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Gene Editing Humans: It's Not Just about Safety

By Mildred Z. Solomon

Chinese scientist He Jiankui surprised the scientific community and the world when he announced in November 2018 that he had genetically modified two embryos and then allowed them to develop into babies. Not only that, he believed he had acted in accordance with guidelines offered by a 2017 report by the National Academies of Sciences, Engineering, and Medicine.

More recently Denis Rebrikov, a Russian scientist, announced his intention to edit a human embryo and implant it in a woman, allowing it to develop. These renegade scientists have prompted what STAT News called a "do-over" by the National Academy of Sciences, the National Academy of Medicine and the U.K.'s Royal Society.

Last week these organizations convened the first of a series of important meetings of their jointly sponsored International Commission on the Clinical Use of Human Germline Genome Editing. In addition, the World Health Organization has formed an Expert Advisory Committee on Developing Global Standards for Governance and Oversight of Human Genome Editing.

These groups are aiming to be much clearer this time around and to establish a governance framework so that scientists such as He and Rebrikov will understand and respect the guidelines that their peers have established: human germ-line modification is not yet safe. Because there are still many unresolved issues, including so-called off-target results, partial edits and other problems, basic bench gene-editing research can go on, so long as embryos are not allowed to develop.

Even as these bodies regroup to produce clearer guidance, however, I sense a shift in the debate. For a very long time, the scientific and bioethical consensus was that we must not do human germ-line modifications—that we should not change gametes and embryos in ways that would be permanent, affecting all future generations. In contrast, somatic modifications, which affect only the person in whom the edits are made, have been mainly uncontroversial.

But that border between germ-line and somatic genome modification is blurring; the zeitgeist feels different. There is a growing sense of inevitability that we will eventually do human germ-line modification and that our only obligation is to wait until it is safe. When that day comes, we may want to make permanent heritable changes to the human species to eradicate otherwise intractable diseases. We should, however, enter this discussion with eyes wide open, considering each application on its own merits and anticipating a wide range of issues that go well beyond safety. Many of these issues are explored in *Human Flourishing in an Age of Gene Editing,* which will be published by Oxford University Press on August 28, 2019.

Although we do not yet know the genetic predictors of many conditions, as we learn more, the temptation to use gene-editing technologies to "enhance" ourselves will be extraordinary—and particularly problematic if we gain the ability to reduce the likelihood of highly stigmatized traits, such as homosexuality, or to edit in highly desirable ones, such as tallness or athleticism. Many parents will, perhaps legitimately, assert that they are not prejudiced against homosexuality, or some other way of being, but just think that it makes life harder. So why not edit out the genes that increase the odds of it occurring? And don't all good parents strive to give their children advantages?

Many of the choices coming our way will be ones that should rightly reside with prospective parents. But even when decisions are personal and private, they should be well informed, which is why we need far more ways to engage the public in conversations about germ-line genome editing. Vigorous community discussion of the values at stake is necessary for truly informed personal decision-making.

We need broad community conversation on issues beyond safety for another reason, too. What people choose to do on their own can change the collective, even when those changes were not intended for the population as a whole. Human germ-line genome editing is the quintessential example of a technology that will have both personal and collective impacts, affecting our shared environment.

How, for example, might the ability to select the features we want in our children affect the relationship between parents and children and the virtues we want to see in our communities? Commentators such as Michael Sandel of Harvard University have warned that control over the genomes of our children could lead to a sense of "hyperagency," whereby we would lose the sense of children as gifts to be nurtured as they come to us and rather see them as objects we have designed. Will children who have been edited to have greater musical talent or athletic prowess feel obliged to fulfill their parents' dreams even more than children usually do?

Moreover we could craft our progeny on the basis of popular but suspect norms such as homophobia or certain physical features. We could also inadvertently set up what some commentators have called a "genetic arms race," in which parental attempts to give children an advantage just leave everyone competing at ever higher levels of whatever trait is being sought.

Surely such control is a long way off, but we are now charting a path toward human enhancement that might ultimately reduce variation in the species or, over a long period of time, lead to sub-speciation. Indeed, transhumanists advocate exactly that result—a melding of new biological and synthetic powers that will essentially change the very nature of our species.

We need forums and strategies for discussing beyond-safety implications: books for scholars, policy makers and interested members of the public that will anticipate the wide array of social, economic and ethical implications of enhancement: educational experiences for students and their teachers; literature and films that do not sensationalize but help us consider the social and ethical complexity of our newfound powers; deliberative polling and other forms of democratic deliberation; and multiple channels of communication between experts and non-experts.

Both the international commission and the WHO's committee promise to review a wide range of social and ethical issues, well beyond safety. I hope they stick to that intention. Their meeting last week got off to a great start, with calls for more scientific transparency and renewed commitments to generating a global framework to establish parameters for this research.

But it will take sustained courage to address all of the implications of this technology. In a pluralistic society, it can be frightening to open the Pandora's Box of discussion about deeply held values. With so many different views that are seemingly impossible to reconcile, it will be easier to focus only on safety, which is the bare minimum that just about everyone can agree on. But we avoid the larger, harder conversation at our grandchildren's peril.

China’s tree-planting could falter in a warming world

Researchers warn that the push to hold back deserts could strain water resources.

BY MARK ZASTROW

China has planted billions of trees over the past four decades as part of its fight against expanding deserts, mostly in its north. Each year, the country sows seedlings over an area nearly the size of Ireland. It is even sharing its desert-control methods with others as part of its Belt and Road trade initiative.

The trees have held back China’s deserts. But some scientists worry that the planting could exacerbate water scarcity. Many of the trees are not native to the regions where they have been planted, and they use a lot of water — and are being placed in areas that are experiencing reduced rainfall owing to global warming.

“The idea is nice, but it’s kind of foolish to plant trees in a desert,” says Troy Sternberg, a geographer at the University of Oxford, UK.

Chinese scientists say there are good reasons to plant vegetation in barren areas, but that the program needs to take into account local conditions. They say local and national governments are already planting more shrubs, herbs and other native vegetation that needs less water.

The Gobi Desert and similarly arid regions are expanding as processes such as overgrazing deplete vegetation on their borders, letting wind and gravity erode soil. China’s largest tree-planting drive, the Three-North Shelter Forest Program, also called the Great Green Wall, is designed to halt that encroachment. The government says it has planted more than 66 billion trees across 13 provinces in the country’s north since the program began in 1978.

Around 2000, deserts across the country were expanding by 10,400 square kilometers a year, says the government. But in 2017, it reported that China’s deserts were shrinking by more than 2,400 square kilometers a year.

A 2018 study 1 of satellite data from the US National Oceanic and Atmospheric Administration found that forest cover has increased in line with government statistics, but suggested that changes in logging policy were more important than afforestation — planting forests where none were before.

In 1999, the Chinese government began planting millions of trees in its Grain for Green Program, intended to repair damaged farmland in the northern Loess Plateau, which is roughly the size of France.

And the afforestation drive is continuing apace: in 2018, the government announced a target of 30% forest coverage by 2050. At the moment, the coverage is around 22%.

It’s still too early to determine whether it has solved the problem, says CongbinFu, director of the Institute for Climate and Global Change Research at Nanjing University. Land restoration can take several decades or even 100 years, he says.

There are pitfalls to mass tree-planting. Large parts of China — including some areas where trees are being planted — are getting drier. A paper 2 co-authored by Sternberg found that arid areas in China had increased by roughly 1.6 million square kilometres, about the size of Iran, since 1980 — probably due largely to anthropogenic climate change.

Many of the plants introduced to the Loess Plateau use more water than native vegetation. A 2016 study found that the revitalized ecosystem is already sucking up rainfall and reducing the amount of water that runs off to rivers; a drier climate could exacerbate the situation and trigger water shortages for humans. A modelling study co-authored by Fu and published last month reached similar conclusions, and cautioned against continuing the Grain for Green Program.

Considering water shortages is important, says Shixiong Cao, an ecologist at Beijing Forestry University. He thinks the national forestry department has recognized the error of planting trees in arid areas, and that in recent years, it has moved towards planting shrubs with lower water requirements.

The head of the forestry department, Zhang Jianlong, told state media in March that efforts should go to keep vegetation healthy, rather than simply planting trees.

Social Media Are Changing The Way Art Is Seen And Presented

The marriage of art and apps is especially conspicuous in China

On a wintry weekend, young couples wander through “LOVE LOVE LOVE', an exhibition at the Today Art Museum in Beijing. Some of the items on display are tenuously related to the theme, but the visitors seem not to mind, intent as they are on snapping a striking selfie amid the mirrors and neon lights. A young woman poses on a white staircase, peeking over her shoulder at her friend’s camera.

Elsewhere in the museum "Bord de Mer”, a film by Agnes Varda, a late French director, plays on a loop. The floor of the gallery has been covered in sand; deckchairs are set up in front of a screen showing gently lapping waves. Viewers discuss the best angle for a picture. Each has around ten seconds to rush into a chair, simulate a relaxing beach scene and get out of the way. Experiencing love, or Varda’s sea view, seems less important than showing others that you have experienced it.

Galleries across the world are attracting snap-happy youngsters eager to impress their online followers. Immersive exhibitions of the art of Yayoi Kusama and Vincent van Gogh have drawn camera-wielding crowds from Melbourne to New York. But in China the marriage of art and social media is especially conspicuous. The country's private museums have long been subject to oversight by local bureaucrats. Increasingly, however, curators are as beholden to the whims of online taste makers and fads as they are to the censors. Old assumptions about power in the art world are being overturned. More and more it is the crowd, not the experts, who determine the status of artworks.

Young at art

The word wanghong roughly means “viral” or “internet famous”, with a hint of tackiness. As a noun, it can refer to China's social-media influences, otherwise known as “key opinion leaders” (KOLs). As an adjective, it describes hotspots to which young Chinese flock to take selfies, urging their followers to “da ka”, or check in, at the same place: the phrase basically means “been there, done that”, says Cathy Cao, a 22-year-old KOL “It validates that you are on the trend and that you aren’t left behind.” The wanghong location might be a cafe, a tree------or, quite often, an art gallery.

The wanghong effect can be mutually beneficial. Reliant on ticket sales as they are, many private art museums welcome it. Galleries often hike their prices in anticipation of wanghong-inspired demand. Philip Tinari, director of the UCCA Centre for Contemporary Art in Beijing, says his institution “has evolved to embrace” KOLs, who are invited to private views. A partnership with Douyin------the inside-China version of TikTok------means UCCA’s shows are promoted to its 600m daily users.

As marketing, it works. Mr Tinari says UCCA has seen a boost in visitor numbers since it began thinking hard about social media. A recent exhibition on Maurizio Cattelan, an Italian artist, was crammed with wanghong devotees, thanks to a promotional push that included social-media competitions, KOLs and Chinese pop idols. Search for the show on Xiaohongshu, photo-sharing app, and you find posts advising visitors to sport dark colors to complement its neutral palette. In their pictures they lie languidly beside a stuffed horse, a sign reading “INRI”(the Latin abbreviation for “Jesus of Nazareth, the King of the Jews”) jutting out of its flank.

Much more than in Western galleries, these visitors tend to be young------and, says Mr Tinari, they “don’t have this accumulated austerity” in their approach to art. Many private contemporary-art galleries and museums in China are young too, and attitudes in and towards them are different; the Western etiquette of hushed tones and awed deference is absent. Although many visitors want to explore and learn, these are also places to hang out and have fun.

These technological and demographic shifts are opening up old debates about the role and value of art. What is it for, diversion or edification------and who has the authority to say? For centuries, museums, curators and collectors have judged what is enduring and what is schlock. They sought to interpret the intentions, influences and contexts of each piece. On social media, that hierarchy is upended and scholarly

exposition discarded. Here, says Mr Tinari, “everyone has a perspective, and that perspective has some degree of validity.”

Some internet celebrities seem to care about art for art’s sake. Ms Cao’s feed on Weibo, a microblogging service on which she has over 267,000 fans, is a mix of museum selfies and photos of the works. She does not post lengthy captions about the artists or canvases, but strives to “take pictures that can really show the glamour and the beauty of the artwork”, and to dress in “harmony” with the exhibits. But detractors of the wanghong trend argue that paintings and sculptures are being relegated to mere backdrop for marketing. The art itself is receding from view.

Concern, or snobbery, about seriousness and expertise is not the only objection to the rise of wanghong art. Curators dislike it when KOLs paid to promote clothing or perfumes stage photoshoots in their museums. A few are discouraging the practice, banning visitors from taking pictures with people in them, or asking KOLs to delete them when they do.

But dissenters are in a shrinking minority. Mr Tinari says shows that priorities photo opportunities are being put on “all over the place” (though not by UCCA, he insists).The curators of an exhibition of Man Ray’s photography at the M Woods museum in Beijing installed artificial grass and a tree as aids to posing. The Fosun Foundation in Shanghai posted an article on WeChat, another app, encouraging visitors to exploit the interplay of light and shadow in certain rooms. The Museum of Art Pudong, also in Shanghai, has publicized the top selfie spots in and around the building.

In China and beyond, apps with hundreds of millions of users will increasingly shape the ways visual art is displayed and consumed------and ultimately, because artists want their work to be seen and bought, how it is created. When Ms. Cao promoted an exhibition of Raphael’s work in Beijing, the vast majority of comments remarked on her appearance rather than the art. Piggybacking on her post, the organizers promised that visitors to the show “may come across beautiful people like her”.

How AI Helps Us Understand Human Vision

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Author Nicoletta Lanese

The human brain has long been compared to an advanced computer, full of crisscrossing wires that pulse with electricity, carrying information from place to place. In fact, mathematician John von Neumann compared the physical parts of the nervous system to the vacuum tubes and other hardware comprising computers of the 1950s.

But even before von Neumann made such comparisons, computer scientists, including Alan Turing, began posing a fascinating and disturbing question: could computers someday function and "think" like humans? By the 60s and 70s, they began envisioning brain-inspired computer programs that would pave the way for modern artificial intelligence.

Today, the AI systems that were originally inspired by the brain are helping neuroscientists study the brain itself. They've become particularly important in studies of human visual perception.

In crafting systems to mimic human vision, engineers developed tools that help neuroscientists understand how we see the world. In turn, engineers are leveraging our growing knowledge of vision to improve their computer models and technologies. It's a classic feedback loop.

The AI systems employed to model human vision are called neural networks, and they were inspired by simplified models of neurons in the brain, says Carnegie Mellon computer scientist David Held.

Neural networks were inspired by a simplified model of a neuron, which can be thought of as a "system that takes in inputs, multiplies the inputs by weights, and adds up the resulting values. If the sum exceeds a certain threshold, the output is 'one,' and if it's below that threshold the output is 'zero,'" Held explains. A "neuron" responds to a specific tidbit of information. Linked together, these neurons can tackle more complex problems, he said.

The visual cortex relies on linking together actual neurons. It is comprised of groups of neurons lying on top of each other like layers of an onion. Each progressive layer picks out more complex features of an image. For example, when you look at a tabby cat, neurons in your brain work together to analyze the animal's shape then later identify its orange fur, pointed ears, triangular nose, and fuzzy tail. Activity across the whole network dictates what the system finally perceives.

In computing neural networks, nodes function as "neurons." When triggered by incoming data, these bits of computer code send out a signal. Like neurons in the visual cortex, nodes can be grouped into stacked layers to create a "deep" neural network. Researchers are uncovering how each layer interacts with the next to arrive at a final output.

In 2012, a class of deep neural network called a convolutional neural network (CNN) showed success in computer vision, classifying images with unprecedented accuracy. As CNNs grew more popular, neuroscientists got in on the action.

Fordham University neuroscientist Elissa Aminoff notes these CNNs are doing so well in computer vision, that the question has become "do they reflect how the brain is processing [visual] information? What we started to do was…see whether the way these models represent an image is the same way that different areas of the brain represent an image.

CNN is a data hog. It becomes more accurate the more data it receives. The system "learns" by picking up patterns in that data, so it needs a lot of it. With that in mind, Aminoff's team gathered brain scans from participants as each viewed roughly 5,000 images of objects and scenes.

The researchers will use their dataset to identify patterns in human brain activity that relate back to specific visual features and stimuli. According to Aminoff, computer vision models are helping neuroscientists "identify visual features and develop a visual vocabulary to talk about these images.

Brain activity patterns can guide the construction and testing of artificial neural network models that serve as hypotheses of how the organ works. "If the brain is a complicated system, you're going to need complicated models," says MIT neuroscientist James DiCarlo.

DiCarlo's team attempted to model human vision by training neural networks on a library of one million images. Networks learned to recognize objects by strengthening or weakening connections between certain nodes. Then DiCarlo showed macaque monkeys a suite of new test images. Based on their computer model, the team could predict how certain neurons in the macaques' brains would react to each image. They also developed new images with exaggerated features discovered by the model and found they could strongly activate certain subsets of neurons.

Critics of this computational method of neuroscience argue that the models can be as cryptic as the brain and may not reflect human brain function at all. However, DiCarlo says building models "becomes this virtuous cycle." Scientists build an algorithm, test its accuracy by comparing its responses with the brain's responses, refine their design, and test it again. Over time, they come closer to capturing reality.

Energy in Asia

—Transitional justice

When the electricity cut out earlier this month in her flat in Dhaka, Sabi-na Yeasmin's first thought was for her 17-month-old daughter. Bangladesh's capital fills with dengue-carrying mosquitoes at this time of year. With no working fan orair conditioner, Ms.Yeasmin could not put her toddler under the stifling mosquito net. A diesel shortage had put the backup generator out of commission. Even the price of candles had quadrupled. Ms.Yeasmin could barely keep from crying.

The power cut that plunged her building into darkness on October 4th did the same to most of Bangladesh: four-fifths of the country's 165m people lost electricity for seven hours. Factories ground to a halt. Pumps in tenements ceased to work, depriving residents of water. The grid failure was an extreme symptom of an electricity shortage caused by geopolitics. Over the past decade, Bangladesh has added a lot of generation capacity to keep up with its growing economy, mostly by building natural-gas plants that run on imported fuel. Russia's invasion of Ukraine pushed up the price of gas. Gulf gas producers have prioritized exports to Europe, which pays top dollar, over those to poor countries.

The problems faced by Bangladesh are a harbinger of things to come. Asian economies will be the world's fastest-growing in the coming decade. Their demand for energy will surge. At the same time, countries in the region are already among the worst affected by climate change. The cost of floods, droughts and heatwaves will only rise. Meanwhile the availability of fossil fuels is subject to political vagaries. Asia's future success and the well-being of its people, including the ability to keep the lights on, will depend on whether it can green its energy supply quickly enough. It is a formidable challenge. Energy demand for the ten members of the Association of South-East Asian Nations (ASEAN) is projected to increase by about a third of the EU's current total by 2050. India alone will probably need additional capacity equivalent to that of today's EU by 2040. Ideally, much of that extra demand will be met by renewables. Yet fossil fuels continue to dominate the energy mix across the region. Their dominance is entrenched through subsidies or political favoritism. In India, Indonesia, Malaysia and the Philippines coal, the filthiest of fossil fuels, remains king. India, the world's third-biggest emitter after China and America, has set a zero-carbon target date of 2070, two decades later than large Western economies. Some countries have yet to make a commitment at all.

Breaking away from coal is a priority. Though existing coal plants will be needed to ensure the stability of grids across the region for years to come, the construction of new ones must slow. China, Japan and South Korea, which were funding 95% of such plants, have promised to stop financing them abroad, albeit with loopholes. New forms of financing should help retire old ones. India, Indonesia and Vietnam are lobbying to copy a model being tried in South Africa, where rich countries provide grants and cheap loans to shut coal generators. The Asian Development Bank wants to blend aid with private capital to refinance coal barons' debts. The idea is to allow them to make their money ahead of schedule on the condition that they close their plants early, too.

As for new sources of energy, hopes are rising for “green” hydrogen--made from splitting water using renewable energy. Hydrogen is abundant, clean and energy-dense, but both the technology and the infrastructure are untested at scale. Plans are nevertheless ambitious. In the Pilbara region of Western Australia, a renewable energy hub will, its boosters claim, cover 6,500 square kilometers of desert and have capacity of 26GW a year, to be used to produce hydrogen and ammonia (a way to store hydrogen and make it portable) for export.

Given the uncertainties surrounding green hydrogen, for now solar energy and wind power will be the chief focus of Asia's energy transition. Some dream big: one Australian company promises a $18.7 billion underwater power link sending electricity from solar panels in Australia's Northern Territory to Singapore, using 12,600km (7,800 miles) of cables. If completed as promised, by 2029 it will supply

one sixth of the city-state’s electricity.

Most Asian renewable projects will be smaller in scale. Yet their cumulative impact could be significant. The Economist Intelligence Unit, a sister company of The Economist, forecasts that renewables will double their share in Asia's electricity mix from 15% to 31% by 2031. India's share will reach 21%, with 200GW of fresh, non-hydro renewable capacity. China is expected to add 700GW of such capacity. The head of China's planning agency claims 450GW worth of wind projects will be built in the Gobi desert alone. For the transition to work, nuclear will need to be a part of the mix, as it already is in China. Bangladesh, India and South Korea are all adding nuclear capacity. Asia's large-scale manufacturing of green-energy products will help. Yet not all projects will be commercially viable. Weaning Asia off carbon will require some $26trn-37trn in investment between now and 2050, estimates the Asia Investor Group on Climate Change, a club of business types. Grants and subsidies from rich countries will be needed to spur private investment. India's Prime Minister, Narendra Modi, has named his price for agreeing to net zero: $1trillion in funding by 2030 alone. That is ten times the annual amount promised to all poor countries under the Paris agreement of 2015, little of which has so far been disbursed. When countries meet in Egypt next month at the UN's annual climate summit, money will be at the heart of discussions. Asia's low-carbon future hangs on the outcome.

Should the Government Fight Recessions with Spending Hikes Rather Than Tax Cuts?

When George W. Bush became president in 2001, the economy was slipping into a recession. He responded by cutting tax rates. When Barack Obama became president in 2009, the economy was in the middle of the Great Recession, the worst economic downturn in many decades. He responded with a stimulus package that offered some tax reductions but also included substantial increases in government spending. The contrast between these two policies illustrates a classic question of macroeconomics: Which instrument of fiscal policy—government spending or taxes—is a better tool for reducing the severity of economic downturns?

Pro: The Government Should Fight Recessions with Spending Hikes

John Maynard Keynes transformed economics when he wrote *The General Theory of Employment, Interest and Money* in the midst of the Great Depression of the 1930s, the worst economic downturn in U.S. history. Since then, economists have understood that the fundamental problem during recessions is inadequate aggregate demand. When firms are unable to sell a sufficient quantity of goods and services, they reduce production and employment. The key to ending recessions is to restore aggregate demand to a level consistent with full employment of the economy's labor force.

To be sure, monetary policy is the first line of defense against economic downturns. By increasing the money supply, the central bank reduces interest rates. Lower interest rates in turn reduce the cost of borrowing to finance investment projects, such as new factories and new housing. Increased spending on investment adds to aggregate demand and helps to restore normal levels of production and employment.

Fiscal policy provides an additional tool to combat recessions. When the government cuts taxes, it increases households' disposable income, encouraging them to increase spending on consumption. When the government buys goods and services, it adds directly to aggregate demand. Moreover, these fiscal actions can have multiplier effects: Higher aggregate demand leads to higher incomes, higher incomes lead to additional consumer spending, and additional consumer spending leads to further increases in aggregate demand.

Fiscal policy is particularly useful when the tools of monetary policy lose their effectiveness. During the Great Recession of 2008 and 2009, for example, the Federal Reserve cut its target interest rate to about zero. The Fed cannot reduce interest rates below zero, because, at that point, people would hold onto their cash rather than lending it out at a negative interest rate. Thus, once interest rates are at zero, the Fed loses its most powerful tool for stimulating the economy. In this circumstance, it is natural for the government to turn to fiscal policy—taxes and government spending—to prop up aggregate demand.

Traditional Keynesian analysis indicates that increases in government purchases are a more potent tool than decreases in taxes. When households get extra disposable income from a tax cut, they will likely save some of that additional income rather than spend it all (especially if households view the tax reduction as temporary rather than permanent). The fraction of the extra income saved does not contribute to the aggregate demand for goods and services. By contrast, when the government spends a dollar buying a good or service, that dollar immediately and fully adds to aggregate demand.

In 2009, economists in the Obama administration used a conventional macroeconomic model to calculate the magnitude of these effects. According to their computer simulations, each dollar of tax cuts increases GDP by $0.99, whereas each dollar of government purchases increases GDP by $1.59. Thus, increases in government spending offer a bigger "bang for the buck" than decreases in taxes. For this reason, the policy response in 2009 featured fewer federal tax cuts and more increases in federal spending.

Con: The Government Should Fight Recessions with Tax Cuts

There is a long tradition of using tax policy to stimulate a moribund economy. President Kennedy proposed a tax reduction as one of his major economic initiatives; it eventually passed under President

Johnson in 1964. President Reagan also signed into law significant tax cuts when he became president in 1981. Both of these tax reductions were soon followed by robust economic growth.

Tax cuts have a powerful influence on both aggregate demand and aggregate supply. They increase aggregate demand by increasing households' disposable income, as emphasized in traditional Keynesian analysis. At the same time that tax cuts increase aggregate demand, they can also increase aggregate supply. When the government reduces marginal tax rates, workers keep a higher fraction of any income they earn. As a result, the unemployed have a greater incentive to search for jobs, and the employed have a greater incentive to work longer hours. Increased aggregate supply, along with the increased aggregate demand, means that the production of goods and services can expand without putting upward pressure on the rate of inflation.

There are various problems with increasing government spending during recessions. First of all, consumers understand that higher government spending, together with the government borrowing needed to finance it, will likely lead to higher taxes in the future. The anticipation of those future taxes induces consumers to cut back spending today. Because of these various effects, government-spending multipliers may be smaller than is conventionally believed.

Tax cuts have the advantage of decentralizing spending decisions, rather than relying on a centralized and highly imperfect political process. Households spend their disposable income on things they value. Firms spend their investment dollars on projects they expect to be profitable. By contrast, when the government tries to spend large sums of money fast, subject to various political pressures, it may end up building "bridges to nowhere." Ill-conceived public projects may employ some workers, but they create little lasting value. Moreover, they will leave future generations of taxpayers with significant additional debts. In the end, the short-run benefits of additional aggregate demand from increased government spending may fail to compensate for the long-run costs.

AI translates Hokkien, an unwritten language, for the first time

Tech at Meta, Oct.19, 2022

Peng-Jen Chen is well aware of how language barriers can affect people's ability to communicate. Chen grew up in Taiwan speaking Mandarin Chinese, but his father, Sheng-Jiang Chen, a 70-year-old retired factory lead technician, hails from Southern Taiwan, where Taiwanese Hokkien is widely spoken. Though the two languages are related, they're different enough that Chen's father sometimes finds it tricky to conduct complex conversations in Mandarin. "I have always wished my father could communicate with everyone in Taiwanese Hokkien, which is the language he's most comfortable speaking," said Chen, a Meta AI researcher. "He understands Mandarin well but speaks more slowly when communicating about complex topics."

But rather than simply worrying, Chen is doing something about the problem — he's leading the development of new technology to translate between Hokkien and English.

This is a daunting task, because while languages like Mandarin, English, and Spanish are both written and spoken, Hokkien — which is widely spoken within the Chinese diaspora — is primarily oral. In fact, Chen and his team of researchers are among the first to use artificial intelligence (AI) to construct a translation system for languages like Hokkien that lack a formal or widely known writing system. While the initial stage of the project translates between English and Hokkien, researchers plan to allow the translation of more unwritten languages. It's part of Meta's ongoing effort to develop a Universal Speech Translator that will allow the translation of many languages in real time and could eventually help millions of people around the world like Chen's father become more effective communicators.

"The ability to communicate with anyone in any language — that's a superpower people have dreamed of forever, and AI is going to deliver that within our lifetimes," said Meta Founder and CEO Mark Zuckerberg in an online presentation earlier this year.

Using computers to translate languages isn't a new concept, but previous efforts have focused on written languages. Yet of the 7,000-plus living languages, over 40 percent are primarily oral and do not have a standard or widely known writing system like Hokkien.

AI translation

Building an AI speech translation system for Hokkien was no easy task. These tools are usually trained on large quantities of text. But for Hokkien, there is no widely known standard writing system. Furthermore, Hokkien is what's known as an underresourced language, which means there isn't much paired speech data available in comparison with, say, Spanish or English. Also, with few human English-to-Hokkien translators, it was difficult to collect and annotate data to train the model.

To get around these problems, Meta researchers used text written in Mandarin, which is similar to Hokkien. The team also worked closely with Hokkien speakers to ensure that the translations were correct. "Our team first translated English or Hokkien speech to Mandarin text, and then translated it to Hokkien or English — both with human annotators and automatically," said Meta researcher Juan Pino. "They then added the paired sentences to the data used to train the AI model."

The researchers will make their model, code, and benchmark data freely available to allow others to build on their work. While the model is still a work in progress and can currently translate only one full sentence at a time, it's a step toward a future where simultaneous translation between many languages is possible.

Challenges of communication

Speakers of unwritten languages often face hurdles when trying to participate in online communities, said Laura Brown, a Meta researcher and linguistic anthropologist. Many of these speakers are not able to easily communicate in the digital realm because they are not used to writing in their language.

“It can be a barrier to confidence, fluency, and authenticity,” Brown said. “We know at Meta that there are tons of people all over the world who have their interface set to English, who use English on our platforms — even though they are much more confident in other languages and writing systems. As soon as we give them the ability to do audio in their own language, their comfort and confidence in the digital space shoot way up.”

Communicating with speakers of a different language can be challenging for speakers of unwritten languages. It can be hard to recognize the units of sound in an unwritten language when it’s transcribed in a way meant to be understood as it’s heard. This complication often makes it harder to teach unwritten languages and can result in younger generations losing the ability to communicate in the language of their parents.

Some languages without a standardized written form are at risk of dying out. Linguists are trying to preserve languages with a dwindling number of speakers by writing the languages down, but that can be challenging when they don’t have a conventional written form. Mexico’s National Institute of Indigenous Languages is one institution that is working to preserve the unwritten languages of Indigenous peoples by recording the vocabulary.

The many possibilities of AI translation

Meta researchers believe AI could help solve many communication challenges for speakers of unwritten languages. Pino said that the new translation system could eventually make it easier to navigate the internet and communicate in different languages, whether virtually or in real life.

For Chen, though, the goal of the new Hokkien translation system is more personal. “I just want my father to be able to speak to whomever he wants,” he said.

Britain Transport

Scoot first, ask questions later

The public may not like them, but a trial of E-scooters looks encouraging

On England's south coast, Michael Dewey is about to hop onto a coral-coloured e-scooter. Mr Dewey usually drives to and from Portsmouth Harbour, where he works in the docks, but today he left his car in the garage. It will cost him £1.90 ($2.10) to rent the scooter for the four-mile (6km) journey home. He reckons a taxi fare would be four times that.

"E" stands for "electric", but in Britain it could also mean "experimental". Since 2020 the Department for Transport has allowed 31 English local authorities to carry out e-scooter rental trials. The scheme was fast-tracked during the pandemic, when lockdowns restricted public transport. Its primary aim is to help the government decide whether to legalize e-scooters as a way of reducing emissions (private scooters are illegal unless ridden on private land, though some ride them regardless). Lynne Stagg, a member of Portsmouth council, which is running a trial, says the city has "a major congestion problem" and poor air quality. "We wanted to get as many people as possible out of their cars."

Not everyone is keen. In surveys, two-thirds of non-users in Portsmouth say they want them banned. One concern is safety. Across the country stories abound of drug dealers scooting to drop-offs to evade the police, and of the deaf, the blind and the old being mown down by these quiet machines. In 2021 the total number of reported e-scooter crashes tripled, to 1,352. No pedestrians died, but ten riders did.

It is tricky to read much into such numbers, which blend private and rental scooters. PACTS, a charity, estimates, from the crashes for which data are available, that 82% involve illegal machines. The government has not yet released statistics specific to the trials, but other figures suggest e-scooters are safer than the alternatives. According to the Royal Society for the Prevention of Accidents, another charity, e-scooters are involved in 0.7 collisions per 1m miles, compared with 3.3 for bicycles and 5.9 for motorbikes.

Transport infrastructure makes a difference to safety. To the ire of many motorists, rented e-scooters may be driven on the road (but not on motorways) and in special cycle lanes. A recent study of six European countries found that traffic accidents reported to the police increased by an average of 8.2% after rented e-scooters were introduced, but did not rise in towns with good cycle lanes.

Another reason given to oppose e-scooters is that they may not be as green as people think. Rides typically replace short journeys on foot or by bike, rather than by car, says Christian Brand of the University of Oxford. A French study found that, because of an e-scooter's short life, the total emissions from its use can be six times those from taking the metro. In Portsmouth, however, the council says that 34% of users responding to its surveys say they would otherwise have used a car for their most recent e-scooter journey. Only 15% walk or cycle less than they did before.

One of the most notable things about the English scheme is that it allows for local experimentation, notes Lorna Stevenson of the University of Westminster, who is completing a PhD on the trials. In consultation with councils, e-scooter companies constantly refine their "geofencing", which uses the satellite-based global positioning system to map "no-go" areas, where the scooters shut down, and to automatically enforce speed restrictions. In Oxford riders cannot scoot by the river, presumably to stop students dumping the machines during drunken nights out.

Public feedback also informs the schemes. Surveys consistently show a demand for more parking bays, as well as concerns about safety. Britain has more mandatory parking bays than other European countries, notes Jim Hubbard of Voi, the Swedish firm that operates the fleets in Portsmouth and Oxford.

If interest is a measure of success, the trials are going well. So far 29 of the 31 councils have chosen to continue them. The trial period has been extended to 2024. But its most tangible result may come sooner, if private e-scooters are legalized, which could happen in a transport bill expected next year. Then "e" might also stand for "everywhere".

Elements of Life

The creation of life requires a set of chemical elements for making the components of cells. Life on Earth uses about 25 of the 92 naturally occurring chemical elements, although just 4 of these elements—oxygen, carbon, hydrogen, and nitrogen—make up about 96 percent of the mass of living organisms. Thus, a first requirement for life might be the presence of most or all of the elements used by life.

Interestingly, this requirement can probably be met by almost any world. Scientists have determined that all chemical elements in the universe besides hydrogen and helium (and a trace amount of lithium) were produced by stars. These are known as heavy elements because they are heavier than hydrogen and helium. Although all of these heavy elements are quite rare compared to hydrogen and helium, they are found just about everywhere.

Heavy elements are continually being manufactured by stars and released into space by stellar deaths, so their amount compared to hydrogen and helium gradually rises with time. Heavy elements make up about 2 percent of the chemical content (by mass) of our solar system; the other 98 percent is hydrogen and helium. In some very old star systems, which formed before many heavy elements were produced, the heavy-element share may be less than 0.1 percent. Nevertheless, every star system studied has at least some amount of all the elements used by life. Moreover, when planetesimals—small, solid objects formed in the early solar system that may accumulate to become planets—condense within a forming star system, they are inevitably made from heavy elements because the more common hydrogen and helium remain gaseous. Thus, planetesimals everywhere should contain the elements needed for life, which means that objects built from planetesimals—planets, moons, asteroids, and comets—also contain these elements. The nature of solar-system formation explains why Earth contains all the elements needed for life, and it is why we expect these elements to be present on other worlds throughout our solar system, galaxy, and universe.

Note that this argument does not change, even if we allow for life very different from life on Earth. Life on Earth is carbon based, and most biologists believe that life elsewhere is likely to be carbon based as well. However, we cannot absolutely rule out the possibility of life with another chemical basis, such as silicon or nitrogen. The set of elements (or their relative proportions) used by life based on some other element might be somewhat different from that used by carbon-based life on Earth. But the elements are still products of stars and would still be present in planetesimals everywhere. No matter what kinds of life we are looking for, we are likely to find the necessary elements on almost every planet, moon, asteroid, and comet in the universe.

A somewhat stricter requirement is the presence of these elements in molecules that can be used as ready-made building blocks for life, just as early Earth probably had an organic soup of amino acids and other complex molecules. Earth's organic molecules likely came from some combination of three sources: chemical reactions in the atmosphere, chemical reactions near deep-sea vents in the oceans, and molecules carried to Earth by asteroids and comets. The first two sources can occur only on worlds with atmospheres or oceans, respectively. But the third source should have brought similar molecules to nearly all worlds in our solar system.

Studies of meteorites and comets suggest that organic molecules are widespread among both asteroids and comets. Because each body in the solar system was repeatedly struck by asteroids and comets during the period known as the heavy bombardment (about 4 billion years ago), each body should have received at least some organic molecules. However, these molecules tend to be destroyed by solar radiation on surfaces

unprotected by atmospheres. Moreover, while these molecules might stay intact beneath the surface (as they evidently do on asteroids and comets), they probably cannot react with each other unless some kind of liquid or gas is available to move them about. Thus, if we limit our search to worlds on which organic molecules are likely to be involved in chemical reactions, we can probably rule out any world that lacks both an atmosphere and a surface or subsurface liquid medium, such as water.

Right-and left-handedness in humans

Why do humans, virtually alone among all animal species, display a distinct left of right-handedness? Not even our closest relatives among the apes possess such decided lateral asymmetry, as psychologists call it. Yet about 90 per cent of every human population that has ever lived appears to have been right-handed. Professor Bryan Turner at Deakin University has studied the research literature on left-handedness and found that handedness goes with sidedness. So nine out of the people are right- handed and eight are right-footed. He noted that this distinctive asymmetry in the human population is itself systematic. 'Humans think in categories： black and white, up and down, left and right. It's a system of signs that enables us to categorize phenomena that are essentially ambiguous.'

Research has shown that there is a genetic or inherited element to handedness. But while left-handedness tends to run in families, neither left nor right handers will automatically produce off-spring with the same handedness; in fact about 6 per cent of children with two right-handed parents will be left-handed. However, among two left-handed parents, perhaps 40 per cent of the children will also be left-handed. With one right and one left-handed parent, 15 to 20 per cent of the offspring will be left-handed. Even among identical twins who have exactly the same genes, one in six pairs will differ in their handedness.

What then makes people left-handed if it is not simply genetic? Other factors must be at work and researches have turned to the brain for clues. In the 1860s the French surgeon and anthropologist, Dr. Paul Broca, made the remarkable finding that patients who had lost their powers of speech as a result of a stroke (a blood clot in the brain) had paralysis of the right half of their body. He noted that since the left hemisphere of the brain controls the right half of the body, and vice versa, the brain damage must have been in the brain's left hemisphere. Psychologists now believe that among right-handed people, probably 95 per cent have their language center in the left hemisphere, while 5 per cent have right-sided language. Left-ganders, however, do not show the reverse pattern but instead a majority also have their language in the left hemisphere. Some 30 per cent have right hemisphere language.

Dr. Brinkman, a brain researcher at the Australian National University in Canberra, has suggested that evolution of speech went with right-handed preference. According to Brinkman, as the brain evolved, one side became specialized for fine control of movement (necessary for producing speech) and along with this evolution came right-hand preference. According to Brinkman, most left-handers have left hemisphere dominance but also some capacity in the right hemisphere. She has observed that if a left-handed person is brain-damaged in the left hemisphere, the recovery of speech is quite often better and this is explained by the fact that left-handers have a more bilateral speech function.

In her studies of macaque monkeys, Brinkman has noticed that primates (monkeys) seem to learn a hand preference from their mother in the first year of life but this could be one hand or the other. In humans, however, the specialization in function of the two hemispheres results in anatomical differences: areas that are involved with the production of speech are usually larger on the left side than on the right. Since monkeys have not acquired the art of speech, one would not expect to see such a variation but Brinkman claims to have discovered a trend in monkeys towards the asymmetry that is evident in the human brain.

Two American researchers, Geschwind and Galaburda, studied the brains of human embryos and discovered that the left-right symmetry exists before birth. But as the brain develops, a number of things can affect it. Every brain is initially female in its organization and it only becomes a male brain when the male fetus begins to secrete hormones. Geschwind and Galaburda knew that different parts of the brain mature at different rates; the right hemisphere develops first, then the left. Moreover, a girl's brain develops somewhat faster than that of a boy. So, if something happens to the brain's development during pregnancy, it is more likely to be affected in a male and the hemisphere more likely to be involved is the left. The brain may become less lateralized and this in turn could result in left-handedness and the development of certain superior skills that have their origins in the left hemisphere such as logic, rationality and abstraction. It should be no surprise then that among mathematicians and architects, left-handers tend to be more common and there are more left-handed males than females.

The results of this research may be some consolation to left-handers who have for centuries lived in a world designed to suit right-handed people. However, what is alarming, according to Mr. Charles Moore, a writer and journalist, is the way the word ‘right’, reinforces its own virtue. Subliminally he says, language tells people to think that anything on the right can be trusted while anything on the left is dangerous or even sinister. We speak of left-handed compliments and according to Moore, ‘it is no coincidence that left-handed children, forced to use their right hand, often develop a stammer as they are robbed of their freedom of speech’. However, as more research is undertaken on the causes of left-handedness, attitudes towards left-handed people are gradually changing for the better. Indeed when the champion tennis player Ivan Lendl was asked what the single thing was that he would choose in order to improve his game, he said he would like to become a left-hander.