18 inches (46 centimetres) around the body...*

Miller, Sara G. ‘Debate 2016: What Goes on in Your Brain When People Invade Your Personal Space?’. *Scientific American*. (2016, October 13). Retrieved from: <https://www.scientificamerican.com/article/debate-2016-what-goes-on-in-your-brain-when-people-invade-your-personal-space/>

4. *This was the case with SM, a patient with significant amygdala lesions*

Moseman, Andrew. ‘The Science of Close-Talkers Revealed’. *Big Think*. (2009, August 31). Retrieved from: <https://bigthink.com/the-science-of-close-talkers-revealed>

5. *In the animal kingdom, birds like the American robin, for instance, are aggressive towards other robins...*

Mayntz, Melissa. ‘How Birds Claim Territory’. *The Spruce*. (2017, October 3). Retrieved from: <https://www.thespruce.com/how-birds-claim-territory-386444>

6. *Chimpanzees likewise guard their space from their own species.*

‘Chimpanzees As Neighbors’. Canisius Ambassadors for Conservation. Retrieved from: [http://www.conservenature.org/learn\\_about\\_wildlife/chimpanzees/chimp\\_neighbors.htm](http://www.conservenature.org/learn_about_wildlife/chimpanzees/chimp_neighbors.htm)

7. “the distance a reindeer can travel before needing to stop to and urinate.”

‘Obsolete Finnish units of measurement’. *Wikipedia*. Retrieved from: [https://en.wikipedia.org/wiki/Obsolete\\_Finnish\\_units\\_of\\_measurement](https://en.wikipedia.org/wiki/Obsolete_Finnish_units_of_measurement)

8. *Witold Kula writes in Measures and Men, throughout most of history the human body acted as “the measure of all things.”*

Kula, Witold. *Measures & Men*. Princeton, NJ: Princeton University Press. 1986. p 24

10. “imposition of standard, binding measures of distance, surface or volume,  
Bauman, Zygmunt. *Globalization and human consequences*. New York, NY: Columbia University Press, 1998. p28-29

9. “throughout the realm there shall be the same yard of the same size and it should be of iron.”

‘History of Length Measurement’. National Physical Laboratory. Retrieved from: <http://www.npl.co.uk/educate-explore/factsheets/history-of-length-measurement/>

10. “There shall be standard measures of wine, ale, and corn (the London quarter), throughout the kingdom.”

Stone, Jon. 'Beer Day Britain: How the Magna Carta created the humble pint'. *The Independent*. (2015, June 15). Retrieved from: <https://www.independent.co.uk/news/uk/home-news/the-magna-cartas-role-in-creating-the-humble-pint-of-beer-10320844.html>

11. *"the total length of the left feet of the first sixteen men to leave church on Sunday morning."*

'History of Length Measurement'. National Physical Laboratory. Retrieved from: <http://www.npl.co.uk/educate-explore/factsheets/history-of-length-measurement/>

12. *"the "yard" was proudly defined as the "breadth of the chest of the Saxon race."*

'Report from the Select Committee on Weights and Measures; together with the Proceedings of the Committee, Minutes of Evidence, Appendix and Index.' Communicated from the Commons to the Lords. (1862, August 4). p2.

13. *"that under the cover of some eight hundred names, the Ancien Régime of France..."*

Alders, Ken. *The Measure of All Things: The Seven-year Odyssey and Hidden Error that Transformed the World*. New York, NY: Simon & Schuster. 2002, p.2

14. *The French set up a new system that they declared would be "for all people, for all time."*

Kirby, Gavin. 'The History of the Metric System: from the French Revolution to the SI'. *The Glasgow Insight into Science and Technology*. (2014, May 29). Retrieved from: <https://the-gist.org/2014/05/the-history-of-the-metric-system-from-the-french-revolution-to-the-si/>

14. *"The thought that someday, through an earthquake or a calamitous fire, the world might be 'without the meter' was indeed a nightmare."*

Kula, Witold. *Measures & Men*. Princeton, NJ: Princeton University Press. 1986. p.81

15. *"the length of the path travelled by light in vacuum during a time interval of 1/299 792 458 of a second."*

Ibid.

16. *"Measurement is one of our most ordinary actions. We speak its language whenever we exchange..."*

Alders, Ken. *The Measure of All Things: The Seven-year Odyssey and Hidden Error that Transformed the World*. New York, NY: Simon & Schuster. 2002, p.2

17. *the US Army trains on battlefields known as Synthetic Training Environments...*

Robitzski, Dan. 'Soldiers Are Training in Virtual Environments Generated From Real Cities'.

*Futurism*. (2018, April 23rd). Retrieved from: <https://futurism.com/army-virtual-reality-synthetic-training-environment/>

18. “*Project 2851 is about the virtual reproduction and archiving of the entire planet...*”

Sterling, Bruce. “War is Virtual Hell”. *Wired*. 1.1. (1993, March/April)

19. “*(i) points 60 nautical miles from the foot of the continental slope; or...*”

‘Maritime jurisdiction and boundaries in the Arctic region. IBRU, Durham University. Retrieved from: <https://www.dur.ac.uk/resources/ibru/resources/Arcticmap04-08-15.pdf>

20. *That’s because where a continental shelf extends farther than the 200 miles, a country can tack on an addition 350 miles from the baseline...*

‘The United Nations Convention on the Law of the Sea’. Oceans & Law of the Sea. United Nations. (1998). Retrieved from: [http://www.un.org/depts/los/convention\\_agreements/convention\\_historical\\_perspective.htm#Exclusive%20Economic%20Zone](http://www.un.org/depts/los/convention_agreements/convention_historical_perspective.htm#Exclusive%20Economic%20Zone)

21. “*The United States and Europe were at one time connected...*”

Parfitt, Tom. ‘Russia plants flag on North Pole seabed’. *The Guardian*. (2007, August 2). Retrieved from: <https://www.theguardian.com/world/2007/aug/02/russia.arctic>

22. “*This isn’t the 15th century...*”

Ibid.

23. “*Departure From: [Place and Country]” it simply read: Moon.*

Malik, Tariq. ‘Back from the Moon, Apollo Astronauts Had to Go Through Customs’. *space.com*. (2009, July 24). Retrieved from: <https://www.space.com/7044-moon-apollo-astronauts-customs.html>

24. “*Citizens of Western countries like the US are rarely aware of the enormous luxury of their travel documents...*”

Tharoor, Kanishk. ‘Borderline Crisis’. *The Hindu Business Line*. (2018, August 17). Retrieved from: <https://www.thehindubusinessline.com/blink/talk/borderline-crisis/article24715015.ece>

25. “*few governments actually had comprehensive physical control of their borders...*”

Dowty, Alan. *Closed borders: the contemporary assault on freedom of movement*. New Haven: CT, Yale University Press, 1987. p62

26. *“Before 1914, the earth had belonged to all....”*

cit in. Levine, Allan. ‘Before the Great War, people travelled freely without passports or identification’. *Winnipeg Free Press*. (2014, August 18). Retrieved from: <https://www.winnipegfreepress.com/opinion/analysis/papers-please-271631431.html>

27. *“parts of the Netherlands inside parts of Belgium...”*

‘Most Ridiculous Borders and Walls Series : Baarle-Hertog’. *Interesly*. (2016, November 11). Retrieved from: <https://www.interesly.com/most-ridiculous-borders-and-walls-series-baarle-hertog/>

28. *“There are two civic governments — which means there are two elections for two mayors...”*

Murray, Doug. ‘Dutch-Belgian town borders on the absurd.’ *Georgia Straight*. (2004, July 29). Retrieved from: <https://www.straight.com/article/dutch-belgian-town-borders-on-the-absurd>

29. *“this seems innocent enough, but it endows the territorial state with the legitimacy...”*

Agnew, John & Corbridge, Stuart. *Mastering Space: hegemony, territory and international political economy*. London, UK: Routledge, 1995, p.83

30. *Thus, when people say “Do you speak Chinese?” they are conflating at least eight different linguistic groups and hundreds of different dialects.*

Frascione, Giulia. ‘How many languages are spoken in China?’ *Linguese*. (2016, February 29). Retrieved from: <http://linguese.com/blog/how-many-languages-are-spoken-in-china>

31. *Given that there are 195 countries.*

‘How Many Countries Are There in the World in 2018?’ *Stratfor*. (2018, February 15). Retrieved from: <https://worldview.stratfor.com/article/how-many-countries-are-there-world-2018>

32. *“a generation ago, the Bedouin and their camels roamed the deserts of the Middle East.”*

Pearce, Fred. *Land Grabbers: The New Fight Over Who Owns The Earth*. Boston, MA: Beacon Press, 2012. p.546

33. *“larger hierarchies not only won more wars but also fed more people through economies of scale...”*

MacKenzie, Debora. ‘End of nations: Is there an alternative to countries?’ *New Scientist*. (2014, September 3). Retrieved from: <https://www.newscientist.com/article/mg22329850-600-end-of-nations-is-there-an-alternative-to-countries/>

34. *Those that migrated tended to be physically much healthier.*

Schuster, Ruth. 'Surprise in Silk Road Study: Nomads Ate Better Than City Folk'. *Haaretz*. (2018, May 2). Retrieved from: <https://www.haaretz.com/archaeology/MAGAZINE-surprise-in-silk-road-study-nomads-ate-better-than-city-folk-1.6052019>

35. *were nomads really predators, or were they prey?*

Næss, Marius Warg. 'Predatory or prey – the rise of nomadic empires'. *Pastoralism, Climate Change and Policy*. (2015, November 20). Retrieved from: <https://pastoralism-climate-change-policy.com/2015/11/20/predatory-or-prey-the-rise-of-nomadic-empires/>

36. *"The governments of Finland and Norway are trying to make salmon fishing illegal..."*

Malinen, Fanny & Rushton, Steve. 'The EU's last indigenous peoples fight for self-determination and land rights'. *Equal Times*. (2017, November 15). Retrieved from: <https://www.equaltimes.org/the-eu-s-last-indigenous-peoples?lang=en>

37. *Germany (where most of the fighting took place), lost 20-30% of their population by some estimates.*

Theibault, J. (1997). 'The Demography of the Thirty Years War Re-revisited: Gunther Franz and his Critics.' *German History*, 15(1), 1–21. doi:10.1093/gh/15.1.1

38. *The individual now entered into a contract and became legally accountable for the land that they possessed...*

Agnew, John & Corbridge, Stuart. *Mastering Space: hegemony, territory and international political economy*. London, UK: Routledge, 1995, p.85

39. *As John Agnew suggests, the state became a "harmonizer of society."*

Ibid.

40. *"individual choice, particularly economic choice, now becomes possible."*

Nelson, Brian. *The Making of a Modern State*. cit in. Agnew, John & Corbridge, Stuart. *Mastering Space: hegemony, territory and international political economy*. London, UK: Routledge, 1995, p.85

41. *for the Greeks, property wasn't something that an individual had the right to trade in.*

Coulanges, Fustel de. (Trans.) Ashley, William James. *The Origin of Property in Land*, Volume 20. London: Swan Sonnenschein & Co. (1892). p.118-9

42. *"Cuius est solum, eius est usque ad coelum et ad inferos"*

‘Cuius est solum, eius est usque ad coelum et ad inferos’. *Wikipedia*. Retrieved from: [https://en.wikipedia.org/wiki/Cuius\\_est\\_solum,\\_eius\\_est\\_usque\\_ad\\_coelum\\_et\\_ad\\_inferos](https://en.wikipedia.org/wiki/Cuius_est_solum,_eius_est_usque_ad_coelum_et_ad_inferos)

43. “as many as six to ten of their chickens were killed in one day by flying into the walls from fright. The total chickens lost in that manner was about 150.”

‘United States v. Causby, 328 U.S. 256 (1946)’. *Justia*. Retrieved from: <https://supreme.justia.com/cases/federal/us/328/256/>

44. *land owners could extend their property rights indefinitely up into the sky.*

As the Supreme Court ruled, “The common law doctrine that ownership of land extends to the periphery of the universe has no place in the modern world.”

Ibid.

45. *The FAA grants unmanned aerial vehicles the permission to fly below 400 feet.*

‘Operation and Certification of Small Unmanned Aircraft Systems; Final Rule’. Department of Transportation, Federal Aviation Administration. Federal Register. Vol. 81, No. 184. (2016, June 28). Retrieved from: <https://www.gpo.gov/fdsys/pkg/FR-2016-06-28/pdf/2016-15079.pdf>

46. *And so, according to the judge, Meredith was well within his rights to shoot the drone down.*

Sneed, Annie. ‘So Your Neighbor Got a Drone for Christmas’. *Scientific American*. (2015, December 22). Retrieved from: <https://www.scientificamerican.com/article/so-your-neighbor-got-a-drone-for-christmas/>

47. *Harvard astronomer Jonathan McDowell has argued the Kármán line should in fact be set at eighty kilometres, as some elliptical satellites have been observed at this altitude without “crashing to Earth”.*

McDowell, Jonathan. ‘Where does space begin? Here’s why it’s closer than you think’. *New Scientist*. (2018, July 30). Retrieved from: <https://www.newscientist.com/article/2175496-where-does-space-begin-heres-why-its-closer-than-you-think/>

48. *It is ironic however, that it is out there and not here on Earth that space is free and a “province for all mankind.”*

‘Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies’. United Nations Office for Outer Space Affairs. Retrieved from: <http://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introouterspacetreaty.html>

49. “as an international scientific organisation, the IAU dissociates itself entirely from the commercial practice of “selling” fictitious star names.”

‘Buying Stars and Star Names’. International Astronomical Union. Retrieved from: [https://www.iau.org/public/themes/buying\\_star\\_names/](https://www.iau.org/public/themes/buying_star_names/)

50. “engage in the commercial exploration and exploitation of ‘space resources’ [including...water and minerals]”

‘H.R.2262 - U.S. Commercial Space Launch Competitiveness Act 114th Congress (2015-2016)’. [congress.gov](https://www.congress.gov/bill/114th-congress/house-bill/2262/text). Retrieved from: <https://www.congress.gov/bill/114th-congress/house-bill/2262/text>

51. “humanity’s hope for a future beyond Earth.”

Messeri, Lisa. *Placing Outer Space: An Earthly Ethnography of Other Worlds*. Durham NC: Duke University Press, 2016. Ebook: p.18

52. “The idea that one man could possess all rights to one stretch of land to the exclusion of everybody else’...”

Fairlie, Simon. ‘A Short History of Enclosure in Britain’. *The Land Magazine*. The Land Issue. (2009, Summer). Retrieved from: <http://www.thelandmagazine.org.uk/articles/short-history-enclosure-britain>

53. “when a labourer becomes possessed of more land than he and his family can cultivate in the evenings...”

*The Commercial, Agricultural and Manufacturer's Magazine*, Volume 3. (1800, July). p165

54. “Should a poor man take one of your sheep from the common, his life would be forfeited by law...”

Neeson, J.M. *Commoners: Common Right, Enclosure and Social Change in England, 1700-1820*. New York, NY: Cambridge University Press. p.326

55. *In England and Wales, 65% of the population lived in rural areas in 1801, exactly one hundred years later, only 23% of the population remained.*

Fairlie, Simon. ‘A Short History of Enclosure in Britain’. *The Land Magazine*. The Land Issue. (2009, Summer). Retrieved from: <http://www.thelandmagazine.org.uk/articles/short-history-enclosure-britain>

56. *According to Oxfam, in the last decade alone, 81 million acres of land (about the size of Germany) have been seized...*

‘The truth about land grabs’. Oxfam America. Retrieved from:  
<https://www.oxfamamerica.org/take-action/campaign/food-farming-and-hunger/land-grabs/>

57. *“about four-fifths of the continent’s 6 billion acres is not formally owned by anyone other than the state.*

Pearce, Fred. *Land Grabbers: The New Fight Over Who Owns The Earth*. Boston, MA: Beacon Press, 2012. p.555

58. *between 2000 to 2010, China went from having 3.6 million traditional villages to 2.7 million villages.*

Johnson, Ian. ‘In China, ‘Once the Villages Are Gone, the Culture Is Gone’’. *The New York Times*. (2014, February 1). Retrieved from:  
<https://www.nytimes.com/2014/02/02/world/asia/once-the-villages-are-gone-the-culture-is-gone.html>

59. *By 2034, China’s National Bureau of Statistics estimates that less than 25% of the population will be rural...*

Phillips, Tom. ‘China's villages vanish amid rush for the cities’’. *The Telegraph*. (2013, November 23). Retrieved from:  
<https://www.telegraph.co.uk/news/worldnews/asia/china/10470077/Chinas-villages-vanish-amid-rush-for-the-cities.html>

60. *Globally, UN Habitat has estimated that in 2009 alone, 3 million people were moving to cities every week.*

‘The World’s Cities in 2016’’. United Nations. Retrieved from:  
[http://www.un.org/en/development/desa/population/publications/pdf/urbanization/the\\_worlds\\_cities\\_in\\_2016\\_data\\_booklet.pdf](http://www.un.org/en/development/desa/population/publications/pdf/urbanization/the_worlds_cities_in_2016_data_booklet.pdf)

61. *In London, 7 out of every 10 residences in these prime areas, are investments for overseas buyers...*

Booth, William & Adam, Karla. ‘London mayor targets ‘ghost mansions’ and ‘zombie flats’’. *The Washington Post*. (2017, September 18). Retrieved from:  
[https://www.washingtonpost.com/world/europe/london-struggles-with-ghost-mansions-and-zombie-flats-the-empty-units-in-city-bereft-of-affordable-housing/2017/09/18/253d67fa-97c4-11e7-af6a-6555caeb8dc\\_story.html](https://www.washingtonpost.com/world/europe/london-struggles-with-ghost-mansions-and-zombie-flats-the-empty-units-in-city-bereft-of-affordable-housing/2017/09/18/253d67fa-97c4-11e7-af6a-6555caeb8dc_story.html)

62. *In England, nearly half the country is owned by less than 1 per cent of the population.*

Karasz, Palko. "Half of England Is Owned by Less Than 1% of Its Population, Researcher Says." *The New York Times*. (2019, April 19). Retrieved from:  
<https://www.nytimes.com/2019/04/19/world/europe/england-land-inequality.html>

63. *“most of the rest of us spend half our working lives paying off the debt on a patch of land barely large enough to accommodate a dwelling and a washing line.”*

Ibid.

64. *In 2018 in the UK, there were 216,000 homes that were empty for 6 months or more*

‘More than 11,000 UK homes empty for 10 years’. *BBC*. (2018, January 1). Retrieved from: <https://www.bbc.com/news/uk-42536418>

65. *“China is the world’s most populated country that without a doubt has the world’s largest number of empty homes.”*

Shepard, Wade. Ghost Cities. cit in. Chi, Guanghua; Liu, Yu; Wu, Zhengwei & Wu, Haishan. “‘Ghost Cities’ Analysis Based on Positioning Data in China’. Institute of Remote Sensing and Geographic Information Systems, Peking University, Beijing, China. (2015, October 28) Retrieved from: <https://arxiv.org/ftp/arxiv/papers/1510/1510.08505.pdf>

66. *researchers from Peking University in Beijing found that there are approximately fifty “ghost cities” in the country that remain largely uninhabited.*

Ibid.

67. *Dormitory blocks built to house 50,000 workers at a time are filled with steel bunkbeds.*

Knowles, George. ‘Life for China's migrant workers: dorm that looks like prison’. *South China Morning Post*. (2016, May 27). Retrieved from: <https://www.scmp.com/magazines/post-magazine/article/1955023/life-chinas-migrant-workers-dorm-looks-prison>

68. *“roughly the size of three toilet cubicles...”*

Ng, Naomi. ‘Average living space for Hong Kong’s poorest residents same as that of prisoners, survey reveals’. *South China Morning Post*. (2017, October 31). Retrieved from: <https://www.scmp.com/news/hong-kong/community/article/2117810/average-living-space-hong-kongs-poorest-residents-same>

67. *“coffin cubicles.” These are so small, they are only 15 square feet in total.*

Stack, Sarah. ‘Life Inside Hong Kong’s ‘Coffin Cubicles’’. *National Geographic*. (2017, July 26). Retrieved from: <https://www.nationalgeographic.com/photography/proof/2017/07/hong-kong-living-trapped-lam-photos/?user.testname=none>

68. *“There is no difference between me and the people who live in the posh condominium above...”*

‘The Rat Tribe: Life Under the Capital’. *ChinaFile*. (2012, October 16). Retrieved from: <http://www.chinafile.com/multimedia/video/rat-tribe>

## Chapter 9

1. That dot was Michael Hall, a cyclist in a 5,500- kilometre endurance race being watched online by a community of “dot watchers,”

Maddox, Gary. ‘Champion cyclist Mike Hall killed in accident during Indian Pacific Wheel Race’. *The Sydney Morning Herald*. (2017, March 31). Retrieved from: <https://www.smh.com.au/sport/cycling/champion-cyclist-mike-hall-killed-in-accident-during-indian-pacific-wheel-race-20170331-gvaj79.html>

2. “*You’d go from checking maybe once or twice a day, to checking a couple of times a day...*”

Evans, Jake. ‘Mike Hall's death won't be last time tragedy unfolds via Google Maps, expert says’. *ABC*. (2017, April 8). Retrieved from: <https://www.abc.net.au/news/2017-04-09/mike-halls-death-watched-on-google-maps-by-thousands/8415522>

3. The signals are controlled by the *U.S. Air Force and used by about a billion people a day*.

Bender, Bryan & Klimas, Jacqueline. ‘Space war is coming — and the U.S. is not ready’. *Politico*. (2018, April 6). Retrieved from: <https://www.politico.com/story/2018/04/06/outer-space-war-defense-russia-china-463067>

4. “*Cook: What use are invisible stars? Commander: We don’t need to see them...*”

Frazier, Eric and Easton, Richard. *GPS Declassified: From Smart Bombs to Smartphones*. Lincoln, Nebraska: Potomac Books: 2013. Ebook: p78

5. “*the total energy picked up by all the radio telescopes on the entire planet...*”

Sagan, Carl. *Cosmos*. New York, NY: Ballantine Books Trade Paperbacks. 2013, p277

6. “*two snowflakes...maybe three.*”

Beamjockey. ‘Speaking Frankly: The Snowflake and the Radio Telescopes’. (2013, March 14). Retrieved from: <https://beamjockey.livejournal.com/212211.html>

7. *On May 1, 2000, President Clinton turned off “selective availability” for GPS, effectively giving civilian GPS the same capability that existed for the military. By flipping the switch, he instantly made the signals ten times more accurate than they had been previously.*

Frazier, Eric and Easton, Richard. *GPS Declassified: From Smart Bombs to Smartphones*. Lincoln, Nebraska: Potomac Books: 2013. Ebook: p.150

8. *Geosynchronous satellites orbit the planet in synch with our sidereal day, or once every twenty-three hours, fifty-six minutes and four seconds, and thus appear to an Darth observer to be in the same place at the same time once a day. A geostationary satellite also orbits the planet once a day but is stationed high above the equator and thus will appear to an Darth observer to be stationary in the same place throughout the day.*

‘Gravitation (7 of 17) Geosynchronous and Geostationary Orbits’. Step-by-Step Science. (2017, June 4). Retrieved from: <https://www.youtube.com/watch?v=BCthAICkKig>

9. *geostationary satellites are “thousands of times further away”*

Managh, Geoff. ‘Tracking Earth's Secret Spy Satellites’. *The Atlantic*. (2016, June 10). Retrieved from: <https://www.theatlantic.com/technology/archive/2016/06/mapping-clandestine-moons/485915/>

10. *The UK’s Carbonite-2 satellite was able to record HD, full colour video filmed from 505 kilometres away.*

Amos, Jonathan. ‘UK satellite makes HD colour movies of Earth’. *BBC*. (2018, April 16). Retrieved from: <https://www.bbc.com/news/science-environment-43775440>

11. *Google uses will now be able to show images at 25 centimetres of resolution...*

Wanshel, Elyse. ‘Google's Satellites Could Soon See Your Face from Space’. *Motherboard*. (2014, August 11). Retrieved from: [https://motherboard.vice.com/en\\_us/article/8qx54b/googles-satellites-could-soon-see-your-face-from-space](https://motherboard.vice.com/en_us/article/8qx54b/googles-satellites-could-soon-see-your-face-from-space)

12. *Imaging resolution is said to be at least twelve centimetres.*

‘What is a keyhole satellite and what can it really spy on?’ *How Stuff Works*. Retrieved from: <https://science.howstuffworks.com/question529.htm>

13. *“Just like the Earth has a coordinate grid, with latitude and longitude, the sky has a coordinate grid...”*

Griggs, Mary Beth. ‘Meet the amateur astronomers who track secretive spy satellites for fun’. *Popular Science*. (2018, January 11). Retrieved from: <https://www.popsci.com/zuma-spy-satellite-amateur-astronomer>

14. *“Any accidental interruption or deliberate severance of space-based services would cause immense financial losses...”*

Al-Rodhan, Nayef. ‘Preventing Future Conflicts in Outer Space’. *Center for Security Studies, ETH Zurich*. (2018, March 14). Retrieved from: <https://isnblog.ethz.ch/security/preventing-future-conflicts-in-outer-space>

15. *On January 11th 2007, China launched a ballistic missile from Xichang Space Center.*

Pontin, Mark Williams. 'China's Antisatellite Missile Test: Why?'. *MIT Technology Review*. (2007, March 8). Retrieved from: <https://www.technologyreview.com/s/407454/chinas-antisatellite-missile-test-why/>

16. *The Outer Space Treaty banned weapons of mass destruction in orbit and outer space but does not ban conventional weaponry in orbit.*

'2007 Chinese anti-satellite missile test'. *Wikipedia*. Retrieved from: [https://en.wikipedia.org/wiki/2007\\_Chinese\\_anti-satellite\\_missile\\_test](https://en.wikipedia.org/wiki/2007_Chinese_anti-satellite_missile_test)

17. *"To the lady in the brown dress" the voice from CCTV camera said...*

'Surveillance cameras talk'. *Daily Planet*. (2008, February 15). Retrieved from: <https://www.youtube.com/watch?v=GvxEuL-kQv0>

18. *In North London however, where similar cameras are installed on council estates, they are oppressive...*

'Talking CCTV Camera Orders Residents To Leave Their Own Property'. *Leaksource*. (2012, February 9). Retrieved from: <https://www.youtube.com/watch?v=gsarT43VdMw>

19. *"a voice from the heavens to warn you not to step out of line."*

Chazan, David. 'French town installs 'talking CCTV cameras' to scare off litterbugs'. *The Telegraph*. (2016, March 28). Retrieved from: <https://www.telegraph.co.uk/news/2016/03/28/french-town-installs-talking-cctv-cameras-to-scare-off-litterbug1/>

20. *"one of the largest non military databases in the UK."*

'Surveillance Camera Commissioner, Annual Report 2016/7'. (2018, January 28). Retrieved from: [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/672286/CCS207\\_CCS0118716124-1\\_Annex\\_A\\_-\\_AR\\_2017-\\_web.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/672286/CCS207_CCS0118716124-1_Annex_A_-_AR_2017-_web.pdf)

21. *more than 170 million CCTV cameras installed in the country.*

Russell, Jon. 'China's CCTV surveillance network took just 7 minutes to capture BBC reporter'. *Techcrunch*. (2017, December 13). Retrieved from: <https://techcrunch.com/2017/12/13/china-cctv-bbc-reporter/>

Deahl, Dani. 'Suspect caught in China at music concert after being detected by facial recognition technology'. *The Verge*. (2018, April 12). Retrieved from: <https://www.theverge.com/2018/4/12/17229530/china-facial-recognition-technology-suspect-music-festival>

22. *the system also knows “who you are and who you frequently meet.”*

‘In Your Face: China’s all-seeing state’. *BBC*. (2017, December 10). Retrieved from: <https://www.bbc.com/news/av/world-asia-china-42248056/in-your-face-china-s-all-seeing-state>

23. *“public buses in San Francisco; Athens, Georgia; Baltimore; Eugene, Oregon; Traverse City, Michigan...”*

Staples, William G. *Everyday Surveillance: Vigilance and Visibility in Postmodern Life*. Lanham, MD: Rowman & Littlefield. 2014. Ebook: loc 2023

24. *the Intellistreets system has been installed.*

Schoenmann, Joe. ‘Joe Downtown: Be careful what you say; downtown street lights could one day listen in on your conversation’. *Las Vegas Sun*. (2013, November 13). Retrieved from: <https://lasvegassun.com/news/2013/nov/13/be-careful-what-you-say-downtown-street-lights-cou/>

25. *“sensors are hidden in lights, on walls, under desks...”*

Condliffe, Jamie. ‘Your Cubicle Has Ears—and Eyes, and a Brain’. *MIT Technology Review*. (2017, February 14). Retrieved from: <https://www.technologyreview.com/s/603648/your-cubicle-has-ears-and-eyes-and-a-brain/>

26. *Companies like Humanzye provide what they call “people analytics”.*

‘Smile, you’re on camera: There will be little privacy in the workplace of the future’. *The Economist*. (2018, March 28). Retrieved from: <https://www.economist.com/special-report/2018/03/28/there-will-be-little-privacy-in-the-workplace-of-the-future>

27. *“how long an individual goes without uttering a word to anyone—and when that word does come, where does it happen and to whom is it addressed.”*

Condliffe, Jamie. ‘Your Cubicle Has Ears—and Eyes, and a Brain’. *MIT Technology Review*. (2017, February 14). Retrieved from: <https://www.technologyreview.com/s/603648/your-cubicle-has-ears-and-eyes-and-a-brain/>

28. *current video surveillance market worth \$36 billion USD and projected to reach \$68 billion by 2023.*

‘Video Surveillance Market Worth 68.34 Billion USD by 2023’. *PR Newswire*. (2018, May 7). Retrieved from: <https://www.prnewswire.com/news-releases/video-surveillance-market-worth-6834-billion-usd-by-2023-681933911.html>

29. *“strategies [are] used by both public and private organizations to influence our choices...”*

Staples, William G. *Everyday Surveillance: Vigilance and Visibility in Postmodern Life*. Lanham, MD: Rowman & Littlefield. 2014. Ebook: loc 168

30. *As one driver put it, telematics “should be known as Harassamatics.” Another stated that the data made him look guilty when he was innocent: “They assume that every driver is cheating...”*

Ibid. loc: 2359-2364

31. *“Concealed in regular safety helmets or uniform hats, these lightweight, wireless sensors constantly monitor the wearer’s brainwaves...”*

Chen, Stephen. ‘Forget the Facebook leak’: China is mining data directly from workers’ brains on an industrial scale’. *South China Morning Post*. (2018, April 29). Retrieved from: <https://www.scmp.com/news/china/society/article/2143899/forget-facebook-leak-china-mining-data-directly-workers-brains>

32. *For six months in 2008, over 1.8 million Yahoo! chat accounts were compromised...*

Johnston, Ian. ‘Intimate’ webcam images, Snowden files reveal’. *The Independent*. (2014, February 27). Retrieved from: <https://www.independent.co.uk/life-style/gadgets-and-tech/yahoo-webcam-users-intimate-images-intercepted-by-gchq-spy-programme-snowden-files-reveal-9158140.html>

33. *Data from public records has found a 92% false positive rate for facial recognition: “public records request shows that of the 2,470 alerts from the facial recognition system, 2,297 were false positives. In other words, nine out of 10 times, the system erroneously flagged someone as being suspicious or worthy of arrest.*

Farivar, Cyrus. ‘UK police say 92% false positive facial recognition is no big deal’. *Ars Technica*. (2017, May 7). Retrieved from: <https://arstechnica.com/tech-policy/2018/05/uk-police-say-92-percent-false-positive-facial-recognition-is-no-big-deal/>

34. *We still have no way of knowing how much access they have to our private video and audio communications...*

Note: Optic Nerve was only one a suite of spy programs that Snowden revealed. A full list of what he revealed in one year can be seen here:

Szoldra, Paul. ‘This is everything Edward Snowden revealed in one year of unprecedented top-secret leaks’. *Business Insider*. (2016, September 16). Retrieved from: <https://www.businessinsider.com/snowden-leaks-timeline-2016-9>

35. *A 2013 survey by the International Chiefs of Police found that 96% use social media in some capacity.*

‘International Association of Chiefs of Police 2013 Social Media Survey Results.’ *ACP’s Center for Social Media*. (2013). Retrieved from: <https://www.berkeleyside.com/wp-content/uploads/2014/02/2013SurveyResults.pdf>

36. *He posted, “Joe Lipari might walk into an Apple store on Fifth Avenue with an Armalite AR-10 gas powered semi-automatic weapon and pump round after round into one of those smug, fruity little concierges.”*

Motal, Julius. ‘Charges Dropped Over Facebook Apple Rant’. *PCMag*. (2011, June 28). Retrieved from: <https://www.pcmag.com/article2/0,2817,2387730,00.asp>

37. *“I always thought we were on the side of the people...”*

Lipari, Joe. ‘I’m Joe Lipari, the NYC comedian turned terror suspect because of a Facebook post. I was featured on/in "This American Life" and "Terms & Conditions May Apply”’ *AMA Reddit*. Retrieved from: [https://www.reddit.com/r/IAMA/comments/1ndvop/im\\_joe\\_lipari\\_the\\_nyc\\_comedian\\_turned\\_terror/](https://www.reddit.com/r/IAMA/comments/1ndvop/im_joe_lipari_the_nyc_comedian_turned_terror/)

38. *the average person leaves behind a 500 megabyte digital footprint.*

‘Do You Trust This Computer’. *Paper cut films*. 2018. Retrieved from: <http://doyoutrustthiscomputer.org/>

39. *That’s because the vast majority of the world’s information—some say up to 99.8%—was created in the last two years.*

Leung, Leo. ‘99.8 percent of the world’s data was created in the last two years’. *Tech Expectations*. (2014, October 23). Retrieved from: <https://techexpectations.org/2014/10/23/99-percent-of-the-worlds-data/>

40. *According to one study, the digital universe will contain 44 trillion gigabytes of data by 2020.*

‘EMC Digital Universe Study with Research and Analysis by IDC’. *EMC* (2014). Retrieved from: <https://canada.emc.com/leadership/digital-universe/index.htm>

41. *Michael Kosinski put it: if you imagine just one day of humanity’s data printed out in 12 font on double sided paper...*

Kosinski, Michael. cit in: ‘Do You Trust This Computer’. *Paper cut films*. 2018. Retrieved from: <http://doyoutrustthiscomputer.org/>

42. *“the world’s most valuable resource is no longer oil, but data.”*

‘Regulating the internet giants: The world’s most valuable resource is no longer oil, but data’. *The Economist*. (2017, May 6). Retrieved from: <https://www.economist.com/leaders/2017/05/06/the-worlds-most-valuable-resource-is-no-longer-oil-but-data>

43. *“The game is selling access to the real-time flow of your daily life - your reality.”*

Zuboff, Shoshana. ‘The Secrets of Surveillance Capitalism’. *FAZ.net*. (2016, May 3). Retrieved from: <http://www.faz.net/aktuell/feuilleton/debatten/the-digital-debate/shoshana-zuboff-secrets-of-surveillance-capitalism-14103616-p2.html>

44. *“just Facebook and Google, Apple or Amazon that harvest and use our data...”*

Sachs, Jeffrey D. ‘Facebook and the future of online privacy’. *The Jordan Times*. (2018, April 21). Retrieved from: <http://www.jordantimes.com/opinion/jeffrey-d-sachs/facebook-and-future-online-privacy>

45. *“platform bids on each individual impression through RTB based on what is known about the user...”*

Kluge, Peter. ‘Display Advertising Basics (DSPs, RTB, Ad Exchanges, DMPs)’. (2014, May 19). Retrieved from: [https://www.youtube.com/watch?v=xnX1nxMM\\_R0](https://www.youtube.com/watch?v=xnX1nxMM_R0)

46. *Users were told that the app was “a research tool used by psychologists”*

Swant, Marty. ‘A Researcher’s Quiz App Deceptively Harvested Data for Political Research, Facebook Alleges’. *Adweek*. (2018, March 17). Retrieved from: <https://www.adweek.com/digital/a-researchers-quiz-app-deceptively-harvested-data-for-political-research-facebook-alleges/>

47. *“The algorithm...trawls through the most apparently trivial, throwaway postings...”*

Cadwalladr, Carole and Graham-Harrison, Emma. ‘How Cambridge Analytica turned Facebook ‘likes’ into a lucrative political tool’. *The Guardian*. (2018, March 17). Retrieved from: <https://www.theguardian.com/technology/2018/mar/17/facebook-cambridge-analytica-kogan-data-algorithm>

48. *“not only read minds but change them.”*

‘Cambridge Analytica: Whistleblower reveals data grab of 50 million Facebook profiles’. *Channel 4 News*. (2018, March 17). Retrieved from: <https://www.youtube.com/watch?v=zb6-xz-geH4>

49. *“computers are better at understanding who you are as a person, than even your co-workers, or your friends.”*

Ibid.

50. *“including old chats, pokes, and mater that had been deleted years before.”*

Gilliom, John & Monahan, Torin. *SuperVision: An Introduction to the Surveillance Society*. Chicago, IL: The University of Chicago Press, 2013. Ebook: loc 919

51. *“Golden Record”*

Kelley, Debbie. ‘Colorado Parents Worry About What Government, Businesses Know About Their Kids’. *The Gazette*. (2015, February 21). Retrieved from: [https://gazette.com/news/colorado-parents-worry-about-what-government-businesses-know-about-their/article\\_e84f57b5-ac08-537f-bbff-bc7521ff7dcc.html](https://gazette.com/news/colorado-parents-worry-about-what-government-businesses-know-about-their/article_e84f57b5-ac08-537f-bbff-bc7521ff7dcc.html)

52. *Every other year, students are given the “Healthy Kids Colorado Survey,” which pries into personal details, asking, for example, “how old you were when you first had sexual intercourse, have you ever been molested, how many times you’ve driven a car when you’d used marijuana.”*

Ibid.

53. *“help guide parents, teachers, school, districts and state leaders, as we work together to improve student achievement...”*

Ibid.

54. *In a 2013 video, Dan Domagala, the chief information officer of the Colorado Department of Education stated that the longitudinal information can be shared in a “hub and spoke approach.”*

Logue, Gretchen. ‘Colorado State Education Agency Sharing Identifiable Student Information with Various Agencies. Will This Happen in Missouri?’. *Missouri Education Watchdog*. (2014, March 20). Retrieved from: <http://missourieducationwatchdog.com/colorado-state-education-agency-sharing-identifiable-student-information-with-various-agencies-will-this-happen-in-missouri/>

55. *“no parent has ever been able to access their child’s Golden Record.”*

Engel, Angela. ‘Please identify all vendors that receive any type of data or metadata related to Colorado students.’ [AngelaEngel.com](http://AngelaEngel.com) Retrieved from: <https://www.angelaengel.com/faqs/please-identify-all-vendors-that-receive-any-type-of-data-or-metadata-related-to-colorado-students/>

56. *to add insult to injury he was now being “disrespected and violated” at the funeral home.*

‘Florida Police Fail to Unlock Biometrics-Protected Phone With Dead Suspect’s Fingerprint’. *Find Biometrics*. (2018, April 24). Retrieved from: <https://findbiometrics.com/florida-police-dead-suspects-fingerprint-404245/>

57. *Police can hire a company like Cellebrite to unlock the phone and bypass biometric readers as well. The cost is \$1,500-\$3,000 per phone.*

Brewster, Thomas. ‘Yes, Cops Are Now Opening iPhones With Dead People’s Fingerprints’. *Forbes*. (2018, March 22). Retrieved from: <https://www.forbes.com/sites/thomasbrewster/2018/03/22/yes-cops-are-now-opening-iphones-with-dead-peoples-fingerprints/#46a4fed2393e>

58. *hacked off the owner’s index finger so they could drive away with the car.*

Kent, Jonathan. ‘Malaysia car thieves steal finger’. *BBC*. (2005, March 31). Retrieved from: <http://news.bbc.co.uk/2/hi/asia-pacific/4396831.stm>

59. *At Michigan State University, experts took a 2D fingerprint...*

‘Biometrics Expert Helps Police Spoof Fingerprints for Smartphone Access’. *Find Biometrics*. (2016, July 28). Retrieved from: <https://findbiometrics.com/police-spoof-smartphone-307281/>

60. *to use an algorithm to match a person to their “intervocalic breath sounds”...*

Baraniuk, Chris. ‘How we breathe between words can be used to identify us’. *New Scientist*. (2017, December 6). Retrieved from: <https://www.newscientist.com/article/2155620-how-we-breathe-between-words-can-be-used-to-identify-us/>

61. *“The codes show IBM’s numerical designation for various camps. Auschwitz was 001, Buchenwald was 002.”*

Black, Edwin. ‘IBM’s Role in the Holocaust — What the New Documents Reveal’. *Huffington Post*. (2012, February 27). Retrieved from: [https://www.huffingtonpost.com/edwin-black/ibm-holocaust\\_b\\_1301691.html](https://www.huffingtonpost.com/edwin-black/ibm-holocaust_b_1301691.html)

62. *“In the Netherlands, 73% of Dutch Jews were found, deported, and executed. In France, that figure was 25%...”*

Burns, Heather. Twitter. (2018, January 27). Retrieved from: <https://twitter.com/WebDevLaw/status/957256426392494080>

Davis, Amanda. ‘A History of Hacking’. *The Institute, IEEE*. (2015, March 6). Retrieved from: <http://theinstitute.ieee.org/technology-topics/cybersecurity/a-history-of-hacking>

63. *“identification is the starting point of surveillance.”*

Lyons, David. *Identifying Citizens* cit. in Gilliom, John & Monahan, Torin. *SuperVision: An Introduction to the Surveillance Society*. Chicago, IL: The University of Chicago Press, 2013. Ebook: loc 718

64. “nothing more surprising than the easiness with which the many are governed by the few.”

Hume, David. ‘Essay IV: Of The First Principles of Government’. *Essays Moral, Political, Literary* (LF ed.) 1777. Retrieved from: [http://oll.libertyfund.org/titles/hume-essays-moral-political-literary-lf-ed#Hume\\_0059\\_131](http://oll.libertyfund.org/titles/hume-essays-moral-political-literary-lf-ed#Hume_0059_131)

65. “People are willing to do such things when they trust the figments of their collective imagination.”

Harari, Yuval Noah. *Sapiens: A brief history of humankind*. Signal Books, 2014. p.180

66. *taken away and charged because of unspecified “economic crimes.”*

Deahl, Dani. ‘Suspect caught in China at music concert after being detected by facial recognition technology’. *The Verge*. (2018, April 12). Retrieved from: <https://www.theverge.com/2018/4/12/17229530/china-facial-recognition-technology-suspect-music-festival>

67. *It’s been called the “gamification of good behaviour”*

Hvistendahl, Mara. ‘Inside China’s Vast New Experiment in Social Ranking’. *Wired Magazine*. (2017, December 14). Retrieved from: <https://www.wired.com/story/age-of-social-credit/>

68. “The aim is for every Chinese citizen to be trailed by a file compiling data from public and private sources...”

Ibid.

69. “shopping habits to online speech.”

Wang, Maya. ‘China’s Chilling ‘Social Credit’ Blacklist’. *Wall Street Journal*. (2017, December 11). Retrieved from: <https://www.wsj.com/articles/chinas-chilling-social-credit-blacklist-1513036054>

70. “you become effectively, a second-class citizen.”

Hvistendahl, Mara. ‘Inside China’s Vast New Experiment in Social Ranking’. *Wired Magazine*. (2017, December 14). Retrieved from: <https://www.wired.com/story/age-of-social-credit/>

71. *four million people have been blocked from high-speed train travel, and eleven million more have been blocked from buying airline tickets.*

Chan, Tara Francis. 'China's social credit system has blocked people from taking 11 million flights and 4 million train trips'. Business Insider. (2018, May 21). Retrieved from: <https://www.businessinsider.in/Chinas-social-credit-system-has-blocked-people-from-taking-11-million-flights-and-4-million-train-trips/articleshow/64255175.cms>

72. According to an article in the *The Sydney Morning Herald*, "The first phase of the national credit sharing information platform was being used by forty-four departments, across all provinces and sixty private enterprises, to disclose information and mete out 'joint punishment'".

Needham, Kristy. 'If you get on China's 'blacklist,' you can be banned from travel'. *The Sydney Morning Herald*. (2018, March 6). Retrieved from: <https://www.smh.com.au/world/asia/big-brother-stops-millions-boarding-planes-trains-in-china-20180306-p4z33u.html>

73. "We usually think of surveillance cameras as digital eyes, watching over us or watching out for us, depending on your view..."

Vincent, James. 'Artificial intelligence is going to supercharge surveillance'. *The Verge*. (2018, January 23). Retrieved from: <https://www.theverge.com/2018/1/23/16907238/artificial-intelligence-surveillance-cameras-security>

74. Studies have found that using this surface texture analysis improves facial recognition accuracy by 20-25%.

Pontin, Mark Williams. 'Better Face-Recognition Software'. *MIT Technology Review*. (2007, May 30). Retrieved from: <https://www.technologyreview.com/s/407976/better-face-recognition-software/>

75. This 'gaydar' has an accuracy rate of 91 percent.

Levin, Sam. 'New AI can guess whether you're gay or straight from a photograph'. *The Guardian*. (2017, September 8). Retrieved from: <https://www.theguardian.com/technology/2017/sep/07/new-artificial-intelligence-can-tell-whether-youre-gay-or-straight-from-a-photograph>

76. 18.8 million people were required to participate in the *Physicals for All* program in 2017.

'China: Minority Region Collects DNA from Millions: Private Information Gathered by Police, Under Guise of Public Health Program'. *Human Rights Watch*. (2017, December 13). Retrieved from: <https://www.hrw.org/news/2017/12/13/china-minority-region-collects-dna-millions>

77. "Security checkpoints with identification scanners guard the train station and roads in and out of town."

Chin, Josh & Bürge Clément. 'Twelve Days in Xinjiang: How China's Surveillance State Overwhelms Daily Life'. *Wall Street Journal*. (2017, December 19). Retrieved from:

<https://www.wsj.com/articles/twelve-days-in-xinjiang-how-chinas-surveillance-state-overwhelms-daily-life-1513700355>

78. *In India, healthcare workers are using fingerprints as a primary form of ID for children without official documents.*

Tung, Liam. ‘World’s first’ biometric fingerprint scanner for newborns’. CSO. (2016, October 19). Retrieved from: <https://www.cso.com.au/article/608761/world-first-biometric-fingerprint-scanner-newborns/>

79. *in the UK, four out of ten schools use biometric fingerprinting.*

Garner, Richard. ‘Privacy concerns raised as more than one million pupils are fingerprinted in schools’. *The Independent*. (2014, January 3). Retrieved from: <https://www.independent.co.uk/news/education/education-news/privacy-concerns-raised-as-more-than-one-million-pupils-are-fingerprinted-in-schools-9034897.html>

80. *The system can even be scaled up, “expanded, at no additional cost, to handle time and attendance, event admission, parking lot security and the tracking of students riding on school buses.”*

Gilliom, John & Monahan, Torin. *SuperVision: An Introduction to the Surveillance Society*. Chicago, IL: The University of Chicago Press, 2013. Ebook: loc 1527

81. *“their children wouldn’t be allowed to eat school lunches at all.”*

Ibid. loc 1536

82. *“the poor must scan their fingerprints at the ration shop to get their government allocations of rice.”*

Goel, Vindu. ‘Indian ‘Big Brother’ using fingerprint identification system for food, benefits and bank accounts’. *The Independent*. (2018, April 10). Retrieved from: <https://www.independent.co.uk/news/world/asia/india-tech-fingerprint-eye-scan-id-food-benefits-bank-accounts-a8297391.html>

83. *in Venezuela over 20,000 fingerprint scanners were installed in supermarkets.*

Valencia, Robert. ‘Maduro’s Hunger Games: Biometric Food Rationing in Venezuela’. *Splinter News*. (2015, March 11). Retrieved from: <https://splinternews.com/maduro-s-hunger-games-biometric-food-rationing-in-vene-1793846338>

84. *“man is born free, but everywhere he is in chains.”*

Rousseau, Jean-Jacques. ‘On the Social Contract; or, Principles of Political Rights’. France. 1762

85. “disciplinary power is exercised through its invisibility...[and] at the same time it imposes on its subjects a compulsory visibility...”

Foucault, Michel. *Discipline and Punish: The Birth of the Prison*. New York, NY: Vintage Books, 1977, p.187

86. “the best way to understand the world is not as a metaphorical prison but a literal one.”

Berger, John. ‘Fellow Prisoners’. *Guernica*. (2011, July 15). Retrieved from: [https://www.guernicamag.com/john\\_berger\\_7\\_15\\_11/](https://www.guernicamag.com/john_berger_7_15_11/)

87. *Synopsis: Vegan Halloween Party Details: Philadelphia obtained an Internet posting*

Shapiro, Ryan. ‘#FBI domestic terrorism priorities less than 1 year after 9/11: Vegan Halloween Costume Party. #FOIA’. *Twitter*. (2016, November 2). Retrieved from: <https://twitter.com/rshapiro/status/793827588187623424>

88. *Where ag-gag laws have been struck down, activists are being charged through other means. Rescues of sick or injured animals, for example, fall under federal theft with a charge of five years.*

Greenwald, Glenn. ‘Six Animal Rights Activists Charged With Felonies for Investigation and Rescue That Led to Punishment of a Utah Turkey Farm’. *The Intercept*. (2018, May 4). Retrieved from: <https://theintercept.com/2018/05/04/six-animal-rights-activists-charged-with-felonies-for-investigation-and-rescue-that-led-to-punishment-of-a-utah-turkey-farm/>

89. “The list of top eco-terrorism crimes from one of the top adversaries of these movements does not include a single injury or death.”

Potter, Will. *Green Is the New Red: An Insider's Account of a Social Movement Under Siege*. San Francisco, CA: Citylight Books. 2011. loc: 1824

90. “Jail. Lindsey and I had never experienced anything like that: being arrested for doing our jobs...”

Bernstein, Paula. ‘Lessons from The Reluctant Radical: How The First Amendment Protects Filmmakers’. *Filmmaker Magazine*. (2017, May 4). Retrieved from: <https://filmmakermagazine.com/102370-lessons-from-the-reluctant-radical-how-to-film-a-protest-without-getting-arrested/>

91. “abusing democratic freedoms to infringe on the interests of the state, organisation and people, and opposing officers on duty.”

‘Vietnam jails activist for 14 years for livestreaming pollution march’. *The Guardian*. (2018, February 6). Retrieved from: <https://www.theguardian.com/environment/2018/feb/06/vietnam-jails-activist-for-14-years-for-livestreaming-pollution-march>

92. *In 2017 alone, 197 environmental activists were killed for exposing systemic abuses.*

Watts, Jonathan. 'Almost four environmental defenders a week killed in 2017'. *The Guardian*. (2018, February 2). Retrieved from: [https://www.theguardian.com/environment/2018/feb/02/almost-four-environmental-defenders-a-week-killed-in-2017?CMP=share\\_btn\\_tw](https://www.theguardian.com/environment/2018/feb/02/almost-four-environmental-defenders-a-week-killed-in-2017?CMP=share_btn_tw)

## Chapter 10

1. "When the Fed had received a total of 70 fraudulent payment orders to four bank accounts in the Philippines and one in Sri Lanka..."

Hammer, Joshua. 'The Billion Dollar Bank Job'. *The New York Times Magazine*. (2018, May 3). Retrieved from: <https://www.nytimes.com/interactive/2018/05/03/magazine/money-issue-bangladesh-billion-dollar-bank-heist.html?mtrref=www.google.ca&mtrref=undefined>

2. *The British forced tariffs on their colonies until the first half of the twentieth century when "imperial preference" came to the fore as a method of promoting unity. In an effort to solidify Britain's rise as a global power and combat increasing protectionism within the United States and Germany, the principle was, "Home producers first, empire producers second, and foreign producers last."*

'Imperial preference'. *Encyclopaedia Britannica*. Retrieved from: <https://www.britannica.com/topic/imperial-preference>

3. *"In the past, colonial powers were able to dictate terms directly to their colonies..."*

Hickel, Jason. *The Divide: Global Inequality from Conquest to Free Markets*. New York, NY: W. W. Norton & Company. Ebook: p.27

4. *"typically intended to be hidden and unobservable."*

'Illicit Financial Flows to and from Developing Countries: 2005-2014'. *Global Financial Integrity*. (2017, April). Retrieved from: [https://www.gfintegrity.org/wp-content/uploads/2017/05/GFI-IFF-Report-2017\\_final.pdf](https://www.gfintegrity.org/wp-content/uploads/2017/05/GFI-IFF-Report-2017_final.pdf)

5. *approximately \$8.6 trillion dollars sat untaxed in offshore accounts.*

Zucman, Gabriel. *The Hidden Wealth of Nations* cit. in: Lowe, Jaime. 'The White-Collar-Crime Cheat Sheet'. *The New York Times Magazine*. (2018, May 3). Retrieved from: <https://www.nytimes.com/interactive/2018/05/03/magazine/money-issue-white-collar-crimes-cheat-sheet.html>

6. *In Canada, the 60 biggest corporations were found to have over 1000 subsidiaries in offshore zones.*

Oved, Marco Chown. 'Canada's biggest corporations have more than 1,000 subsidiaries in tax havens, report says'. *The Star*. (2017, November 15). Retrieved from: <https://www.thestar.com/news/paradise-papers/2017/11/15/canadas-biggest-corporations-have-more-than-1000-subsidiaries-in-tax-havens-report-says.html>

7. *As Fortune magazine notes, in 2017 Apple Inc. held \$252 billion of company profits offshore so that it could avoid paying U.S. taxes.*

Hoxie, Josh. 'Commentary: Apple Avoided \$40 Billion in Taxes. Now It Wants a Gold Star?' *Fortune*. (2018, January 18). Retrieved from: <http://fortune.com/2018/01/18/apple-bonuses-money-us-350-billion-taxes-trump/>

8. *Amazon made over \$3 billion in profits, but it paid almost nothing in federal taxes.*

Pagano, Alyssa & Kovach, Steve. 'How Amazon gets away with not paying taxes'. *Business Insider*. (2018, April 26) Retrieved from: <https://www.businessinsider.com/amazon-not-paying-taxes-trump-bezos-2018-4>

9. "82 percent of wealth created across the globe went to the top 1 percent."

'Reward Work Not Wealth - Oxfam Briefing Paper'. *Oxfam*. (2018, January). Retrieved from: [https://www.oxfam.org/sites/www.oxfam.org/files/file\\_attachments/bp-reward-work-not-wealth-220118-en.pdf](https://www.oxfam.org/sites/www.oxfam.org/files/file_attachments/bp-reward-work-not-wealth-220118-en.pdf)

10. *The Bank of America for example has proposed a \$12 fee for monthly balances below \$1500.*

Wiener-Bronner, Danielle. 'Customers angry after Bank of America tightens free-checking rules'. *CNN*. (2018, January 22). Retrieved from: <https://money.cnn.com/2018/01/22/news/companies/bank-of-america-fees/index.html>

11. "stores associated with poor repayments"

O'Neil, Cathy. *Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy*. New York, NY: Broadway Books, 2017. p156

12. "Despite a lack of affordable housing and shelter space, many cities have chosen to criminally or civilly punish people..."

'Housing Not Handcuffs: Ending the Criminalization of Homelessness in U.S. Cities'. *National Law Centre on Homelessness & Poverty*. Retrieved from: <https://www.nlchp.org/documents/Housing-Not-Handcuffs>

13. *bans on sitting or lying down in public spaces have increased by 52 percent.*

Ibid.

14. *In the U.S. over 50 cities, including Atlanta, Los Angeles, Miami, Phoenix and San Diego, have anti-camping, or anti-food-sharing laws.*

Pearce, Matt. 'Homeless feeding bans: Well-meaning policy or war on the poor?'. *Los Angeles Times*. (2012, June 11). Retrieved from: <http://articles.latimes.com/2012/jun/11/nation/la-na-nn-homeless-feeding-bans-20120611>

15. *84 percent of British lawmakers do not know where money comes from.*

Coppola, Frances. 'How Bank Lending Really Creates Money, And Why The Magic Money Tree Is Not Cost Free'. *Forbes*. (2017, October 31). Retrieved from: <https://www.forbes.com/sites/francescoppola/2017/10/31/how-bank-lending-really-creates-money-and-why-the-magic-money-tree-is-not-cost-free/#3c2138d73073>

16. *the physical currency of banknotes and coins, accounts for approximately \$5 trillion, only 16 percent of all the money circulating in the world.*

Hartman, Mitchell. 'How much money is there in the world?'. *Marketplace*. (2017, October 30). Retrieved from: <https://www.marketplace.org/2017/10/30/world/how-much-money-there-world>

17. *"Whenever a bank makes a loan, it simultaneously creates a matching deposit in the borrower's bank account..."*

McLeay, Michael; Radia, Amar; Thomas, Ryland. 'Money creation in the modern economy'. *The Bank of England*. (2014, Quarterly Bulletin). Retrieved from: <https://www.bankofengland.co.uk/-/media/boe/files/quarterly-bulletin/2014/money-creation-in-the-modern-economy.pdf>

18. *Globally, the world is sitting on \$247 trillion.*

Tanzi, Alexandre. 'Global Debt Topped \$247 Trillion in the First Quarter, IIF Says'. *Bloomberg*. (2018, July 10). Retrieved from: <https://www.bloomberg.com/news/articles/2018-07-10/global-debt-topped-247-trillion-in-the-first-quarter-iif-says>

19. *a debt rate that has grown a jaw-dropping 40 percent in the last ten years.*

Matsuzaki, Yusuke & Ishikawa, Jun. 'Global debt ballooned 40% in decade after financial crisis.' *Nikkei Asian Review*. (2018, September 15). Retrieved from: <https://asia.nikkei.com/Economy/Global-debt-ballooned-40-in-decade-after-financial-crisis>

20. *In total, according to Hickel, that amounts to \$4.2 trillion dollars that have flowed from the pockets of poor countries to rich countries in interest payments alone.*

Hickel, Jason. 'Aid in reverse: how poor countries develop rich countries'. *The Guardian*. (2017, January 14). Retrieved from: <https://www.theguardian.com/global-development-professionals-network/2017/jan/14/aid-in-reverse-how-poor-countries-develop-rich-countries>

21. "rates charged to these [rich] countries to borrow money cover the use of the money..."

Logue, Annie. 'U.S. Debt Is Massive and Other Countries Are Desperate to Keep It That Way'. *How We Get To Next*. (2016, March 29). Retrieved from: <https://howwegettonext.com/here-s-why-other-countries-are-desperate-to-add-to-the-u-s-government-s-massive-debt-7d4ae66397cd>

22. *As a corporate villain in the TV series Mr. Robot once said: "Give a man a gun and he can rob a bank. Give a man a bank and he can rob the world."*

Wellick, Tyrell in *Mr. Robot*. Ep. 1. Ones and Zeroes. (2015)

23. *Today, the next generation of this tree stands firm and "free" in its inherited soil - and is now over 50 feet tall.*

Kanuckel, Amber. 'A Tree That Owns Itself?' *Farmers' Almanac*. Retrieved from: <https://www.farmersalmanac.com/a-tree-that-owns-itself-25869>

24. *these are social creatures that parent their young, communicate with one another, experience pain, have a capacity for memory, and have sex.*

Brown, Mark. 'Trees talk to each other, have sex and look after their young, says author'. *The Guardian*. (2017, May 31). Retrieved from: <https://www.theguardian.com/environment/2017/may/31/trees-talk-have-sex-look-after-young-peter-wohlleben-hay-festival>

25. *Dr. Suzanne Simard, professor of ecology at the University of British Columbia has found that using these mycorrhizal networks, trees can communicate signals of distress...*

Simard, Suzanne. 'How Trees Talk to Each Other'. *TEDSummit*. Retrieved from: [https://www.ted.com/talks/suzanne\\_simard\\_how\\_trees\\_talk\\_to\\_each\\_other](https://www.ted.com/talks/suzanne_simard_how_trees_talk_to_each_other)

26. *April 5th, 2018 Colombia's supreme court did just that and changed the status of the country's Amazon basin so that it became an "entity subject of rights."*

Wright, Louisa. 'Colombia's top court orders government to protect Amazon for future generations'. *DW*. (2018, April 6). Retrieved from: <https://www.dw.com/en/colombias-top-court-orders-government-to-protect-amazon-for-future-generations/a-43288343>

27. *Between 2015 to 2016 alone, deforestation increased by 44% to 70,074 hectares or about the size of New York City.*

Stubley, Peter. 'Colombian government ordered to protect Amazon rainforest in historic legal ruling'. *Independent*. (2018, April 6). Retrieved from: <https://www.independent.co.uk/news/world/americas/amazon-rainforest-colombia-protect->

[deforestation-environment-logging-supreme-court-legal-rights-a8292671.html](https://www.rollingstone.com/politics/news/the-rights-of-nature-movement-goes-on-trial-w515299)

28. *“Whanaungatanga is actually broader than kinship in the sense that it relates not only to relations between living humans...”*

Boyd, David R. *The Rights of Nature: A Legal Revolution That Could Save The World*. Toronto, ON: ECW Press, 2017. p.133

29. *“to pollute the water is to pollute the people.”*

cit. in Williams, Justice Joseph. ‘Lex Aotearoa: An Heroic Attempt to Map the Māori Dimension in Modern New Zealand Law [Harkness Henry Lecture]’ in *Waikato Law Review*, Vol. 21.

(2003). p.19 Retrieved from:

[https://www.waikato.ac.nz/\\_data/assets/pdf\\_file/0003/257484/Waikato-Law-Review-2013-Vol.-21.pdf](https://www.waikato.ac.nz/_data/assets/pdf_file/0003/257484/Waikato-Law-Review-2013-Vol.-21.pdf)

30. *“absurd” and a “circus act” claiming that “a watershed lacks consciousness...”*

Boyd, David R. *The Rights of Nature: A Legal Revolution That Could Save The World*. Toronto, ON: ECW Press, 2017. p.119

31. *“unreasonable”, “implausible” and an “enormous expense to parties and taxes limited judicial resources.”*

Nobel, Justin. ‘The Rights of Nature Movement Goes on Trial’. *Rolling Stone*. (2018, January 10). Retrieved from: <https://www.rollingstone.com/politics/news/the-rights-of-nature-movement-goes-on-trial-w515299>

32. *“Many of the same arguments [PGE’s lawyers] used to attack the watershed’s standing are equally applicable to their own client.”*

Boyd, David R. *The Rights of Nature: A Legal Revolution That Could Save The World*. Toronto, ON: ECW Press, 2017. p.119

33. *corporations gained their first rights in 1809, half a century before legal rights were championed for African Americans, or women.*

Winkler, Adam. *We The Corporations: How American Businesses Won Their Civil Rights*. New York, NY: W.W. Norton & Company, 2018. p. xi

34. *In the case of the Renoir, a judge ruled that the rightful owner was the museum.*

Shapira, Ian. ‘Flea market’ Renoir ordered back to Baltimore Museum of Art by federal judge’. *The Washington Post*. (2014, January 10). Retrieved from:

[https://www.washingtonpost.com/local/flea-market-renoir-ordered-back-to-baltimore-museum-of-art-by-federal-judge/2014/01/10/c1fa2796-79f9-11e3-8963-b4b654bcc9b2\\_story.html](https://www.washingtonpost.com/local/flea-market-renoir-ordered-back-to-baltimore-museum-of-art-by-federal-judge/2014/01/10/c1fa2796-79f9-11e3-8963-b4b654bcc9b2_story.html)

35. *property litigation accounts for as much as 66% of annual court cases.*

Thakur, Pradeep. 'Property and family disputes account for 76% of litigation'. *The Times of India*. (2016, April 26). Retrieved from: <https://timesofindia.indiatimes.com/india/Property-and-family-disputes-account-for-76-of-litigation/articleshow/51987414.cms>

36. *human beings have a “blind impulse” to form attachments to things.*

Lindlater, Andro. *Owning the Earth: The Transforming History of Land Ownership*. New York, NY: Bloomsbury, 2013. p4.

37. *“A man’s Self is the sum total of all that he CAN call his, not only his body and his psychic powers...”*

James, William. *The Principles of Psychology*. New York, NY: Henry Holt & Company, 1890. Retrieved from: <https://psychclassics.yorku.ca/James/Principles/prin10.htm>

38. *“I AM the most offensively possessive man on earth. I do something to things.”*

Rand, Ayn. *The Fountainhead*. New York, NY: Plume, 1993. p564.

39. *Using fMRI scans, scientists have found that when people imagine an object that they own versus one owned by someone else, the medial prefrontal cortex lights up.*

Kim, K., & Johnson, M. K. Extended self: spontaneous activation of medial prefrontal cortex by objects that are ‘mine’. *Social cognitive and affective neuroscience*. (2013). Retrieved from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4090970/>

40. *high-ranking baboons respect the rights of possession, and will not take an object away from another troop member.*

Sigg, H., & Falett, J. Experiments on respect of possession and property in hamadryas baboons (*Papio hamadryas*). *Animal Behaviour*, (1985) 33(3), 978-984. [http://dx.doi.org/10.1016/S0003-3472\(85\)80031-2](http://dx.doi.org/10.1016/S0003-3472(85)80031-2)

41. *“people settled down, they became more susceptible to environmental disaster.”*

George, Alison. 'Stuff: Humans as hunters and mega-gatherers'. *New Scientist*. (2014, March 26). Retrieved from: <https://www.newscientist.com/article/mg22129620-700-stuff-humans-as-hunters-and-mega-gatherers/>

42. *The ‘Endowment Effect’, a key principle in studies of ownership, is absent in some isolated hunter-gatherer societies.*

Lerner, Evan. 'Penn: 'Endowment Effect' Not Present in Hunter-Gatherer Societies'. *Penn Today*. (2013, October 28). Retrieved from: <https://penntoday.upenn.edu/news/penn-research-helps-show-endowment-effect-not-present-hunter-gather-societies>

43. *Studies by developmental psychologists have found that as early as 18 months.*

Fasig, L. G. Toddlers' understanding of ownership: Implications for Self-Concept development. *Social Development*, (2000), 9, 370-382.

44. *by two years of age, they can reason that ownership belongs to the person who acquired something first.*

Kanngiesser, Patricia & Hood, Bruce M. 'Young children's understanding of ownership rights for newly made objects.' *Cognitive Development* 29 (2014) 30–40

45. *"objects are claimed to distinguish them from something belonging to the other..."*

Fasig, L. G. Toddlers' understanding of ownership: Implications for Self-Concept development. *Social Development*, (2000), 9, 370-382.

46. *In a study where toddlers watched puppets throw objects into the garbage bin...*

Rossano, Federico; Rakoczy, Hannes; Tomasello, Michael. 'Young children's understanding of violations of property rights'. *Cognition* 121 (2011) 219–227

47. *"collecting seashells lying on a public beach is acceptable, [while] helping yourself to seashells sold at a beach side stand is not."*

Nancekivell, S. E. , Vondervoort, J. W. , & Friedman, O. 'Young children's understanding of ownership'. *Child Development Perspectives*, (2013). 7(4), 243–247

48. *"ownership is not a "natural" property of objects, but is determined by human intentions."*

Kim, Sunae& Kalish, Charles W. 'Children's ascriptions of property rights with changes of ownership'. *Cognitive Development*. (2009, July-September). Volume 24, Issue 3, Pages 322-336. Retrieved from: <https://doi.org/10.1016/j.cogdev.2009.03.004>

49. *Max Palamar and his colleagues explored this idea of ownership and intention by using the thought experiment of a feather.*

Palamar, Max; Le, Doan T.; Friedman, Ori. 'Acquiring ownership and the attribution of responsibility'. *Cognition*. (2012, August). Volume 124, Issue 2, Pages 201-208. Retrieved from: <https://doi.org/10.1016/j.cognition.2012.04.006>

50. *In one study, toddlers were given identical toy cars to play with...*

Markman, Art. 'Kids Learn About Ownership Early On'. *Psychology Today*. (2012, October 1). Retrieved from: <https://www.psychologytoday.com/ca/blog/ulterior-motives/201210/kids-learn-about-ownership-early>

51. *First possession for instance, can be trumped by the creative “investment” in an object.*

Kanngiesser, Patricia; Gjersoe, Nathalia; Hood, Bruce M. ‘The Effect of Creative Labor on Property-Ownership Transfer by Preschool Children and Adults’. *Psychological Science*. (2010, September) 21(9):1236-41. Retrieved from: <https://doi.org/10.1177/0956797610380701>

52. *Given borrowed wood to make a statue, most 3 and 4-year olds believe that they should get to keep the statue.*

‘Psychology of ownership and possession’. *Bristol Cognitive Development Centre, University of Bristol*. Retrieved from: <http://www.bris.ac.uk/bcdc/research/ownership.html>

53. *The study found that when two materials were loaned to participants - one paper and one gold...*

Kanngiesser, Patricia; Hood, Bruce. ‘Not by Labor Alone: Considerations for Value Influence Use of the Labor Rule in Ownership Transfers’. *Cognitive Science*. (2013, October 9). Volume 38, Issue 2. Retrieved from: <https://doi.org/10.1111/cogs.12095>

54. *In one of the scenarios, a boy is using a crayon to make a card for his mother...*

Neary, Karen R. Neary and Friedman, Ori. ‘Young Children Give Priority to Ownership When Judging Who Should Use an Object’. *Child Development*, (2014 January/February), Volume 85, Number 1, Pages 326–337.

55. *“As much land as a man tills, plants, improves, cultivates, and can use the product of, so much is his property.”*

Locke, J. *Two treatises of government*. Cambridge, England: Cambridge University Press, 1698/1960.

56. *“Though the Earth, and all inferior Creatures be common to all Men, yet every Man has a Property in his own Person...”*

Ibid.

57. *“to the total exclusion of any other individual in the universe...”*

Blackstone, William. *Commentaries on the Laws of England*. Web Edition: The University of Adelaide. Retrieved from: <https://ebooks.adelaide.edu.au/b/blackstone/william/comment/book2.1.html>

58. *“All things have a bit of soul.”*

‘Japan's Old Robot Dogs Get Traditional Funeral’. *NDTV*. (2018, May 2). Retrieved from: <https://www.ndtv.com/offbeat/japans-old-sony-aiba-robot-dogs-get-traditional-funeral-1845904>

59. *after 100 years objects are said to acquire a “soul.”*

Rodriguez, Ariel. ‘The Household Objects That Turn Into Ghosts In Japanese Folklore’. *Cultural Colectiva*. (2018, April 13). Retrieved from: <https://culturacolectiva.com/art/hunted-household-objects-tsukumogami/>

60. *While collectors are similarly known for their vast acquisitions of “stuff” the difference relates to their intentions.*

Belk, Russell. ‘Ownership and Collecting’ in *The Oxford Handbook of Hoarding and Acquiring*. (eds. Frost, Randy O. & Steketee, Gail). Oxford, UK: Oxford University Press, 2014. p.38

61. *“They are so artless and so free with all they possess, that no one would believe it without having seen it. Of anything they have...”*

Columbus, Christopher. *Letter to the sovereigns on his first voyage*. (1493 February 15-March 4). Retrieved from: [http://www.digitalhistory.uh.edu/disp\\_textbook.cfm?smtID=3&psid=57](http://www.digitalhistory.uh.edu/disp_textbook.cfm?smtID=3&psid=57)

62. *They had no need for “superfluties”.*

cit. in: Lent, Jeremy. *The Patterning Instinct: A Cultural History of Humanity's Search for Meaning*. Amherst, NY: Prometheus Books, 2017. p.91

63. *“things must be almost as quickly devoured and discarded as they appeared in the world.”*

Arendt, Hannah. *The Human Condition: Second Edition*. Chicago IL: The University of Chicago Press, 1998. p. 134.

64. *According to a study in Journal of Marketing, as a result, they are missing the key ingredient of “love”.*

American Marketing Association. ‘Consumers value handmade products: What's love got to do with it?’ [phys.org](https://phys.org). (2015, March 24). Retrieved from: <https://phys.org/news/2015-03-consumers-handmade-products.html>

65. *But as aggressive pushing and shoving began in line, an “unhappy customer” unleashed a canister of pepper spray...*

‘Black Friday Pepper Spray Incident in Porter Ranch.’ *NBC Los Angeles*. (2011, November 24). Retrieved from: <https://www.nbclosangeles.com/news/Black-Friday-Pepper-Spray-Incident-in-Porter-Ranch-134481693.html>

66. *In 2013, Amazon alone, sold 26.5 million items on Cyber Monday, or about 426 items per second.*

Palladino, Valentina. 'Amazon sold 426 items per second in run-up to Christmas'. *The Verge*. (2013, December 26). Retrieved from: <https://www.theverge.com/2013/12/26/5245008/amazon-sees-prime-spike-in-2013-holiday-season>

67. *By 2017, Alibaba's Single's Day sales hit \$5 billion dollars in the first 15 minutes...*

Haas, Benjamin. 'Chinese shoppers spend a record \$25bn in Singles Day splurge'. *The Guardian*. (2017, November 12). Retrieved from: <https://www.theguardian.com/world/2017/nov/12/chinese-shoppers-spend-a-record-25bn-in-singles-day-splurge>

68. *As Greenpeace Asia calculated, aside from the product waste, manufacturing, packaging and shipping...*

'China's "Singles Day" clothing sales produced 258,000 tonnes of CO2 in 2016 - Greenpeace' *Greenpeace*. (2017, November 9). Retrieved from: <https://www.greenpeace.org/archive-international/en/press/releases/2017/Chinas-Singles-Day-clothing-sales-produced-258000-tonnes-of-CO2-in-2016---Greenpeace/>

69. *annually 760,000 air pollution deaths are directly linked to consumer goods production.*

Zhang, Qiang; Jiang, Xujia; Tong, Dan; Davis, Stephen J. et al. 'Transboundary health impacts of transported global air pollution and international trade'. *Nature*. (2017, March 30) 543, pages 705–709

70. *"I desire at the time of writing the sixth incarnation of the Apple Macintosh internet-enabled smart telephone..."*

Brown, Derren. *Happy: Why More or Less of Everything is Absolutely Fine*. London, UK: Penguin Random House, 2016. p.61

71. *researchers have found that people can have high self-esteem and be unhappy, or be happy and have low self-esteem.*

'Happiness and Self-Esteem: Can One Exist without the Other?' *American Psychological Association*. (2004, July 29). Retrieved from: <https://www.apa.org/news/press/releases/2004/07/happy.aspx>

72. *frequently creates a "negative social comparison"*

De Veirman, Marijke and Hudders, Liselot. 'Disclosing Sponsored Instagram Posts: The Role of Material Connection with the Brand and Message-Sidedness when Disclosing Covert Advertising'. *ICORIA Conference*. (2018). Retrieved from: <https://biblio.ugent.be/publication/8527450/file/8527454.pdf>

73. *“What research has shown in literally dozens of studies is that the more that people prioritize materialistic values, the less-happy they are...”*

Nesterak, Evan. ‘Materially False: Q&A with Tim Kasser about the Pursuit of the Good through Goods’. *The Psych Report*. (2014, September 9). Retrieved from: <http://thepsychreport.com/conversations/materially-false-qa-tim-kasser-pursuit-good-goods/>

74. *According to a study by JWT, a New York marketing firm, “fame and fortune have replaced faith and family...”*

cit. in: Lane, Anderson. ‘The Instagram effect: How the psychology of envy drives consumerism’. *Wicked Local Plymouth*. (2014, April 12). Retrieved from: <http://plymouth.wickedlocal.com/article/20140412/NEWS/304129939>

## Chapter 11

1. *In 1951 Solomon Asch conducted a famous experiment to illustrate this point.*

Asch, S. E. ‘Effects of group pressure upon the modification and distortion of judgment’. In H. Guetzkow (ed.) *Groups, leadership and men*. Pittsburgh, PA: Carnegie Press. 1951

2. *researchers at Emory University modified the Asch experiment*

Berns, G. S., Chappelow, J., Zink, C. F., Pagnoni, G., Martin-Skurski, M. E., & Richards, J. (2005). Neurobiological correlates of social conformity and independence during mental rotation. *Biological Psychiatry*, 58(3), 245-253. DOI: 10.1016/j.biopsych.2005.04.012

3. *“Nothing appears more surprising to those who consider human affairs with a philosophical eye than the easiness with which the many are governed by the few...”*

Hume, David. *Of the First Principles of Government*. 1741. Web edition: *The University of Adelaide*. Retrieved from: <https://ebooks.adelaide.edu.au/h/hume/david/of-the-first-principles-of-government/>

4. *the veil obscuring the true, eternal world.*

Lent, Jeremy. *The Patterning Instinct: A Cultural History of Humanity's Search for Meaning*. Amherst, NY: Prometheus Books, 2017. p.168

5. *“If ones says, ‘This is how these things are done,’ often enough one believes it oneself...”*

Berger, Peter L. & Luckmann, Thomas. *The Social Construction of Reality: A Treatise in the Sociology of Knowledge*. New York, NY: Doubleday. 1966, p.19

6. *“On the one hand, the objective reality of rivers, trees and lions; and on the other hand, the imagined reality of gods, nations and corporations.”*

Harari, Yuval Noah. *Sapiens: A brief history of humankind*. Signal Books, 2014. p.32

7. *According to the World Wildlife Fund, by 2020 we will have seen a staggering 67% decline in wildlife populations across the planet.*

‘Living Planet Report 2016.’ *World Wildlife Fund*. Retrieved from:  
[http://www.wwf.ca/newsroom/reports/wwf\\_living\\_planet\\_report\\_2016.cfm](http://www.wwf.ca/newsroom/reports/wwf_living_planet_report_2016.cfm)

8. *“Populations of vertebrate animals—such as mammals, birds, and fish—have declined by 58% between 1970 and 2012.”*

Ibid.

9. *Nine out of 13 of the ancient landmarks linked to climate change by researchers.*

‘Giant African baobab trees die suddenly after thousands of years’. *The Guardian*. (2018, June 11). Retrieved from: <https://www.theguardian.com/world/2018/jun/11/giant-african-baobab-trees-die-suddenly-after-thousands-of-years>

10. *“By mid-century, if we continue on our current trajectory, we face a world with no fisheries, no coral reefs, no rainforests...”*

Stewart, Rob. ‘Imagine a World Worth Fighting For’. *Wildify*. (2015, July 21). Retrieved from:  
<http://wildify.org/imagine-a-world-worth-fighting-for/>

11. *“What I find far more ominous is how seldom, today, we see the phrase ‘the 22nd century.’”*

Riesman, Abraham. ‘William Gibson Has a Theory About Our Cultural Obsession With Dystopias’. *Vulture*. (2017, August 1). Retrieved from:  
<http://www.vulture.com/2017/08/william-gibson-archangel-apocalypses-dystopias.html>

12. *According to Donella Meadows, a pioneer of systems thinking, a system can be defined as “a set of things—people, cells, molecules, or whatever—that are interconnected in such a way that they produce their own pattern of behavior over time.”*

Meadows, Donella. *Thinking In Systems: A Primer*. White River Junction, VT: Chelsea Green Publishing. Ebook: p.1

13. *In a letter entitled “World Scientists’ Warning To Humanity” more than 1,500 leading scientists and Nobel laureates put their names to the following caution: “Human beings and the natural world are on a collision course...”*

Ripple W.J., Wolf C, Newsome T.M., Galetti M., Alamgir M, Crist E, Mahmoud M.I., Laurance W.F. "World Scientists' Warning to Humanity: A Second Notice". *BioScience*. (2017, November 13) *BioScience*, Volume 67, Issue 12, 1 Pages 1026–1028, <https://doi.org/10.1093/biosci/bix125>

14. *"If a factory is torn down but the rationality which produced it is left standing, then that rationality will simply produce another factory..."*

Pirsig, Robert. *Zen and the Art of Motorcycle Maintenance*. New York, NY: Bantam Books, 1984. p.88

15. *Writing about Carl Sagan's work, literary critic Maria Popova has observed: "We navigate the world by our common-sense perception, but that perception has blinded us to reality again and again..."*

Popova, Maria. 'Carl Sagan on Mystery, Why Common Sense Blinds Us to the Universe, and How to Live with the Unknown'. *Brain Pickings*. (2018, April 5). Retrieved from: <https://www.brainpickings.org/2018/04/05/carl-sagan-jonathan-cott-rolling-stone-interview/>

16. *"appeared not only ignorant of mechanics, but a dreadfully bad physical scientist as well."*

Naughton, John. 'Thomas Kuhn: the man who changed the way the world looked at science'. *The Guardian*. (2012, August 19). Retrieved from: <https://www.theguardian.com/science/2012/aug/19/thomas-kuhn-structure-scientific-revolutions>

17. *one which still has a memory of its prior being.*

McKenna, Phil. 'Butterflies remember caterpillar experiences'. *New Scientist*. (2008, March 5). Retrieved from: <https://www.newscientist.com/article/dn13412-butterflies-remember-caterpillar-experiences/>

18. *"the marks on paper that were first seen as a bird are now seen as an antelope, or vice versa. That parallel can be misleading. Scientists do not see something as something else; instead, they simply see it."*

Kuhn, Thomas S. *The Structure of Scientific Revolutions*. Chicago, IL: The University of Chicago Press, 2012. Ebook: loc: 85

19. *"The cautious will gladly say that one's view of the world changes, but the world stays the same..."*

Hacking, Ian. (Introduction) in Kuhn, Thomas S. *The Structure of Scientific Revolutions*. Chicago, IL: The University of Chicago Press, 2012. Ebook: loc: 85

20. *"theoretical entities, such as electrons, [observing things] at which one cannot point"*

Ibid, loc: 10

21. *In a recent poll by the Pew Research Center and the American Association for the Advancement of Science*

Vaidyanathan, Gayathri. 'Big Gap between What Scientists Say and Americans Think about Climate Change'. *Scientific American*. (2015, January 30). Retrieved from: <https://www.scientificamerican.com/article/big-gap-between-what-scientists-say-and-americans-think-about-climate-change/>

22. *The share of the general public saying that global warming is a very serious problem has fluctuated in Pew Research polling between a low of 32 percent in 2010 to a high of 47 percent in 2009.*

'An Elaboration of AAAS Scientists' Views'. *Pew Research Center*, (2015, July). Retrieved from: <http://www.pewinternet.org/2015/07/23/an-elaboration-of-aaas-scientists-views/>

23. *When scientists say there is "uncertainty" about an effect, the public inference is that uncertainty means lack of knowledge or "ignorance"...*  
Somerville, RC, and Hassol, S.J.'Communicating the Science of Climate Change'. *Physics Today*. (2011, October). p.51

24. *"a new scientific truth does not triumph by convincing its opponents and making them see the light"*

Kuhn, Thomas S. *The Structure of Scientific Revolutions*. Chicago, IL: The University of Chicago Press, 2012. Ebook: loc: 151

25. *"For many of them, it's given them a particular attitude about themselves and their relationship to others."*

Rosen, Stanley G. 'Space Consciousness: The Astronauts' Testimony'. *Michigan Quarterly Review*. p. 281 Retrieved from: <http://hdl.handle.net/2027/spo.act2080.0018.002:26>

26. *As the astronaut Chris Hadfield once told me, it is not the cupola view from the ISS, or the "overview effect", that changes your perspective but rather, your life experience.*  
Hadfield, Chris. Personal Communication. (2017, November 18)

27. *"If the rate of expansion one second after the Big Bang had been smaller by even one part in a hundred thousand million million, it would have re-collapsed before it reached its present size."*

Hawking, Stephen., *A Brief History of Time*. Bantam: New York NY, 1988, p.121

28. *"if g [the gravitational constant] were smaller, the dust from the big bang would just have continued to expand..."*

Miller, K.R., *Finding Darwin's God: A Scientist's Search for Common Ground Between God and Evolution*. HarperCollins: New York NY, 2000, pp.227-228.

29. *Factoring in the chances of your parents meeting (1 in 20,000), and the chances of them staying together...*

Spector, Dina. 'The Odds Of You Being Alive Are Incredibly Small'. *Business Insider*. (2012, June 11). Retrieved from: <https://www.businessinsider.com/infographic-the-odds-of-being-alive-2012-6>