## Chapter 18: Checking our numbers

We’ve seen that people change over time, and that both their beliefs and the rate of change in those beliefs vary depending on the population density of their environment. To understand what this’ll mean over the longer term, we also need to consider the effects of demographic and generational turnover.

In Chapter 5, we saw that Americans at all ages have fewer children today than it would take to replace the population. This is especially true in the city, where the average birth rate drops precipitously low. Partly, this is because cities skew toward younger people, and especially younger women. There are likely a number of factors in play here; one is the American tradition in which couples move to the suburbs to have kids. Since, in heterosexual partnerships, the woman is typically younger, hence the effect on the female urban age distribution is especially pronounced.

However, even if we look only at the number of children born to post-menopausal women (I’ve picked ages 44-64), the difference in fertility is striking. Below 100 square meters per person, women average fewer than one child. Below about 1,000 square meters per person, the threshold above which most people think of themselves as living in the suburbs, the figure is 1.5 or fewer. Only at the most rural extreme, around 200,000 square meters per person, does the number of children per female, normally called the “total fertility rate” or TFR, approach replacement rate, estimated by the UN Population Division to be about 2.1 in the developed world.

There’s an obvious and striking conclusion here: cities aren’t even remotely demographically self-sustaining. They’re population sinks. Not only do they need the material resources of the countryside to survive; they also need a continual influx of young people from elsewhere. Before exploring this further, let’s delve a bit deeper into the theory behind population growth and decline.

Replacement TFR isn’t exactly two because women and men aren’t born in precisely equal proportions, and more importantly, because early deaths before or during a person’s fertile years have to be taken into account. Without modern medicine, replacement TFR is well above two, as infant and childhood mortality are common. While this factor isn’t generally considered, based on what we’ve learned, I think that in advanced economies, a good deal of the excess above two is also due to the not so tiny percentage of intersex children![[1]](#footnote-21)

At any rate, in a closed community with no immigration or emigration, and with a TFR of precisely the replacement rate, a population’s size will remain constant. If the potential mothers average fewer than two children each over their reproductive years, the population will shrink exponentially; if they have more than two-point-something children on average, it will grow exponentially. Replacement rate represents the knife’s edge in between. Stability is elusive.

To get a sense of how elusive, we can do some rough calculations. Let’s assume for the moment that a “generation” is 30 years, and for simplicity’s sake, let’s pretend that replacement TFR is precisely two, ignoring premature mortality and other corrections. Then, under steady conditions, a total fertility rate of 5, which was roughly the world average from 1950-1970,[[2]](#footnote-23) leads to a doubling of the population every 23 years or so. Over a century, it would grow by 21-fold! On the other hand, a TFR of one works out to a halving of the population every 30 years; or of 1.5 works out to a halving every 72 years, and a drop to 10% of the original population size after 240 years. At that rate, 2,300 years from now, there would be only two people left.[[3]](#footnote-25) 2,300 years is not a long time compared to human history so far, which extends back more than 100,000 years.

Given the runaway logic of exponential growth or decline, it may seem astonishing that we’re still around after so many millennia. It seems like we should either have gone extinct a long time ago, or our numbers should have exploded until suffering a massive die-off from overpopulation, at which point, presumably, the cycle would repeat.

This is, in fact, how life works in general. Historically, our species’s reproductive pattern has been much like those of any other animal: we’ve mated and generated offspring, or tried to, at a healthy clip— well above replacement, for otherwise, we’d continually teeter on the brink of extinction. Our reproductive powers aren’t as impressive as those of some species— a male seahorse releases up to 1,000 young— but we’re certainly capable of explosive growth. Much more so, in fact, than our primate cousins, the chimpanzees and bonobos, for whom nursing and infancy are far more protracted due to a lack of alloparental help. The country with the highest current fertility rate, Niger, has a TFR of nearly 7. That works out to a population doubling time of 17 years. Unchecked, high fertility would mean rapid exponential growth, and a planet stacked neck deep with human bodies in a couple of dozen generations. In the past, that hasn’t happened for the same reasons the planet isn’t stacked neck deep with any other animal: malnutrition and starvation, disease, violence, and predation.

In 1798, the Reverend Thomas Robert Malthus published this observation in his famous *Essay on the Principle of Population*, noting how fundamental a force these miseries have been in shaping our numbers over time. It was a shock to many of his readers:[[4]](#footnote-26)

Population, when unchecked, increases in a geometrical ratio. Subsistence increases only in an arithmetical ratio. A slight acquaintance with numbers will shew the immensity of the first power in comparison of the second.

By that law of our nature which makes food necessary to the life of man, the effects of these two unequal powers must be kept equal.

This implies a strong and constantly operating check on population from the difficulty of subsistence. This difficulty must fall somewhere and must necessarily be severely felt by a large portion of mankind.

Puts this that way, it’s a bleak but pretty basic observation. Why did it take until 1798 for someone to notice this?

It turns out that Malthus was not quite unique in making his observation. Others were doing so too, around the same time. One was Hong Liangji (洪亮吉), a Chinese scholar whose 1793 essay *On Governance and Well-being of the Empire* (Zhi Ping Pian, 治平篇) raised the same point. The timing wasn’t coincidental. A Hong Liangji or Thomas Malthus would have needed several key ingredients to make and pass on the observations they did on exponential population growth and the role of starvation in limiting it:

1. Literacy.
2. The leisure to ponder and write treatises, and an intelligentsia to read said treatises.
3. Enough knowledge of math to understand exponential growth (what Malthus meant by “geometric” increase).
4. Observation of obvious population growth within their own lifetimes, to prompt this line of thinking.
5. Observation of starvation at work to limit the population.

Today, despite our many remaining social inequities, a majority of Americans tick the first four of these boxes— including many who work multiple jobs and didn’t go to college. Literacy and numeracy are widespread, we have enough leisure to spend hours daily watching TV, and we have seen extraordinary rises in population within our own lifetimes. Almost no Americans today tick the fifth box, though. We live in a time and place where starvation and child mortality are no longer significant forces keeping the population in check. It’s telling that today, poverty is correlated with obesity, not skinniness.

That has not been the norm throughout human history. The website *Our World in Data* is a great source for demographic data and analysis, and offers a startling perspective on extreme poverty.

What counts as “extreme poverty” is a subject of intense debate (and, like the terms “city” and “countryside”, has no perfectly objective definition), but the scale of this worldwide change over the past 200 years is breathtaking regardless of how the line is drawn. To live in extreme poverty means, in practice, that your time and energy throughout the day are spent in a struggle to get enough calories to survive and reproduce. There are still people in the world living under these conditions, but not only are they a minority; there are fewer of them in absolute numbers than there were in 1820, when there were just over an eighth the number of humans alive as there are today. Back in 1820— and at every time up until then— the overwhelming majority of people lived in extreme poverty.

Thomas Malthus and Hong Liangji were privileged members of tiny elites in their respective countries with the leisure and education to do the kind of scholarship that got them Wikipedia entries a couple of centuries later. At the same time, neither they nor their (also privileged) readers had to venture far from their front gates to encounter the other 99%— a population that had begun to grow explosively yet was still visibly constrained by starvation and other “positive checks”, as Malthus calls them:

The positive check to population, by which I mean the check that represses an increase which is already begun, is confined chiefly, though not perhaps solely, to the lowest orders of society.

[…] I believe it has been very generally remarked by those who have attended to bills of mortality that of the number of children who die annually, much too great a proportion belongs to those who may be supposed unable to give their offspring proper food and attention, exposed as they are occasionally to severe distress and confined, perhaps, to unwholesome habitations and hard labour. This mortality among the children of the poor has been constantly taken notice of in all towns. It certainly does not prevail in an equal degree in the country, but the subject has not hitherto received sufficient attention to enable anyone to say that there are not more deaths in proportion among the children of the poor, even in the country, than among those of the middling and higher classes. Indeed, it seems difficult to suppose that a labourer’s wife who has six children, and who is sometimes in absolute want of bread, should be able always to give them the food and attention necessary to support life. The sons and daughters of peasants will not be found such rosy cherubs in real life as they are described to be in romances. It cannot fail to be remarked by those who live much in the country that the sons of labourers are very apt to be stunted in their growth, and are a long while arriving at maturity. Boys that you would guess to be fourteen or fifteen are, upon inquiry, frequently found to be eighteen or nineteen. And the lads who drive plough, which must certainly be a healthy exercise, are very rarely seen with any appearance of calves to their legs: a circumstance which can only be attributed to a want either of proper or of sufficient nourishment.

These conditions were hardly of recent origin. With malnutrition and disease keeping the death rate up— especially among children, who are the most vulnerable— being a parent in the real Flintstones era would have been very different from today. It would have been a parade of loss and grief; perhaps also, out of necessity, a time of less emotional investment in the lives of individual children. That’s why, in many traditional cultures, babies aren’t even named until they make it to a certain age.[[5]](#footnote-27) It’s remarkable that we can now assume that every child will grow to adulthood, and that it’s such an unexpected shock when that doesn’t happen. This is a consequence of recent medical and social technologies having disabled Malthus’s “positive checks”.

By “medical technologies”, I mean safer childbirth, antibiotics, vaccines, and so on. By “social technologies”, I mean the laws, norms, and institutions that greatly lower the murder rate, make honor killings unacceptable, provide at least basic universal food, clothing, and shelter, and in other ways prevent many of the deaths that would have happened in an earlier era. These benefits are still not fairly distributed. Black infants in America, for instance, are more that twice as likely to die before their first birthday as white infants.[[6]](#footnote-28) However, none of this even approaches conditions in Malthus’s day, when childhood mortality was far, far higher for everyone, nobles and peasants alike. Still, by the 18th century, positive checks on population had started to lift, and the resulting population explosion was obvious.

To wrap our heads around this population growth and put it in historical context, we’ll need to look at historical data. What follows is necessarily simplified, and the numbers involve guesswork as we venture deep into the past, but the outlines of the story are fairly clear. Beginning with a zoomed-out view of population since the dawn of agriculture, we see something that barely looks like a graph at all. It’s more like a flat line, followed by a vertical spike at the very end.

To even make sense of this, we’ll need a logarithmic population axis. When we look at the data this way, an exponential increase looks like a straight line, where the slope of the line is the growth rate.

The spike at the end is still there, but now we can see that what looked like a flat line over the 10,000+ years during which humans were practicing traditional agriculture was already more or less steady exponential growth. Despite being invisible in the earlier plot because the numbers are so much smaller than today’s population, during those 10,000 years, the population grew about 70-fold. Evidently, agriculture has been a significant positive-check-eliminating technology.[[7]](#footnote-30) It gives us enough excess calories for the population to grow faster than hunting and gathering, but it’s not exactly a bonanza. As Malthus notes, driving the plough by hand and eating the produce from your traditional family farm won’t put a lot of meat on your calves.

A convincing case has been made that the hunter-gatherer lifestyle might actually have been a lot healthier— for the survivors— than primitive subsistence farming. Keep in mind, though, that we’re talking about populations, not individuals. Without agriculture, there’s no way for a limited land area to support a large population. As hunter-gatherers, we might have been physically impressive in adulthood, but we had very high infant and childhood mortality, often due to starvation. Furthermore, high mortality rates continued into adulthood due to violence, accidents, infections, and childbirth. Even strong, healthy people were walking a tightrope of “positive checks”, and could die suddenly of myriad causes. That precariousness still holds in the few remaining hunter-gatherer societies today.

When the last Ice Age ended and the glaciers retreated, subsistence farming caught on in many parts of the world, gradually bringing higher population density with it. A 70-fold population increase may seem large— and it is— but it happened slowly. Assuming, as we did earlier, 30 years per generation, this amounts to an “effective” fertility rate of only 2.025 children per potential mother surviving into adulthood— barely above two— for a doubling time of about 1,600 years. Traditional farming, in other words, does provide enough calories for the population to grow, but just barely.

Irish economist Morgan Kelly and economic historian Cormac Ó Gráda have studied the positive check from traditional farming in England in some detail. In a 2014 paper,[[8]](#footnote-31) they write:

[W]hile average living standards in England were high by contemporary standards, a substantial fraction of the population nonetheless lived in deep poverty. Gregory King, in 1688, estimated that one-fifth of England’s population had annual incomes of £2, placing them at the edge of biological survival.

With some very significant wobbles up and down due mainly to the Black Death, things had remained in this low gear up until about a century before Malthus wrote his essay, with the effective fertility rate averaging 2.06 between 600 CE and 1700 CE.

We should pause to take stock of the Black Death, otherwise known as Bubonic Plague. It was the deadliest pandemic in recorded history, making COVID look insignificant by comparison. The *Yersinia pestis* bacterium, today treatable with antibiotics, may have killed up to 200 million people in Europe, Asia, and North Africa in epidemic waves from the Middle Ages up to the 17th century (though its deep history appears to go far back into antiquity). This was a major positive check, resulting in episodes of population decline even as farming technologies slowly improved.

The unevenness of harvests was an important factor too. Hunger interacted with disease in ways that are less obvious to us nowadays than they would have been back then. Per Kelly and Ó Gráda:

[I]t is only with improved public health in the twentieth century that people began literally to starve to death: before this most famine victims succumbed to epidemic disease. That epidemics followed poor harvests was not simply because of hunger—the connection between nutritional status and immune functioning is not straightforward, with malnourishment, which reduces immune functioning through lessened secretion of the hormone leptin from adipose tissue, increasing susceptibility to some diseases but not others—but to the interaction between malnutrition and vagrancy. As hungry people took to the roads in search of work or charity, the combination of malnutrition, poor hygiene, exposure to the elements, and psychological stress turned them into both victims and vectors of contagious disease.

All told, between 600 CE and 1700 CE, the worldwide population doubling time works out to about 700 years. We know this because modern scholarship has allowed a worldwide research community to assemble historical records and put together centuries of data from many recorded sources. This adds up to a powerful trend when compounded over centuries, but over an average 50 year period, it only amounts to a 5% increase, which would hardly have seemed noteworthy to a contemporary observer. So by fits and starts, in a slow increase largely unnoticed by scholars at the time, the world population crept up to about 600 million by the year 1700.

To be clear, this is a worldwide average. At certain times and in some places over those centuries there were populations that grew far more quickly. On the other hand, if a plague had just decimated the country and one couldn’t zoom out to see the big picture, it would hardly have been obvious that life was slowly winning out over death. An overpopulation argument like Malthus’s would have seemed farfetched, regardless of the math.

Around the year 1700, though, something remarkable happens. The slope suddenly becomes *much* steeper, with the effective fertility rate jumping to 2.36, for a doubling time of only 124 years. With Plague-scale pandemics on pause, the increase in population would have been noticeable for the first time over a single human lifespan. Hence the timing of the observations by Hong Liangji and Thomas Malthus about a hundred years later, when the new trend had been firmly established, is unsurprising— inevitable, even. Evidence of a population explosion was all around.

The big changes taking place in Europe around this time were the Scientific and Industrial Revolutions.[[9]](#footnote-32) They gave rise to a cascade of new technologies that made farming more productive, as well as improving medical care and social systems. Chinese farming technologies had undergone their own period of rapid development as well, and were starting to reap the benefits of energy-intensive New World crops, especially corn. In the century leading up to Hong Liangji’s essay, the Chinese population had tripled, from about 100 million to about 300 million.

In 1945, the population growth rate again steps up in a big way. This is the Baby Boom. Boomers are often thought of as an American post-World War II phenomenon, and indeed, the war did delay a cohort of pregnancies that would otherwise have been conceived while the men were away, creating a bulge in the postwar birthrate in the US and many other countries. However, the population graph reveals this demographic turn to be a more profound worldwide event in human history, not just a transient wartime phenomenon. What happened? As with the Scientific and Industrial Revolutions, developments in healthcare and agriculture were the key.

During the Second World War, antibiotics were mass-produced, eliminating a great deal of death from bacterial infection. That had important consequences for injuries on the battlefield, of course, but it also meant that soldiers contracting gonorrhea, chlamydia, or that worst of old Victorian bogeymen, syphilis, could easily be treated. Rather than vainly trying to impose moral strictures on sex, publicity campaigns began to encourage anyone with symptoms to visit a doctor, promising a quick and effective cure. For once, these ads delivered on their promise. Other everyday infections in civilian life became treatable too. Many of us alive today have had infections that could well have killed us in an earlier era, both in childhood and in adulthood. Bacteria, from the Plague’s *Yersinia pestis* to gastrointestinal *E. coli* to *Staphylococcus* from cuts, were a major positive check on human population throughout our entire history— until antibiotics.

Around the same time, farming was being further revolutionized by the widespread adoption of oil-derived chemical fertilizers and new generations of hyper-efficient, scientifically engineered crops. The boutique practices we now refer to nostalgically as “organic” farming— cultivation of heirloom varieties, avoidance of chemical fertilizers and pesticides— used to be *all* farming. Whether we really achieved “better living through chemistry”[[10]](#footnote-33) may be debatable, but it has certainly enabled a much larger number of us to be counted among the living.

The pharmaceutical and agricultural developments of the twentieth century have also brought us a raft of new sustainability problems. Factory farming depletes the soil, pollutes freshwater, poisons pollinating insects, and relies heavily on fossil fuels. Routine use of antibiotics has led to widespread antibiotic resistance, and perhaps even more insidiously, modern sanitation in general may be responsible for weakening our immune systems and devastating our microbial biome.[[11]](#footnote-35) And of course, super-exponential human population growth remains in itself unsustainable on a finite planet.

Malthus understood this. He was afraid that with the removal of positive checks, our numbers would explode until we exceed the Earth’s carrying capacity, at which point we’d once again see immiseration and death, but now on an unprecedented, apocalyptic scale. The baby boom led to a revival of these concerns, most famously in a 1972 report, *The Limits to Growth*, commissioned by an interdisciplinary group of intellectuals styling themselves the “Club of Rome”.[[12]](#footnote-36) This widely read report used the newly available technique of computer modeling to try to quantify Malthus’s intuition under a range of scenarios, taking into account not only population growth and arable land area, but growth in *per capita* industrial output, pollution, non-renewable resource depletion, and a number of other variables. Although in the ensuing 50 years the model has been heavily critiqued— even ridiculed— its premises and methods are reasonable. It makes the key observation, too, that straining Earth’s carrying capacity degrades the ecosystem, which in turn decreases carrying capacity, making any ensuing die-off especially grim.

Remarkably— remember, this is 1972— *The Limits to Growth* specifically calls out global warming as a cause for concern, noting that based on 14 years of carbon dioxide measurements at the observatory on Mauna Loa, CO2 concentrations would reach 380 parts per million by the year 2000, “an increase of nearly 30 percent of the probable value in 1860”. The authors add,

If man’s energy needs are someday supplied by nuclear power instead of fossil fuels, this increase in atmospheric CO2 will eventually cease, one hopes before it has had any measurable ecological or climatological effect.

Unfortunately, this ship has sailed. We reached 380 parts per million in 2005, and today, we’re seeing arable land area shrinking as global warming turns equatorial land into desert. As of this writing, in 2022, CO2 levels have shot up to 420 parts per million.[[13]](#footnote-37)

In a 2008 essay, *Cassandra’s Curse*, Ugo Bardi, a professor of physical chemistry at the University of Florence, took stock of some of the forces arrayed against *The Limits to Growth* in the decades since its publication:[[14]](#footnote-39)

[The] reaction […] arrived from at least four different fronts. One was from those who saw the book as a threat to the growth of their businesses and industries. A second set was that of professional economists, who saw LTG as a threat to their dominance in advising on economic matters. The Catholic world [ … was] piqued at the suggestion that overpopulation was one of the major causes of the problems. Then, the political left in the Western World saw the LTG study as a scam of the ruling class, designed to trick workers into believing that the proletarian paradise was not a practical goal. And this […] is a clearly incomplete list; forgetting religious fundamentalists, the political right, the believers in infinite growth, politicians seeking for easy solutions to all problems and many others.

Despite many attempts to discredit the report,[[15]](#footnote-41) its “World Model Standard Run”, which assumes “no major change” in “physical, economic, or social relationships”, is still roughly tracking reality 50 years on.[[16]](#footnote-42)

Luckily for our entire planet, we aren’t seeing yet another kink upward in the exponential growth of human population. In the most sudden transition yet, we’re now seeing population growth slow dramatically, and there’s good reason to believe that in the not very distant future we’ll see it start to fall, just as *The Limits to Growth* predicted. This marks a profound change for humanity, and we’re on the cusp of it right now.

[[[https://ourworldindata.org/grapher/fertility-rate-complete-gapminder?tab=chart&country=IDNMDAFJIUSAOWID\_WRL](https://ourworldindata.org/grapher/fertility-rate-complete-gapminder?tab=chart&country=IDN~MDA~FJI~USA~OWID_WRL)]]

Also luckily, the decline is— at least, so far— not driven by a sudden die-off due to lack of basic resources; we’re simply opting for fewer children. To be clear, *The Limits to Growth* modeled this effect, too. Declining rates of fertility in the most developed countries were obvious in 1972. Even Malthus had noticed that his own set had fewer children than the poor, but whereas he framed it in terms of morals and social class, in reality this effect is demographic and applies in every country. As *Our World In Data* puts it,[[17]](#footnote-45)

In all countries we observed the pattern of the demographic transition, first to a decline of mortality that starts the population boom and then a decline of fertility which brings the population boom to an end. The population boom is a temporary event.

In the past the size of the population was stagnant because of high mortality, now country after country is moving into a world in which the population is stagnant because of low fertility.

The late Swedish public health expert Hans Rosling (1948-2017) put it even more strikingly— and optimistically— in his posthumously published book, *Factfulness* (2018):[[18]](#footnote-47)

For thousands of years up to 1800 the population curve was almost flat. Have you heard people say that humans used to live in balance with nature? Well, yes, there was a balance. But let’s avoid the rose-tinted glasses. Until 1800, women gave birth to six children on average. So the population should have increased with each generation. Instead, it stayed more or less stable. Remember the child skeletons in the graveyards of the past? On average four out of six children died before becoming parents themselves, leaving just two surviving children to parent the next generation. There was a balance. It wasn’t because humans lived in balance with nature. Humans *died* in balance with nature. It was utterly brutal and tragic. Today, humanity is once again reaching a balance. […] But this balance is dramatically different from the old balance. The new balance is nice: the typical parents have two children, and neither of them dies. For the first time in human history, we *live* in balance.

When the UN runs population size simulations based on historical data for the more economically developed regions of the world, they conclude that as of now, population in these places has already peaked and will likely not increase further. It seems that nearly all remaining worldwide population increases will come from the less economically developed parts of the world, and the rate at which *their* fertility declines will primarily be a function of how quickly they develop economically.

Why is this happening? Malthus assumed that the inextinguishable “passion between the sexes” automatically led to serial pregnancies and an unending parade of offspring. At the time, he wasn’t far off. Birth control just wasn’t that great in 1798. Reusable condoms existed, typically made from chemically treated linen or animal gut (these would be supplanted by thick rubber sheaths in the 19th century). They could be bought at chemist shops, barbershops, and theaters, though they weren’t cheap. In his memoirs, the infamous libertine Giacomo Casanova (1725-1798) describes blowing up his condom before use to inspect for holes.[[19]](#footnote-48) This was very much a gentleman’s game. For a typical sex worker, such a condom might have cost several months’ pay.[[20]](#footnote-49)

What worked for Casanova in the 18th century has only become more democratized quite recently. “Preventive checks”, which cause people to have fewer children, emerge almost universally as our social and medical technologies improve. Birth control pills have been the single most important development in this transition. Primatologist Frans de Waal, who grew up in the Catholic South of the Netherlands, puts it this way:[[21]](#footnote-51)

My parents didn’t want a large family, but […] the Church held outsize sway. It opposed any kind of family planning. A familiar story in our family is how my mother, not long after she had delivered her sixth child, got angry at a priest visiting our home. Sitting comfortably with coffee and a cigar, the priest had casually brought up “the next one.” He didn’t get to finish his coffee and was sent packing. I got no more new siblings after that. Attitudes were already changing before the Pill, but once it arrived, it made everything easier. In the decades that followed, the size of families in our region dropped precipitously. Thus, a bit of tinkering with human biology reshaped the playing field […]. Humanity needed the Pill because the most logical alternative way to prevent pregnancy doesn’t quite work for us. We could simply have stopped having sex or at least abstained for intermittent periods. But this is too much to ask of the lusty apes that we are. Also solutions that require men to stop and think and put on a condom before they act have proven unreliable. This is partly due to the passion of the moment and partly because it leaves things up to the least concerned gender. The Pill changed all that. Human biology required a biological answer. It still does, even if we have begun to worry about the Pill’s side effects on mood and mental health.

Of course, condoms have also gotten a lot better, and we now have a number of other good contraceptive options too. Abortion and elective sterilization (increasingly, vasectomy for men, as it’s a far less invasive procedure than sterilization for women) have also played important roles. These have emerged alongside the social technologies described in Chapter 9— changes in the workforce, the economy, laws, and customs that make it possible and even attractive for people to live fulfilling lives with few or no children.

Until recently, it’s also been extremely difficult for women to stay independent and single, or to divorce. Plenty of older female survey respondents are trapped in marriages they don’t really want, due to some combination of social pressure, the obligations of motherhood, and economics (again, see Chapter 9). Being a single woman has gotten a lot easier, though, and that has also lowered birth rates. Then there’s the greater social acceptance of lesbian and gay couples, or the many other configurations in which love, sex, and companionship aren’t necessarily geared toward producing kids. Of course same-sex couples *can* have kids, but it won’t “just happen” due to a missed pill or a slipup in the bedroom. It’s something they have to want, choose, and work for.

Today, even for heterosexual couples, it’s largely the case that having children is a conscious choice, rather than a default. For that matter, the same is true of being partnered at all. The sociologist Eric Klinenberg wrote a book a few years ago whose title pretty much gives away the plot: *Going Solo: The Extraordinary Rise and Surprising Appeal of Living Alone*.

During the past half century, our species has embarked on a remarkable social experiment. For the first time in human history, great numbers of people—at all ages, in all places, of every political persuasion—have begun settling down as singletons. Until recently, most of us married young and parted only at death. If death came early, we remarried quickly; if late, we moved in with family, or they with us. Now we marry later. […] We divorce, and stay single for years or decades. We survive our spouses, and do whatever we can to avoid moving in with others—even, perhaps especially, our children. […]

Not long ago, it might have made sense to treat living on our own as a transitional stage between more durable arrangements, whether coupling up with a partner or moving into an institutional home. This is no longer appropriate, because today, for the first time in centuries, the majority of all American adults are single. The typical American will spend more of his or her adult life unmarried than married, and for much of this time he or she will live alone. Naturally, we are adapting. We are learning to go solo, and crafting new ways of living in the process.

Klinenberg points out that this is largely an urban phenomenon, and the survey data bear that out.

About 47.5% of Americans over 18 are married.[[22]](#footnote-52) While a majority of countryside dwellers at every age over 35 are married, for city dwellers, the overall average just barely reaches half between ages 40-60. This is very different from the old Flintstones era norm, where to be an unmarried adult was to be seen as odd or a failure. Even in the countryside, that’s obviously no longer the case. In Klinenberg’s words,

Numbers never tell the whole story, but […] the statistics are startling. In 1950, 22 percent of American adults were single. Four million lived alone, and they accounted for 9 percent of all households. […] People who live alone [today] make up 28 percent of all U.S. households, which means that they are now tied with childless couples as the most prominent residential type—more common than the nuclear family, the multigenerational family, and the roommate or group home. […] Unlike their predecessors, people who live alone today cluster together in metropolitan areas and inhabit all regions of the country.

Klinenberg is at pains to point out that for many, this doesn’t imply a lonely life, nor is it about prioritizing freedom and lack of commitment over intimacy. In this sense, “solo” is a misnomer: “Living alone gives us time and space to discover the pleasures of being with others.” Singletons often have multiple close connections, whether social, sexual, or romantic. These may be stable for long periods and may involve long-term commitments, or they may shift over time, but there’s no indication that singletons are as a population less connected or emotionally healthy than married people. This kind of social fulfillment is easier to find in the city, where there’ll tend to be a lot more of “your people” around, whomever they are. Presumably that’s why this trend started in cities, and is so much more pronounced there.

Sexuality itself seems to be evolving in a similar way. People are deciding what they want to do more intentionally, rather than just acting out a received script. This only works, however, if the economic and social conditions allow for it. In particular, it only works in a sexually egalitarian society where women are able to survive and thrive without being dependent on a man— a *status quo* that has been a defining feature of most agricultural societies for thousands of years, in both monogamous and polygynous variants. A happy irony is that letting go of patriarchy makes men freer too.

Reproductive choice is the key to self-determination for both women and men. It’s especially important for women, though, given that the costs and risks of labor, childbirth, nursing, and child care are disproportionately theirs to bear, even with the “post-gendering” technologies described in Chapter 15. That so many women, including an increasing number who are unpartnered, still willingly choose to take these burdens on speaks to the fact that having kids remains intrinsically rewarding for many (though by no means all).

Why do we do it? As economic sociologist Viviana Zelizer puts it, “A national survey of the psychological motivations for having children confirms their predominantly sentimental value.” A child, she wryly observes, “is expected to provide love, smiles, and emotional satisfaction, but no money or labor.”[[23]](#footnote-53) These intangibles do count for something. But despite the delights of having children, as we’ve seen, few potential mothers with reproductive choice decide to have *large* numbers of them: the average is below two.

While reproductive choice isn’t perfect in the US, it remains greater than in many other countries, despite successful strategies from conservative and religious groups to roll back the historical protections of *Roe v. Wade*. The numbers are similar in other developed countries. We may therefore be starting to get a realistic view of how many babies potential mothers choose to have when they can make that choice freely. Our reproductive numbers may remain artificially high, though, as there are plenty of American women today whose access to social support, money, information, health care, contraception, and abortion still curtails reproductive choice.

In the developed world, not only does poverty result in larger numbers of children, but also, large numbers of children further impoverish people. As Zelizer points out, this isn’t only because kids fail to bring money into the household: “They are also expensive.” And they’re getting more so every year, as any parent who has needed to pay a child’s educational expenses can attest. This can lead to inter-generational cycles of poverty. Or to turn this on its head, having *fewer* children can mean *more* time and resources per child, as well as for the parents.

It’s tempting to assume that this explains the well documented inverse correlation between a country’s wealth and its fertility. But this isn’t the whole story. If kids cost their parents so much money, how could we have been raising so many more of them back when everybody was so much poorer?[[24]](#footnote-57) Were we impoverished *because of* our high fertility?

In fact, it was the opposite. Children used to enrich families, not impoverish them:

In sharp contrast to contemporary views, the birth of a child in eighteenth-century rural America was welcomed as the arrival of a future laborer and as a security for parents later in life. The economic value of children for agricultural families has been well documented by anthropologists.

Children could be good little factory workers too, back in the days before that was frowned upon![[25]](#footnote-58) Agricultural child labor is the most common kind, though, due to the correlation between economic development and urbanization. These patterns still hold today. Among Niger’s 17 million citizens, for example, agriculture remains the primary economic activity, and 43% of children between the ages of 5 and 14 work.[[26]](#footnote-59) Recall that Niger has a world-topping total fertility rate of nearly 7 children per woman.[[27]](#footnote-61) Overall about one fifth of all African children, about 72 million, are laborers— a higher proportion than on any other continent— and 85% of this child labor is agricultural.[[28]](#footnote-65)

Today, only 1% or so of American women have as many children as the average in Niger, but this wasn’t always so. Back in 1922, Henry Stanton considered 7 entirely reasonable, though he cautioned against 14:[[29]](#footnote-67)

It is far better to give birth to seven children, who will live and be healthy, than to bear fourteen, of whom seven are likely to die, while the numerous successive births wear out and age the unfortunate mother.

Urbanization was less advanced in 1922, but its inverse correlation with fertility had already been noticed long before Stanton’s day. He and his contemporaries still thought of children as generators of wealth, though, and so concluded that the trend toward fewer children must have been cultural— and deplorable:

Material changes have taken place in the birth-rate of a number of countries during the past fifteen or twenty years which cannot be attributed to purely economic causes. They do not seem to depend on such things as trade, employment and prices; but on the spread of an idea or influence whose tendency must be deplored, that of “birth control,” a phrase much heard in these days.

The fact that a decline in human fertility and a falling birth rate are most noticeable in the relatively prosperous countries is a proof that it does not proceed from economic causes; but is due rather to the spread of the doctrine that it is permissible to restrict or control birth. In such countries as the United States, England and Austalasia, where the standards of human comfort and living are notoriously high, the decline in the birth rate has been most noticeable.

The reality is both economic *and* cultural. Birth control technologies and women’s rights are part of the picture. But also, as societies transition away from agriculture, children go from being an economic asset to a costly choice— which means opting to have fewer of them, and perhaps, accordingly, thinking of them as more precious.

Let’s also not forget biology.

negative checks in other species under density

alloparenting and infanticide; blurs positive v negative check

problem of scales. predator/prey dynamics vs sperm competing for egg. top down is culture, bottom up is biology.

Based on all of these patterns, we’d expect to find lower fertility in the city than in the countryside, and as we’ve already seen, this is indeed the case. When we do a breakdown by age, we can see that not only do women in the countryside have children at a faster pace, but also that they start having children younger. Remember that to calculate a rate of population growth, we need to take into account not only how many children women have on average by menopause, but also the generation time, which we arbitrarily fixed at 30 years. Since urban mothers tend to have children later in life, though, their typical generation time is longer. This slows urban population growth still further.

Even in the American countryside, the fertility rate is far from that of the old days— or the developing world. The average only exceeds two for women well beyond menopause, illustrating how the average number of children per potential mother in the countryside (and, indeed, everywhere in the country) has been in decline for decades. The generation who have just reached menopause had children at a rate well below replacement, both in the city and in the countryside. Hence people with high TFRs in sparsely populated ZIP codes are a small minority, and are “living in the past” in several senses: their cultural norms belong to an earlier generation, they themselves are typically older, and as a result their average fertility rate is typical of an earlier generation.

Running the fertility calculations only for white women, we find an even lower overall total fertility rate of 1.3. This is unsurprising, since we’ve seen that nowadays, lower fertility correlates with wealth and privilege. It also means that even if the US were to stop admitting immigrants, the population would rapidly become less white over time.

There are some political ironies here. If the ethno-nationalist right is concerned about being demographically “replaced” by non-white people, they should advocate for foreign aid, racial equity, and abortion rights. More foreign aid would lower fertility rates abroad, reducing immigration from poorer countries; and greater racial equity in the US, together with freer access to abortion, would lower the fertility rate of non-white people at home.

This last was, in fact, one of the arguments marshaled by Margaret Sanger (1879-1966), the founder of Planned Parenthood. Sanger worked relentlessly for women’s reproductive rights, but was also associated with the eugenics movement and enthusiastically cited demographic studies by Nazi researchers. (A good reminder, regardless of one’s politics today, that it’s hard to find either perfect heroes or perfect villains— especially in history books.) In her 1920 book *Woman and the New Race*, Sanger wrote,[[30]](#footnote-68)

If we are to develop in America a new race with a racial soul, we must keep the birth rate within the scope of our ability to understand as well as to educate. We must not encourage reproduction beyond our capacity to assimilate our numbers so as to make the coming generation into such physically fit, mentally capable, socially alert individuals as are the ideal of a democracy.

The intelligence of a people is of slow evolutional development—it lags far behind the reproductive ability. It is far too slow to cope with conditions created by an increasing population, unless that increase is carefully regulated.

We must, therefore, not permit an increase in population that we are not prepared to care for to the best advantage—that we are not prepared to do justice to, educationally and economically. We must popularize birth control thinking. We must not leave it haphazardly to be the privilege of the already privileged. We must put this means of freedom and growth into the hands of the masses.

“A new race with a racial soul” is, by today’s standards, a very unfortunate turn of phrase. Such passages, along with Sanger’s ambiguous attitude toward eugenics, have led to a great deal of belated soul-searching and apology on the part of Planned Parenthood.[[31]](#footnote-69) Still, her main point here is that birth control should not remain the prerogative of the Casanovas of the world; it must be accessible to the poor, who can least afford to raise large families. She understood clearly that birth control is both enabled by, and enables, economic mobility and development, particularly in the city.

This idea has withstood the test of time. While the project of universal access to birth control is unfinished, we’ve now reached a point where “preventive checks” are outpacing the absence of “positive checks” for virtually all Americans.

Our brief period of unchecked growth has drawn to a close.

1. Today, the odds of an American woman dying under the age of 44 are only about 3%, so intersexuality (which often implies lifelong sterility) is at least as likely. [[REF <https://www.ssa.gov/oact/STATS/table4c6.html>]] [↑](#footnote-ref-21)
2. [[REF]] Start with Wikipedia page for TFR <https://en.wikipedia.org/w/index.php?title=Total_fertility_rate&oldid=1086534103> [↑](#footnote-ref-23)
3. People do of course live longer than a single “generation”, so at least initially, the drop wouldn’t be quite so quick. [↑](#footnote-ref-25)
4. Malthus, *Essay on the Principle of Population*, 1798. [↑](#footnote-ref-26)
5. McCormick, Al. “Infant mortality and child-naming: A Genealogical Exploration of American Trends.” The Journal of Public and Professional Sociology 3, no. 1 (2010): 2. [↑](#footnote-ref-27)
6. [[REF Start with <https://en.wikipedia.org/w/index.php?title=Infant_mortality&oldid=967835681>]] [↑](#footnote-ref-28)
7. Much earlier developments, like cooking with fire and the use of language, may also have weakened positive checks, but the population growth impacts of these earlier developments are hard to put real numbers on. [↑](#footnote-ref-30)
8. Kelly and Ó Gráda, *Living standards and mortality since the middle ages*, 2014. [↑](#footnote-ref-31)
9. It has been argued (e.g. by Steven Shapin, in his influential 1996 book *The Scientific Revolution*) that these weren’t properly “revolutions”, but gradual accumulations of evolutionary changes which we only impose a “revolutionary” narrative on in historical retrospect. There’s some truth to this. On the other hand, the sudden changes in the population curves suggest that the term “revolution” isn’t mere historical hyperbole for what happened around 1700. [↑](#footnote-ref-32)
10. A slogan chemical giant DuPont adopted in 1935, then quietly dropped in 1982. [[REF <https://en.wikipedia.org/w/index.php?title=Better_Living_Through_Chemistry&oldid=1072882994> ]] [↑](#footnote-ref-33)
11. [[REF]] [↑](#footnote-ref-35)
12. [[REF Limits to Growth.]] [↑](#footnote-ref-36)
13. [[REF <https://gml.noaa.gov/ccgg/trends/> ]] [↑](#footnote-ref-37)
14. [[REF <http://www.sustainable.soltechdesigns.com/cassandra.html> ]] [↑](#footnote-ref-39)
15. Some of these critiques were leveled at the report’s predictions of imminent resource depletion based on known reserves (e.g. of chromium); subsequent resource exploration based on the market demand increased these reserves a good deal, making the estimates look alarmist. This is hardly a compelling argument for dismissing the report or the model, though, given that these particular resource limitations weren’t central to report’s overall conclusions. [↑](#footnote-ref-41)
16. [[REF include several from <https://en.wikipedia.org/w/index.php?title=The_Limits_to_Growth&oldid=1087088021#Validation> including Turner, Graham M. “A comparison of The Limits to Growth with 30 years of reality.” Global environmental change 18, no. 3 (2008): 397-411.]] [↑](#footnote-ref-42)
17. [[[OurWorldInData.org](https://ourworldindata.org/world-population-growth)]]. [↑](#footnote-ref-45)
18. [[REF Factfulness]] [↑](#footnote-ref-47)
19. [[REF]] [↑](#footnote-ref-48)
20. [[REF start from [Wikipedia](https://en.wikipedia.org/w/index.php?title=History_of_condoms&oldid=948993750)]] [↑](#footnote-ref-49)
21. Frans de Waal, *Different*. [↑](#footnote-ref-51)
22. Like the graphs themselves, these figures are calculated by re-weighting the answers from groups of respondents to match the overall demographics of the United States (see the Appendix for details). [↑](#footnote-ref-52)
23. Zelizer, whose work focuses on the attribution of cultural and moral meaning to the economy, wrote these rather tart words in her 1985 book, *Pricing the Priceless Child*. Perhaps her son, Julian, took it as a challenge; in 2007 he joined her at Princeton’s Department of History and Public Affairs, to form the first mother-son professorial team in Princeton’s history. [[REF Rubin, Debra (October 6, 2008). [“Prof: Election dynamic bodes well for the Jews”](https://web.archive.org/web/20130916150555/http://njjewishnews.com/njjn.com/101608/njProfElectionDynamic.html). [New Jersey Jewish News](https://en.wikipedia.org/wiki/New_Jersey_Jewish_News). Archived from [the original](http://njjewishnews.com/njjn.com/101608/njProfElectionDynamic.html) on 2013-09-16.]] [↑](#footnote-ref-53)
24. For “everybody”, read “almost everybody”; refer back to the *Our World in Data* graph showing how the proportion of people living in extreme poverty has changed over time. [↑](#footnote-ref-57)
25. See Babbage’s notes on child factory labor in *On the Economy of Machinery and Manufactures* in Chapter 15. [↑](#footnote-ref-58)
26. [[REF <https://www.dol.gov/agencies/ilab/resources/reports/child-labor/niger> ]] [↑](#footnote-ref-59)
27. [[REF [Wikipedia](https://en.wikipedia.org/w/index.php?title=Agriculture_in_Niger&oldid=950678108): [Agriculture](https://en.wikipedia.org/wiki/Agriculture) is the primary economic activity of a majority of [Niger](https://en.wikipedia.org/wiki/Niger)’s 17 million citizens.]] [↑](#footnote-ref-61)
28. [[REF [https://www.ilo.org/africa/areas-of-work/child-labour/lang–en/index.htm](https://www.ilo.org/africa/areas-of-work/child-labour/lang--en/index.htm) 2016 ILO Global Estimates of Child Labor]] [↑](#footnote-ref-65)
29. [[REF Stanton, 1922.]] [↑](#footnote-ref-67)
30. Sanger, *Woman and the New Race*, 1920. [↑](#footnote-ref-68)
31. [[REF]] [↑](#footnote-ref-69)