1AC---Adv---Final Frontier

Advantage 1 is the FINAL FRONTIER.

Generative AI enables successful exploration and colonization of space.

Nakazawa ’25 [Rika Nakazawa; January 17th; Chief of Commercial Innovation at NTT, senior technology leader, VC investor, and public speaker on technology-powered industry transformation; “‘Extraterrestrial’ Intelligence”; DGI – Geospatial Intelligence for Defense and Security; https://dgi.wbresearch.com/blog/extraterrestrial-intelligence] ejs squad

Engineering and System/Material Design Optimization

GenAI facilitates the creation of **innovative satellite** and **spacecraft designs** by analyzing extensive datasets to propose **novel configurations** - **accelerating** the design **process** and **enhancing performance** and **efficiency**. According to a Capgemini survey, **41%** of **aerospace** and **defense organizations** are experimenting with **gen**erative **AI** in **3D modeling** to **accelerate design** processes, **optimize parts** for aerodynamics, and **lower costs**. AI has demonstrated its astonishing ability to generate unique structural designs that engineers can then refine to yield optimized spacecraft components.

Meanwhile, **AI** is a powerful tool to **produce space-resilient materials**, responding to **everything** from the **vacuum** of **deep space** to the high **radiation** levels near stars. By analyzing **countless combinations** of **elements** and **structures**, AI can uncover materials with **exceptional properties** suited for **spacecraft**, heat **shields**, or **life support** systems. The **rapid exploration** of possibilities within complex simulated environments both **shortens development** timelines but also **enhances** the **likelihood** of **successful missions**.

Mission Planning and Simulation

Since the 1950s, global Space missions have vaulted more than 25,000 objects into Earth orbit, and by some estimates, this number could triple in the next few years. By **leveraging GenAI**, space **agencies** can **simulate** complex **mission s**cenarios, including **orbital mechanics** and potential **system failures**. This **predictive capability** enables more **effective** mission **planning** and **risk mitigation**, ensuring **higher success rates** for **space missions**.

In the blooming space economy, GenAI is key to catalyze innovation, efficiency, and investor confidence, as well as manage satellites and energy development.

Nakazawa ’25 [Rika Nakazawa; January 17th; Chief of Commercial Innovation at NTT, senior technology leader, VC investor, and public speaker on technology-powered industry transformation; “‘Extraterrestrial’ Intelligence”; DGI – Geospatial Intelligence for Defense and Security; https://dgi.wbresearch.com/blog/extraterrestrial-intelligence] ejs squad

‘Extraterrestrial’ Intelligence

As our civilization’s ambitions reach beyond the stars, the intersection of **advanced tech**nologies and the modern **acceleration** of the **space economy** is a **pivotal** force in **reshaping industries** and **expanding possibilities**. A **major movement** in this force is, yes, Artificial Intelligence – traditional AI and **Gen**erative **AI** (genAI). While already disrupting domains like content creation and healthcare, the new breed of **genAI** tools is yielding **significant advances** in the **space** and **satellite** domain.

In our rapidly evolving landscape that spans **satellite** communication**s**, Earth observation, **space tourism**, and **interplanetary logistics**, the ability to **analyze** massive **data**sets, **generate insights**, and **optimize resources** is **paramount**. **GenAI** is a **catalyst** for the **innovation** and **efficiency** that will help us navigate the anticipated **exponential growth** to a **$1.8 trillion space economy** in the next 10 years. AI is reshaping the space economy through multiple facets by unlocking new opportunities and simplifying complexities at speed and scale.

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Space Traffic Management

With the increasing number of devices in orbit, managing **space traffic** is crucial. In 2023, **SpaceX** launched 1800 new satellites in Orbit and in the first half of 2024 they made **50,000** collision-avoidance **maneuvers** with the help of **AI**. **AI** assists in **predicting satellite trajectories** and potential **collisions**, facilitating **proactive measures** to **prevent accidents** and **maintain** sustainable space **op**eration**s**.

Autonomous Satellite Operations

With software-defined satellites composing a larger share of spacecraft manufacturing, **AI** will contribute to the **development** of **autonomous satellite systems** capable of making real-time decisions, such as **adjusting orbits** or **managing** onboard **systems** without human intervention. This autonomy enhances **operational efficiency** and reduces reliance on ground control. The U.S. **Space Force** is now utilizing **AI** to **advance decision** cycle**s** and **optimize** strategic **planning** by using **space-sourced datasets** to **assess** potential **risks** and **design response strategies**.

Satellite Data Analysis

The vast amount of data generated by Earth observation satellites can be efficiently processed using GenAI. AI models can identify patterns and anomalies in satellite imagery, providing valuable insights for applications such as environmental monitoring, disaster response, and compliance adherence. The Φsat-2 satellite from ESA that launched in August 2024 features a multispectral camera paired with an advanced AI computer capable of analyzing and processing imagery directly onboard, offering a more intelligent and efficient approach to monitoring Earth's environment. With six AI applications running onboard, the satellite is designed to turn images into maps, detect clouds in the images, classify them and provide insight into cloud distribution, detect and classify vessels, compress images on board and reconstruct them in the ground reducing the download time, spot anomalies in marine ecosystems and detect wildfires.

Cosmic Energy Harvesting

What was once a concept confined to the realm of science fiction most notably from Isaac Asimov—**s**pace-**b**ased **s**olar **p**ower stations—is now edging closer to reality. **AI** plays a **critical role** in **optimizing** the **design**, **construction**, and **operation** of these massive structures. It also offers innovative **solutions** for efficiently **transmitting energy** back to Earth, ensuring minimal energy loss during the transfer process.

Education is key:

1. INTERDISCIPLINARY LEARNING.

Singh '23 [Dr. Himanshu Singh; September 15th; Product Manager at Meta Reality Labs, Ph.D. from the Indian Institute of Technology Kanpur, M.B.A. from the Darden School of Business at the University of Virginia; "AI and School Space Exploration and Astronomy"; Teachflow; https://teachflow.ai/ai-and-school-space-exploration-and-astronomy/] ejs squad

Introduction to AI, Space Exploration, and Astronomy in School Education

Space exploration and astronomy have always fascinated **students** and sparked their curiosity about the vast universe. However, with the rapid advancements in technology, **a new frontier** is emerging in these fields – the integration of **a**rtificial **i**ntelligence (AI) in school **education**. AI is revolutionizing various industries, and its applications in **space exploration** and astronomy are no exception.

In this section, we will provide an introduction to the connection between AI, space exploration, and astronomy in school education. We will explore why these subjects are crucial in fostering curiosity, critical 6thinking, and scientific inquiry among students. Additionally, we will highlight the importance of incorporating AI into the educational landscape to enhance the learning experience and prepare students for the future.

Space exploration and astronomy offer a **unique opportunity** for students to engage in **interdisciplinary learning**. By combining the principles of **physics**, **math**ematics, **comp**uter **sci**ence, and more, students can develop a **holistic understanding** of the universe and the technologies used to explore it. AI, with its ability to process vast amounts of data, analyze complex patterns, and make intelligent decisions, plays a pivotal role in advancing our understanding of space and the celestial bodies within it.

By introducing **AI** in the context of **space exploration** and astronomy, educators can provide students with a hands-on and **immersive learning** experience. Students can explore **real-world challenges** faced by scientists and engineers, such as **analyzing** space **data**, **designing missions**, and **controlling** robotic **systems**. Through these activities, students develop critical skills in **problem-solving**, **collab**oration, and **data interpretation**, all while deepening their understanding of the universe.

2. TRAINING.

Fowler '24 [Gary Fowler; April 4th; CEO, President, and Founder of GSD Venture Studios and Yva.ai, M.A. from the West Chester University of Pennsylvania, B.A. in Business and Psychology from the Commonwealth University-Lock Haven;

“Exploring New Frontiers: How Generative AI is Transforming Space Exploration”; GSD Venture Studios; https://www.gsdvs.com/post/exploring-new-frontiers-how-generative-ai-is-transforming-space-exploration] ejs squad

Impact of AI on Astronaut Training and Missions

Generative **AI** has a **profound impact** on **astronaut training** and the execution of **space missions**. Enhanced **training** techniques powered by **AI** simulations **prepare astronauts** more effectively for the **challenges** of space. During missions, AI assists in navigation, decision-making, and problem-solving, ensuring safer and more efficient space travel. The **integration** of AI into **astronaut training** and mission operations marks a significant advancement in our **spacefaring capabilities**.

Operations are key to enable future development.

Singh ’23 [Dr. Himanshu Singh; September 15th; Product Manager at Meta Reality Labs, Ph.D. from the Indian Institute of Technology Kanpur, M.B.A. from the Darden School of Business at the University of Virginia; “AI and School Space Exploration and Astronomy”; Teachflow; https://teachflow.ai/ai-and-school-space-exploration-and-astronomy/] ejs squad

The Role of AI in Modern Space Exploration

AI is playing a **crucial** role in modern **space exploration**, enabling us to delve deeper into the mysteries of the universe. One of the key contributions of AI is in **data analysis** and **interpretation**. With the vast amount of data collected from space missions and telescopes, AI algorithms can **process** and **analyze** this data to **uncover patterns**, **identify** celestial **objects**, and make **predictions**. This ability to handle large datasets and extract meaningful information is invaluable in advancing our understanding of the universe.

Another significant area where AI is making an impact is in autonomous systems and robotics. **AI**-powered **robots** and **rovers** are being used in space **missions** to perform tasks that are **too risky** or challenging for humans. These robots can navigate through **hazardous terrains**, **collect samples**, and **conduct experiments**, all while being guided by AI algorithms. This **integration** of AI and robotics not only **expands** our **capabilities** in **space exploration** but also provides **students** with opportunities to learn about the **design** and **operation** of such systems.

Multiplanetary colonization prevents extinction. A.

Reuter ’21 [Timothy Reuter; December 9th; Head of Aerospace and Drones at the World Economic Forum, M.A. in International Relations and Economics from the School of Advanced International Studies at Johns Hopkins University; “Why the human race must become a multiplanetary species”; World Economic Forum; https://www.weforum.org/stories/2021/12/humans-multiplanetary-species/] ejs squad

Becoming a **multiplanetary** species could **protect** the **future** of the **human race** and help humanity reach its **full potential**.

Human habitation across multiple planets will create new hubs of innovation and experimentation leading to advances in science, technology and commerce.

Significantly increasing government and private sector spending on crewed spaceflight is an investment in national and international security against long-tail risks.

In 2021, a new era of space exploration dawned with the first privately organized flights ferrying civilian passengers across the line that separates our planet from the rest of the universe. Much of the media coverage of the three flights launched by Virgin Galactic, Blue Origin and SpaceX has either been of the “isn’t this cool” variety or has characterized these endeavours as symbols of inequality. As such, the question of what the value of human spaceflight is has gone largely unanswered.

Supporters of space exploration sometimes suggest that sending robotic probes to the remote corners of the solar system and beyond can teach us what we need to know about the universe at less cost and risk than sending people. Yet, for the **safety** of our **descendants** and to reach humanity’s full potential, we **must** become a **multiplanetary** species.

Existential risk

Humans have a one in six chance of going extinct this century according to Oxford Philosopher Toby Ord. In his book, The Precipice: Existential Risk and the Future of Humanity, Dr Ord lays out a variety of **long-tail risks** that are both **existential** and **very difficult** to **mitigate**. These include nature-based risks like **asteroids**, large-scale **volcanic eruptions** and **stellar explosions**. Although we can track many of these phenomena, we do not have the technology (nor are we likely to develop it anytime soon) to prevent large eruptions or redirect large asteroids. Initial efforts to nudge space objects are just beginning. This is to say nothing of the human-created risks of **nuclear war** or **bioweapons** intentionally or unintentionally released on the public, a scenario made easier to imagine by the current pandemic.

As long as humanity is grouped together on a single planet there will always be a possibility that **all of us can be killed at once**. It is equivalent to having everyone in a single building: there is always a risk greater than zero of a collapse or fire that kills everyone. By establishing, at first, **small outposts** and eventually larger scale settlements on other planets, the risk of our species being destroyed is **significantly curtailed**.

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Realizing humanity's potential On a more positive note, human habitation in a greater variety of settings will radically expedite science and commerce. While we currently have small-scale experimentation with manufacturing items in micro and zero gravity on the International Space Station, the potential for us to set up large-scale industry in different physics requires us to have a presence on other celestial locations. Large-scale settlements of people are hubs of innovation and human flourishing. Just think of how many more discoveries and marvels could be created by 80 billion people in the future instead of today's 8 billion. Our current planet has a limited carrying capacity but our solar system can accommodate many more people than any single planet can. Just as cultural and geographic variety contributes to the richness of our current society, further expanding the diversity of human settings would continue to expand the creativity of our species. Space travel itself has already been an incredible inspiration to numerous scientists, engineers and artists with many people citing seeing the moon landing as one of the most formative events of their lives. Hastening science and technology development The technologies we develop on our way to becoming a multiplanetary species will also benefit us here on earth. Today, satellites are used to monitor carbon and other greenhouse gas emissions to give us a better picture of the causes of global warming and promote accountability. In her first speech devoted to space, US Vice-President Kalama Harris said: "I truly believe space activity is climate action." In a recent report, the World Economic Forum's Global Future Council on Space laid out the many ways satellite data is being used to address climate change and suggests feeding data from space-based assets into an "Earth Operations Centre" to provide a real-time picture of activities and phenomena that contribute to warming. Less well known are the many other technologies developed on our way to space but used in our daily lives. The CMOS sensor was first invented at NASA's Jet Propulsion Laboratory in the 1990s. No one could have predicted that this technology would eventually be part of all our phones, enabling high-quality digital images and affecting everything from how we document human rights abuses to how we present ourselves to potential mates on dating apps. The limits of space settlement It is important to note that becoming a multiplanetary species will not address what are commonly understood to be our most pressing problems here on earth. Increasingly, people see global warming and social inequality as twin crises that are the most urgent issues of our time. Although space-based assets can help us better understand global warming, investing in technologies or instituting policies to prevent an ecological catastrophe on earth will always be more efficient ways to address ecological degradation than terraforming another planet. We can also easily replicate the social inequities of our planet out in space, as has been illustrated by numerous works of science fiction. Spaceflight is not an escape from those important challenges.

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However, for **certain classes** of long-tail **risk** that add up to **significant existential danger**, diversifying our planetary footprint is the **most effective** mitigation **strategy** and one that provides a path for human flourishing that exceeds what could possibly be accomplished on one planet. For these reasons, significantly increasing government and private sector spending on **crewed spaceflight** is an **investment** in our national and international security.

Natural adaptation and novel gene editing tools prevent biological breakdown post colonization. Learn '21 [Joshua R. Learn; October 8th; award-winning science journalist; citing Dr. Scott Solomon; Associate Teaching Professor of Ecology, Evolutionary Biology, and Behavior at Rice University, Research Associate at the Smithsonian Institution's National Museum of Natural History, Ph.D. in Ecology, Evolution, and Behavior from the University of Texas at Austin; "Colonizing Mars could speed up human evolution"; Astronomy Magazine; https://www.astronomy.com/science/colonizing-mars-could-speed-up-human-evolution/] ejs squad

As it turns out, human **colonization** of the harsh and exotic atmosphere on Mars (if we can achieve it) might **accelerate** our species' **evolution**. "Given how different the martian environment is, you'd expect strong **natural selection**," says Scott Solomon, an evolutionary biologist at Rice University in Houston, Texas.

Mars sits about 34 million miles (55 million kilometers) away from Earth, depending on the orbital position of both planets, and us Earthlings still face a number of obstacles before we could even reach it. But if we get to Mars and establish a **colony** of permanent residents, factors like comparatively **higher radiation**, **lower gravity** and a vast change in lifestyle could prompt significant **evolutionary changes** in human bodies — much quicker than those that have **transpired** on our **native planet**.

Lost in space

Solomon first began pondering how humans might further evolve while teaching introductory biology. He asked students to imagine the ways in which humans may continue to evolve — this question led him down a rabbit hole that inspired his 2016 book, Future Humans.

Solomon's **research** touches on the **hypothetical evolutionary outcomes** of humanity's colonization of Mars. A determining factor in this venture: the precise level of **isolation**, which would **vastly influence** how quickly humans would adapt to new conditions. If humans moved **back** and **forth** from Earth and Mars as quickly as every generation or two, new **influxes** of Earth-born human genes moving to the martian colony could **slow** the effects of certain **genetic mutations**. Meanwhile, remaining within the vastly **different conditions** on Mars might speed up the pace of **human evolution**. "It could be hundreds of years in the right circumstances," Solomon says.

Here on Earth, evolution often requires a species to experience complete isolation for thousands of years from other populations of the same species. When modern humans and our evolutionary ancestors began to spread across the Earth tens of thousands of years ago, populations were isolated in various places for generations — sometimes for thousands of years.

Meanwhile, certain **populations** have developed **characteristics** to help them deal with **local conditions**. For example, **high-altitude** dwelling groups of humans may have adapted **traits** that helped them live in such **extreme environments**. Still, much of this is just plasticity, or the ability of a species to adapt to specific surroundings by taking on various sizes, behaviors and shapes, rather than true evolution. "We can adjust our physiology to different circumstances to a pretty large extent," Solomon said, as evidenced by the fact that modern humans never evolved into new species despite experiencing vast environmental differences.

But it's possible that martian humans could live completely isolated from Earth due to a number of conditions, whether economic, political, or otherwise. For one, diseases unique to either Earth or Mars could emerge and invoke travel embargoes.

Mutant martians

More **intense radiation** on Mars could also provoke **elevated** rates of **genetic mutations** in humans born there. And any **favorable mutations** that help humans better **cope** with conditions on Mars may be inherited by **future generations**. "Increasing the **mutation rate** gives **natural selection** more **material** to operate with," Solomon says.

But these mutations could also be random. If a number of people happen to develop the same chance mutations, either among those living on Mars or their ancestors on Earth, it could cause something like a founding effect. A Mars settlement is likely to consist of a relatively small community in the beginning, and any traits that these founders may share could have a disproportionate effect on the future human development there: This could be as simple as a relatively high number of redheads.

But patterns in hair (or even skin) color wouldn't technically qualify Martians as a new species, Solomon cautions. Yet it's possible that even the first generation of Martians may develop notable physical differences from Earthlings due to gravity changes in a foreign atmosphere, among other adjustments. "They might look different, they might act different," he says. "They might have physical changes that might be obvious to people that compare them."

Natural selection

Survival of the fittest is a key concept in evolution. But it doesn't mean the environment will primarily dictate the type of traits that render people well-suited for Martian life. Height seems like an obvious factor in these differences, since Mars has **three-eights** of **Earth's gravity**.

"Science fiction has often portrayed martians or aliens coming from Mars as being tall and lanky and thin," Solomon says. But the effect could actually be the opposite. The problem is that these body types might pose certain hazards during childbirth — weakened skeletons could fracture people's pelvises while giving birth. So, natural selection may actually favor **shorter people** with **denser bones**.

Also, Mars' **high radiation levels** could directly affect **characteristics** like **skin color** or **eyesight** over generations of evolution. This has already happened on Earth — melanin is **more resistant** to **u**ltra**v**iolet **rays**, for example.

"Perhaps in the face of this **high radiation**, we might evolve some new type of skin pigment to help us deal with that **radiation**," Solomon says, adding that we could potentially evolve **cancer-resistant** genes. "Maybe we get our own green men."

He cautions also that these specific ideas of how we might change are mere speculation. We still need to learn plenty, like how childbirth or an infant's survival and development may be affected by space living.

Writing our own evolutionary destiny

Unique cultural traditions that develop on Mars could also have a long-term effect on evolution. Distinctive eating practices, for example, if maintained over generations, may affect the evolution of our digestive system.

Epigenetics, or the influence of behavior and environment on gene expression, could also play a factor in human evolution on the Red Planet. But this science isn't very well understood yet, Solomon notes. He points to the research on the astronaut twins Scott and Mark Kelly performed by NASA. The former spent a year in space while the latter remained on Earth. Analysis detected changes in Scott's genes, though it's still unclear how these shifts may affect him in the long term.

But based on significant **advances** in **gene editing** tools like **CRISPR**, it's possible that humans on Mars may not need to leave **evolution** up to **natural selection**. Solomon says we currently have the tools to work with potential Mars residents — we just don't necessarily know what specifically to tweak (or how to do it). Nevertheless, scientists could modify people's **genes** before or after a **Mars** journey. "It could potentially be a **powerful tool** to go ahead and make those changes so people could **survive** and be adapted to the martian environment," Solomon says.

Space exploration is inevitable, but doing it sooner rather than later is key to unlock exploration, resource mining, and asteroid deflection.

Saletta '18 [Dr. Morgan Saletta; February; Academic Specialist at the University of Melbourne, Ph.D. in Science and Technology Studies from the University of Melbourne; Dr. Kevin Orrman-Rossiter; Ph.D. from the University of Salford; "Can space mining benefit all of humanity?: The resource fund and citizen's dividend model of Alaska, the 'last frontier'"; Space Policy; Vol. 43; pp. 1-6; https://doi.org/10.1016/j.spacepol.2018.02.002; brackets original] ejs squad

1. The 'final frontier', utopian ideals and pragmatic governance: is it possible to balance commercial space exploitation, profit motives, and benefits to all of humanity?

In 1903, Konstantin Tsiolkovsky suggested that exploiting asteroid resources [1] would be key to conquering what Gene Roddenberry and his fellow producers later called the 'final frontier' [2]. While the idea of asteroid mining thus predates the space age, the prospect of a space economy fuelled in part by the exploitation of asteroids, the moon and other celestial bodies is increasingly technologically and financially feasible.

In situ **resource exploitation** is often cited as a **crucial part** of **ambitious plans** underway by the **steadily increasing number** of spacefaring **nations** and **commercial**, entrepreneurial ventures in space-plans that include **orbital outposts** and hotels, **s**pace **b**ased **s**olar **p**ower stations [3] and manned and/or robotic **missions** to the Moon and Mars in the coming decades. **Resources** from the Moon, Mars and asteroids have been proposed for use in human space exploration to produce **propellants**, **water** for life support, **structural materials**, radiation shielding and heat shields [1,4]. While competing and evolving visions for space exploration and **political**, **budgetary** and **economic realities** make the **future** of such plans **uncertain**, there are many **indications** that resource **exploitation** of **n**ear **E**arth **o**bjects (NEOs), the moon or other celestial bodies is **rapidly becoming feasible** [5].

Additionally, the **mining** of celestial bodies, including NEOs, has frequently been **presented**, both in specialist literature and in popular media as a way to solve **terrestrial shortages** of **precious metals**, semiconducting materials and **rare elements** such as **Helium-3**. Because of its proximity and composition, the moon is an attractive **starting point** for resource prospecting [6]. On the other hand, NEOs have received particular **attention** because they may be **richer** in some desired raw materials, especially metals, than the surface of the moon, while also having a much weaker gravity well [7–10]. Public scientists and science communicators such as Neil deGrasse Tyson have promoted **asteroid mining** both as a way to solve **conflicts** over **terrestrial resources** while enriching **humanity** as well as providing the technologies necessary to **detect** and **deflect** asteroids that threaten Earth [11]. The popular founding manifesto for asteroid mining, John S. Lewis' Mining the Sky (1997) estimated that **mining asteroids** for valuable metals could provide **trillions** of **dollars** of **precious metals** [12], though such claims, oft repeated, should be regarded sceptically in absence of detailed and sophisticated economic modelling.

Some studies have **optimistically** suggested that profit making '**space mining**' ventures could be undertaken with little or no **government funding** [8]. This does not, however, reflect that which has already been invested in **research**, **surveys** and **mapping** of celestial bodies and the development of space technology by governments (including public/private partnerships), or the necessary technological developments likely to emerge from **future missions** by NASA and other Space Agencies. **NASA's** use of **S**pace **A**ct **A**greements to engage in **p**ublic-**p**rivate **p**artnership**s** such as that with SpaceX and Orbital ATK is part of a **broad reshaping** of the

aerospace industry that will see increased privatization and commercial activities in space and new forms of **P**ublic-**P**rivate **P**artnerships (PPPs) which may also play a **role** in **space resource exploitation** [13]. As **greater numbers** of **actors**, with complex **relationships** to **stakeholders**, including national governments, become **active** in outer **space**, the need to insure **peaceful interactions**, one of the primary goals of the OST, will be increasingly important.

That solves terrestrial shortages by unlocking a whole universe of unlimited AND highly concentrated resources.

Knapp ’23 [Alex Knapp; October 18th; Senior Editor covering healthcare, science, and cutting edge technology for Forbes, J.D. from the University of Kansas School of Law, B.S. in Biochemistry from the Worcester Polytechnic Institute; “This Asteroid Mining Startup Is Ready To Launch The First-Ever Commercial Deep Space Mission”; Forbes; https://www.forbes.com/sites/alexknapp/2023/10/18/this-asteroid-mining-startup-is-ready-to-launch-the-first-ever-commercial-deep-space-mission/?sh=48e6e61f674a] ejs squad

Early next year, a **SpaceX rocket** will be launching a **drill** to the surface of the **Moon** as part of its Artemis program. And hitching a ride on that rocket will be a smaller spacecraft, with a much more distant destination: an asteroid that will take about nine months to reach. That ship, called the Brokkr-2, is being built by California-based **Astroforge** as part of its journey to **commercialize** mining in **space**.

Last month, the company **successfully test fired** the rockets that will enable the spacecraft to make it to the **distant object**, a **crucial last step** before the spacecraft is integrated with the rocket it will launch on next year. If successful, it would mark the first time a private company sent a mission into space beyond Earth and Moon.

That **test** was the **last major milestone** the company needed to hit before sending its **ship off-world**, Astroforge cofounder and CEO Matt Gialich told Forbes. “The fact that that went smoothly and we didn't show you a picture of a fireball means that we got through that **gate**. We're in a really **good position** to make an **attempt** at the world's first commercial deep **space mission**.”

Mining asteroids sounds like **sci**ence **fi**ction but has a very practical force behind it: as the **world** transitions away from **fossil fuels** and begins to rely even more heavily on **electricity**, it’s going to need **more metals**. But **Earth’s resources** are **limited** and many of the **best places** to mine for important metals are **already** being **tapped**. On Monday, an **analysis** published in the Proceedings of the National Academy of Science found that the **metals** needed for **batteries** and **renewable** energy **infrastructure** could start to go up in **price**, “potentially delaying the clean energy transition.“ The analysis goes on to suggest that demand for metals will force mining companies to dig in places where such metals aren’t as readily available, which comes with significant economic and environmental costs.

Many of the **asteroids** in our solar system, however, are **chock full** of the **metals** that are needed for the **industries** of the future, such as **cobalt**, **nickel** and **platinum-group metals**. Plus, those metals can be found at **higher concentrations** than on Earth, meaning **smaller amounts** of **material** can be mined to **produce** more metals. The analysis suggests that over time, it would be **possible** to **transition** away from **mining** on **Earth** for the most part, instead relying on **space resources** to supply the planet’s needs. That’s exactly the market that Astroforge hopes to tap.

But it isn’t the first company to try its hand at space mining. In the early 2010s, two major efforts — Deep Space Industries and Planetary Resources — launched to a lot of fanfare and collectively attracted over $60 million in venture capital from investment firms like Bryan Johnson’s OS Fund. But both companies eventually closed their doors before the decade was out. Gialich and Acain are keenly aware of this history and say they’ve had lots of conversations with former employees of those two companies to learn from their experiences. But one **major difference** between then and **now**, they say, is the fact that SpaceX and other companies have **radically lowered** the **costs** involved in doing business in space. One example cofounder Jose Acain cites is that a decade ago, a deep space mission would have required reserving a rocket at a cost of hundreds of millions. But today smaller spacecraft routinely share space with larger spacecraft on one rocket, which dramatically lowers the costs involved. The company estimates the total cost of its Brokkr-2 mission will be less than $10 million.

With just $13 million in seed funding, Astroforge is certainly putting the cost issue to the test. But **another advantage** of the current market is the fact that, unlike 10 years ago, there’s now a **thriving ecosystem** of **space companies offering** off-the-shelf **components**, meaning the **company** doesn’t have to design its **systems** from the **ground up**. Astroforge already launched a spacecraft earlier this year, which is currently in orbit testing the company’s mineral refining technology.

“It’s certainly not out of the question” that lower launch costs could make a big difference for Astroforge’s chances of success, space industry analyst Chris Quilty told Forbes in an email. Although he hasn’t studied the company’s specific economic model, he said the fact that launch **costs** have been “**reduced** by an **order of magnitude**” opens up a “**whole universe**” of **opportunities** for business in space.

Signaling space development assuages global fears over scarcity which drive wars.

Autino et al ’21 [Adriano V. Autino; June 26th; Founder and former President of Space Renaissance International; Amalie Sinclair; Director of the Leeward Space Foundation; Kevin Myrick; Enterprise Collaboration Engineer at CDW; Corrinne Graham; strategic advisor at CRYPSA; Manuel Perez; President of Space Renaissance USA; Susan Jewell; CEO of the Space Medicine Clinical Scientist at DoD; Jim Crisafulli; Executive Director at ACES Worldwide; Joe Pelton; Former Dean of the International Space University and Former Director of Strategic Policy at INTELSAT; Jerry Stone; Professor at the Space Renaissance International; “Status of Civilization and perspective of expansion into outer space”; Space

Renaissance International; 3rd World Congress;
https://2021.spacerenaissance.space/wp-content/uploads/2021/07/PAPER-SRIC3-SCT-4.1.01-007.pdf] //ejs squad

The resources of our planet are clearly **showing** their **scarcity**, in addressing the needs of almost 8 billion citizen. Statistics say we are consuming each year **1,5 times** the available resources on our planet, yet environmentalists repeat that “We don’t have a planet B”.

The **energy** sources of our planet are **not sufficient** for the development of 8 billion citizens. Replacing fossil energy sources with renewable sources, though it could at least downsize the issue of pollution, will not solve the future energy needs problem (as better argued in further chapter of this document).

The planetary globalization of informational resources encouraged many people living in poor and underdeveloped conditions to seek to migrate towards more advanced countries, in trying to improve desperate living conditions, creating large illegal migration movements, with attendant risk of death during the passage. Such huge migration processes will also be seen as generating social conflicts in destination countries, whose cultural systems are often not durable enough to integrate the flow of newcomers.

Employment is in deep crisis over many decades, due to several concurrent threads:

- the relocation of manufacturing productions from traditional industrialized countries to recently industrialized countries

- the obsolescence of the taylorist mode of production

- the advent of automation and artificial intelligence

- the predominance of pure financial economy over the industrial economy

- the crisis of the concept of industry itself, due to the massive ecological and environmentalist concerns

What it was called, already in 1996 by Viviane Forrester “the redundancy of the workers” 2 poses the urgent and still overdue need for new social organization models, while the inertia of the older rationales still prevents the needed evolution.

All of the above crises are ferociously attacking equitable human civilization, questioning mainstream social models, and undermining the achievements that an expansive industrial society had assured to the citizen of the advanced countries, and which had provided the peoples of emerging countries with an objective to aim for.

Each of these crisis points acts as a **feedback** on the **other** crisis points, feeding **social conflicts** and the possibility of **resource wars**, for the **control** of the **residual** few **resources**.

1.2 The risk of extensive cultural damage in the philosophical cage of the closed world

The **awareness** that the planet’s resources are **finite**, and that they will not be **sufficient forever** in supporting any number of humans, generates a generalized **fear** of the future, and the growing consciousness that our children and nephews will live in conditions worse than ours.

Such an impetus causes a horrible sensation that people are useless and redundant, we are given a **zero-sum game** where the only possibility to survive is to “win” some kind of lottery, grabbing some kind of prize. And, since dreaming of prizes doesn’t fill suffice, a **fertile** ground for unscrupulous mafias and **neomedieval social models** is gaining momentum.

The high risk of an economical endemic crisis and involution, with dramatic falling employment, will feed the social fear, this is the apparent social dividend of the multicrises. Societies will feel powerless to help themselves, while their aspirations as citizens, and subjects of any government, will shipwreck in the general unavailability of decent jobs.

The ground will be laid for **isolationist**, **repressive** and **authoritarian regimes** to ascend. **nations** and alliances will be **fragment**ed, the road to international **coop**eration will become just a **dream** of some elders, and insular tribal societies will take over.

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1.3 The risk of uncontrolled pollution 1.3.1 Planetary pollution and extreme climate change Perhaps we don’t yet understand exactly how much and in which ways our growth in the closed planet system impacts the planet’s climate. Certainly our capacity for pollution – and our inability to fix it – is moving towards an increasing risk of unrecoverable environmental disasters. The question is not whether our industrial activities are increasing the global warming process or not. We are already seeing the calamitous effects of extreme climate events, the melting of polar ices, the melting of the permafrost and the consequent liberation of huge quantities of methane. And it should be understood that methane is a greenhouse gas, very much more dangerous than carbon dioxide. Uncontrolled pollution poses a high risk. Micro plastic and other wastes already permeate the sea. Poisoning the ocean is the means to poison our planetary life supporting system, which gives us oxygen and a great part of the food we daily consume. All of our terrestrial countermeasures should be assessed for their cost, real effectiveness and benefits – since, as Robert Heinlein wrote, “There Ain’t No Such a Thing As a Free Launch” (TANSTAAFL)3 – and they should be applied in the proper measure. However, the most effective countermeasure, to mitigate the pollution risk and, in general terms, the human environmental footprint on Planet Earth, is to progressively move our industrial burden outside the planet, and achieve a far larger environment, an extension where our human metabolism will develop greater resources and with much less damage and impact. 1.3.2 Space debris Since the beginning of the space age more than seventy years ago humanity has launched many thousands of satellites into orbit, and most of these are now inactive, dangerous wreckages, which pose an increasing risk of collision with other satellites and the operations of manned spacecrafts. When wreckages eventually collide, an unpredictable mass of smaller debris are produced, which greatly increase the general risk: any small fragment, traveling at orbital speed, can open holes in the hull of manned spacecrafts, causing quick depressurization. Hereafter is the NASA’s view of such a problem: “LEO is an orbital space junk yard. There are millions of pieces of space junk flying in LEO. Most “space junk” is moving very fast and can reach speeds of 18,000 miles per hour, almost seven times faster than a bullet. Due to the rate of speed and volume of debris in LEO, current and future space-based services, explorations, and operations pose a safety risk to people and property in space and on Earth. There are no international space laws to clean up debris in our LEO. LEO is now viewed as the World’s largest garbage dump, and it’s expensive to remove space debris from LEO because the problem of space junk is huge – there are close to 6,000 tons of materials in low Earth orbit.”4 According to ESA, the increasing arena of objects in space orbit dramatically increases the likelihood of collisions. The following picture represents the evolution of space debris since 1957 to end of 2020. Red (PL) = Payload; Orange (RB) = Rocket Body; Dark Green (RM) = Rocket mission related object. Space debris, and in general terms the orbital pollution, represents a very high risk for the navigation through the interface between Earth and Cosmos. Such a risk could represent a serious hindrance to civilian space development. 1.4 The risk of progressive decrease of freedom, democracy and ethics There is a great variety and diversity of human types. In referring to Steven Wolfe’s human types classification5 and to Howard Gardner’s types of intelligences outlined6 , we are provided with an immense variety of different human psychological and attitudinal characters. Encompassing the prospect of equitable cultural diversity, we obtain an extremely rich and profound enumeration of human types, in our world. Each one of these organisms having their unique and proper inclinations, psychological characteristics, goals, wishes, and paths to reach their own self-realization and highest objectives (as illustrated by Abraham Maslow’s scale). To further qualify Steven Wolfe’s classification of the seven human basic types: the Wanderer, the Settler, the Inventor, the Builder, the Visionary, the Protector, the Evolver. Howard Gardner classification of the eight types of human intelligence: Linguistic, Logical/Mathematical, Spatial, Bodily-Kinesthetic, Musical, Interpersonal, Intrapersonal, and Naturalist. Imagine the combinations inherent among the above two orders of human types, add in the cultural geo-located and ethnic variety, and you will have a general idea of the huge diversity of human types, and then consider how much any fixated or coercive regime or ideology was and will always be refuted, in thinking to impose a unique model, defining social behaviors, limits and social organization. For example: a wanderer might never accept remaining closed in their own domain, yet they could be comfortable using the tools which obtain a remote worldview across the planet and beyond. A builder may not understand the needs of wanderers, and protectors even less: they may see the expansive activities of exploration as worthless and extremely dangerous. Mathematical intelligences may consider musical intelligent people as bizarre, and so on. If we think about the conundrum, it is perhaps true that each different ideological biases will have their origin in one of the different human types: when one of these ideologies reaches power, it will tend to glorify its own human type, and oppress the other types. Recollecting these classifications is useful to always have in mind how it is hard and complex cultivating freedom for all of the human types. The current pandemics, and before that point, the numerous strategies oriented to containment and degrowth, are clearly indicating the future we have before ourselves, should humanity choose to remain confined within the boundaries of planet Earth. In order to combat the contagion, and before vaccines are fully available, our freedom of movement has been greatly reduced. With the loss of freedom of movement, the freedom to have social contacts, to meet people, to work with other people, or even to love and ultimately have children will become severely impacted. Such effects will be “assured”, even without imposing restrictive laws similar to those imposed by Chinese government some decades ago in pursuit of population control. Needless to say, such a momentum is going to destroy the essential human nature itself: humans are social animals, and our civilization cannot survive without traveling, meeting people, working together, falling in love, making children, the expectation of working together for the future. In the worst case, we might assume that a society of individuals closed and isolated in their own cubicles, constrained to onanistic virtual relationships, will be extremely weak, very much vulnerable to the many risks which are posed by the closed world environment. A society of individuals forced to immobility and mortified in their vital fertility, closed in their homes, cheated of their future and basic rights, will quickly decay. Human civilization will implode and die. 1.5 The cosmic threats 1.5.1 Life-ending asteroid and comet impacts Existential life threatening and extinction events, such as asteroid and comet impacts have been discussed many times, from the very beginning of the space advocacy movement. The argument that humans shouldn’t keep all of their eggs in one rather vulnerable basket seems to be obvious common sense. Near Earth asteroids cross Earth’s orbit several times each year. Since the low perception of the risk is a significant part of our vulnerability, our mission is mainly focused on outreach and raising awareness of the risks to civilization and possible countermeasures. Therefore it is worth analyzing the way that this topic is managed by the media, and explained to the public. The threat from near Earth objects is often reported in the media in a rather over-dramatic fashion, and as a problem for which we have no solution. The media report that an object has passed close to the Earth, or will do so in the future, but they rarely mention the real and pervasive ongoing threat that asteroids and comets represent to the survival of our species on this planet. There are many millions of asteroids in the Solar System, mainly to be found in the Main Asteroid Belt between Mars and Jupiter. Most have unstable orbits and can potentially drift into the inner Solar System, becoming hazards to the terrestrial planet. We have made significant progress in discovering and tracking the orbits of the majority of large Earth crossing asteroids that have the potential to destroy the environment on a planetary scale, but our monitoring infrastructure is still unable to detect small objects – those that pose a threat on a local or regional basis. While progress is being made we cannot reliably detect smaller potentially dangerous objects with enough time to develop and deploy suitable countermeasures. Any global asteroid risk assessment program would recommend the deployment of countermeasures as soon as possible, but this process would require sufficient detection and monitoring resources to be in place. Alternatively is also worth considering that asteroids and comets represent vast reservoirs of the resources that we will can extract in space, including water, minerals, building materials and so on. Asteroids will become essential raw materials for space exploration and settlement. Even from these brief notes it should be clear that the magnitude of the asteroid and comet impact hazard is unacceptably high, as is our vulnerability to the effects – it is the most serious danger that our species faces. In fact it is the only naturally occurring environmental hazard that puts the future of our entire species at risk. Unlike other natural hazards this one is predictable and avoidable. 1.5.2 Cosmic radiations Hard radiation, coming from the sun and from remote supernovae, is very dangerous in space, and represents a serious threat to human life and health, and to any forms of life that we will bring with us during our expansion outside Earth. On Earth surface, these radiations are less dangerous, because the atmosphere acts as a shield as does the magnetic terrestrial field. The amount of radiation which reaches Earth is tolerated, by humans. In developing on this planet, our biology has adapted to the existing conditions. It could be that we would eventually adapt to different environmental conditions, but this would involve many generations, failures, serious illnesses and genetic modifications. Earth owns a magnetic field, due to its liquid metallic nucleus, but Mars does not, since its nucleus is colder, and almost solid. Cosmic radiations could become dangerous on Earth surface too, due to: - particularly high sun flares - unexpected changes of the protection conditions – Earth’s magnetic field - inversion of the magnetic poles, a process that occurred in the past, causing immense environmental catastrophes, and which could be already in progress. The risk represented by cosmic radiations should be considered potentially high on Earth, and extremely dangerous in space, with progressive increase of the danger, according to different protection conditions: - Earth surface - Low Earth orbit - Geo-stationary Earth orbit - Within Van Allen Belt, mid-way between Earth and the Moon - Moon surface - Cislunar space - Outside magnetic Earth, 1.5 million km from Earth - Mars orbit - Mars surface - Beyond Mars, Asteroid Belt, and beyond The mitigation of the cosmic radiations risk requires a program of immediate action, giving high priority to scientific research for protection technologies and suitable strategies, both on Earth and in space. It is evident that the risk represented by cosmic radiations is a real danger even on Earth surface, our civilization has a high interest to fully master the matter and implement mitigation strategies, both in space and on Earth. The aim is to study and develop both active and passive shields that work with high efficiency. Active shields are those that create a deflection of the radiation through the production of a strong magnetic field, and thus protect a whole living module. Passive shields, instead, are characterized by absorbing the radiation, and generally consist of special garments/covers for astronauts and/or equipment.7 1.6 The great success of our species and its growth in a closed environment Despite the many moralistic explanations of the multi-crises, aiming to charge different social subjects as responsible entities, the crisis is ultimately due to humans growth, as a species, within the closed environment of planet Earth. After the historic renaissance of 1500, the development of science, and later several industrial revolutions, generated the great success of a biological species that termed itself as human, on the third planet of this solar system. The catalytic industrial revolution allowed social growth, the development of mass education and health systems. We saw human dignity assured by having a monthly income, without being forced to struggle in deathly competition or to adapt to immoral compromises. Mass education systems has enhanced the growth of new generations of entrepreneurs enabled not only by the dream of prosperity, but by guiding humanist ideals as well. Recent concepts such as the making of mankind a spacefaring species may be in fact be our sole possibility to survive and keep on growing and developing, as a unified global civilization. The trend of an exponential industrial growth continued unabated until the demographic development of humans reached a dimension that is now questioning their sustainability within the limits of this planet. Once such a breakpoint was reached, the only possible scenario was a global crisis. That’s what we have now. But certainly, humans are a cultural species, not just an animal one. Therefore we are also attempting to provide workable cultural responses to the mult-crises, not only to contemplate the death of millions, though this is what we are doing, with COVID19. So far, the response that has emerged in society at large, is a passive one: degrowth. Such a reaction is the most obvious, given the usual physical paradigm of action and contrary reaction: the crisis was caused by our growth, then we shall degrow. Degrowth, for a complex society, that reached the limits of its ecological niche, is the simplest and least demanding option, at least in terms of strategy, design and projects development. In the current situation, zero strategy and zero projects is enough, to fully pursue a de-growthist goal: while nature will do the whole dirty job. When our number falls vertically, markets will narrow, science and technology will retire, so will ingenuity and enthusiasm for new discoveries and technological advances. Though simple and less demanding – in terms of engagement and work –, degrowth doesn’t seem to be the best solution, in a humanist scheme of values. To go over the planet’s limits, and accessing a greater ecological niche, though more demanding, seems to be a far better solution. 1.7 Anti-humanist ideological misconceptions 1.7.1 Learning sustainability on our planet before going to space Not only in society at large, but also inside the space community, we often heard the following concept: “Humans have not learned how to live sustainably on Earth, and we need to learn this lesson before seeking to create settlements in space”. Critics will also say that we, the optimistic space advocates, and future space citizens, are proposing untimely and unrealistic plans. Can we work together with the bearers of such a different vision? Yes, I would say that we should, certainly we will never get tired to discuss with them, to demonstrate that they are utterly wrong. Clearly the statement “Humans have not learned out to live sustainably on Earth and we need to learn this lesson before seeking to create settlements in space” positions civilian space development in a hypothetical future, giving the highest and urgent priority to a viewed sustainability on Earth. We should always claim that, at least, the two strategies have the exact same priority. The argument is a strongly divisive item, we should finally acknowledge it as a concept that it tends to separate humanist from non-humanist space advocates. The first answer was given by Krafft Ehricke in his “The Extraterrestrial Imperative” (Bulletin of the Atomic Scientists, 1971) “One of the most irresponsible statements, parroted ad nauseam since rational concern for our environment has exploded into an emotional syndrome, defines man as the only animal smearing his nest. Each animal fills its nest with the products of its metabolism if it is unable to get out of it. Space technology gives us for the first time the freedom to leave our nest, in order not to dirty it.”

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To say that we humans need to learn to live sustainably in the closed system of our mother planet before to start moving to outer space is like to say that a bird should "learn" to clean its nest before learning to fly, and taking its own wastes elsewhere.

The reality is the exact reverse: none of the 17 Sustainable Development Goals of the UN 2030 agenda will be achievable under these terms, Humankind in fact does **not have any possibility** to achieve **sustainability on Earth** if we don't start **immediately expand**ing **into space**. To start expanding into space is a **necessary condition** for **any sustainable development**.

What else will we “learn”, remaining confined within the limits of our mother planet? Maybe we will have to learn again how to light a fire in a cavern, in a time shorter than we expect…

We must begin **moving** the burden of our industrial development **outside our planet**. This is the key, as Jeff Bezos wisely understood, making his cislunar development plans accordingly, with the goal of perpetuating human development and making of Earth a beautiful garden. Is Bezos's plan unrealistic and untimely? Are Elon Musk's plans to travel to the Moon and Mars unrealistic and untimely?

Such plans can be considered unrealistic and untimely only in the frame of a redundant 'old space' vision, that is perfectly in tune with the use of space only for Earth. The priority goal of the planetsavers is to mitigate climate change and pollution in the closed Earth, using outer space for such goals. This is exactly the UN strategy that we saw in Wien in 2018, at UNISPACE+50. Even so we have to admit that UN, at least, in their 17 SDG's include many social issues, totally neglected in the narration of the planet-savers.

1.7.2 Degrowth will only lead to more degrowth and, finally, to premature death of civilization

If humanity has to remain closed within the limit of Earth atmosphere, the only sustainable strategy is the one indicated by Serge Latouche8 : degrowth.

The demographic issue is all but simple, and it was so far managed with some superficiality by the supporters of a green transition within the closed world. Demographic stabilization is given and discounted as a desirable goal, without analyzing (i) its real feasibility and (ii) the outcomes, that will be worse than the problem it tries to resolve. **Stabilization** is **not** a **feasible** possibility, since there are only two options: growth or degrowth, followed by extinction. Working towards **stabilization** in the closed world will lead to **implosion of civilization**.

Demographic stabilization is not a good goal, for humankind9 . Cultural growth cannot move ahead alone, without demographic growth, new **growing** markets are **essential** for social opportunity and improvement. The nursery of ideas can grow up only in a growing population10. Adriano V. Autino wrote that "Actually we could certainly state that: the circulating money is not wealth itself. Money is just one of the measuring instruments of wealth. Real wealth is uniquely made up of natural resources and human culture, including scientific and technological knowledge and the working potential."11 Therefore humanity was never rich as it is now, with 8 billion human beings. The only missing part on Earth are now our depleting natural resources, even so there's great abundance in the solar system! That's why we need to expand. If we are not humanist, we don't need space.

It is a matter of growth versus multiplication12. Both the forces are concurring: qualitative growth of science and technology and population multiplication, that will keep alive the market opportunities, working against depression, devolution, and degrowth. We might say that the multi- crises and the consequent increasing pressure is the way that nature pushes evolution to make giant leaps ahead.

Any "**new**" social **model**, oriented to **decrease** the consumption of energy, will be **worse than the problem**. In times of pandemics, such concepts were evinced by several indicators.

Working and communicating mainly from home is an introspective yet consuming lifestyle. Moreover, the continuous use of webcams in our virtual meetings consumes a lot of energy. Therefore we will be constrained to renounce even to this slim means of keeping us alive, as social beings. On other fronts, electric cars need big batteries, difficult to dispose and consuming rare earths. Leaving alone the fact that their efficiency is far from the combustion engine, and that is another limitation to our freedom of movement.

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1.8 The energy dilemma But let us have a deeper look at the 'energy dilemma', as it is called by Arthur Woods and Marco C. Bernasconi in their elaboration of the "Space Energy Option"13 "Humanity is facing an imminent Energy Dilemma in that the limited proven reserves of fossil fuels could reach exhaustion levels at mid-century and none of the alternative terrestrial energy options – nuclear – wind – ground solar (PV) – can be sufficiently scaled to achieve the goal of divesting from fossil fuels by the year 2050 as is being called for by the United Nations, the European Union, many governments and numerous organizations to address the Climate Emergency." From their article we see that, in 2019, total World Primary Energy consumption was 162,194 TWh. Of that amount: • Fossil Fuels: 136,761 TWh (84.3%) • Hydroelectricity, 10,461 TWh (6.5%) • Nuclear power, 6,922 TWh (4.3%) • Renewables and other energy sources 8,050 TWh (5%) With current world population of 7.7 billion expected to increase by 25% to 9.7 billion between now and 2050, at current energy consumption levels a very minimum of 23 TW (+25%) of power will be necessary to sustain civilization. However, based on the current average energy consumption increase of 1.5% per year, more likely humanity will require more than 30 TW of continuous power by mid-century. Using nuclear power as an example, to replace current fossil fuel usage of 136,761 TWh with nuclear power (assuming a 90% availability) would require the deployment of up to 17,347 new 1 GW nuclear reactors. This means, for the next 30 years, 578 nuclear power plants would have to go online each year. Fusion nuclear technology is still in the research stage and far from being a useful and scalable solution by the year 2050. Wind and solar photovoltaic (PV) generators have significantly lower availability: the inherent intermittency and storage aspects, make it necessary to deploy multiples of their equivalent rated (peak) power levels to equal the output, e.g., of nuclear power systems. For wind, the generating capacity needs to be some 3.35 times higher and for PV, 6-7 times higher. Thus, to replace 2019 use of fossil fuels with wind and solar, no less than 65 TW (depending on the assumed wind/ PV mix) of power generating capacity from these two renewable sources would need to be installed. This translates into 2 TW of electrical generating capacity from wind and solar to be installed every year from now until the year 2050 – i.e., 5 GW per day – and this, as with nuclear power, would have to start immediately. Additionally, both photovoltaic and wind technologies pose many environmental issues that are similar to the problem of asbestos disposal. Wind turbines deliver a huge quantity of a blade material composed by glass fibers and resins that cannot be recycled and are difficult to dispose of14. Photovoltaic technology poses huge environmental problems related to both waste disposal15 and their production which uses nitrogen trifluoride, a common byproduct of electronics manufacture, and is a greenhouse gas 17,000 times more potent than carbon dioxide. 16 Both photovoltaic and wind technologies have a low efficiency, high intermittency and use extensive land. Unlocking Earth's vast energy reserves enabled our species to embark on an industrial revolution leading to a technological civilization that is on the threshold of expanding permanently into the near cosmos. Earth's energy reserves are finite and inadequate for this next stage of a cultural and societal evolution which would enable humanity to become a spacefaring species. Indeed, all terrestrial energy alternatives have serious economic issues that make them totally unsustainable as well, as was analyzed by Woods & Bernasconi in their article: a clear counter argument to the claimed sustainability of the terrestrial green transition. Any energy strategy limited within the atmosphere of planet Earth: • will not solve the energy dilemma and the climate emergency, • will accelerate the many environmental problems, • will destroy the industrial development model without replacing it with a more efficient alternative, • will not satisfy any of the 17 UN 2030 Sustainable Development Goals 1.9 The risk of a Civilization implosion The sum of all the mentioned risks, and related crises, could lead to a civilization implosion, as Stephen Hawking also had predicted. And the breaking point of such an event is closer than it was expected. The implosion of civilization was discussed by astrophysicist Stephen Hawking17 and other thinkers of different orientations, but Hawkins was strangely consonant with James Lovelock18 . These two authors were in agreement, when looking at the possibility that the world system will remain physically and philosophically closed for much longer than the already three-quarters of a century since humans' first rocket reached space.

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According to many scholars of ancient civilizations, civilization **collapses** have occurred **many times** in history, and in the large part of cases, the collapse was not due to a single factor, but to several concurrent factors19 . Exactly as in our current situation, as we discussed in 1.1 - The risks created by the tremendous conjunction of the multi-crises.

Yet the **main problem**, even **before** finite planetary resources are **exhaust**ed, is the very strong **psychological** depression that this critical situation determines: humans extensively feel, on a biological level even more than rationally, the limited nature of Earth environment. Many people are now embarking on involutional and retrograde directions -- such as through the adaptation of radical environmentalism and de-growthism or even the uptake of animalism and animality as ethical models. When people will realize that a future under these conditions only construes as misery and deprivation, the hour of anger will come; this way, and the process of the **implosion of civilization** will be further **sped up**. This will happen, as matter of course, if the system is kept stubbornly **closed** by the joint action of several **concurrent** stolidly **retrograde forces**.

Modern Western society was once compared to a stable bicycle whose wheels are kept spinning by economic growth. Should that forward-propelling motion stop, the pillars supporting our society – democracy, individual liberties, social tolerance and more – would start staggering. When the wheels remain steady for too long, a total civilization collapse could be looming.

Safa Motesharrei, a mathematician conducting studies on societal dynamics, wrote: "If we make rational choices to reduce factors such as inequality, explosive population growth, the rate at which we deplete natural resources and the rate of pollution – all perfectly doable things – then we can avoid collapse and stabilize onto a sustainable trajectory, but we cannot wait forever to make those decisions."20 As many other thinkers, Motesharrei seems to be sure that reducing factors of inequality and human environmental footprint is perfectly doable. Such concept – the claimed simplicity of the solutions -- is part of the problem, not of the solutions.

The society of 8 billion humans is not simple at all, rather it is quite **complex**, and its wheels are moving **only** thanks to an **immense** neural **network** of commercial **connections**, all of them based on **cascade debts**, called investments. People keep **investing** until when there's a prevailing hope that the debts will be remitted. In other words, investments will generate a **return**.

The multi-crises were already braking the economy before pandemics, under the impact of the leading crises: environmental issues and climate change.

But it was not enough: another powerful civilization-collapser came up: COVID19. The global economy is now almost frozen, with the sole exception of China, that has attempted to restart moderate growth.

The situation generates and perpetuates a planetary psychological depression21, the hope to have a decent return on investment is falling more and more.

Many bearers of simplistic solutions are showing up everywhere, with recipes based on the mantra of “Simple: it is enough that everybody…” In that is-enough-that-everybody stands the totalitarian threat to freedom of our complex society.

There’s no such thing as something that everybody can do without being forced.

The multi-crises can be **reverted**, and **civilization avoid the collapse**, only if people will see true reasons to expect that they can go back to their social life, meeting, working together, loving, having children. These humane essentials come before everything else.

The above circumstance means that we are in dramatic need of a vaccine against the pandemic. But growth can restart only if a **valid development vector** raises the **scenery**. Only the combined effect of immunity from Covid19 and the inspiring **locus** of an industrial **space development** can **avoid the forthcoming civilization implosion**.

Resource wars cause extinction.

Klare ’21 [Dr. Michael T. Klare; May 31st; Professor Emeritus of Peace and World Security Studies at Five College Consortium, Director of the Five College Program in Peace and World Security Studies, Ph.D. from the Graduate School of the Union Institute, B.A. and M.A. from Columbia University; “Will there be resource wars in our renewable energy future?”; Salon; https://www.salon.com/2021/05/31/will-there-be-resource-wars-in-our-renewable-energy-future_partner/] ejs squad

With other nations moving in a similar direction, it's tempting to conclude that the days when competition over finite supplies of energy was a recurring source of conflict will soon draw to a close. Unfortunately, **think again**: while the sun and wind are indeed infinitely renewable, the **materials** needed to convert those resources into electricity — minerals like cobalt, copper, lithium, nickel, and the rare-earth elements, or REEs — are **anything but**. Some of them, in fact, are far **scarcer** than petroleum, suggesting that **global strife over** vital **resources may not**, in fact, **disappear** in the Age of Renewables.

To appreciate this unexpected paradox, it's necessary to explore how wind and solar power are converted into usable forms of electricity and propulsion. Solar power is largely collected by photovoltaic cells, often deployed in vast arrays, while the wind is harvested by giant turbines, typically deployed in extensive wind farms. To use electricity in transportation, cars and trucks must be equipped with advanced batteries capable of holding a charge over long distances. Each one of these devices usessubstantial amounts of copper for electrical transmission, as well as a variety of other non-renewable minerals. Those wind turbines, for instance, require manganese, molybdenum, nickel, zinc, and rare-earth elements for their electrical generators, while electric vehicles (EVs) need cobalt, graphite, lithium, manganese, and rare earths for their engines and batteries.

At present, with wind and solar power accounting for only about 7% of global electricity generation and electric vehicles making up less than 1% of the cars on the road, the production of those minerals is roughly adequate to meet global demand. If, however, the U.S. and other countries really do move toward a green-energy future of the kind envisioned by President Biden, the demand for them will skyrocket and global output will fall far short of anticipated needs.

According to a **recent study** by the **I**nternational **E**nergy **A**gency (IEA), "The Role of Critical Minerals in Clean Energy Transitions," the **demand** for lithium in 2040 could be **50 times** greater than today and for cobalt and graphite 30 times greater if the world moves swiftly to replace oil-driven vehicles with EVs. Such rising demand will, of course, incentivize industry to develop new supplies of such minerals, but **potential sources** of them are **limited** and the process of bringing them **online** will be **costly** and **complicated**. In other words, the world could face significant shortages of critical materials. ("As clean energy transitions accelerate globally," the IEA report noted ominously, "and solar panels, wind turbines, and electric cars are deployed on a growing scale, these rapidly growing markets for key minerals could be subject to price volatility, geopolitical influence, and even disruptions to supply.")

And here's a further complication: for a number of the most **critical materials**, including lithium, cobalt, and those rare-earth elements, production is **highly concentrated** in just a **few countries**, a reality that could lead to the sort of **geopolitical struggles** that accompanied the world's dependence on a few major sources of oil. According to the IEA, just one country, the Democratic Republic of the Congo (DRC), currently supplies more than 80% of the world's cobalt, and another — China — 70% of its rare-earth elements. Similarly, lithium production is largely in two countries, Argentina and Chile, which jointly account for nearly 80% of world supply, while four countries — Argentina, Chile, the DRC, and Peru — provide most of our copper. In other words, such future supplies are far more concentrated in far fewer lands than petroleum and natural gas, leading IEA analysts to worry about future struggles over the world's access to them.

From Oil to Lithium: the Geopolitical Implications of the Electric-Car Revolution

The role of petroleum in shaping global geopolitics is well understood. Ever since oil became essential to world transportation — and so to the effective functioning of the world's economy — it has been viewed for obvious reasons as a "strategic" resource. Because the largest concentrations of petroleum were located in the Middle East, an area historically far removed from the principal centers of industrial activity in Europe and North America and regularly subject to political convulsions, the major importing nations long sought to exercise some control over that region's oil production and export. This, of course, led to resource imperialism of a high order, beginning after World War I when Britain and the other European powers contended for colonial control of the oil-producing parts of the Persian Gulf region. It continued after World War II, when the United States entered that competition in a big way.

For the United States, ensuring access to Middle Eastern oil became a strategic priority after the "oil shocks" of 1973 and 1979 — the first caused by an Arab oil embargo that was a reprisal for Washington's support of Israel in that year's October War; the second by a disruption of supplies caused by the Islamic Revolution in Iran. In response to endless lines at American gas stations and the subsequent recessions, successive presidents pledged to protect oil imports by "any means necessary," including the use of armed force. And that very stance led President George H.W. Bush to wage the first Gulf War against Saddam Hussein's Iraq in 1991 and his son to invade that same country in 2003.

In 2021, the United States is no longer as dependent on Middle Eastern oil, given how extensively domestic deposits of petroleum-laden shale and other sedimentary rocks are being exploited by fracking technology. Still, the connection between oil use and geopolitical conflict has hardly disappeared. Most analysts believe that petroleum will continue to supply a major share of global energy for decades to come, and that's certain to generate political and military struggles over the remaining supplies. Already, for instance, conflict has broken out over disputed offshore supplies in the South and East China Seas, and some analysts predict a struggle for the control of untapped oil and mineral deposits in the Arctic region as well.

Here, then, is the question of the hour: Will an explosion in electric-car ownership change all this? EV market share is already growing rapidly and projected to reach 15% of worldwide sales by 2030. The major automakers are investing heavily in such vehicles, anticipating a surge in demand. There were around 370 EV models available for sale worldwide in 2020 — a 40% increase from 2019 — and major automakers have revealed plans to make an additional 450 models available by 2022. In addition, General Motors has announced its intention to completely phase out conventional gasoline and diesel vehicles by 2035, while Volvo's CEO has indicated that the company would only sell EVs by 2030.

It's reasonable to assume that this shift will only gain momentum, with **profound consequences** for the **global trade** in resources. According to the IEA, a typical electric car requires six times the mineral inputs of a conventional oil-powered vehicle. These include the copper for electrical wiring plus the cobalt, graphite, lithium, and nickel needed to ensure battery performance, longevity, and energy density (the energy output per unit of weight). In addition, rare-earth elements will be essential for the permanent magnets installed in EV motors.

Lithium, a primary component of lithium-ion batteries used in most EVs, is the lightest known metal. Although present both in clay deposits and ore composites, it's **rarely** found in easily mineable concentrations, though it can also be extracted from brine in areas like Bolivia's Salar de Uyuni, the world's largest salt flat. At present, approximately **58%** of the world's lithium comes from **Australia**, another 20% from Chile, 11% from China, 6% from Argentina, and smaller percentages from

elsewhere. A U.S. firm, Lithium Americas, is about to undertake the extraction of significant amounts of lithium from a clay deposit in northern Nevada, but is meeting resistance from local ranchers and Native Americans, who fear the contamination of their water supplies.

Cobalt is another key component of lithium-ion batteries. It's **rarely** found in unique deposits and most often acquired as a byproduct of copper and nickel mining. Today, it's almost **entirely** produced thanks to **copper** mining in the **violent**, chaotic **D**emocratic **R**epublic of the **C**ongo, mostly in what's known as the copper belt of Katanga Province, a region which once sought to break away from the rest of the country and still harbors secessionist impulses.

Rare-earth elements encompass a group of 17 metallic substances scattered across the Earth's surface but rarely found in mineable concentrations. Among them, several are essential for future green-energy solutions, including dysprosium, lanthanum, neodymium, and terbium. When used as alloys with other minerals, they help perpetuate the magnetization of electrical motors under high-temperature conditions, a key requirement for electric vehicles and wind turbines. At present, approximately **70% of REEs** come from **China**, perhaps 12% from Australia, and 8% from the U.S.

A mere glance at the location of such concentrations suggests that the green-energy transition envisioned by President Biden and other world leaders may encounter **severe geopolitical problems**, not unlike those generated in the past by reliance on oil. As a start, the most militarily powerful nation on the planet, the United States, can supply itself with only **tiny percentages** of REEs, as well as other critical minerals like nickel and zinc needed for advanced green technologies. While Australia, a close ally, will undoubtedly be an important supplier of some of them, China, already increasingly viewed as an adversary, is crucial when it comes to REEs, and the Congo, one of the most conflict-plagued nations on the planet, is the leading producer of cobalt. So don't for a second imagine that the transition to a renewable-energy future will either be easy or conflict-free.

The Crunch to Come

Faced with the prospect of inadequate or hard-to-access supplies of such critical materials, energy strategists are already calling for major efforts to develop new sources in as many locations as possible. "Today's supply and investment plans for many critical minerals fall well short of what is needed to support an accelerated deployment of solar panels, wind turbines and electric vehicles," said Fatih Birol, executive director of the International Energy Agency. "These hazards are real, but they are surmountable. The response from policymakers and companies will determine whether critical minerals remain a vital enabler for clean energy transitions or become a bottleneck in the process."

As Birol and his associates at the IEA have made all too clear, however, surmounting the obstacles to increased mineral production will be anything but easy. To begin with, launching new mining ventures can be extraordinarily expensive and entail numerous risks. Mining firms may be willing to invest billions of dollars in a country like Australia, where the legal framework is welcoming and where they can expect protection against future expropriation or war, but many promising ore sources lie in countries like the DRC, Myanmar, Peru, and Russia where such conditions hardly apply. For example, the current turmoil in Myanmar, a major producer of certain rare-earth elements, has already led to worries about their future availability and sparked a rise in prices.

Declining ore **quality** is also a concern. When it comes to mineral sites, this planet has been thoroughly scavenged for them, sometimes since the early Bronze Age, and many of the best deposits have long since been discovered and exploited. "In recent years, ore quality has continued to fall across a range of commodities," the IEA noted in its report on critical minerals and green technology. "For example, the average copper ore grade in Chile declined by 30% over the past 15 years. Extracting metal content from lower-grade ores requires more energy, exerting upward pressure on production costs, greenhouse gas emissions, and waste volumes."

In addition, extracting minerals from underground rock formations often entails the use of **acids** and other **toxic substances** and typically requires vast amounts of water, which are contaminated after use. This has become ever more of a problem since the enactment of environmental-protection legislation and the mobilization of local communities. In many parts of the world, as in Nevada when it comes to lithium, new mining and ore-processing efforts are going to encounter increasingly fierce local opposition. When, for example, the Lynas Corporation, an Australian firm, sought to evade Australia's environmental laws by shipping ores from its Mount Weld rare-earths mine to Malaysia for processing, local activists there mounted a protracted campaign to prevent it from doing so.

For Washington, perhaps no problem is more challenging, when it comes to the availability of critical materials for a green revolution, than this country's deteriorating relationship with Beijing. After all, China currently provides 70% of the world's rare-earth supplies and harbors significant deposits of other key minerals as well. No less significant, that country is responsible for the refining and processing of many key materials mined elsewhere. In fact, when it comes to mineral processing, the figures are astonishing. China may not produce significant amounts of cobalt or nickel, but it does account for approximately 65% of the world's processed cobalt and 35% of its processed nickel. And while China produces 11% of the world's lithium, it's responsible for nearly 60% of processed lithium. When it comes to rare-earth elements, however, China is dominant in a staggering way. Not only does it provide 60% of the world's raw materials, but nearly 90% of processed REEs.

To put the matter simply, there is no way the United States or other countries can undertake a massive transition from fossil fuels to a renewables-based economy without engaging economically with China. Undoubtedly, efforts will be made to reduce the degree of that reliance, but there's no realistic prospect of eliminating dependence on China for rare earths, lithium, and other key materials in the foreseeable future. If, in other words, the U.S. were to move from a modestly Cold-War-like stance toward Beijing to an even more hostile one, and if it were to engage in further Trumpian-style attempts to "decouple" its economy from that of the People's Republic, as advocated by many "China hawks" in Congress, there's no question about it: the Biden administration would have to abandon its plans for a green-energy future.

It's possible, of course, to imagine a future in which nations begin **fighting** over the world's **supplies of critical minerals, just as** they **once** fought **over oil**. At the same time, it's perfectly possible to conceive of a world in which countries like ours simply abandoned their plans for a green-energy future for lack of adequate raw materials and reverted to the oil wars of the past. On an already overheating planet, however, that would lead to a **civilizational fate worse than death**.

C2: Avian Flu aka H5N1

Over reliance on ineffective stockpiles makes H5N1 existential - Carr ‘21

Carr, Teresa (Teresa Carr is a Colorado-based investigative journalist and a senior contributor for Undark). “Could an Old Drug Protect against a New Pandemic? | Published by Journal of Health Economics and Outcomes Research.” *Jheor.org*, 1 Oct. 2024, jheor.org/post/2706-could-an-old-drug-protect-against-a-new-pandemic. Accessed 26 Feb. 2025.*ejs squad

Since reports emerged earlier this year that **dairy cows across the country had been infected with H5N1 bird flu**, the prospect that **the virus could evolve to** spark **another pandemic** has stoked serious concern. But unlike Covid-19, the flu is an old, well-known foe. And health authorities have reassured the public that the **U.S.** has **squirreled away** millions of doses of the **flu med**ication **oseltamivir**, known under the brand name Tamiflu. As health policy expert Leana S. Wen wrote in a Washington Post opinion piece, the drug “works against seasonal flu and is expected to work well against H5N1.” While **oseltamivir may help in cases of severe flu, some experts are concerned that the U.S. is banking far too much on a so-so drug while failing to prioritize research on new treatments**. Relatively few people have been infected with bird flu, so scientists must rely, in part, on **oseltamivir’s** track record against seasonal flu to make educated guesses about how well the drug would work against H5N1. But research shows that it **doesn’t work** particularly well **for** most people with **garden-variety flu and doesn’t keep people out of the hospital.** In fact, for standard-risk patients the **drug’s effectiveness has proved “kind of crappy,”** said Shira Doron, an infectious disease physician at Tufts Medical Center. And even if it is effective against H5N1, “influenza strains

are **unpredictable** in **when** they **develop resistance**," said infectious disease clinician and researcher Andrew Pavia, who advises government and professional organizations on influenza and pandemic preparedness. In other words, **what works today might not work tomorrow**. But promising alternatives are scarce, said Pavia. And largely because **antiviral flu drugs haven't been terribly profitable for drug companies**, he said, there are few treatments in the pipeline. For standard-risk patients the drug's effectiveness has proved "kind of crappy." Both Doron and Pavia emphasized that the current risk to Americans — excluding farmworkers — from bird flu is low. At least so far, the disease appears to be hard to catch and rarely spreads from person to person. Since 2022, the U.S. Centers for Disease Control and Prevention has recorded only 15 probable cases. All but one were mild and involved farmworkers who were in direct contact with infected animals. However, **with a couple genetic shifts, the U.S. variant could evolve into a more virulent and widespread virus.** "We are vulnerable," said Pavia. "And we should have a **deeper bench in reserve."** Oseltamivir has a controversial past. Governments around the world have spent billions of dollars to stockpile the drug since the early 2000s based on evidence that it reduced the risk of serious complications such as pneumonia for people with seasonal flu. But as revealed in The BMJ's open data campaign, and by reporting by The Guardian, and other outlets, scientists asserted that the drug's manufacturer, Roche, had withheld unfavorable data. **Evidence of the drug's benefit, they say, hinged on cherry-picked, mostly unpublished trials funded by Roche.** According to the BMJ, in 2013, after years of pressure from the journal and Cochrane, a not-for-profit organization that conducts systematic reviews of medical treatments and devices, Roche finally released the full set of data it had on oseltamivir. Findings from Cochrane's updated review incorporating the tranche of new data did not inspire much confidence: The drug **shortened** seasonal flu **symptoms by** about **half a day for adults and a day for children**, but **didn't reduce complications** or keep people out of the hospital. It also **increased the risk of nausea and vomiting**. "We are vulnerable. And we should have a deeper bench in reserve." Canadian researchers also concluded that oseltamivir did not reduce hospitalizations in an analysis of 15 clinical trials published in JAMA Internal Medicine last year. Today, most experts agree that the best use of the drug is for people who are seriously ill or are at higher risk for complications. While there is little data from randomized clinical trials focused exclusively on that group, said Pavia, the overall weight of the evidence supports a significant benefit for high-risk or hospitalized patients. **There's** also **no** randomized **clinical trial data on antivirals and H5N1**. "In the **absence of a randomized controlled clinical trial, I would never claim to guess what the effectiveness of that Tamiflu would be at preventing severe disease**, hospitalization, and death," said Doron, who along with Pavia is a member of a working group dedicated to avian flu at the Infectious Diseases Society of America. But, she said, evidence from some observational studies suggests the drug could be lifesaving for people hospitalized with severe bird flu. In a 2010 study, for example, researchers used a global H5N1 registry to look at outcomes for 308 patients, about half of which got oseltamivir. The dataset wasn't ideal — some information was missing, and treatment regimens varied. Still, after statistically adjusting for uncertainties, the researchers concluded that the drug cut the mortality rate by about half. But over the last 14 years, **the virus has continued to evolve**. One way to predict if oseltamivir will work against current variants is to look for specific **genomic sequences that indicate susceptibility to antiviral drugs,** said Benjamin Anderson, an assistant professor of environmental and global health at the University of Florida. It's reassuring, he said, that a recent study of viruses isolated from cows and cats infected in the U.S. outbreak found no genetic mutations that would confer antiviral resistance. However, he added in an email, **"the influenza virus can mutate and we need to constantly [monitor] those changes to make sure resistance does not develop."** In addition, to date, **avian** flu viruses have proved susceptible to oseltamivir and the same is true of the most recent strains, according to research by St. Jude Children's Research Hospital. Based on those laboratory findings, scientists have a "pretty good" sense that oseltamivir would have some effectiveness against the infections caused by the current H5N1 strains, said Anderson. Exactly how effective is an open question. If oseltamivir worked about as well against H5N1 as it does seasonal flu, it could potentially benefit high-risk, very ill patients; for others, the **drug wouldn't necessarily do much to ease symptoms or keep them out of the hospital.** So far, the U.S. has only seen mild H5N1 infections, which oseltamivir may not help, said Doron. Still, oseltamivir is a safe drug, she said, and given the uncertainties over how severe a case of H5N1 could become, use of the antiviral makes sense. Public health authorities agree. The CDC advises treating known and suspected cases with oseltamivir as soon as possible. (The drug works best against seasonal flu when started within 48 hours of symptom onset.) As a preventive measure, the agency also **recommends treating close contacts of those who get infected**. Those recommendations come out of abundance of caution, said Pavia. "You have a drug that is active in the test tube that makes a difference with other strains of influenza," he said. "So, it's been given to patients who probably would recover well without it." **If H5N1 were to evolve into a pandemic virus, public health recommendations would probably echo those for seasonal flu, prioritizing use of oseltamivir for patients at highest risk**, said Pavia. "Which, of course," he said, "brings up the question of 'Why don't we have something better?'" **Oseltamivir** is one of the best-studied antiviral flu treatments, but **not the only one.** First approved as the brand name drug Tamiflu in 1999, oseltamivir belongs to a class of medications called neuraminidase inhibitors, which keep the virus from escaping infected cells and navigating to other cells. **The drugs target only one of the two types of proteins in Type A flus such as H5N1 and the seasonal** flu, so they **can't completely neutralize** the virus, said Hui-Ling Yen, an influenza researcher in the School of Public Health at the University of Hong Kong. Two other neuraminidase inhibitors exist — an inhaled drug and an intravenous one — but neither has been proven to work against severe seasonal flu, so the CDC doesn't typically recommend them for H5N1. "Why don't we have something better?" The **newest flu drug on the market, baloxavir marboxil** (also known as Xofluza), was **approved** in the U.S. in **2018** and works by **blocking** an **enzyme** that the **virus uses** to make **copies** of itself. In terms of how quickly they alleviate symptoms, oseltamivir and baloxavir are on par, said Yen. But baloxavir is better at reducing the viral load — that is, the amount of virus circulating in the blood — she said, potentially shortening how long an infected person is contagious. One of **the biggest concerns** with antivirals **is that** as **flu viruses multiply**, they **can evolve to become resistant to treatments.** While such mutations have been rare with oseltamivir, studies show that they happen more often in people taking baloxavir, said Pavia. That **doesn't** have much of an **effect** on **most** people whose **immune systems** will clear the virus, said Pavia. But it could pose a **problem for those with compromised immunity** such as **cancer patients** who could harbor the resistant virus longer and possibly pass it on to others. Should seasonal flu, H5N1, or any other variant develop resistance to oseltamivir and baloxavir, providers and their patients would have **extremely limited options.** "Suffice it to say that we're vulnerable," said Pavia. When it comes to H5N1, so far, the **analyses of U.S. strains have been reassuring**. "The prevalence of resistance mutations was very, very low," he said. "But," he added, "it's not zero." And Pavia said it's not clear what it **would take for one of those mutations to catch hold.** Pavia pointed to the example of SARS-CoV-2, the virus that causes Covid-19, which developed resistance to treatment with **monoclonal (laboratory-made) antibodies within a matter of months each time** researchers developed a new version. One reason for the lack of alternatives is that **antivirals** are **tricky to develop**, said Anderson. Viruses **can't replicate** on their **own** but **rely** on **hijacking** a **living cell's** inner workings to make **copies** of **themselves**. That makes it hard to target a virus without harming the host cell. "Some **antivirals are pretty harsh**," said Anderson. The goal is to find something that works without really severe side effects, he said. "For antivirals, it's a much harder thing to come up with." One of the biggest concerns with antivirals is that as **flu viruses multiply,** they can **evolve to become resistant to treatments**. By comparison, it's easier to develop antibiotics to treat bacterial infections, he said. Bacteria are single-celled organisms that live on their own, and there are several approaches for taking them out that don't damage healthy cells. It would be **great to have a better flu drug**, said Pavia. One that **helps someone recover quickly**, that still **works well even if started after** they've been sick for several days. But **antivirals — expensive to develop** and **taken for a short** time — **aren't big money makers**, he said. Several factors **disincentivize** drug **companies from developing antivirals for future pandemics**, according to a 2023 Government Accountability Office report: It's **difficult** to **predict** the **timing** and **scale of demand** for the drugs and **developers prefer to focus on the existing market**. **Once a pandemic hits, political and social**

pressure to keep prices low limits profits. And so, **devoting years** and **possibly billions of dollars to finding a new option hasn't been a priority for drug companies.** "Would it make enough money to justify that investment by a large pharma company that's doing very well, thank you, in other areas of the market?" asked Pavia. "Probably not." When it comes to preparing for the next pandemic, public **health authorities** tend to **focus what's available**, rather than **what's ideal**, said Anderson. "There's a balance between what exists and then what needs to be developed," he said. "It's always easier to default to what exists." Currently, oseltamivir exists and is available. Although the exact contents of the U.S. Strategic National Stockpile are not publicly disclosed, federal officials said that **we have tens of millions of courses of oseltamivir** as well as hundreds of **thousands of courses of baloxavir.** Even if oseltamivir is not a sure-fire antiviral, it will likely have some effect, said Anderson. In a pandemic preparedness plan, he said, "we're going to include that as part of one of our tools, as well as vaccination, **as well as other things, other strategies that would be a part of that plan**." "There's a balance between what exists and then what needs to be developed. It's **always easier to default to what exists."** As things stand, Americans could be caught **flatfooted in the face of pandemic of H5N1 or other form of flu,** said Pavia, who has consulted for the CDC on seasonal and pandemic influenza issues. What the country needs is more and better flu treatments that the government could stockpile before the next pandemic. But that would require people to take the threat seriously, he said, and "Congress being willing to invest in things that we might need but might never use." It would also, he added, require better incentives for pharmaceutical companies to develop novel antiviral treatments. Meanwhile, on Sept. 6, the CDC reported the first case in the U.S. outbreak without a known exposure to sick or infected animals. The Missouri patient, who had underlying medical conditions, was hospitalized and has since recovered according to the agency. "We don't know if the Missouri case is evidence of human to human transmission, Pavia wrote in response to a follow-up email on the development. "If it is, it could suggest that there is more undetected transmission out there." The big unknown is whether this case is an anomaly or portends wider spread of the disease. If America, and possibly the world, is on the cusp of a major H5N1 outbreak, then certainly society would be better served with a more robust arsenal of antivirals, said Pavia — "perhaps sooner rather than later."

Gen AI is assisting drug discovery for H5N1 - Pasquini '24

Pasquini, Nina (Nina Pasquini is a metro intern for The News & Observer. She is a graduate of Harvard University). "Using Generative AI to Predict Viral Mutations and Develop Vaccines | Harvard Magazine." *Harvard Magazine*, 8 Oct. 2024, www.harvardmagazine.com/2024/11/ai-medicine-predicting-viral-evolution-vaccines. Accessed 26 Feb. 2025.//ejs squad

In medicine, "There's a **quiet revolution happening at the moment,"** says professor of systems biology Debora Marks. Most **people** have become **familiar with artificial intelligence** through chatbots such as ChatGPT, which function by predicting the next word in a sequence based on patterns learned from vast amounts of Internet text. But **researchers at Harvard Medical School** are **applying generative AI's** predictive capabilities **to biological and evolutionary data, creating models that** can **predict viral evolution, design never-before-seen proteins, and anticipate the effects of genetic mutations.** "The **coming together** of these **new AI** methods with the **power** of **evolutionary information** and **biological data**," Marks says, "is giving us an opportunity to do things that were really closed doors before." Researchers in Marks's lab made a breakthrough in the use of AI to study biological data in 2021, when they developed EVE, short for Evolutionary model of Variant Effect. They **trained EVE to detect patterns** of genetic **variation across** the **genomes** of **hundreds of thousands of nonhuman species**—then to **predict**, **based** on **that data**, whether similar **human genetic mutations** would **cause disease**. This addressed a longstanding challenge in biological research: though scientists have developed increasingly advanced technology for sequencing human genomes, they have struggled to discern the significance of many of the genetic variations they identified. Which are benign, and which are disease-causing? In a 2021 paper, Marks and colleagues found that EVE could make that distinction in genes related to conditions such as cancer and heart rhythm disorders. During the COVID pandemic, Marks and her lab colleagues realized this technology could also help them respond to the quickly evolving virus. They adapted EVE to create EVEscape, a tool designed to predict viral variants before they emerge. EVEscape consists of two parts: an AI model trained on evolutionary sequences—which reveal how similar viruses have evolved in the past—and biological and structural information about the current virus. Had EVEscape been used at the beginning of the pandemic, lab members reported in a 2023 paper, it would have **anticipated** the **most frequent mutations** and the most **consequential variants** of the **COVID virus** that **actually developed** and **spread. This** work **is a major break from traditional vaccine and therapeutic design, which relies on** either **costly and slow experiments** based on animal testing, or data generated during a **disease outbreak** in **humans.** The limitations of the traditional approach became evident during the pandemic, says Noor Youssef, a researcher who works with Marks. "We've **had to resort to these annual boosters**, where **every year** we're **getting** a **new vaccine** that **matches the current strain**," she says. "What **these generative models allow us to do is see ahead of time where the virus is going to evolve, so you can make a vaccine that is future-proof"—responsive to** both **current and potential future variants.** Marks and her colleagues have modified EVEscape to create EVEvax, which designs vaccines tailored to predicted mutations, and are **using** this **technology** to **develop** a **vaccine** for **sarbecovirus**, the subgenus that includes SARS-Cov-2. The new vaccine would be effective against COVID and other commonly circulating coronaviruses that cause the common cold. **They** have also **received funding** from Project CEPI (the Coalition for Epidemic Preparedness Innovations) **to develop a long-lasting vaccine for bird flu.** That disease hasn't yet spread widely in humans—but **when it does, it will likely evolve rapidly to overcome human immunity.** The scientists aim to develop a vaccine responsive to those **future changes as early as next spring.** "There are already FDA-approved vaccines in the freezer, **based on the strains from a few years ago."** Youssef says. But with the help of EVEscape, "You can have something in the freezer that's going to work for the strains that are around now—but also **work against things that might arise in the future."** Generative AI has also enabled researchers to **design new proteins, such as antibodies that attack certain viral mutations.** Using the AI technology from EVE and EVEscape, the Marks lab **developed AI models** that are **trained** on **protein sequences.** These models **generate new sequences tailored to designated** goals—**and** also **assess whether those predicted sequences will result in functional proteins.** Similarly, when ChatGPT is trained on text data, it not only **learns what words are associated with each other, but** also the **structure** of **language**: how grammar rules constrain the shape of its outputs. Like large language models, **AI protein design models are "going to try to understand the biochemical constraints that underpin the function of those proteins,**" says Pascal Notin, a machine-learning specialist in the Marks lab. In addition to creating new virus-specific antibodies, these protein-design models can be used to combat genetic diseases that cause a loss or malfunction of enzymes, proteins that catalyze biochemical reactions and enable the body to break down biological waste. Patients with such conditions are typically treated with enzyme replacement therapy (ERT); the AI tools can help design more stable, **effective enzymes** for such **treatment**. Marks says these models signal a fundamental shift in how research is conducted because, for the first time, "we've been **able** to make **predictions without [the preliminary experimentation]** process"—predictions that can then be **tested and refined by more focused experiments.** Researchers have long had access to the data on which such models are trained: the billions of DNA and RNA sequences that make up the genomes of hundreds of thousands of species and viral strains. But this trove of data was simply too large for individuals to fully parse. By detecting patterns and making predictions, **generative AI has enabled scientists to unlock that data's value**. "Evolutionary information, **human population sequencing**, and **viral sequencing**," Marks emphasizes, "are much more powerful than anybody thought they would be."

And, drug discovery happens at universities - Dror '22

Dror, Ron (Computer Science and, by courtesy, Molecular and Cellular Physiology and Structural Biology) "About." AI for Structure-Based Drug Discovery, Stanford University, 2024, aisbdd.stanford.edu/about. Accessed 22 Feb. 2025.//ejs squad

Dramatic recent **progress in** both **a**rtificial **i**ntelligence and structural biology has **created** tremendous **opportunities for using machine learning** methods not only **to** predict three-dimensional structures of drug targets but also to **design** safer, more effective **drugs**. Since 2015, multiple **research groups at Stanford** have been **developing machine learning methods** to leverage structure for the design of both biologics and small-molecule therapeutics. Current research directions include prediction of ligand binding poses, affinities, functional effects, and off-target properties; virtual screening; generative models for drug candidates; methods to achieve selectivity; and design of antibodies to optimize their developability. **The Artificial Intelligence for Structure-Based Drug Discovery program provides opportunities for exchange of ideas between Stanford researchers d**eveloping groundbreaking machine learning methods that leverage molecular structure and industry scientists who wish to apply such methods to bring better drugs to the market efficiently. In order to maximize the real-world impact of their research, Stanford researchers welcome input from industry partners—for example, on which problems to tackle or which software features to add. Industry partners also benefit through exposure to cutting-edge research, a forum to ask questions about deployment of algorithms and software, and opportunities to network with both Stanford researchers and other industry partners.

And, the next pandemic will come from the U.S. - Weintraub ‘23

Weintraub 23 [Karen Weintraub (National Editor that covers a wide range of medical issues, including infectious diseases, genetics, neuroscience and cancer), 22-7-2023, The next pandemic could spring from the US meat supply, new report finds, https://www.usatoday.com/story/news/health/2023/07/22/deadly-covid-style-pandemic-could-easily-start-in-us-report-finds/70442786007/] ejs squad

The next global pandemic could come from the United States. That's the sobering message of a report from Harvard Law School and New York University, examining how humans, livestock and wild animals interact here. Many familiar – and terrifying diseases – originated in animals, including HIV/AIDS, Ebola, Zika, pandemic flu and COVID-19. Some started in other countries, typically on the African or Asian continents. These so-called zoonotic diseases are often blamed on poor hygiene, lack of government oversight, or unsafe practices in those places. While Americans often think "it couldn't happen here," regulations are so loose and interactions so frequent, researchers found, that a virus or another contagious bug could easily jump from animals to people in the U.S., sparking a deadly outbreak. "There really is this false sense of security and unfounded belief that zoonotic disease is something that happens elsewhere," said Ann Linder, one of the report's lead authors and associate director of policy and research with the Brooks McCormick Jr. Animal Law & Policy Program at Harvard Law School. "In fact, I think we're more vulnerable than ever in many ways." The report, also led by NYU's Center for Environmental and Animal Protection, highlights several areas of vulnerability, including commercial farms where millions of livestock come into close contact with each other and their handlers; the wild animal trade in which animals are imported with few or no health checks; and the fur trade in which minks and other animals are bred for their coats, with little safety oversight. "Through globalization, we've erased seas and mountains and other natural boundaries of disease," said Linder, an expert in law and animal policy. "We're mixing animals and pathogens across different continents and circulating at a dizzying and ever-increasing pace." About **10 billion** land **animals** are **raised in the U.S.,** a number which is increasing by about 200 million a year, according to the report. Pigs and poultry, for instance, are raised in **higher numbers** in the United States **than** almost **anywhere else** in the world, the report found, and are the most likely vectors for a particularly lethal outbreak of the flu. Industry representatives were quick to defend the safety of their practices. "According to the CDC, the likelihood of spreading an avian disease to a human in the United States is extremely rare," Ashley Peterson, National Chicken Council senior vice president of scientific and regulatory affairs, said in an emailed statement. A pork industry group did not immediately return a request for comment. Workers on pig and poultry farms are particularly vulnerable because of a lack of regulations protecting them, said Delcianna Winders, an associate professor of law and director of the Animal Law and Policy Institute at Vermont Law and Graduate School in Royalton. "There is virtually no regulation of on-farm raising of animals. There's limited **regulation** of the slaughterhouse but it **is** extremely **inadequate and** it's **getting worse**," said Winders, who was not involved in the report, but researches a similar area. "Right now, the federal government is deregulating slaughter, **rather than increasing oversight.**" Because the mink and larger fur industry does not produce food, it is even less regulated, Linder said. A different study published last week in "Proceedings of the National Academy of Sciences," found "that mink, more so than any other farmed species, pose a risk for the emergence of future disease outbreaks and the evolution of future pandemics." Other studies have shown that mink are susceptible to SARS-CoV-2, the virus that causes COVID-19, and outbreaks were detected on 18 American mink farms during the pandemic's first two years. At least four Americans, two of whom worked on mink farms, were believed to have been infected by the animals. Challis Hobbs, Executive Director of the Fur Commission USA, a trade group, said "we unequivocally assert our commitment to the health and safety of our animals, our workforce, and the communities in which we operate." The industry, working with the federal government and state agencies, vaccinated 95% of the U.S. mink population beginning summer 2021, he said. The cost was entirely covered by the mink farmers, who also are helping to fund a SARS-CoV-2 surveillance project on mink farms. "Despite claims from animal rights advocates," he said, "there is no significant threat to the general public from U.S. farmed mink. About 220 million live wild animals are imported into the United States every year for pets and other purposes, many without health or safety checks, Linder said. If someone wants to bring a dog or cat into this country, there's a process, Linder said. "But if I'm a wildlife importer and I want to bring in 100 wild mammals from South America, I can do that with very little regulation of any kind." Perhaps the earliest Ebola case, which sparked the outbreak in West Africa from 2013 to 2016, was blamed on bush meat. It's illegal to import bush meat to the United States, but it's not illegal to import the same live animals that bush meat comes from, she said. "There are wide gaps." Both Linder and Winders also highlighted the lack of industry transparency. "So much of this is hidden from public view," Winders said. "There's so much we don't know because we're not monitoring." Winders said she's concerned about how much money the government spends subsidizing and protecting industries she believes put the American public at risk. She hopes Congress will take advantage of this year's reenactment of the Farm Bill to limit subsidies and impose new safety regulations on animal industries. "Don't we see the writing on the wall?" Winders asked. "Scientists are telling us **there's a looming** threat of a zoonotic **outbreak that could make COVID look like a cakewalk**, and we're still just ignoring it, even after what we've gone through over the last couple of years."

And, pandemics happen every 5 years - 2025 is the brink - COVID started EXACTLY 5 YEARS AGO. - Davies ‘20

[Sally Davies (Dame Sally Davies is master of Trinity College, Cambridge, and a former chief medical officer for England), former chief medical officer for England and master of Trinity College, Cambridge, 9-26-2020, "The next pandemic is on its way. Coronavirus must help us prepare for it", https://www.theguardian.com/commentisfree/2020/sep/26/next-pandemic-coronavirus-prepare] // ejs squad

We are at a crossroads. As the impacts of Covid-19 continue the world over and the second wave moves through Europe, we have a choice to make. Will we simply respond to the here and now, or do we take a moment to stop, look up and see beyond the horizon of this pandemic towards the next one? Because there will be a next one. **Covid-19 is neither the first nor the last health emergency we will face**. My fellow **scientists estimate that we will face a pandemic** or health emergency **at least once every five years from here on**. **There is a chance that this is the optimistic scenario. The reality could be far worse.** Recognising this, **we can, and must, say "never again"**. We must do better to identify the next health threat, respond to that threat before it becomes an epidemic or pandemic, and if it does, recover in a way that does not exacerbate health, economic and social inequalities.

These developments prevent extinction - Suzuki ‘21

Suzuki 21 [Tatsujiro Suzuki 21, Director and Professor at the Research Center for Nuclear Weapons Abolition, Nagasaki University, Former Vice Chairman of Japan Atomic Energy Commission, et al, Nagasaki University, 1-20-2021, Pandemic Futures and Nuclear Weapon Risks: The Nagasaki 75th Anniversary pandemic-nuclear nexus scenarios final report, Taylor & Francis, https://www.tandfonline.com/doi/full/10.1080/25751654.2021.1890867] //ejs squad

The Challenge: Multiple Existential Threats The relationship between **pandemics** and **war** is as **long as human history**. Past **pandemics have set the scene** for wars by **weakening societies**, undermining resilience, **and exacerbat**ing **civil** and **inter-state conflict**. Other disease outbreaks have erupted during wars, in part due to the appalling public health and battlefield conditions resulting from war, in turn sowing the seeds for new conflicts. In the post-Cold War era, pandemics have spread with **unprecedented speed** due to **increased mobility** created by **globalization**, especially between urbanized areas. Although there are positive signs that scientific advances and rapid innovation can help us manage pandemics, it is likely that deadly infectious viruses will be a challenge for years to come. The **COVID-19** is the most demonic pandemic threat in modern history. It has erupted at a juncture of other existential global threats, most importantly, accelerating climate change and resurgent nuclear threat-making. The most important issue, therefore, is how the coronavirus (and future pandemics) will increase or decrease the risks associated with these twin threats, climate change effects, and the next use of nuclear weapons in war.5 Today, the nine nuclear weapons **arsenals** not only can annihilate hundreds of cities, but also **cause nuclear winter and mass starvation of** a billion or more people, if not **the entire human species**. Concurrently, climate change is enveloping the planet with more frequent and intense storms, accelerating sea level rise, and advancing rapid ecological change, expressed in unprecedented forest fires across the world. Already stretched to a breaking point in many countries, the current pandemic may overcome resilience to the point of near or actual collapse of social, economic, and political order. In this extraordinary moment, it is timely to reflect on the existence and possible uses of weapons of mass destruction under pandemic conditions – most importantly, nuclear weapons, but also chemical and biological weapons. Moments of extreme **crisis** and vulnerability can **prompt aggressive** and counterintuitive **actions that** in turn may **destabilize** already **precariously balanced** threat **systems**, underpinned by **conventional** and **nuclear weapons**, as well as the threat of weaponized **chemical** and **biological tech**nologies. Consequently, the risk of the use of weapons of mass destruction (WMD), especially nuclear weapons, increases at such times, possibly **sharply**. The COVID-19 pandemic is clearly driving massive, rapid, and unpredictable changes that will redefine every aspect of the human condition, including WMD – just as the world wars of the first half of the 20th century led to a revolution in international affairs and entirely new ways of organizing societies, economies, and international relations, in part based on nuclear weapons and their threatened use. In a world reshaped by pandemics, nuclear weapons – as well as correlated non-nuclear WMD, nuclear alliances, "deterrence" doctrines, operational and declaratory policies, nuclear extended deterrence, organizational practices, and the existential risks posed by retaining these capabilities – are all up for redefinition. **A pandemic** has potential to **destabilize** a **nuclear-prone conflict by incapacitating** the supreme **nuclear commanders** who have to issue **nuclear strike orders**, creating **uncertainty** as to who is in charge, how to handle nuclear mistakes (such as errors, accidents, technological failures, and entanglement with conventional operations gone awry), and **opening** a **brief opportunity for a first strike** at a time when the COVID-infected state may not be able to retaliate efficiently – or at all – due to leadership confusion. In some nuclear-laden conflicts, **a state** might **use a pandemic as a cover for** political or military **provocation**s in the belief that the adversary is **distracted** and partly **disabled** by the **pandemic**, **increasing the risk of war** in a **nuclear-prone conflict**. At the same time, a pandemic may lead nuclear armed states to increase the isolation and sanctions against a nuclear adversary, making it even harder to stop the spread of the disease, in turn creating a pandemic reservoir and transmission risk back to the nuclear armed state or its allies. In principle, the common threat of the pandemic might induce nuclear-armed states to reduce the tension in a nuclear-prone conflict and thereby the risk of nuclear war. It may cause nuclear adversaries or their umbrella states to seek to resolve conflicts in a cooperative and collaborative manner by creating habits of communication, engagement, and mutual learning that come into play in the nuclear-military sphere. For example, militaries may cooperate to control pandemic transmission, including by working together against criminal-terrorist non-state actors that are trafficking people or by joining forces to ensure that a new pathogen is not developed as a bioweapon. To date, however, the **COVID-19 pandemic** has **increased** the **isolation** of some nuclear-armed states and provided a textbook case of the **failure** of states to **cooperate** to overcome the pandemic. **Borders** have slammed shut, trade shut down, and budgets blown out, creating enormous pressure to focus on immediate domestic priorities. Foreign policies have become **markedly more nationalistic**. Dependence on nuclear weapons may increase as states seek to buttress a global re-spatialization6 of all dimensions of human interaction at all levels to manage pandemics. The effect of nuclear threats on leaders may make it less likely – or even impossible – to achieve the kind of concert at a global level needed to respond to and administer an effective vaccine, making it harder and even impossible to revert to pre-pandemic international relations. The result is that some states may **proliferate** their own nuclear weapons, further reinforcing the spiral of conflicts contained by nuclear threat, with cascading effects on the **risk of nuclear war**.

Extinction. - Starr '15

Steven **Starr 15**, 2/28/2015, (Steven Starr is an Associate member of the Nuclear Age Peace Foundation and has been published by the Bulletin of the Atomic Scientists). Starr is also an expert on the environmental consequences of nuclear war, Nuclear War: An Unrecognized Mass Extinction Event Waiting to Happen, Symposium: The Dynamics of Possible Nuclear Extinction, https://ratical.org/radiation/NuclearExtinction/StevenStarr022815.html)//ejs squad

A war fought with 21st century strategic **nuclear weapons would be more than just a great catastrophe in human history. If we allow it to happen, such a war would be a mass extinction event that ends human history.** There is a profound difference between extinction and "an unprecedented disaster," or even "the end of civilization," because even after such an immense catastrophe, human life would go on.

But extinction, by definition, is an event of utter finality, and a nuclear war that could cause human extinction should really be considered as the ultimate criminal act. It certainly would be the crime to end all crimes.

The world's leading climatologists now tell us that nuclear war threatens our continued existence as a species. Their studies predict that **a** large **nuclear war**, especially one fought with strategic nuclear weapons, **would create a post-war environment in** which for many years it would be **too cold** and dark **to** even **grow food.** Their findings make it clear that not only **humans,** but most large animals and many other forms of complex life **would likely vanish** foreverin a nuclear darkness of our own making.

The environmental consequences of nuclear war would attack the ecological support systems of life at every level. Radioactive fallout

Independently, Vaccines facilitate diplomacy---otherwise extinction.

Hotez 21, MD, PhD, is dean of the National School of Tropical Medicine and professor of pediatrics, molecular virology, and microbiology at Baylor College of Medicine, where he is also the codirector of the Texas Children's Center for Vaccine Development, also university professor of biology at Baylor University, faculty fellow at the Hagler Institute for Advanced Study at Texas A&M University, fellow in disease and poverty at the Baker Institute for Public Policy at Rice University, and senior fellow at the Scowcroft Institute of International Affairs at Texas A&M University (Peter J., 2021, "1. A New Post-2015 Urgency," and "2. A Cold War Legacy," Preventing the next Pandemic: Vaccine Diplomacy in a Time of Anti-Science, Johns Hopkins University Press, pp. 12–33)//ejs squad

Global Health Diplomacy

Each visit with Heloisa reinforced my conviction that vaccine diplomacy could one day hold a special place in modern society. In our post-2015 world, we **need vaccine diplomacy more than ever**. Global infectious diseases have taken **a**n unexpected **turn for the worse**. Owing to breakdowns in health infrastructure from **war and instability**, together with other modern twenty-first-century forces, infectious diseases once thought to be on their way out, or even **gone**, are now **back**. The **COVID**-19 pandemic is **testing international relations** on an unprecedented level. Solving **these** and **future** infectious disease public health **crises** will require us to **integrate** the science of tackling global infections with these new **social and physical determinants**: poverty, **war, political instability, human migrations, urbanization**, and anti-science. In turn, navigating such troubled waters will require new approaches **linking** biomedical and **social sciences**, including **political** science and **foreign policy**.

In my two years in the Obama administration as US science envoy, I came to realize that understanding the biomedical science, the vaccinology, was essential but not always sufficient to solve issues related to building vaccine infrastructures across nations. This was especially true in a complicated space like the Middle East, where deep-seated tribal and Sunni-Shia rivalries continuously threw up roadblocks—often in interesting and unexpected ways. It became apparent that building vaccines, expanding vaccine coverage, and tackling NTDs requires integrating new types of knowledge, including skills related to diplomacy. In some ways, this might bear some resemblance to what Sabin achieved in Cuba and the USSR (okay, maybe not Brazil!) in the 1960s, but widening the tent to include both scientists and nonscientists. To achieve this, I suggested a new framework of vaccine diplomacy that connects political science, philosophy, and foreign policy to the most powerful life science technology ever invented—vaccines.

Before describing and defining vaccine diplomacy, I think it is helpful to first provide a broader understanding of how global health in general is linked to international relations and solving disease problems on a large scale [2]. Some might say it began as an early version of quarantine during the 1300s, when laws were implemented to prevent plague originating in Asia Minor from entering Dubrovnik on Croatia's Adriatic coast—or much later, starting in the 1850s, when international sanitary conferences were held in Europe to prevent cholera, plague, and other pandemic infectious disease threats from spreading [2]. Then, in the early twentieth century, the Office International d'Hygiène Publique was created in Paris, as well as a health organization linked to the League of Nations [3]. In parallel, the nations in the Western Hemisphere also established a Pan American Sanitary Bureau, later named the Pan American Health Organization, which became the regional office of WHO in the Americas. The actual World Health Organization itself was established in the aftermath of World War II, following the formation of the UN. The WHO's constitution was enacted on April 7, 1948, now designated as World Health Day. Almost twenty years later, the WHO embarked on the eradication of smallpox through a global vaccination campaign.

Global health diplomacy rapidly accelerated after promulgation of the UN's Millennium Development Goals, first in 2005, with a revised set of International Health Regulations (IHR), and then in 2007, after the ministers of health of seven nations connected global health to foreign policy through an Oslo Ministerial Declaration [2]. IHR, also known as IHR (2005), is an agreement between all WHO member states focused on global health security, especially for the detection and assessment of major public health events and for strengthening disease control efforts at national entry points, such as seaports and airports. A key driver of the IHR (2005) was the 2003 pandemic of severe acute respiratory syndrome (SARS) that resulted in more than 8,000 cases, with roughly 10% mortality [4]. The SARS pandemic also severely affected the economies of Hong Kong and Toronto, Canada, and were a wake-up call for the disruptive power of lethal epidemics. These initiatives were later strengthened in 2019 following the Ebola epidemic in DR Congo and ultimately were called on to respond to COVID-19 the following year. In this context, my former Yale colleague, Ilona Kickbusch, defines global health diplomacy as a system of global governance in health, while Rebecca Katz, a colleague and former student now at Georgetown University, provided an operational definition. She refers to it as a framework to include treaties between nations—such as IHR, or recognized international partnerships with UN international organizations, Gavi, or global partnerships involving the Gates Foundation or other non-state actors [2].

Vaccine Diplomacy

Throughout modern history, vaccines have surpassed **all other biotechnologies** in terms of their impact on global public health. Because of vaccines, smallpox was eradicated, and polio has been driven to near global elimination, while measles deaths have declined more than 90%, and Haemophilus influenzae type b meningitis is now a disease of the past in the United States and elsewhere.

I define one part of vaccine diplomacy as a subset or specific aspect of global health diplomacy in which large-scale vaccine delivery is employed as a humanitarian intervention, often led by one or more of the UN agencies, most notably Gavi, UNICEF, and WHO, or potentially a nongovernmental development organization [2]. Examples might include emergency cholera or Ebola vaccinations during outbreaks in Africa, measles vaccination campaigns linked to the Venezuelan diaspora in Brazil or Colombia, or polio eradication campaigns in the conflict areas of Afghanistan, Pakistan, or the Middle East. Other aspects of vaccine diplomacy relate to vaccine access during pandemics, such as efforts to ensure equitable delivery of a vaccine to combat influenza, especially during an epidemic or even a pandemic situation.

Another critical element of vaccine diplomacy includes the development or refinement of new vaccines achieved jointly between scientists of at least two nations. Rather than a UN agency or nongovernmental development organization, the actual scientists lead both the vaccine science and diplomacy [2]. It is especially relevant that scientists from nations in opposition or even outright conflict can work in research organizations, or that they are able to work together and engage in collaborations under conditions of political instability or stress. Under this definition, vaccine diplomacy reached its full expression during a 20-year period of the Cold War between the United States and Soviet Union that began around the time of the

Sputnik satellite launch and mostly ended in 1977 with the eradication of smallpox [5]. In my role as US science envoy, I worked to resurrect this vaccine science diplomacy while collaborating with scientists from Muslim-majority countries of the Middle East and North Africa [6].

Do vaccines really deserve their own designation for a special type of diplomacy? Yes, I believe so, especially when we consider that between the past century and this one vaccines have saved **hundreds of millions of lives** [2]. In this sense, the **technology** of vaccines and their **widespread delivery** represent our **most potent counterforce to war and political instability in modern times**. Vaccines represent not only life-saving technologies and unparalleled instruments for reducing human suffering, but they also serve as **potent vehicles** for promoting **international peace** and prosperity. They are humankind's **single greatest invention**.

A Brief History of Vaccine Diplomacy

The history of vaccine diplomacy traces an interesting narrative parallel to the history of the vaccines themselves. It started with the British physician Edward Jenner, who in the late 1700s developed the first and original smallpox vaccine. Indeed the word vacca, Latin for "cow," refers to the fact that the attenuated virus used in the vaccine derived from cows infected with the cowpox virus. However, a more recent analysis questions the true origins of the virus that Jenner actually used, which might have been horse pox, or even another virus entirely, designated simply as "vaccinia" [7]. Jenner's smallpox vaccine had an immediate impact on public health in England, and it was transported across the Atlantic Ocean to America, where Thomas Jefferson himself conducted vaccine trials in and around Virginia. When he commissioned Meriwether Lewis and William Clark for their expedition a year after the Louisiana Purchase in 1803, Jefferson either encouraged or arranged for them to carry the vaccine into the frontier [2]. Back then, smallpox was devastating Native American populations in the Northern Plains, so the vaccine was potentially a gesture of peace or goodwill. Unfortunately, some historians report that the vaccine preparation degraded to a point where it was never actually used.

In Europe, both England and France celebrated and honored Jenner's achievements despite increasing hostilities between the two nations. In the period following the French Revolution and after Napoleon became military dictator of France in 1799, Britain had become increasingly concerned about his armies expanding across Europe and his efforts to stop European nations from trading with England. Finally, in 1803, Britain declared war on France, beginning with a naval blockade of the country. Historic battles at Austerlitz and Trafalgar ensued. However, Jenner's reputation and veneration as the first vaccine scientist had grown to such a point that he was asked to write letters (and possibly engage in other activities) mediating the releases or exchanges of prisoners [2]. For example, in a letter to the French National Institute of Health, he asserted that "the sciences are never at war." In turn, Napoleon (or some say Empress Josephine) declared, "Jenner—we can't refuse that man anything" [2]. Ultimately, the Napoleonic wars ended with Napoleon's defeat at Waterloo, the last time France and England went to war.

These vignettes highlight a future paradigm that subsequently held for the next 200 years—namely, (1) the immediate recognition of the impact of a vaccine as a highly valued technology, and (2) the enormous scientific and professional stature of vaccinologists—vaccine scientists and vaccine developers. That is, until the modern-day anti-vaccine movement began to target us beginning in the early 2000s. An elusive third element, although one not as straightforward and tangible, also attaches to vaccines: the potential for vaccines to both prevent diseases arising out of conflict or twenty-first-century forces, and in some cases, to directly address the actual social determinants. For example, Jenner's vaccine was itself employed as an instrument of peace during the Napoleonic wars, creating a novel thread through modern history. When another renowned Frenchman, Louis Pasteur, developed the next few vaccines in the mid-1800s, he also used his stature to launch a network of Pasteur Institutes across the Francophone world, including North Africa and Southeast Asia, which initially focused on reproducing Pasteur's method to prepare and deliver the first rabies vaccine. Echoing Jenner's comments, Pasteur in an 1888 speech at the founding of the Institut Pasteur in Paris remarked that "science has no country, because knowledge belongs to humanity and is the torch which illuminates the world" [2].

The **Cold War** was a 45-year period of **political hostilities** between the United States and the Union of Soviet Socialist Republics that began after World War II and divided much of the globe into two major spheres of influence. Ironically, it became the signature period that generated the fullest expression of vaccine diplomacy. Two enemies **put aside their animosities** in order to collaborate on the development and testing of the oral **polio** vaccine, which is now leading to its global elimination or eradication. This is an extraordinary story that few people outside the vaccine world know about. The 1957 launch of the Sputnik satellite was a key moment in American history, when the nation feared falling behind the Soviets in mastery of both space and missile technology. It became a dark chapter in US history when—following on the heels of the "red scare" that resulted from the Soviet annexation of eastern Europe, the Berlin blockade, and our proxy war with China in Korea—we became vigilant, even hyper-vigilant, for any signs of Communist presence on our soil.

Rebuttal:

A2 Critical Thinking:

In fact, Gen AI is good for education AND critical thinking

Meta-study proves AI improves test scores significantly

Sun, L., & **Zhou**, L. (20**24**). School of Education, Minzu University of China, Beijing, China. Does Generative Artificial Intelligence Improve the Academic Achievement of College Students? A Meta-Analysis. Journal of Educational Computing Research, 62(7), 1896-1933. https://doi.org/10.1177/07356331241277937//ejs squad **The use of generative artificial intelligence (Gen-AI) to assist college students in their studies has become a trend**. However, there is no academic consensus on whether**Gen-AI can enhance the academic achievement of college students**. Using a

meta-analytic approach, this study aims to investigate the effectiveness **of Gen-AI in improving the academic achievement of college students and to explore the effects of different moderating variables. A total of 28 articles (65 independent studies, 1909 participants) met the inclusion criteria for this study.** The results showed that **Gen-AI significantly improved college students' academic achievement** with a medium effect size (Hedges's g = 0.533, 95% CI [0.408,0.659], p < .05). There were within-group differences in the three moderator variables, activity categories, sample size, and generated content, when the generated content was text (g = 0.554, p < .05), and sample size of 21–40 (g = 0.776, p < .05), the use of independent learning styles (g = 0.600, p < .05) had the most significant improvement in college student's academic achievement. The intervention duration, the discipline types, and the assessment tools also had a moderate positive impact on college students' academic achievement, but there were no significant within-group differences in any of the moderating variables. This study provides a theoretical basis and empirical evidence for the scientific application of Gen-AI and the development of educational technology policy.

GenAI improves critical thinking—3 independent warrants

A. DISCOVERY.

Gonsalves 24 [Chahna (Chahna Gonsalves, Marketing, King's College London, Bush House, 30 Aldwych, London WC2B 4BG, UK); King's College London, UK; 12-23-2024; "Generative AI's Impact on Critical Thinking: Revisiting Bloom's Taxonomy," Sage Journals; https://journals.sagepub.com/doi/10.1177/02734753241305980 DOA: 3-5-2025]//ejs

squad Cognitive Domain

Discovering Information

In line with Bloom's "remembering" stage, ChatGPT proved pivotal for students in gathering, organizing, and making sense of foundational information. This process went beyond simple retrieval, as participants engaged in iterative exploration and synthesis. For example, Participant 1 stated, "I'm going to use ChatGPT now to help me with finding things I need to do or read to create a powerful brand," illustrating how the tool provided structured content while sparking creative exploration. By offering a scaffold of ideas—such as brand identity elements and storytelling techniques—ChatGPT facilitated brainstorming and served as a foundation for deeper, customized work.

Participant 3 similarly noted, "I don't want to directly reference ChatGPT . . . so I had to cross-check with sources like Google Scholar and reputable websites." This approach combined the speed and breadth of AI-generated outputs with the reliability and rigor of traditional research practices. Participant 2 further illustrated this dynamic, using ChatGPT for initial brainstorming and then expanding on its suggestions through manual research. This iterative cycle of guidance, validation, and refinement demonstrates how AI can complement traditional learning by transitioning students from broad exploration to critical inquiry.

Despite these benefits, participants also identified limitations in the credibility and specificity of ChatGPT's outputs, often requiring supplementary research. For instance, Participant 6 expressed frustration at ChatGPT's inability to provide reliable statistics or source citations, saying, "I'm getting the feeling that ChatGPT is not able to provide this sort of statistics," and instead turned to external databases to confirm findings. This limitation led Participant 6 to refine their research approach, blending AI-generated insights with traditional sources to ensure accuracy and rigor.

Overall, this iterative process of integrating AI with traditional research reflects a pattern of deeper analytical engagement. Students critically evaluated AI outputs, validated them with trusted sources, and refined their strategies, transforming the discovery process into a reflective and critical inquiry.

P1a: The use of generative AI tools enables students to quickly discover and structure a wide range of information, fostering a foundational understanding that serves as an initial guide for exploring complex topics.

P1b: The initial validation of AI-generated content against traditional sources prompts a more critical stance, enabling students to recognize inconsistencies, question outputs, and develop a discerning approach that lays the foundation for deeper analytical skills.

B. ANALYZING CONTENT.

Gonsalves 24 [Chahna (Chahna Gonsalves, Marketing, King's College London, Bush House, 30 Aldwych, London WC2B 4BG, UK); King's College London, UK; 12-23-2024; "Generative AI's Impact on Critical Thinking: Revisiting Bloom's Taxonomy," Sage Journals; https://journals.sagepub.com/doi/10.1177/02734753241305980 DOA: 3-5-2025] //ejs

squad Analyzing AI-Generated Content

Corresponding to Bloom's "evaluating" and "analyzing" stages, participants critically evaluated AI-generated content for accuracy and bias. Participant 2 remarked, "I didn't just take ChatGPT's answer. I looked for validation in Google Scholar." This behavior highlights their growing capacity to cross-check AI outputs against authoritative sources. Participant 3 expressed similar concerns, noting, "The data couldn't be validated on it. It could never tell me the source of where it got the information from."

This evaluative process required trust, skepticism, and judgment (Larson et al., 2024), pushing students beyond passive validation to examine the logic, assumptions, and biases within AI outputs. Participant 3's frustration over the lack of source transparency underscores the cognitive effort needed to navigate ambiguity and assess reliability. These critical inquiries helped students refine their understanding and engage deeply with alternative resources.

P4: Analyzing AI-generated content encourages students to move beyond validation, prompting them to deconstruct assumptions, identify biases, and assess the credibility and relevance of the information. This process cultivates advanced critical thinking skills, enabling students to synthesize diverse perspectives and generate nuanced insights.

C. CREATION.

Gonsalves 24 [Chahna (Chahna Gonsalves, Marketing, King's College London, Bush House, 30 Aldwych, London WC2B 4BG, UK); King's College London, UK; 12-23-2024; "Generative AI's Impact on Critical Thinking: Revisiting Bloom's Taxonomy," Sage Journals; https://journals.sagepub.com/doi/10.1177/02734753241305980 DOA: 3-5-2025] //ejs

squad Creating

Reflecting Bloom's "creating" stage, AI acted as a transformative catalyst for innovation, empowering students to synthesize diverse inputs into original concepts. Participant 1 used ChatGPT to develop promotional strategies tailored to specific market contexts, emphasizing inclusivity and empowerment. This capacity to adapt AI outputs highlights how generative tools extend creative boundaries by offering a foundation for personalization and refinement. Similarly, Participant 2 utilized ChatGPT for brand name generation, producing options that were both compelling and market-aligned: "It helped me come up with names that actually made sense for the product." Participant 3 echoed this utility, streamlining the brainstorming process to enhance the relevance and appeal of final choices.

Beyond generating ideas, ChatGPT encouraged iterative innovation, merging AI suggestions with personal expertise and creative intuition. Participant 4 refined pricing strategies by integrating AI recommendations with human insights, discovering novel approaches like value-based pricing aligned with their project's broader goals. These examples highlight how AI enables students to navigate the intersection of generative technology and human creativity, unlocking solutions not revealed through traditional methods. By fostering experimentation and expanding ideation, AI appears to support a reimagining of students' creative processes, helping them articulate and execute cohesive, innovative strategies with greater precision and sophistication.

P5: Generative AI tools serve as catalysts for creative thinking, enabling students to expand beyond conventional ideas, experiment with novel solutions, and refine innovative concepts. This process enhances their ability to synthesize diverse inputs into cohesive, original strategies.

Alt causes

RJ **Cross** 23, 8-14-20**23**, [], "How misinformation on social media has changed news", U.S. PIRG Education Fund, https://pirg.org/edfund/articles/misinformation-on-social-media/, 3-6-2025 (B.A., Phi Beta Kappa, University of Kansas R.J. focuses on data privacy issues and the commercialization of personal data in the digital age. Her work ranges from consumer harms like scams and data breaches, to manipulative targeted advertising, to keeping kids safe online. In her work at Frontier Group, she has authored research reports on government transparency, predatory auto lending and consumer debt. Her work has appeared in WIRED magazine, CBS Mornings and USA Today, among other outlets. When she's not protecting the public interest, she is an avid reader, fiction writer and birder.) //ejs squad

When a tourist submersible lost contact during a dive to view the wreckage of the Titanic last month, the international rescue operation caught the attention of millions around the world. The rescue failed, and on June 25th, a video on TikTok broadcasted the screams of the passengers in their final moments. In just 10 days, the video had 4.9 million viewers who heard the five victims' last cries.

Except they hadn't. The audio wasn't from the submersible at all – it was from the video game series Five Nights at Freddy's. But the TikTok went viral fast, and it spread a lot further than the fact-checked truth.

Social media's evolution as a distributor of news has had serious consequences for what counts as journalism and what gets conflated with the truth.

On social media, **news is entertainment**

Today, more than **8 in 10 Americans get their news on digital devices** – beating out TV, radio or print. **Among 18-29 year olds, social media is the most common news source.** They aren't the only ones turning to platforms for information; 53% of Americans get at least some of their news from social media. Twitter, Facebook, and TikTok have all become pseudo-news platforms. When news started migrating to social media, it accelerated some of the changes already underway in the journalism industry. In the 50s and 60s, TV news in particular was more viewed by broadcasters as a public service. In the 80s, however, entertainment conglomerates began buying up networks and started expecting news networks to turn profits like other entertainment divisions. Soon came the 24-hour news cycle, and the emphasis on rapid and attention-grabbing stories. Then came the emphasis on pundits – journalist-esque figures designed to deliver opinions, not always facts. As the news industry changed, so too did people's expectations of what news should look like. With the shift to social media, these dynamics have intensified. When anyone can be a journalist, content is near-endless and easily capable of supplying social media feeds with hundreds of 24-hour news cycles. Instead of opinion sections or dedicated programs for pundits, social feeds mix opinions and facts together. And **the more outlandish a story, the better it does.**

With fast-paced, sensationalized news coverage and opinion-having taken to its extreme, more of what we see online is misinformation – content that simply gets the facts wrong.

What is misinformation?

Misinformation is incorrect or misleading information. Sometimes it can be as simple as an error in reporting. Other times misinformation content is purposefully exaggerated, using clickbait headlines or out-of-context details to make a story harder to look away from.

Misinformation online is growing. New technologies are also making it easier than ever for anyone to substantially edit photos and videos to reflect a reality that doesn't really exist.

Why is there so much misinformation?

The move towards social media as a source for news has allowed misinformation to flourish.

Anyone with a social media account can become a "news" source. For individuals and outlets posting news, the goal is almost always to get seen by as many people as possible. What goes well on social media is not exactly even-keeled and well-researched stories. For posts on large platforms "outrage is the key to virality", as social psychologist Jonathan Haidt puts it. Out of context details distort what's real, and thanks to the "share" button **mistaken impressions can run through a large network of people virtually instantly.** Researchers at MIT have found that fake news can **spread up to 10 times faster than true reporting on social media**. When explosive, misinforming posts go viral, their corrections are never as widely viewed or believed. The outrageous "fact" that blasts through audiences is louder, stickier, and more interesting than a follow-up correction. In the race between the false but interesting and the true but boring, the interesting story wins.

The algorithm spreads misinformation

What we see on social media is determined by an algorithm that curates content. The algorithm's job is to keep you online as long as possible. The longer you're on, the more targeted ads the platform can sell designed to reach you, specifically. This is the business model of all the major platforms.

To keep you on longer, the algorithm uses data about you – like what types of content you have liked and shared in the past, and whose content you are more likely to engage with – to decide what to show you next. If you like or share a post, you'll see more like it. These algorithms reward those that share content most frequently by broadcasting their posts to a higher number of social feeds, earning them more views, likes, comments and shares. As we've seen, exciting or infuriating information tends to stoke more reaction. By nudging frequent users to keep sharing high-performing content, the algorithm ends up fueling networks of ongoing misinformation. A study from USC showed that 15% of frequent social media news-sharers were behind up to 40% of the fake news circulating on Facebook. The tech behind our social feeds is not optimized for providing access to high-quality information. The goal is engagement, allowing outrageous stories and opinions to find a broad audience quickly.

Misinformation on TikTok

TikTok has ushered in a new era of misinformation online, exposing its young user base to bad information frequently. One 2022 study found that when TikTok users searched for top news stories, almost 20% of the videos returned contained misinformation, like the TikTok of the Titan submersible victims.

Misinformation can get actively dangerous – a 2023 study from the University of Arizona found that approximately 40% of medical videos on TikTok contained medical misinformation.

Platforms have a responsibility

Gen Z has inherited a news ecosystem unlike any that has existed before. The social media business model stokes views and clicks and ad revenue to new heights at a very high societal cost. For one, young people in particular have experienced mental health troubles on these platforms. There's also big questions for democracy. Having an engaged and informed citizenry depends in no small part on reliable access to accurate information. With social media's propensity to amplify misinformation, more people accessing news-like content on these platforms may further distort the echo chambers we're currently grappling with as a country.

The social media giants are some of the most powerful and well-resourced companies in the world. They've built the most sophisticated information sharing networks that have ever existed. Misinformation is a complicated problem, but these companies more than anyone have the resources and expertise to tackle this problem head on. Regulators need to pay more attention to what's happening behind the social media feed curtain, and let the tech giants know it's time to prioritize finding solutions.

Ai key to fight misinfo

Christine **Clark** 24, 9-17-20**24**, [], "How AI Can Help Stop the Spread of Misinformation", No Publication, https://today.ucsd.edu/story/how-ai-can-help-stop-the-spread-of-misinformation, 3-6-2025 (Researcher at the University of California San Diego) //ejs squad

Machine learning algorithms significantly outperform human judgment in detecting lying during high-stakes strategic interactions, according to new research from the University of California San Diego's Rady School of Management. The study can have **major implications for the spread of misinformation, as machine learning could be used to bolster efforts to reduce fictitious content on major platforms like YouTube, Tik-Tok and Instagram.**

The paper, to be published in Management Science, focused on participants' ability to detect lying on the popular British TV show "Golden Balls," which aired from 2007 to 2010. It finds that while humans struggle to predict contestants' deception behavior, algorithms perform much better.

"We find that**there are certain 'tells' when a person is being deceptive**," said Marta Serra-Garcia, lead author of the study and associate professor of behavioral economics at the UC San Diego Rady School of Management. "For example, if someone is happier, they are telling the truth and there are other visual, verbal, vocal cues that we as humans are share when we are being honest and telling the truth. Algorithms work better at uncovering these correlations."

The algorithms used in the research achieved an impressive accuracy rate, correctly predicting contestant behavior 74% of the time, compared to the 51%-53% accuracy rate achieved by the more than 600 humans who participated in the study.

In addition to comparing machine learning and human abilities to detect deception, the study also tested how algorithms could be leveraged to help people better tell apart those who lie and those who tell the truth.

In one experiment, two different groups of study participants watched the same set of "Golden Balls" episodes. One group had the videos flagged by machine learning before they viewed them. The flags indicated that the algorithm predicted the contestant was most likely lying. Another group watched the same video and after they viewed it, they were told the algorithm flagged the video for deception. Participants were much more likely to trust the machine learnings' insights and better predict lying, if they got the flag message before watching the video.

"Timing is crucial when it comes to the adoption of algorithmic advice," said Serra-Garcia. "Our findings**show that participants are far more likely to rely on algorithmic insights when these are presented early in the decision-making process.**

This has particular importance for online platforms like YouTube and TikTok, which can use algorithms to flag potentially deceptive content."

Coauthor Uri Gneezy, professor of behavioral economics at the Rady School added, "Our study suggests that these **online platforms could improve the effectiveness of their flagging systems by presenting algorithmic warnings before users engage with the content, rather than after, which could lead to misinformation spreading less rapidly."** Some of these social media websites are already using algorithms to detect suspicious content, but in many cases, a video has to be reported by a user and then investigated by staff who can flag the content or take it down. These processes can be drawn out, as employees at tech companies like TikTok get overburdened with investigations.

The authors conclude, "Our study shows how technology can enhance human decision making and it's an example of how humans can interact with AI when **AI can be helpful**. We hope the findings can help organizations and platforms better design and deploy machine learning tools, especially in situations where accurate decision-making is critical."

Their OMP evidence cites alt causes. East in blue.

Open Minds Foundation 24 "What Riots and Transphobia Teach Us about Critical Thinking." Psychology Today, 2024, www.psychologytoday.com/us/blog/the-art-of-critical-thinking/202408/what-riots-and-transphobia-teach-us-about-critical. Accessed 5 Mar. 2025. [The Open Minds Foundation is dedicated to undermining the effects of coercive control, through critical thinking education and training.]

At the beginning of August, the United Kingdom was swept up by news of the fatal stabbing of three young girls at a dance class, ultimately culminating in **race riots.** Meanwhile, globally, Olympics mania was overshadowed by a wave of transphobia. Both **were triggered by targeted disinformation campaigns, leading to widespread civil unrest and waves of hate.** If nothing else, **they highlight the urgent need to bring critical thinking education to the forefront of curricula, with a tangible focus on media literacy skills to dampen the wildfire spread of fake news sweeping social media platforms.**

A2 C2:

The U.S has had LAWs for decades—there is no brink.

Thomas X. **Hammes** [*BS @ Naval Academy, MA in Historical Research and Doctorate in Modern History @ Oxford University; Distinguished Graduate @ Canadian National Defence College; Nonresident Senior Fellow in Forward Defense Program @ Atlantic Council's Scowcroft Center for Strategy and Security; Distinguished Research Fellow @ Center for Strategic Research @ The Institute of National Security Studies of U.S National Defense University; 30 Years in U.S Marine Corps, Commanding Intelligence Battalion and Chemical Biological Response Force*]. "Autonomous Weapons Are the Moral Choice." *Atlantic Council*, 2 Nov. 20**23**, www.atlanticcouncil.org/blogs/new-atlanticist/autonomous-weapons-are-the-moral-choice/. Accessed 7 Mar. 2025. //ejs squad

Fully autonomous weapons are not only **inevitable**; they **have been** in the United States' **inventory** since at least **1979**, when it fielded the **Captor Anti-Submarine Mine**, which held a torpedo anchored on the bottom that launched when onboard sensors confirmed a designated target was in range. Today, the United States holds a **significant inventory** of **Quickstrike smart sea mines** that, when activated, autonomously select their targets using onboard sensors. The US Navy's Mark 48 ADCAP torpedo can operate with or without wire guidance, and it can use active and/or passive homing. In fact, the fastest-growing segment of the torpedo market is for autonomous torpedoes. **Autonomous anti-ship cruise missiles** have been developed and fielded. **Modern air-to-air missiles** can lock on a target after launch. More than ten nations operate the Israeli-developed Harpy, a fully

autonomous drone that is programmed before launch to fly to a specified area and then hunt for a class of targets using electromagnetic sensors. The follow-on system, Harop, adds visual and infrared sensors. Harop was only the first of a rapidly growing family of weapons known as loitering munitions. These munitions are designed to "loiter" over a battlefield until they can identify a target and then strike it. While many such munitions still require a human operator to select a target, they are essentially a software upgrade away from autonomy. And, of course, **victim-initiated mines**(the kind one steps on or runs into) have been around for well over a century. These mines are essentially **autonomous.** They are unattended weapons that kill humans without another human making that decision.Despite strong international opposition and the Ottawa Convention or Anti-Personnel Mine Treaty, **anti-personnel mines** are **still in use**. But even these primitive weapons are really "human starts the loop" weapons. A human designed the detonators to require a certain amount of weight to activate the mine. A human selected where to place them based on an estimation of the likelihood they will kill or maim the right humans. But once they are in place, they are fully autonomous. Thus, much like current autonomous weapons, a human sets the initial conditions and then allows the weapon to function automatically. The key difference between the traditional automatic mine and a smart, autonomous mine, like the Quickstrike, is that the smart mine attempts to discriminate between combatants and noncombatants. Dumb mines do not. Thus, it is fair to assume that smart mines are inherently **less likely** to **hurt** noncombatants than older mines. In short, arguments about whether democratic nations should field and employ LAWS miss the point. They have used autonomous weapons for decades—in multiple domains and in large numbers. Further complicating the picture, current arguments against autonomous weapons are primarily based on the multi-decade US use of drones to hunt and kill individuals. These missions developed over days or even weeks with operators closely controlling each drone. Analysts had time to evaluate each mission and provide advice to senior officers, who then made the final decision, and usually after consulting with lawyers. During this period, it was both reasonable and ethical to refuse to use LAWS. It will continue to be right to refuse to employ LAWS under these conditions. However, the Ukrainian conflict reveals a rapid, major change in the character of how war is fought. Both sides are using hundreds of drones at a time. Their routine use has been an essential element in Ukraine's ability to hold its own against larger Russian forces. Further, the use of drones is increasing at an almost exponential rate. Ukraine ordered two hundred thousand drones to be delivered during 2023 and has trained ten thousand drone pilots to date. In response, both sides are very active in counter-drone electronic warfare (EW). To defeat Russian EW efforts, Ukraine is combining tactics and technology. Tactically, they are flying lower and seeking gaps in Russian EW coverage. They are also pursuing technology to increase autonomy in existing drones. The logical conclusion of this counter-measure process is full autonomy. Autonomous drones will not have the vulnerable radio link to pilots, nor will they need GPS guidance. Autonomy will also vastly increase the number of drones that can be employed at one time. Both the Harpy and the Shahed drones have demonstrated that it is possible to rapidly launch large numbers from trucks or containers. The era of the autonomous drone swarm has begun.

LAWs solve miscalc---they reduce human error and are more precise.

Nasu 22 (Hitoshi law professor at West Point, 6-21-2022, "Stop the "Stop the Killer Robot" Debate: Why We Need Artificial Intelligence in Future Battlefields," Council on Foreign Relations, https://www.cfr.org/blog/stop-stop-killer-robot-debate-why-we-need-artificial-intelligence-future-battlef ields, DoA 8/17/2022, //ejs squad)

Although the debates around lethal autonomous weapons systems are often framed as humanitarian issues, we should not lose sight of the significant humanitarian benefits that these systems are expected to bring to the battlefield. **Indeed, AI-enabled weapon system autonomy has the great potential to mitigate the risk of human error as an additional oversight tool to assist targeting operations. For example, on-board sensors feeding real-time images and information-sharing in swarms will provide additional technological means to verify military targets. This could enable autonomous systems to suspend the attack maneuver when those sensors detected the presence of civilians or mismatch of target information.** Further, their close combat capabilities reduce the need to use high explosives as the means of delivering lethal effects. Compared to conventional munitions, **autonomous systems will enable more accurate and**

LAWs are developed but NOT deployed due to technological limitations and countermeasures

--- prefer a Harvard policy brief > tech optimists.

Miller 21 [Steven E. Miller, Director of the International Security Program @ Harvard Kennedy School Belfer Center for Science and International Affairs, 3-10-2021, Nuclear Hotlines: Origins, Evolution, Applications, Journal for Peace and Nuclear Disarmament, https://www.tandfonline.com/doi/full/10.1080/25751654.2021.1903763#abstract, //ejs squad] Key Assessments:

The fully autonomous weapon systems envisioned for the defense of Taiwan are at least five years away from operational maturity and fielding. The research, development, and operational testing of advanced AI models and hardware needed for autonomous weapon systems have advanced significantly over the past several years. But, similar to the commercial development of autonomous vehicles, technology optimists often underestimate the technological and operational challenges of fielding fully autonomous weapon systems.

The United States is unlikely to utilize fully autonomous weapon systems against China's most likely strategy: a blockade of Taiwan. Given the risk of escalation and the inherent lack of transparency in advanced AI models, senior policymakers will likely limit the use of autonomous weapon systems in a blockade scenario to missions such as intelligence collection or the deployment of advanced smart mines.

Recent advances in counter-drone technologies will likely limit the efficacy of attritable semi-autonomous weapons and increase the urgency of developing fully autonomous weapons. Since late summer of 2024, the overall efficacy of autonomous platforms on the battlefield in Ukraine has diminished because of increasingly effective counter-UAV capabilities, including electronic warfare and GPS spoofing. Similarly, China's network of defensive capabilities, including anti-aircraft guns, directed energy, and jamming systems, would limit the efficacy of U.S. autonomous weapon systems in a conflict.

Replicator will fuel the U.S.-China security dilemma in the context of autonomous weapon systems. The U.S. fielding of autonomous weapon systems will likely stoke the production and fielding of autonomous platforms and defensive systems, or precipitate an arms race in autonomous weapons systems. This dynamic could ultimately favor Beijing due to its industrial capacity, strength in commercial drone manufacturing, lower production costs, and consistent disregard for international law.

Senior military leaders must continue to develop and exercise realistic, sophisticated concepts of operations for autonomous weapon systems that are fully integrated into any formal military plans for the defense of Taiwan. These plans will both drive operational innovation and bolster the requirements process necessary for the sustainable fielding of autonomous weapon systems. Without detailed concepts of operations, the production and fielding of autonomous weapon systems may stall.
The Department of Defense should prioritize accuracy and traceability over explainability due to the "black box" trade-off. Ideally, AI models for autonomous weapon systems would provide explanations for their decisions, but the advanced deep learning algorithms necessary for fully autonomous weapon systems are too complex to offer semantic explanations understandable to humans. Given these constraints, traceability and accuracy must take priority over explainability to ensure that autonomous weapon systems are effective in combat and comply with the law of armed conflict.

Limited real-world data will require the Department of Defense to manage the risk of using synthetic data for the development of fully autonomous weapon systems' advanced AI models. The Department of Defense must continue to identify and gather the data necessary to develop underlying AI models for autonomous weapon systems. However, limited real-world intelligence data from PLA exercises is not sufficient to train autonomous weapon systems for large-scale conflicts in the defense of Taiwan. Generative Adversarial Network models are useful for creating comprehensive synthetic environments to train autonomous weapon systems, refine the underlying AI model and its ability to identify targets, detect anomalies during missions, and navigate complex terrain.

Fielding fully autonomous weapon systems will require advancements in battery and edge computing technologies. Due to the challenges of exchanging information with cloud computing resources in denied electronic environments, autonomous weapon systems must utilize parallel computing on the edge. The advanced AI models used in autonomous weapon systems will also come with other limitations and drawbacks, such as high energy use, compelling developers to make trade-offs between speed, efficiency, and performance.

The Department of Defense's interpretation of international law will be embedded in the AI algorithms for fully autonomous weapon systems, effectively serving as a codification of the United States' approach to the laws of war. Fully autonomous weapon systems operating in denied electronic environments will need to independently interpret and apply the law of armed conflict, maritime legal regimes, and rules of engagement. The training process for autonomous weapon systems' AI models in these scenarios would represent the codification of the U.S. interpretation of the law. To ensure that fully autonomous weapon systems

operating without direct human oversight can reasonably interpret the law of armed conflict, the Department of Defense should assemble a team of experienced targeting specialists, military lawyers, scientists, and engineers to comprehensively incorporate legal training into AI model development.

China/Russia have Lethal Autonomous Weapons

Mehara 25 [Maya Mehrara, News Reporter at Newsweek based in London, U.K.. Her focus is reporting on international news. She has covered Ukraine, Russia, immigration issues, and the revolution in Iran. Maya joined Newsweek in 2024 from the Londoners and had previously written for MyLondon, the Camden New Journal, BUST Magazine, and Washington Square News. She is a graduate of New York University and obtained her NCTJ at News Associates, 1-2-2025, China and Russia forge major tech collaboration to challenge US, Newsweek, https://www.newsweek.com/china-russia-forge-major-tech-collaboration-challenge-us-2008502, //ejs squad]

In its nearly four-year war with Ukraine, **Moscow has used AI on the battlefield, as the Russians have utilized AI-powered anti-drone devices, and for military training, cyber warfare, and operations with unmanned systems,** according to the International Center for Defense and Security.

China, like Russia, has also been developing AI for combat purposes and has begun to develop fully autonomous AI-powered "killer robots." Beijing and Moscow have reportedly already begun to collaborate on developing AI

1. [A2 Myers 24] The entire card has no mention of generative AI, it only says that nations strive to dominate the AI race. Even then, the military contracts awarded to universities have no relation to AI being used, it's only about making new weapons. East reads blue

James Myers, 02-29-2024, [decades of experience in mathematical, geometric, philosophical, technological research] "Military Funding of AI Education: What Does the Future Hold for Today's Students?," Quantum Record, https://thequantumrecord.com/philosophy-of-technology/military-funding-of-ai-education/, accessed 2-28-2025 //cy

With the obvious advantages that artificial intelligence brings to military operations and weapons development**, major powers are investing heavily in educating** today's**students to be** leaders **in** the **AI-powered battlegrounds** of the future. **The military contest for** the best and brightest minds to advance technological war capabilities is increasing as nations strive to dominate in the global **AI** arms race and fear falling behind. The **competition** is playing out **on university campuses,** most prominently in the U.S. In 2022,**the U.S. Department of Defense** (**DoD**) **provided $195 million** in Multidisciplinary University Research Initiative (MURI) awards, funding 28 research teams for five years at 63 U.S. academic institutions. MURI **awards** have **allowed the discovery of "novel energetics**," which might refer to new **energy sources for weaponry, and** "materials with unprecedented **optical**,**thermal, and mechanical properties for a wide array of DoD application.**

2. [A2 Looi 05] **They cite "artificial intelligence in education" as if it refers to the general concept of AI in education, when in fact it's the name of a specific academic conference.**

Chee-Kit **Looi 05,** Professor Looi obtained his PhD in Artificial Intelligence from the University of Edinburgh, UK. His research focuses on learning sciences, computer-supported collaborative learning, mobile learning, AI in education, and computational thinking. He has had published more than 120 papers in international journal papers, as well as over 50 books or chapters, and produced 160 refereed international conference papers. He served as the President of the Global Chinese Society for Computers in Education from 2017 to 2019, 2005, "Artificial intelligence in education : supporting learning through intelligent and socially informed technology", Bentley University Library,

http://repo.darmajaya.ac.id/4072/1/Artificial%20Intelligence%20in%20Education_%20Supporting%20Learning%20through%20Intelligent%20and%20Socially%20Informed%20Technology%20%28%20PDFDrive%20%29.pdf, Accessed 3-28-2025, \\guadelajara

The 12th International Conference on Artificial Intelligence in Education (AIED-2005) is being held July 18–22, 2005, in Amsterdam, the beautiful Dutch city near the sea. AIED-2005 **is the latest in an on-going series of** biennial **conferences** in AIED **dating back to the mid-1980's when the field emerged from a synthesis of artificial intelligence and education research. Since then, the field has continued to broaden and now includes research and researchers from many areas of technology and social science.** The conference thus provides opportunities for the cross-fertilization of information and ideas from researchers in the many fields that make up this interdisciplinary research area, including artificial intelligence, other areas of computer science, cognitive science, education, learning sciences, educational technology, psychology, philosophy, sociology, anthropology, linguistics, and the many domain-specific areas for which AIED systems have been designed and built.