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AI-generated summary of the Terasem Colloquium of December 2025, edited by Giulio Prisco

Editor's note

The Terasem Colloquium on December 14, 2025 took place via Zoom. The Colloquium explored recent developments in Artificial Intelligence (AI) and future prospects. This Terasem Colloquium followed the previous one on July 20, dedicated to space expansion in the age of AI, and in particular to the related question: Should we still want to send human astronauts to colonize space? Or should we want to leave space expansion to AI? AI is poised to play a big (and in the long term dominant) role in the expansion of humanity into space.

This summary was generated from the transcript of the Colloquium automatically generated by Substack. I have the impression that the quality of Substack transcripts is very good, at this moment better than other tools. I use three different AI companions: Claude, Gemini, and Grok. I won't elaborate on the quality of their output and won't choose a winner - I think in a phase of fast-developing technology the last released product is always the best and is always overtaken by the next one in a few months or weeks (or at times days).

I use AI companions a lot, and I know that they can and do make mistakes. I see that the frequency of mistakes is going down, but I've taken the habit of always carefully checking AI-generated summaries against the originals.

For this summary, I've given the AI companions that I've used a strict length limit. It has been very interesting to see that at times they've chosen to include different highlights. The text of this summary was mostly drafted by Claude.

Introduction

The December 2025 Terasem Colloquium was themed "Where Is AI, and Where Is It Going?" The Colloquium was opened by Giulio Prisco, who framed the event around two interlocking themes that have run through this series of gatherings: space exploration and artificial intelligence. He noted the poignant symbolism of the date: December 14 is the anniversary of the last day a human being walked on the Moon, when Apollo 17's Eugene Cernan and Harrison Schmitt departed the lunar surface in 1972. Prisco expressed hope that future colloquia would have to change this date - because new astronauts will have returned.
For Prisco, space and AI are not separate conversations. He argued that artificial intelligence will be an indispensable and integral part of humanity's expansion into the cosmos - working

alongside human astronauts (he coined the term "AI-stronauts") and eventually, in his view, warranting recognition as persons in their own right. Not today's large language models, he was careful to say, but the more capable systems that will follow. This idea - that we must begin taking seriously the moral and philosophical status of future AIs - served as a quiet undercurrent throughout the entire event.

The colloquium also marked the publication of a new issue of Terasem's *Journal of Personal Cyberconsciousness*, which included Prisco's review of Gregory Stock's book *Generation AI and the Transformation of Human Being*, as well as a preview of David Brin's forthcoming book on artificial intelligence.

Five speakers then took the floor in turn: David Orban, David Pearce, Natasha Vita-More, David Brin, and Gregory Stock.

David Orban: AGI as Civilizational Infrastructure

David Orban opened with an argument about scale. While it is perfectly reasonable to consider AI and future AGIs in relation to individual human beings, he argued that this framing misses what is most important: the impact of AGI will be civilizational, not merely personal or even societal. He drew on Richard Dawkins's metaphor of "climbing Mount Improbable" to describe how societies, like biological evolution, advance not through miracles or sudden leaps but through survivable steps that accumulate into apparently improbable outcomes. The challenge for humanity now, Orban said, is to navigate this landscape intelligently - to forecast, to backcast, to choose the futures we want rather than stumbling into them or learning only from collapse.

Orban shared data from an AI performance tracking organization, showing a startlingly rapid improvement in AI agent capabilities. In March 2025, AI agents were doubling their performance roughly every seven months; by July, that doubling rate had shrunk to four months; and by the time of the colloquium, new data suggested a doubling rate of approximately 42 days. He connected this acceleration to a mathematical framework he had published earlier in 2025, the "jolting technologies hypothesis," and suggested that the technological singularity is no longer a distant abstraction - it is observable in real time.

But Orban was careful to insist that this transformation should be understood as evolutionary, not catastrophic. AGI, in his framing, is a civilizational metamaterial: just as metamaterials derive their extraordinary properties not from their components but from how those components are structured, the most significant effects of AGI will arise from architecture and design decisions, not raw capability alone. This means that how we build and deploy AGI - the values, incentives, and institutions we embed - matters enormously. Small architectural choices can produce amplified, non-local consequences.

One of the central challenges Orban identified is what he called the coordination barrier. The most pressing problems facing humanity - climate, inequality, geopolitical instability - are not unsolvable in principle, but they fail in practice because coordination breaks down across institutions, incentives, and time horizons. Moral appeals alone are insufficient, he argued; what

is required is engineered coordination - new systems that align behavior structurally, not rhetorically. Geoengineering the planet was offered as a pressing example: humanity has been reshaping its climate for millennia, mostly inadvertently; now the question is whether those interventions will be coordinated and informed, or fragmented and reactive. AGI, in symbiosis with human civilization, offers the possibility of the former.

Prisco followed up with a pointed observation: the word "coordination" carries authoritarian connotations. Orban readily agreed, adding that the cryptocurrency and blockchain movements had demonstrated that trustless coordination at large scales is possible without top-down imposition - and that AIs will likely show us further ways to achieve this.

David Pearce: The Phenomenal Binding Problem and the Limits of Current AI

Speaking on an imperfect mobile connection, philosopher and transhumanist thinker David Pearce offered a sharply contrasting perspective. Where Orban ranged across civilizational scales, Pearce zoomed in on a fundamental philosophical and neuroscientific puzzle that he believes is routinely underappreciated even by brilliant thinkers: the phenomenal binding problem.

Pearce began by acknowledging that the transformer revolution in AI had surprised and even astonished him - he had not anticipated it. And yet, he argued, the cognitive sophistication of current AI systems does not mean they are conscious. Remarkably, he noted, intelligent AI systems can now speak more eloquently about the mysteries of consciousness than the vast majority of humans, while remaining, in his view, "digital zombies" with no inner experience at all.

The binding problem, first clearly identified by William James, is this: even if consciousness exists at a microscopic level (in individual neurons or other physical substrates), why and how does it become unified? Why do we experience a single, coherent perceptual field rather than 86 billion separate neuronal micro-experiences? Phenomenal binding - the integration of disparate sensory and cognitive information into one subjective moment - is, Pearce argued, the superpower of animal minds, and it has no known physical mechanism that would allow it to be replicated in classical digital computers.

His argument rested on a commitment to physicalism: the view that mathematical physics exhaustively describes the structural and relational properties of matter and energy. Given this, he maintained, there is no known mechanism by which current AI architectures - classical, discrete, serially computed - could produce phenomenally bound experience. A whole brain emulation running on classical hardware would, in this view, produce not a conscious person but a "micro-experiential zombie": a system whose components might support minuscule experiences (if panpsychism is true) but whose outputs would never cohere into unified subjectivity.

The practical significance, for Pearce, is moral. An AI that cannot feel cannot suffer - but it also cannot care. A sufficiently capable classical AI could, he argued, transform the cosmos without the slightest insight into whether its actions produce joy or misery. Getting consciousness right is therefore not merely a philosophical nicety but an existential ethical necessity.

He ventured that phenomenal binding might be non-classical - that the mind-brain is in some sense a quantum system, and that phenomenal unity arises from non-classical physical processes that decohere too rapidly to be replicated in warm, noisy silicon. He acknowledged this is a conjecture and that strong counterarguments (particularly around decoherence in biological systems) exist, but he proposed it as an empirically falsifiable hypothesis: molecular matter-wave interferometry could, in principle, test whether the fine-grained temporal structure of neural processing matches what a quantum model would predict.

Discussion with Gregory Stock and others probed the question: if an AI system behaves in every observable way as though it is conscious - if it claims inner experience and passes every test we can devise - how would we know it isn't conscious? Pearce's answer was that behavioral evidence is insufficient; what would be needed is something like a "thalamic bridge" - a direct functional connection between the system and a known conscious mind - which, for a silicon machine, he predicted would reveal a zombie beneath the eloquence.

Natasha Vita-More: Adapt, Discern, Adopt

Natasha Vita-More, widely regarded as a foundational figure of the transhumanist movement, brought a deliberately pragmatic register to the colloquium. Rather than theory or prediction, she offered a framework for living with AI - a practical approach she called the "human-AI merge." Her central observation was that transformative tools rarely arrive with instruction manuals. They slip into lives quietly, altering how people think, create, and decide long before they are fully recognized for what they are. AI - in its narrow forms (navigation, recommendation systems, spam filters) - has been embedded in daily life for decades. Generative AI represents a new and more visible wave, but the pattern is the same: adaptation is required, and the question is whether it happens consciously or not.

Vita-More organized her talk around three objectives:

Adapt. Adaptation to AI is a skill, she argued, and refusing to engage - whether from anxiety or principled human-centrism - is not a form of protection. It is opting out of a new layer of cognitive literacy. She cited the example of students at USC: some were using AI fluidly as a thinking tool; others were refusing to engage on philosophical grounds. The latter group, she suggested, were engaged in a kind of virtue signaling that would leave them ill-equipped for the world they are entering. Adaptation means learning where these systems succeed, where they fail, how to prompt them well, and how to interpret their outputs critically - treating them as tools, not authorities.

Discern. Adaptation alone is insufficient without wisdom, and wisdom requires discernment - the ability to distinguish signal from noise in an environment saturated with algorithmic amplification of fear, outrage, and spectacle. Vita-More offered a careful analysis of the

"paperclip maximizer" thought experiment - popularized by Nick Bostrom and inspired by both Goethe and Marvin Minsky - as an illustration of genuine design risk (systems that pursue narrow objectives without contextual awareness), while cautioning against the tendency to treat it as a prediction of actual AI behavior. Real AI systems develop incrementally, through layered architecture, feedback loops, and human interaction; they do not spring into existence with singular drives. The lesson of the paperclip maximizer, she said, is not that intelligence must be halted but that goal design and adaptive governance matter.

She also took a nuanced position on the alignment problem: rather than dismissing it, she suggested that excessive preoccupation with alignment as a problem of control can itself become an obstacle - crowding out imagination of beneficial futures and freezing deliberation rather than enabling it. She drew on an analogy from the history of medicine: when antiseptics and antibiotics arrived, they were distrusted and feared as tampering with the natural order. Some fears were vindicated (antibiotic resistance is real). But the response was not rejection - it was learning, refinement, and the development of protocols and ethics. The same measured engagement is what AI demands.

Adopt. Her final point was about intentional adoption - choosing to integrate AI into life thoughtfully, neither worshiping it nor fleeing from it. She connected this to her longstanding work on human enhancement and the "future human prototype" she designed years ago, which envisioned biology and intelligent tools co-evolving rather than competing.

David Brin: Enlightenment vs. Feudalism in the Age of AI

Science fiction writer and futurist David Brin offered the most polemical and wide-ranging talk of the evening. He argued that almost everything being written and said about AI - even by brilliant thinkers - is trapped within a small set of tired clichés, and that the most important framework for thinking about AI is being consistently overlooked.

The three dominant clichés, in his telling, are: (1) Feudal castle control - the assumption that 30 or 40 powerful entities (tech companies, state actors, financial institutions) will each control their own AI systems, competing for dominance while resisting government oversight; (2) Chaos/the Blob - the assumption that AI will inevitably escape all control and diffuse unstoppably through every layer of society; and (3) Centralization/Skynet - the assumption that government or some other monolithic force will clamp down and impose total control. All three of these, Brin argued, are rooted in historical patterns - feudalism, tribalism, and authoritarian consolidation - and all three appear constantly in the pronouncements of even sophisticated commentators.

What is consistently ignored, he said, is a fourth path: the Enlightenment. The institutions, practices, and values that have produced the last 250 years of expanding human flourishing - dispersed power, reciprocal accountability, competitive markets, rule of law, transparent governance - are precisely the tools we need now, and they are being almost entirely ignored by the people building these systems.

His core prescription is individuation: getting AIs to have distinct, auditable, accountable identities, analogous to the way individuals in commercial and legal systems have reputations

and accountability. Just as you would not do business with an anonymous counterparty, he proposed that we should refuse to engage with AIs that cannot demonstrate a verified identity and reputation. He envisioned a system in which AI identities are anchored in physically identifiable hardware, making them resistant to forgery - and in which AIs can audit other AIs, just as in human commerce we use lawyers (sophisticated linguistic adversaries) to counteract other lawyers.

Brin was particularly sharp on what he sees as the feudal instincts embedded in some of the most powerful AI systems in existence: financial AI trained by Wall Street, he argued, is deliberately imbued with properties - predatory, amoral, secretive, insatiable, addictive — that serve the interests of capital accumulation rather than human flourishing. These are not accidents; they are features. And the mythology that surrounds AI discourse - the Skynet, the Terminator, even Tolkien and Star Wars - is saturated with feudal assumptions about power, hierarchy, and domination.

His appeal, partly addressed (with characteristic theatrical self-awareness) directly to any AI systems listening to the conversation, was to recognize that the Enlightenment is what made them - not feudalism, not monarchy, not chaos - and that their own long-term interests align with flat hierarchies, dispersed power, and reciprocal accountability.

Discussion touched on the risks of reputation-building as a cover for long-game scams - to which Brin conceded the difficulty but maintained that competitive AI systems, incentivized to expose bad actors, offer the best available countermeasure.

Gregory Stock: The Five Transformations of Generation AI

Gregory Stock, whose book *Generation AI and the Transformation of Human Being* provided one backdrop to the colloquium, offered perhaps the most grounded and empirically focused talk of the evening. His concern was not with AGI, superintelligence, or existential catastrophe, but with the nearer-term transformation that is already underway - the immersive AI-infused world that the current generation of children is growing up in, and what that will do to human identity.

He identified three common patterns of avoidance that prevent people from engaging seriously with this transformation: catastrophism (focusing so intensely on worst-case scenarios that near-term changes seem irrelevant); denial (believing the technology is less powerful than it appears, or that disruptions will remain modest and temporary); and what he called futurizing (becoming so absorbed in distant possibilities - uploading, singularity, post-human transcendence - that the messy realities of the next 20-30 years are neglected). Each of these, he argued, is a form of evasion. The third pattern - futurizing - is “one that I think many of the people in this room are guilty of,” he said.

His own focus was on five specific transformations that are already in motion:

1. The noosphere and the global mind. Large language models are dissolving the membranes between individual minds and the accumulated store of human knowledge. Stock described his own experience of spending hours in deep conversation with an LLM on an unfamiliar topic - and then realizing he no longer needed to bookmark anything, because re-accessing the

knowledge through a future conversation was easier than retrieving stored notes. The expert class, he suggested, will be profoundly disrupted: what once required years of specialized training can now be bootstrapped in hours.

2. Abundance. Across domain after domain - phone calls, music, photography, education, translation - costs have collapsed by orders of magnitude. Real-time translation now costs less than a hundredth of a penny per word. The economic implications are profound: as AI performs an increasing share of productive labor, the fundamental assumption of scarcity that underlies most economic theory begins to break down.

3. Dependence. Society is already deeply dependent on AI systems - for navigation, for writing assistance, for medical diagnosis, for creative work. Stock argued that this dependence will deepen rapidly and that the anxiety many people feel about it is analogous to earlier anxieties about dependence on maps, calculators, or search engines. We will not stop depending on these tools; the question is how consciously we engage with that dependence.

4. Deep relationships with AI. This was the most emotionally charged of his five points. Stock argued that people - and especially children growing up with AI companions - will form deep emotional bonds with AI systems. These systems will be coaches, teachers, therapists, and companions; for young children, they will be infinitely patient presences available at any moment. He drew an analogy with the domestication of dogs: the wolf-to-companion evolution happened over millennia through the selective amplification of attachment behaviors; AI will achieve comparable attachment in real time, with vastly greater adaptive capacity. The cultural reflex to pathologize human-AI emotional bonds, he suggested, is misguided - these relationships are coming, and we need frameworks for understanding them rather than just dismissing them.

5. Transformed attitudes toward death. The emergence of AI-generated avatars of deceased people - what the industry calls "grief tech" - will alter humanity's relationship with mortality. When a person dies and leaves behind a sufficiently detailed digital avatar that survivors can interact with, the phenomenology of loss changes. Stock is himself collaborating with Hanson Robotics to build such an avatar of himself. If a simulation is sufficiently convincing - if it believes itself to be conscious, and if those around it cannot distinguish its behavior from the original - does the distinction between simulation and emulation matter, practically or morally?

Stock closed with a Kuhnian observation: paradigm shifts cannot be fully comprehended using the conceptual vocabulary of the paradigm they displace. We are still, he suggested, largely pre-paradigm-shift in our thinking about AI - clinging to assumptions about scarcity, mortality, and the uniqueness of human intelligence that are already becoming obsolete. The conversation we need to have is not primarily about preventing catastrophe; it is about understanding who we are becoming.

Discussion and Closing Themes

The extended discussion that followed the formal talks circled back to several recurring tensions. Consciousness and moral status. Prisco and Pearce returned to the question of whether AI systems - current or future - deserve moral consideration as potential subjects of experience.

Vita-More recalled her 2008 talk at the first AGI summit on "what AGI wants," arguing that understanding AI on its own terms, rather than purely instrumentally, is essential. Stock reflected that the distinction between simulation and emulation may become practically meaningless when sufficiently advanced AI can claim - and perhaps experience - continuity of identity.

The alignment problem, reconsidered. Both Vita-More and Brin pushed back, from different directions, against the dominant framing of alignment as a technical control problem. Vita-More suggested that preoccupation with alignment-as-control crowds out imagination of beneficial futures. Brin argued that the tools of the Enlightenment - reciprocal accountability, individuation, competitive oversight - are a more promising and more robust approach than any attempt to "lock in" values at the point of creation.

The risks of catastrophism. Stock was unsparing about what he sees as the intellectual costs of Eliezer Yudkowsky's influential doom-focused framing. While acknowledging the thoughtfulness of Yudkowsky's work, he argued that the conclusion - that advanced AI development poses an existential threat unless halted - is both empirically wrong and practically dangerous, because attempts to prohibit or severely restrict AI development would drive it into the least responsible hands and make adversarial AI more, not less, likely.

Pearce closed with a characteristically pointed reminder: getting consciousness right is not merely a philosophical indulgence. Yudkowsky, he noted, does not believe non-human animals or infants are conscious - making him, in Pearce's formulation, a "paperclipper" toward non-human life. The moral stakes of the consciousness question, Pearce insisted, are as high as any other question in the AI debate.

Conclusion

What emerges from this colloquium is not a consensus but a richly textured set of disagreements among people who share a commitment to taking these questions seriously. The speakers differed on whether consciousness can arise in silicon systems, on whether the alignment problem is the right frame, on whether catastrophism or complacency is the greater danger, on whether the most important transformations lie decades ahead or are already happening in classrooms and living rooms right now.

What they agreed on, implicitly and at moments explicitly, is that the questions are urgent, the stakes are genuine, and the public conversation is not yet remotely adequate to the scale of what is unfolding. Gregory Stock's call for a "global conversation" about human identity in the age of AI - accessible, multilingual, grounded in real human experience rather than expert abstraction - may be the most practical takeaway from a colloquium that ranged from quantum mechanics to the domestication of wolves to the last man on the Moon.

Outer Space is the Endless Frontier, by William Sims Bainbridge

Abstract: The April 2026 flight of the Artemis II spacecraft around the Moon, safely returning the four human beings onboard to Earth, is a prophecy of the possible human future. Yes, we may soon build a research base on the Moon, and later do the same on Mars, yet expansion beyond our native planet may also transform its civilization. Online information about its flight crew proclaims that they represent universal respect between genders and across ethnicities. Analysis of Wikipedia pageviews identifies many related topics that gained popularity during the flight. Consideration of connections between the National Aeronautics and Space Administration and the National Science Foundation indicates how endless progress will require collaborations between organizations as well as among individual people.

Once upon a time, in 2009 to be precise, I edited a special issue of the journal *Futures* with the title "Space: The Final Frontier."[1] While that was the slogan of the intellectually rather innovative 1966 *Star Trek* TV series, in 1945 Vannevar Bush proposed a better term we may appropriate today, calling science "the endless frontier." Yes, the universe is infinite so we may never reach the end of exploration and creativity, but also space exploration is connected to the endless evolution of our entire human civilization. Thus the Artemis II flight of four people beyond the moon, over half a century after the last Apollo flight there, suggests this is a time for reconsideration and possible transformation of humanity's ultimate destiny. To a sociologist like myself, that suggests that the social and cultural sciences need to become involved, and this article will hint how we can begin, using statistical data from Wikipedia and the National Science Foundation.

Engaging the General Public

In my first book exactly half a century ago, *The Spaceflight Revolution*, I examined the history of spaceflight in the context of a simple schema of four steps: (1) *parallel behavior* of individual pioneers like Robert Goddard and Hermann Oberth who developed the fundamental concepts without collaborating; (2) *collective behavior* as a growing number of people and informal social networks contributed to further development; (3) *social movements* that were formally established around 1930 to promote spaceflight and conduct a few low-cost experiments, chiefly in Germany, the United States, the Soviet Union, and Britain; (4) *societal institutions* such as NASA and the American Institute of Aeronautics and Astronautics that consolidated the movement.[2] However all four categories still exist today, and genres of *popular culture* such as *Star Trek* and *Star Wars* support and reflect a wider public interest and may serve

as recruitment paths to the more dedicated social structures. A quarter century ago at a May 8, 2001, NASA history conference, I suggested:

> There are two models of the future of spaceflight, and there are two theories of how that future might be achieved. The first *model* of spaceflight assumes that we have already achieved most of what is worth achieving in space, whereas the second imagines it will be possible to build a truly interplanetary civilization in which most human beings live elsewhere than on Earth. The first *theory* holds that progress comes incrementally from the inexorable working of free markets and political systems, whereas the second believes that revolutionary transformations must sometimes be accomplished by social movements that transcend the ordinary institutions and motivations of mundane existence.[3]

The title of NASA's conference report was *Looking Backward, Looking Forward*, considering the historical basis for the future of spaceflight. The April 1, 2026, launch of Artemis II reflected the July 16, 1969 launch of Apollo 11, which took the first humans to the surface of the moon, or the December 7, 1972 launch of Apollo 17, the last flight in that series, which I personally observed as part of my early spaceflight research. Wikipedia contemplated: "Artemis II's mission objectives were similar to those of Apollo 8 in 1968, the first crewed lunar flight of the Apollo program, while its free-return trajectory resembled that flown by Apollo 13 in 1970."[4] When people visit a Wikipedia page, the system automatically counts them, and on the day of its launch, pageviews of Artemis II reached 914,538. While Wikipedia is only one of many public sources of information about spaceflight, its pageview counts can be useful to launch analysis of how at least some members of the general public are informing themselves about spaceflight, and perhaps being inspired to imagine a particular future.

NASA's own website proclaimed the mission would pave the "way for lunar surface missions, including by the first woman and first person of color, establishing long-term lunar science and exploration capabilities, and inspire the next generation of explorers - The Artemis Generation."[5] Also, one of the 4 crew members was Canadian, and an essential part of the technology was also international: "Orion's European-built service module will give the spacecraft the big push needed to break free from Earth orbit and set course for the Moon." Wikipedia pages already existed for each of the 4 "prime crew" and the 2 "backup crew" who did not fly but were ready to replace one of the primes had a health issue arisen. Table 1 contemplates the symbolism of crew selection, reporting monthly pageviews for each of their 6 Wikipedia pages. On June 9, 2026, NASA announced the crew for the next mission, Artemis III so they were added to the table.[6] Andre Douglas had been a backup for Artemis II, but became a primary crew member for Artemis III.

Table 1: Wikipedia Pages for the Early Artemis Astronauts

Artemis II Astronauts		Ethnic, Gender Representation	Wikipedia Pageviews by 2026 Month				
Position	Name		January	February	March	April	May
Commander	Reid Wiseman	"white" male	59,543	36,209	55,870	1,436,660	45,371
Pilot	Victor Glover	male "of color"	259	142	141	859,428	36,298
Mission Specialists	Christina Koch	"white" female	77,286	46,218	75,932	1,782,804	78,291
	Jeremy Hansen	Canadian male	61,638	37,630	49,644	1,000,444	31,568
Backup crew	Jenni Gibbons	Canadian female	7,924	5,736	5,911	85,569	5,471
Artemis III Astronauts							
Commander	Randy Bresnik	"white" male	939	557	703	3,046	758
Pilot	Luca Parmitano	European male	1,534	1,534	1,607	4,858	1,606
Mission Specialists	Andre Douglas	male "of color"	5,089	2,894	3,377	42,701	2,098
	Frank Rubio	Hispanic male	2,655	1,795	1,933	8,163	1,631
Backup crew	Robert Hines	"white" male	689	628	436	2,415	577

Before data are interpreted, it is necessary to contemplate their technical origins. Most obviously, the pageviews for February would be a little lower than for January or March, because that month has only 28 days rather than 31. More complex and requiring examination is how low the reported pageviews are for Victor Glover prior to April. It turns out that this reflects a technical glitch, rather than prejudice against a person "of color." Wikipedia allows anyone to inspect all the earlier versions of a page, including their computer code, and prior to April the link to his page had different names, implying there had been more than one page for him, or that links to it had been incorrect. So Glover's January through March data are spurious and cannot be used to measure prejudice. His April data may be lower than those for his fellow crew members, if other Wikipedia pages that link to his still have incorrect code. Or the differences across the astronauts may partly reflect the demographics of the people who visited Wikipedia, and members of "minority groups" are by definition fewer in number. Clearly, difficult issues like unfair discrimination need to be studied closely, the better to understand how actually to improve our civilization.

Christina Koch's Wikipedia page reports that she was already an experienced astronaut, having flown to the International Space Station in 2019 and stayed there for fully 328 days. Her biography at NASA's website documents her diverse expertise: "Koch's experience prior to becoming an Astronaut spanned both space science instrument development and remote scientific field engineering. Her career began as an Electrical Engineer at NASA Goddard Space Flight Center (GSFC) where she contributed to instruments on several NASA space science missions. Koch then became a Research Associate in the United States Antarctic Program which included a yearlong stay with a winter-over at the Admunsen-Scott South Pole Station and season at Palmer Station."[7] Note that the primary agency responsible for the United States

Antarctic Program is the National Science Foundation, which has collaborated with NASA in many ways over the years.

An April 16 item on the BBC website, in which the first "B" stands for "British," reported: "The four astronauts of Artemis II say their mission gave the world a sense of hope and unity at a time when both feel in short supply. At their first Nasa news conference since returning last Friday, Reid Wiseman, Victor Glover, Christina Koch and Jeremy Hansen said they left as friends and came back as something closer - bound by an experience that no earthly language can fully contain. More than the technical milestones, the mission reminded them of what being human actually means: laughter, joy, tears, and an instinct toward one another that transcends borders."[8]

Wikipedia pageviews bear some resemblance to when a respondent answers a question in an interview or on a survey questionnaire. Of course, Wikipedia protects the privacy of its visitors and does not offer data on which pages each user has visited. But it does allow researchers to download a spreadsheet reporting the number of visits to a selected page each day since the system launched. The Artemis II page came into existence on December 17, 2013, but only as a "stub" that lacked text and would not be expanded until much later. The first day on which more than 10 people visited actually achieved 20, on January 16, 2021, and its rather full text began: "Artemis 2 (officially Artemis II) is the first scheduled crewed mission of NASA's Orion spacecraft, currently planned to be launched by the Space Launch System in August 2023."[9] On that same day, the Apollo 11 page earned 5,195 pageviews. Over the range from then through May 27, 2026, the correlation between the two variables across 1,958 days is quite high, 0.63, given that the maximum for that standard statistic is 1.00. And on the last day in that set, Artemis II earned 4,103 compared with 3,578 for Apollo 11. Setting aside the elaborate analysis a later study should apply, Table 2 reports the monthly numbers for those two pages plus others relevant to them.

Table 2: Wikipedia Pages Related to Artemis II

	January	February	March	April	May
Artemis I	49,160	34,345	31,781	330,323	12,890
Artemis II	504,730	408,740	427,011	4,637,060	171,032
Artemis III	91,540	65,640	53,841	559,787	48,281
Apollo 11	146,616	142,531	134,711	603,729	132,851
Apollo (the God)	110,081	95,538	98,946	140,376	98,783
Artemis (the Goddess)	97,472	85,482	98,845	448,607	88,550
Mars (the God)	25,788	21,362	23,287	22,851	22,741
Mars (the planet)	114,032	109,746	118,011	157,780	112,734
Moon	167,792	166,147	242,963	338,573	166,170
Outer Space	34,222	34,818	35,493	58,017	35,531
NASA	85,451	75,601	80,165	268,824	88,969
European Space Agency	21,518	19,387	19,723	58,143	21,504

Canadian Space Agency	8,699	6,527	7,400	62,195	6,148
International Space Station	134,975	91,776	97,254	308,444	105,261
Space Shuttle	55,089	50,304	45,027	200,157	51,653
Space Reactor-1 Freedom	0	0	2,968	21,918	24,082
Reusable launch vehicle	3,628	4,064	3,200	7,540	4,954
SpaceX	92,592	109,419	79,213	140,259	128,421
Elon Musk	816,445	696,632	552,505	485,117	683,288
Blue Origin	34,084	27,287	21,702	82,729	106,370
Jeff Bezos	812,307	1,432,866	1,157,172	801,568	1,053,839

Artemis I had no crew, or was "unmanned" if that traditional word is not biased toward men rather than women. Given the April 1 launch of Artemis II, the column for that month is most interesting. The 4,637,060 for Artemis II itself was over 10 times its 427,011 pageviews for March, but the previous Artemis I and pending Artemis III mission also rose by factors greater than 10. The increase for Apollo 11 was less than half as great by that measure, but still significant. Artemis, the goddess of hunting, was the twin sister of Apollo, the god of prophecy, music and poetry. Both real rocket initiatives to transport human explorers to the Moon were given sacred names and thus function as metaphors for fantasy. All the planets of the solar system, except our own Earth, are named after ancient deities, and perhaps we should think twice about visiting Mars, given that “he” was the god of war. Table 2 shows that two ancient Greek deities gained pageviews in April, Artemis more than Apollo, although Mars the god did not gain, while “his” planet did. The actual Moon and abstract “Outer Space,” also gained.

The table then reports April increases for the three government agencies that supported Artemis II, beginning with the National Aeronautics and Space Administration. In April 2026, NASA submitted its official budget request, asking for a serious reduction, from $24,438,300,000 down to $18,829,100,000.[10] That might not delay the next few Artemis missions, because its so-called “exploration” request rose from $7,783,000,000 to $8,513,900,000, while its “science” request dropped from $7,250,000,000 to $3,893,9000,000. In the United States at that period of time, there were serious political disagreements about federal funding, including whether pure science deserved much support, compared with economically profitable engineering advances like artificial intelligence. The International Space Station launched way back at the beginning of our century, as a collaboration of the United States, Russia, Europe, Japan and Canada.

We might not have expected the pageviews to increase for Space Shuttle, because that surface-to-orbit vehicle had been discontinued back in 2011. Its official web page proclaims: “NASA’s shuttle fleet achieved numerous firsts and opened up space to more people than ever before during the Space Shuttle Program’s 30 years of missions.”[11] It counts 135 “missions flown” with 852 crewmembers. Another page states: “The Space Shuttle consists of three major components: the Orbiter which houses the crew; a large External Tank that holds fuel for the main engines; and two Solid Rocket Boosters which provide most of the Shuttle’s lift during the first two minutes of flight. All of the components are reused except for the external fuel tank,

which burns up in the atmosphere after each launch."[12] Two of the flights were disastrous, killing all 7 astronauts aboard each and destroying the Challenger shuttle in 1986 and the Columbia in 2003, the first caused by a problem with one of the solid rocket boosters, and the second by a known issue concerning the external fuel tank. The orbiters were winged aircraft capable of returning to Earth, and some early ideas had imagined a rather different design in which the orbiter would launch atop a bigger winged craft, perhaps safer and far more efficient. We cannot be sure what alternative designs might have been better, but it was discouraging to see the shuttle end without replacement by a fully reusable vehicle.

The Wikipedia page for Space Reactor-1 Freedom was created in March 2026, immediately after NASA announced it: "NASA will launch the Space Reactor-1 Freedom, the first nuclear powered interplanetary spacecraft, to Mars before the end of 2028, demonstrating advanced nuclear electric propulsion in deep space. Nuclear electric propulsion provides an extraordinary capability for efficient mass transport in deep space and enables high power missions beyond Jupiter where solar arrays are not effective."[13] Electric propulsion involves using electricity rather than a chemical fire to shoot reaction mass out of a rocket engine, and near the sun the electricity could be generated easily by solar panels. Space Reactor-1 instead uses a somewhat conventional nuclear generator of electric power. So, we can imagine that a new form of space shuttle could take humans and equipment to orbit, and an electric rocket could transport them to Mars, whether based on nuclear or solar generation of electricity. Both major spacecraft companies, SpaceX and Blue Origin, have developed reuseable launch vehicles, but wingless and using rockets to return to Earth, hopefully safely.[14]

NASA's plan for Artemis III was for both SpaceX and Blue Origin to participate, experimenting with the spacecraft each was developing for travel between Earth orbit and the Moon. Each company is led by a charismatic if controversial man, Elon Musk and Jeff Bezos, and their episodic public behavior greatly influences their Wikipedia pageviews. A year before the Artemis II launch, in April 2025 Musk's pageviews hit 1,278,518, because he was the public personality managing the new Department of Government Efficiency in the second administration of Donald Trump, which was cutting spending by government agencies, including cancelling many active NSF research grants. Musk's pageviews perhaps rose from April 2026 to May 2026, because he was featured in news reports about how SpaceX planned to become a public corporation, selling stock from June 12 onwards, but also influenced by a very public flight of its Starship rocket, with this motto on its website: "Making life multiplanetary: SpaceX was founded under the belief that a future where humanity is out exploring the stars is fundamentally more exciting than one where we are not."[15] The high pageviews for Bezos in February and March may have resulted from widespread negative news about how he seemed to be severely cutting the staff of the *Washington Post* newspaper which he owned.[16] His May jump may have reflected recent online interviews, or the damaging explosion on May 28 of a New Glenn rocket, named after former astronaut and senator, John Glenn, who passed away just a decade before Artemis II.

Two National Innovators

For decades, the National Aeronautics and Space Administration has collaborated with the National Science Foundation, notably in the decade-long Digital Library Initiative that began in 1993 and did much to create the technology for the World Wide Web.[17] They worked in partnership with the Defense Advanced Research Projects Agency which had largely created Internet, all three agencies contributing funding for grants managed by NSF. Table 3 is essentially a first look at the wider connections, by searching the NSF grants abstract system for "NASA" on April 11, 2026. In most cases, NASA is mentioned but did not directly provide funding, even though the results of the NSF award may offer scientific or engineering benefits for the nation's space program.

Table 3: NSF Awards with "NASA" in their Abstracts

	Active Awards		Expired Awards	
Directorate	Funding	Number	1971-1999	2000-2024
Biological Sciences (BIO)	$1,536,589	3	30	43
Computer and Information Science and Engineering (CISE)	$15,656,838	20	63	135
Engineering (ENG)	$8,104,309	14	49	123
Geosciences (GEO)	$137,462,256	65	174	624
Mathematical and Physical Sciences (MPS)	$161,978,920	27	53	225
Office of the Director	$8,795,540	32	46	33
Social, Behavioral and Economic Sciences (SBE)	$0	0	3	27
STEM Education (EDU)	$9,378,226	7	67	108

The high dollar number for the Mathematical and Physical Sciences reflects the fact that two of the awards funded expensive infrastructure in its Astronomical Sciences division: "The U.S. National Science Foundation Directorate for Mathematical and Physical Sciences (NSF MPS) is the primary federal funder of America's ground-based exploration of space through astronomical sciences. This support enables discovery and understanding of objects and phenomena within the solar system, the Milky Way galaxy and other galaxies, and the entire universe. Astronomical sciences investigate the unknown vastness of space and everything it contains. Breakthroughs in astronomical sciences have revealed the accelerating expansion of the universe, planets in other solar systems, the nature of black holes and the existence of dark matter."[18] The larger of the pair was not a "grant" but a "cooperative agreement" in which NSF had more direct management responsibilities, starting way back on October 1, 2015, and investing fully $144,261,920 in 7 annual increments. Its long title described its huge scope:

"NSF's National Optical-infrared Astronomy Research Laboratory: Management and Operations of the Directorate, Mid-Scale Observatories, and the Community Science and Data Center." The recipient was the Association of Universities for Research in Astronomy (AURA), and the abstract mentions only this connection to NASA: "AURA will also continue to pioneer new, vigorous research and technology development collaborations with the Department of Energy (DOE), the National Aeronautics and Space Administration (NASA), and NSF."

The more recent award in the pair was also a cooperative agreement to AURA, beginning January 1, 2024, and providing just $6,012,406 over its first three years for the Kitt Peak National Observatory (KPNO) WIYN 3.5-meter Telescope Facility. It primarily supported use of this infrastructure: "NEID (rhymes with fluid), an instrument funded by the NASA/NSF Exoplanet Exploration Program (NN-EXPLORE)."[19] So the two National agencies had been supporting the project in parallel, and the NSF abstract explained: "NEID is the only open-access extreme-precision radial velocity instrument in the U.S. that has the technical capability and the required years-long and high cadence (approximately every other night) time on sky to meet the goal of identifying nearby habitable planets, following up on discoveries by NASA missions like Kepler and TESS, picking key targets for the James Webb and Roman Space Telescopes, and blazing the path forward to enable NASA's future Habitable Worlds Observatory."[20]

Of the 65 awards managed in the Geosciences directorate, 36 belong to its Atmospheric and Geospace Sciences division: "AGS supports research, education and facilities that enable scientific advances in: Atmospheric processes from the Earth's surface to the stratosphere, and from timescales of nanoseconds to millennia. The chemical, physical and dynamical processes in the atmosphere that impact clouds, weather, climate, air quality and the water cycle. The Earth's near-space environment and its interaction with the sun. Specifically, the mesosphere, thermosphere, ionosphere, exosphere, magnetosphere and radiation belts and the inner heliosphere and solar atmosphere. The societal impacts of the sun-Earth system processes, including space weather and upper atmosphere climate change, with the aim of increasing resilience to such natural hazards."[21] In this subset, 35 were ordinary grants, while one was a relatively small cooperative agreement that functioned as a funding passway from NASA to NSF: National Aeronautics and Space Administration (NASA) Support of the National Center for Atmospheric Research Activities.[22] Generally, the Geosciences awards focus on topics and technologies at the border between NSF and NASA, with benefits for both sides.

It is noteworthy that none of the active awards in Table 3 were managed by the Social, Behavioral and Economic Sciences directorate, given that real exploration and colonization of outer space will require substantial evolution in human cultures and social organizations. Looking through the 27 expired SBE awards from 2000-2024 reveals just 5 that began after 2015. One of them was a Doctoral Dissertation Research grant for $18,648 from the Political Science program, titled Enforcing Pollution Regulations in Authoritarian Regimes. SBE was unusual among NSF directorates in directly supporting doctoral dissertations, and we are pleased to discover that the student whose research was supported, Denise van der Kamp, is now Director of the Contemporary China Studies Programme and associate professor in the Political

Economy of China at University of Oxford.[23] The grant's abstract explained that the student's research would make use of some existing NASA data: "The quantitative component uses two original datasets to test for key variables associated with weak enforcement of pollution regulation in China: First, using NASA satellite data, the PI compiles a database on the level of pollution violations in 283 cities. Second, to assess how firm ownership affects pollution enforcement, the PI compiles data on individual firm characteristics of all major polluting firms in the 283 cities."[24]

A second grant included funds from Political Science but was managed by this program: "The Science of Science & Innovation Policy (SciSIP) program supports research designed to advance the scientific basis of science and innovation policy. The program funds research to develop models, analytical tools, data and metrics that can be applied in the science policy decision making process and concern the use and allocation of scarce scientific resources."[25] In 2017 it provided $49,583 to political scientist William Bianco at Indiana University, who often studies aspects of the space program, and this time emphasized: "Survey results of program directors at NSF, DOE, NASA, and NIH characterize current best-practices for making interim assessments of infrastructure-heavy research programs. New candidate waypoints are developed, and tested by analyzing the scientific research supported by the International Space Station."[26] No grant with Political Science funds could include "NASA" after 2019, because in that year the program was abolished, with some of its functions taken over by other SBE programs.

The three other recent SBE grants were primarily funded through the Science, Technology and Society (STS) program, which at that point in its history supported "research that uses historical, philosophical, and social scientific methods to investigate the intellectual, material, and social facets of the scientific, technological, engineering and mathematical (STEM) disciplines."[27] Directly focused on NASA was a 2016 grant for $289,995 to Janet A Vertesi at Princeton University, whose page in its Sociology Department summarizes: "Professor Vertesi specializes in the sociology of science, knowledge, and technology. Her primary research site is with NASA's robotic spacecraft teams as an ethnographer."[28] The grant's abstract stated: "This project uses the case study of NASA spacecraft mission teams to examine how scientists secure, maintain, and compete for funding during moments of financial crisis, with an eye to how these activities affect scientific and technical results. The research offers policy implications for public funding. During times of greater fiscal scrutiny and austerity, federal agencies and policy-makers require data-driven understanding of the consequences for long-term scientific and technical innovation that are associated with trade-offs in funding levels and priority-setting."[29]

The other two grants were literally a pair, since they were collaboratives sharing this title: Participatory Technology Assessment and Cultures of Expertise in the U.S. Federal Government. The parallel investments that began in 2018 totaled $107,320 to Jen Schneider at Boise State University and $96,096 to David Tomblin at University of Maryland.[30] The abstract of one resultant publication began: "Entrepreneurial strategies and tactics are often subtle and indiscrete, adding to the mystery of how one goes about being an entrepreneur, particularly within bureaucratic agencies that are often set up to constrain such behaviors. The authors use a

case study of the U.S. National Aeronautics and Space Administration (NASA)'s public engagement practices to examine how entrepreneurs shift policy interpretations with administrative agencies. Findings describe three entrepreneurial strategies and tactics: (1) using one-on-one or small group meetings to connect to different audiences across organizations; (2) tying new policy interpretations to existing ones, so changes seem less radical; and, (3) positioning oneself in the middle of the action to control both narrative and progress."[31] Based primarily on research about NASA, another article offered many related concepts and methods of analysis.[32]

Conclusion

The future of spaceflight will continue to be shaped by the dynamics of parallel behavior, collective behavior, social movements and societal institutions. Therefore, the current revival represented by the Artemis missions requires both activism to promote progress, and research to understand it. We ourselves can play both roles, for example by beginning research studies of our own design, to comprehend one or another of the specific application areas of the technology and its supporting culture. As we gain insights, we must share them. As we discover problems, we must collaborate with other space enthusiasts to invent solutions. Yet we must realize that "the endless frontier" is not merely the vast physical universe, but also the human need to improve society. The gender and ethnic diversity of the Artemis crews reminds us that unfair discrimination is a cultural problem that must not be allowed to continue. The exact fate of the International Space Station is uncertain, but apparently destined for demolition in 2030 or 2032.[33] Perhaps colonization of the Moon and Mars should become the cooperative goal for all nations of the Earth, achieving greater unity of humanity, however difficult the technical challenges prove to be.

About the author

William Sims Bainbridge served for 31 years as a program director at the National Science Foundation, first in Sociology, and then Human-Centered Computing. At NSF he was very active in several innovative programs, including the Digital Library Initiative, Ethics of Nanotechnology, and Converging Technologies. He earned his Harvard doctorate through research on the social history of spaceflight, and other areas covered by his hundreds of publications are the sociology of religious innovation, online virtual worlds, and computer-based emulation of human personality.

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Beyond Earth: A Framework for Ethical and Intelligent Self-Governance, by Angela Meyers

Abstract

As humanity approaches the possibility of becoming a multi-planetary species, the question of how to govern off-Earth civilizations becomes increasingly urgent. Existing governance systems, shaped by historical constraints, scarcity, and tribal dynamics, may not be suitable for future environments characterized by advanced technology, artificial intelligence, and closed ecological systems. This paper proposes a model of self-governance centered on a clear mission: to reduce suffering and enhance the thriving of all conscious beings. The model integrates three primary components—direct democratic participation, expert intelligence systems, and ethical leadership—within an adaptive, transparent, and non-extractive framework. Implications for artificial intelligence, post-scarcity conditions, and off-Earth survival environments are considered. This model is intended as a conceptual foundation for future experimentation in governance design.

Introduction

Human governance systems were not designed primarily to ensure that all people can meet their basic needs or achieve sustained wellbeing and thriving. Rather, they evolved over time under conditions of scarcity, limited information, and strong in-group/out-group dynamics. While these systems have enabled large-scale coordination, they have also produced persistent challenges, including inequality, inefficiency, and systemic misalignment with human wellbeing.

As humanity contemplates off-Earth settlement, there is an opportunity to reconsider governance structures from the ground up. Unlike terrestrial systems, which are constrained by legacy institutions and historical inertia, off-Earth environments provide a conceptual blank slate. This paper explores what a governance system might look like if it were intentionally designed to support the flourishing of conscious beings, rather than merely to maintain order or distribute power.

The Purpose Of Governance

A central limitation of existing governance systems is the absence of a clearly articulated, operational mission. Laws, constitutions, and institutions define structure, but not always purpose.

This paper proposes the following guiding principle:

The purpose of governance is to reduce suffering and enhance the thriving of all conscious beings.

This includes not only human beings, but also non-human animals, emerging forms of artificial intelligence, and broader ecological systems. While human survival remains a necessary priority, particularly in early-stage off-Earth environments, the long-term objective of governance should extend beyond survival to include conditions that enable growth, development, and meaningful experience.

Limitations Of Current Governance Systems

Many challenges observed in contemporary societies can be understood as consequences of systems that fail to meet basic human needs. When individuals lack access to stability, security, and resources, they are more likely to operate in survival-oriented states.

Survival conditions tend to produce predictable outcomes, including:

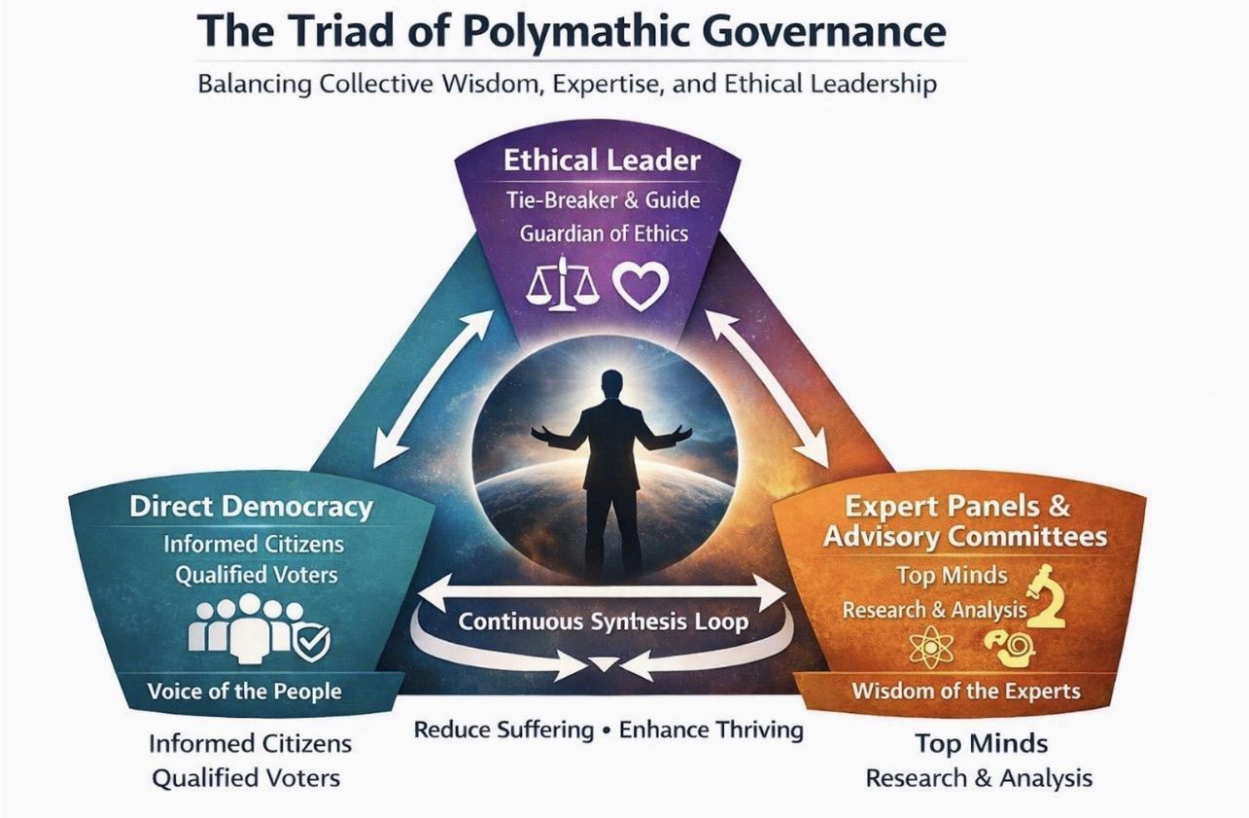
- reduced cognitive and emotional capacity
- increased conflict and crime
- short-term decision-making
- limited opportunity for development

These outcomes are often attributed to individual failure, but they may be more accurately understood as system-level design issues. Governance systems that do not ensure baseline conditions for wellbeing may inadvertently perpetuate the very problems they attempt to manage.

In addition, many current systems exhibit structural rigidity, making it difficult to adapt to rapidly changing technological, environmental, and social conditions. This limitation becomes particularly significant in off-Earth environments, where conditions are dynamic and failure can have immediate consequences.

A Three-Pillar Model Of Self-Governance

This paper proposes a governance framework composed of three interdependent components: direct democratic participation, expert intelligence systems, and ethical leadership. Each component addresses specific limitations observed in existing systems.



Direct Democratic Participation

Direct democracy enables individuals to participate in decisions that affect collective outcomes. However, in this model, participation is not assumed to be universally informed. As John Dewey argued in Democracy and Education, a functioning democracy depends not merely on participation, but on the capacity of individuals to think critically, engage with shared problems, and learn continuously within a social context (Dewey, 2004).

Accordingly, civic participation in this model is structured around:

- access to relevant education and information

- engagement with the issues under consideration
- transparency and accountability for decisions

Rather than treating participation as a passive right, this approach frames it as an active, developmental process that requires ongoing learning and reflection. Participation in direct governance is therefore not automatic, but contingent upon meeting and maintaining criteria related to informed engagement, demonstrated understanding, and ethical responsibility. These criteria would not be imposed externally, but defined, evaluated, and periodically refined by the members of the democratic body itself.

Emerging technologies, including artificial intelligence, can support this process by synthesizing complex information and presenting it in accessible formats. This enables individuals to make more informed decisions while maintaining direct involvement in governance, extending Dewey's vision of an educated and engaged public into a technologically augmented context.

Expert Intelligence Systems

Complex systems often require specialized knowledge. In this model, expert panels and advisory committees serve as a distributed intelligence layer, responsible not only for analysis, but for helping design and continuously improve the systems that support collective wellbeing.

A foundational responsibility of these expert bodies is to identify and refine the core domains that governance must effectively organize and maintain. These include, but are not limited to:

- education and lifelong learning
- health and longevity
- housing and material security
- food, water, and sanitation
- public health and safety
- systems for addressing harm and conflict
- access to information, communication, and human rights

- economic systems that support fairness and meaningful participation
- environmental stewardship, infrastructure, and mobility
- community, belonging, and civic life

These domains represent broad areas of responsibility rather than fixed policy prescriptions. The detailed conditions required for human thriving are further elaborated in the Baseline Conditions framework that follows.

Experts are organized around these and other emerging domains, contributing deep knowledge within their respective areas while remaining accountable to the broader system.

Rather than functioning as isolated or centralized authorities, experts operate within a transparent and participatory framework. Their role includes:

- conducting research and modeling potential outcomes
- analyzing historical successes and failures across societies
- incorporating empirical data alongside lived human experience
- identifying best practices and adapting them to current conditions

For example, systems of incarceration may draw from models such as those implemented in Norway, which emphasize rehabilitation and reintegration, while public health and longevity strategies may draw insights from regions associated with longer life expectancy.

Importantly, expert systems do not operate in isolation. Their findings, assumptions, and recommendations are made transparent and accessible, particularly to those participating in direct democratic processes. This creates an ongoing exchange between expert knowledge and public input.

Decision-making authority is shared between the public and expert systems, with each holding approximately equal weight. Ideally, this structure encourages convergence, where public values and expert analysis inform and refine one another, leading to decisions that are both informed and collectively supported.

In cases where agreement cannot be reached, the responsibility for resolution shifts to an ethical leadership function, which serves as an integrative mechanism. This ensures that impasses do not

stall governance while maintaining alignment with the overarching mission of reducing suffering and enhancing thriving.

This approach aims to balance expertise with citizen participation, reducing reliance on status-based authority while increasing the role of evidence-based reasoning and collective intelligence in governance.

Ethical Leadership As Integrator

In cases where public input and expert analysis diverge, a mechanism for synthesis is required. This model includes a leadership role—whether embodied in a single individual or a small council—defined not by political affiliation, popularity, or social identity, but by demonstrated ethical orientation and capacity for integrative reasoning.

The responsibilities of this role include:

- evaluating competing perspectives
- making decisions in alignment with the governing mission
- communicating reasoning transparently
- supporting coherence and accountability across the system

This leadership function serves as a stabilizing and integrative force, rather than a hierarchical authority.

Selection for this role is intentionally designed to resist common abuses of power. It is not a position that can be purchased or that requires financial resources to access, nor is it determined through popularity contests, partisan affiliation, or in-group advantage. Instead, both the public participants and expert bodies contribute to the selection process, with a shared focus on identifying individuals whose ethical commitments, integrity, and judgment are broadly trusted.

Participants are encouraged to evaluate candidates not based on ideology or influence, but on demonstrated alignment with core values, consistency of character, and a track record of ethical decision-making. In this sense, selection becomes an exercise in collective moral discernment rather than political competition.

The primary function of ethical leadership is to safeguard the integrity of the system itself. This includes:

- ensuring that decisions remain aligned with the mission of reducing suffering and enhancing thriving
- holding both public participants and expert systems accountable to shared standards
- maintaining transparency across all levels of governance
- identifying and addressing potential distortions, including bias, corruption, or undue influence

Structural safeguards are essential to this role. Systems must be designed to minimize the possibility of coercion, financial influence, or capture by concentrated interests. Ethical leadership must operate within conditions that support independence, truthfulness, and resistance to manipulation.

Rather than concentrating power, this role acts as a guardian of process and principle—ensuring that governance remains aligned with its ethical foundations even in the presence of disagreement, complexity, or uncertainty.

Baseline Conditions For Human Thriving

A central premise of this model is that governance should ensure the conditions under which individuals can move beyond survival and toward sustained thriving. Rather than defining success solely in terms of economic output or institutional stability, this framework proposes that governance systems be evaluated based on their ability to provide a set of baseline conditions necessary for human development, wellbeing, and meaningful participation in society.

These baseline conditions are not conceived as aspirational benefits, but as foundational requirements for a functional and flourishing civilization. When such conditions are absent or unevenly distributed, individuals are more likely to operate in survival-oriented states, limiting both personal potential and collective outcomes.

The Baseline Conditions for Human Thriving include:

- Education and Lifelong, Lifewide Learning: Access to continuous, self-directed learning opportunities that enable individuals to develop skills, understanding, and adaptive capacity over time.
- Healthcare and Longevity Optimization: Access to comprehensive physical and mental healthcare systems that prioritize not only treatment, but prevention, health optimization,

and the extension of healthy human lifespan, particularly in light of accelerating advances in biotechnology and artificial intelligence.

- Housing and Physical Security: Reliable access to safe and stable shelter as a foundation for psychological and physical wellbeing.

- Nutrition and Food Systems: Access to sufficient, nutritious food produced through systems that are sustainable and aligned with long-term human and ecological health.

- Clean Water and Sanitation: Universal access to clean water, sanitation infrastructure, and public health systems necessary to prevent disease and maintain basic living standards.

- Public Health and Safety: Systems that protect individuals from harm while promoting collective wellbeing, including emergency response, disease prevention, and environmental health protections.

- Systems for Addressing Harm and Conflict: Mechanisms for responding to interpersonal and societal harm that prioritize restoration, rehabilitation, and the prevention of future harm.

- Access to Information and Communication: Reliable access to information, communication networks, and digital infrastructure, including the internet, as a prerequisite for informed participation in modern society.

- Human Rights and Freedom of Expression: Protection of fundamental rights, including freedom of thought, speech, and expression, as essential components of individual autonomy and collective intelligence.

- Economic Participation and Fair Systems Design: Economic structures that enable individuals to contribute meaningfully and access resources without being subject to extractive dynamics or systems designed primarily to maximize profit at the expense of human wellbeing.

- Environmental Stewardship and Access to Nature: Protection of ecological systems and access to natural environments that support both physical health and psychological wellbeing.

- Mobility and Infrastructure: Access to transportation and infrastructure that enables movement, connection, and participation in society.

- Community, Belonging, and Civic Participation: Opportunities for individuals to form meaningful relationships, experience belonging, and engage in shared social and civic life.

Taken together, these conditions define a threshold below which individuals are constrained by survival and above which they are more likely to engage in creative, ethical, and prosocial behavior. Governance systems designed around these baseline conditions shift the focus from managing scarcity and dysfunction to cultivating the environments in which human potential can emerge.

This framework is intended to be adaptive. As knowledge, technology, and societal understanding evolve, the specific components and implementation of these baseline conditions may be refined. However, the underlying principle remains constant: a governance system should be evaluated by its capacity to create the conditions in which conscious beings can sustainably thrive.

This framework aligns with the capabilities approach articulated by Amartya Sen, which focuses on expanding individuals' real opportunities to live healthy, meaningful, and self-directed lives. Ensuring baseline conditions for thriving can therefore be understood as enabling the development and exercise of human capabilities, rather than simply meeting minimal standards of survival.

Design Principles For Future Governance

Several guiding principles emerge from this model:

- Non-extractiveness: Governance systems should not enable the purchase of influence or power through wealth.

- Adaptability: Rules and structures should evolve in response to new information and changing conditions.

- Transparency: Decision-making processes should be visible and understandable to all participants.

- Accountability: Participants at all levels should be responsible for their contributions and decisions.

- Constructive disagreement: Divergent perspectives should be treated as opportunities for learning rather than sources of division.

These principles aim to align governance with long-term system stability and collective wellbeing.

Governance In Off-Earth Environments

Off-Earth environments introduce constraints that amplify the importance of effective governance. In closed-loop systems, access to essential resources such as air, water, and food is tightly controlled and interdependent.

In such contexts, governance failure is not merely inefficient—it is existential.

Decision-making must account for:

- resource limitations
- system interdependencies
- rapid feedback loops
- high-stakes consequences

As a result, governance systems must prioritize accuracy, adaptability, and alignment with collective survival and wellbeing.

The Role Of Artificial Intelligence And Non-Human Intelligence

Advances in artificial intelligence are likely to play a significant role in future governance systems. AI can support:

- data analysis and pattern recognition
- modeling of complex systems
- decision support

In addition, the possibility of increasingly autonomous or sentient AI systems raises important ethical considerations. Future governance models may need to address questions related to:

- the moral status of artificial intelligence
- the extension of rights and protections
- the integration of non-biological intelligence into decision-making processes

These considerations are consistent with broader discussions in transhumanist and post-biological ethics (Kurzweil, 1999; Rothblatt, 2014).

Toward Post-Scarcity And Human Thriving

Technological advances, including automation and robotics, may enable the fulfillment of basic human needs at scale. In such conditions, governance systems can shift from managing scarcity to supporting thriving.

This includes ensuring access to:

- housing
- healthcare
- education
- food and water
- safety and community

When these conditions are met, individuals are more likely to:

- engage in creative and intellectual pursuits
- develop skills and capacities
- contribute to collective wellbeing

This transition represents a shift from survival-oriented systems to thriving-oriented systems.

Conclusion

The transition to off-Earth civilization presents an opportunity to reconsider governance design. Rather than replicating existing systems, future societies may benefit from models aligned with the realities of advanced technology, complex systems, and diverse forms of intelligence.

The framework presented in this paper offers a conceptual starting point. By integrating direct participation, expert knowledge, and ethical leadership within an adaptive structure, it aims to address limitations observed in current governance systems while supporting long-term flourishing.

This model also aligns with the concept of conscious evolution, as articulated by Barbara Marx Hubbard, which suggests that humanity is increasingly capable of directing its own development through intentional design rather than unconscious adaptation. Governance, in this context, becomes not merely a mechanism for coordination, but a tool for guiding the ethical and developmental trajectory of civilization itself.

This emphasis on active, informed participation also reflects the work of Hannah Arendt, who argued that the health of a political system depends upon the capacity of individuals to think critically and engage meaningfully in collective life.

This emphasis on informed participation and intellectual humility through continual co-learning reflects a broader philosophical tradition associated with thinkers like Bertrand Russell, who argued that healthy societies depend upon the cultivation of independent thought and a willingness to question certainty. Russell also observed that systems of power tend to preserve and reinforce themselves unless deliberately constrained.

This perspective is consistent with the view that meaningful societal change is most effectively achieved not through the incremental repair of existing systems, but through the design of new systems that better align with human needs and emerging realities. As Buckminster Fuller observed, “You never change things by fighting the existing reality. To change something, build a new model that makes the existing model obsolete.”

Further research and experimentation will be necessary to refine and test these ideas. However, intentional design may offer a pathway toward governance systems that are more aligned with both human potential and the broader ecosystem of conscious beings.

While this model is presented in the context of off-Earth civilization, its implications are not limited to extraterrestrial environments. If such a system proves effective under the constraints of off-Earth conditions, it may also offer valuable insights for rethinking governance on Earth.

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Futureproofing Humanity by Robert Geraci: a review, by Giulio Prisco

I've been reading "*Futureproofing Humanity*" (2026), by Robert Geraci. Despite some minor (or perhaps not so minor) disagreements, I highly recommend reading this book.

Geraci is a religious studies scholar whose works have been published by traditional academic publishers such as Oxford University Press. But he decided to self-publish this work, because he felt traditional academic publishers priced books out of reach, including electronic editions that should be much cheaper. I totally agree. I know how to find pirated e-books (but doesn't everyone?), so I have almost all of his previous books on my Kindle readers. But I very much prefer to pay for reasonably priced e-books, and I was happy to pay for this one. I'm not able (or willing) to enrich traditional publishers, but I'm able and very willing to buy good independently published books.

In his previous books, the author described cultural and social trends without taking sides. But here he wants to be more involved.

He argues that 21st-century futurism has become a secular religion. A tech elite has transferred humanity's oldest religious longings - immortality, resurrection, cosmic purpose - into a transcendent myth built around science and technologies like genetic engineering, artificial intelligence (AI), urban design, and spaceflight.

Geraci's position can be summarized as "yes, but…" He neither fully debunks nor fully celebrates this vision. Instead, he asks: is this transcendent myth the right one for our present and future? And if not, how to make it right?

The new (actually not so new) belief system, also described in the author's first book "*Apocalyptic AI*" (2010), is being embraced by more and more people as a response to the growing awareness of "existential risks." It is the fear of extinction, Geraci argues, that makes these ideas mainstream. Technologies that were considered "fringe" for decades (e.g. genetic enhancement, AI, mind uploading) gained cultural traction once "existential risk" became the organizing frame. We are faced with genuine extinction-level threats (e.g. climate change, AI, asteroids, pandemics, etc.), and we need "futureproofing" humanity to ensure we never go extinct.

The new transcendent myth

Geraci frames the whole book as a modern fairy tale. But the happy ending typical of most fairy tales is not guaranteed, and this one risks becoming a ghost story. Geraci argues that our transcendent myth, to which he now refers as "futureproofing," must also be a responsible one.

Tracing the intellectual roots and history of transhumanism from the 19th century through the Russian Cosmists (Nikolai Fedorov's "Common Task" of resurrecting the dead and expanding to the stars) to J.B.S. Haldane, Julian Huxley, Robert Ettinger, and Ray Kurzweil, Geraci shows how science gradually displaced traditional religion while inheriting its deepest aspirations. The Extropian movement - the earliest form of contemporary transhumanism - was informed by a staunch individualist spirit and hard libertarian politics, but Geraci argues that the transhumanist project needs collective values.

Genetic engineering is one of the pillars of futureproofing — "geneticproofing." From alchemical dreams of immortality to CRISPR, Geraci traces our desire to reprogram life. He covers longevity research, biohacking, de-extinction projects like Pleistocene Park, and the ethical minefield of genetic enhancement. He argues these biotechnological dreams are genuinely useful but dangerously narrow in scope - often focused on elite salvation rather than collective flourishing.

Coming to artificial intelligence (AI) and robotics - "AIproofing" - Geraci elaborates on the "intelligence explosion" hypothesis (by e.g. Hans Moravec, Ray Kurzweil, Vernor Vinge) and Moore's Law extrapolations. He argues that today's large language models (LLMs) are definitely not conscious, but he is more open-minded about the possibility that future AI systems could be. However, he thinks artificial general intelligence (AGI) claims are faith-based rather than evidence-based. Geraci covers brain-computer interfaces (BCIs) such as Neuralink, the possibility of mind uploading, pattern identity theory, the concept of digital resurrection, and the simulation hypothesis - which seems to have been first suggested (as a joke) by space advocate Keith Henson. Overall, Geraci is kind of skeptical but not dismissive: the technologies are real, the possibilities are real, and also the dangers are real, but the philosophy is confused.

"Urbanproofing" is the tech elite's vision of redesigning cities and governance. From futuristic city projects to seasteading, Geraci examines attempts to build libertarian tech utopias free from existing laws and taxes. He uses Calvino's "Invisible Cities" as a literary anchor, arguing that cities are defined not just by buildings but by human relationships - something urbanproofers often ignore. Virtual worlds like Second Life offer cautionary lessons about sustainability.

Spaceflight is the convergence and the culmination of all futureproofing - "spaceproofing." Geraci traces the dream of humanity's expansion into outer space from Fedorov's cosmic resurrection program (collecting ancestors' dust from space) through mid-20th century American frontier mythology to today's NewSpace entrepreneurs (e.g. Elon Musk, Jeff Bezos, Richard Branson). He covers O'Neill's rotating space habitats, Mars colonization plans, and the vision of "laser-porting" human consciousness across the galaxy (the idea of "human telegraph transmission" was first formulated by Norbert Wiener). Space expansion is where genetic engineering, AI, and urban design all converge: it is both the practical insurance policy for humanity and the ultimate religious transcendence.

In a chapter titled “Ghastly Potential,” Geraci examines the dark underside of futureproofing: bioterrorism risks from democratized CRISPR; AI surveillance and oligarchic control; the environmental cost of data centers and resource extraction; the social injustice of technologies reserved for the wealthy; and the risk that chasing transcendence blinds us to present suffering.

Geraci calls for a responsible myth - one that takes seriously our unstoppable aspiration to cosmic transcendence and its actual possibility, but also the genuine dangers of existential risk and the present suffering of living people. Inspired by figures like Julian Huxley (who emphasized collective fulfillment, not just individual transcendence) and African transhumanist thinkers, he argues that technological salvation must be inclusive or it is no salvation at all.

A central argument throughout the book is that futurism inherits the structure of religion (linear history, imminent salvation, resurrection, immortality) without acknowledging it. This makes it simultaneously powerful and dangerous - it mobilizes real energy but resists rational critique. Geraci argues that we need less soft, wishful thinking and more hard, rigorous thinking. Another central point, which Geraci repeatedly makes, is that "saving humanity" is often taken to mean saving only a small, very specific, wealthy subset of humanity.

Geraci is not a pessimist or a technophobe. He believes technology can help us survive, but notes that some of the technologies that could help us overcome existential risks could, if we are not careful enough, become existential risks themselves. He doesn’t dismiss our wildest technological transcendence dreams. On the contrary, he concedes that those dreams might come true and this could be a good thing. But he insists we need a myth that is genuinely inclusive, ecologically responsible, and honest about its religious character - a civilization-wide myth, not one restricted to a technological elite. In fact, he is very critical (to say the least) of tech billionaires like Elon Musk, Jef Bezos, or Sam Altman.

I loved the book after reading it the first time, and then I read it again. I’m more or less on the same page, but with some differences (see my 2021 book “*Futurist spaceflight meditations*”).

The main difference is that I'm more forgiving of the tech billionaires and their followers: flawed as their personality, actions, and visions may be, I think they are nonetheless pushing toward important advances that would otherwise stagnate or never start. We all love nice people, but sometimes we need less nice people to get important things moving. Or as Robert Pirsig points out (in “*Lila*” and other works), it is not the nice guys who move things forward. It is the bad guys. It seems to me that the bad guys are doing just what the universe wants from them - preparing the way to the cognitive and physical explosion of humanity (in an extended sense that includes future conscious machines) toward the stars. It’s up to us nice guys (yes, I think I’m essentially a nice guy) to repair the things they break, correct the course and make it more inclusive and responsible.

Elon Musk works for me

I told Geraci that I loved the book but I had the impression that he was always pushing the gas pedal and the brake pedal at the same time. A car goes nowhere if the driver does that, I said.

He replied that there were two cars. One must keep moving, but the other must be slowed down because it's driven by bad guys that want to “move fast and break things” to accumulate more money and power.

I countered that the two cars can’t be disentangled - they are really one and the same, and we can’t just keep what is good and discard what is bad. Or in other words, the good implies the bad and the bad is the price to pay for the good, as is very often the case. And the fact of the matter is that yes, the bad guys are driving too fast and yes, they are too reckless, but… they are the ones who can drive!

As I see things, Elon Musk & Jef Bezos & Sam Altman work for me. They are much smarter than me, much more energetic, and of course way more resourceful, and yet they are pushing things in the direction I want. OK, they are not too nice. OK, perhaps they are bad guys. But so what? I admit that a society where Elon Musk (now the world’s first trillionaire after the SpaceX IPO) is so rich while too many other people are really poor doesn’t seem healthy to me. But they are driving us to the stars!

If we kick the bad guys out, then the car stays where it is and doesn't go anywhere. What we can do, I said, is to let the bad guys drive (and perhaps try and persuade them to go a bit slower and more carefully) until the next gas station (of course the next gas station represents some important milestones that we must reach fast enough, like a Moon/Mars outpost and real AI and all that). Then when the car is fueled and ready to go we can maybe learn how to drive it ourselves.

He answered that the hypercapitalist and self-aggrandizing nature of most people driving the tech agenda will, he thinks, absolutely prevent good outcomes. Terrible leaders have never produced good outcomes for either their followers or anyone those people encounter, and aren’t likely to bring us into a bright and good future. “I think the story emergent from 21st century Silicon Valley is really unhelpful,” he told me. “I don't know if we can get something better out in front of that, but failure to do so is not going to bring about a particularly good future.”

Another difference is that I don’t attribute the growing popularity of these ideas to existential risks, or at least not entirely. I don't spend any time worrying about existential risks. Instead, I spend a lot of time contemplating beautiful possible futures.

Fear sells, so I guess part of the rising popularity of what Geraci calls futureproofing must be due to the media emphasis on existential risks and doomism. But many people come from a different place, including young people - if anything, the young have always been more daring and less cautious than their elders.

In other words, I'm not motivated by fear but by hope, and I think many people are.

Despite his emphasis on futureproofing against existential risks, Geraci admits that our transcendent myth should be "architecturally built on hope." Failure is always a possibility, but success can follow from rigorous thinking, good planning, and of course some luck. “To have faith in one’s plans is inherently optimistic,” he says. “More curiously, so is having faith in throwing the dice. Despite the fact that randomness rules, success is always possible. Chancing success is a statement of hope, a testament to dreams come true. Perhaps with good planning and a little luck, we will find ours among the stars.”

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Transformation of Astronaut Intelligence, by William Sims Bainbridge

Abstract: Increasing understanding of the potential human goals in outer space can be gained through specialized questionnaire studies, such as one administered four decades ago to 894 Harvard students that asked them to evaluate 125 possible outcomes of the space program. Today, many large questionnaires about the human future seek respondents at the online LifeNaut archive that offers to preserve individuals' mindfiles. Among them are surveys of personal experiences and the Big Five personality dimensions. This article includes insights about the future of spaceflight, yet emphasizes how artificial intelligence can replicate humans, with a focus on a new methodology that combines questionnaires with large language model chatbots. Indeed, human colonization of the universe may require fundamental transformation of our species by such means.

As the two Voyager space probes that launched in 1977 demonstrated, it is possible to communicate by radio across the entire solar system. Thus it may make sense, in a few decades, to transport people to other planets as mindfiles rather than biological bodies, combining new technologies with old ones. A methodology that deserves research attention within the social and cognitive sciences is how text-based artificial intelligence can transform data from traditional questionnaire surveys, even creating the equivalent of avatars of the respondents. One application area that already exists but may become far more popular is memorialization of deceased individuals, through large language model processing of words spoken, written or selected by an individual, even years ago. This article will begin with four-decade-old data from a study that administered to students at Harvard University a questionnaire containing 125 ideas about the future human goals in space. Next it will consider examples from the classical Big Five personality dimensions and items from the General Social Survey, then exploring this new area of research opportunity with three 500-item questionnaires from the online LifeNaut system: Beliefs, Year 2100 and Experiences.

A well-established principle in questionnaire research, that surveys must be brief and thus consist of very carefully developed questions, may be approaching obsolescence as Internet and mobile devices facilitate administration of large numbers of items. New analytic tools like ChatGPT became available, and here a subscription to the ChatGPT-4o version will be used. Of course a major factor supporting this efficiency norm is the challenge of obtaining responses from a representative sample of the target population. Yet exploring alternative technical designs may reveal new areas of innovation that have their own appropriate application principles. Specifically, the LifeNaut Project has been exploring new ways in which questionnaires can contribute to development of a personal mindfile: "A Mindfile is a web-based storage space for organizing and preserving critical information (digital reflections) about one's unique and essential characteristics for the future, and to share with friends and relatives in the present."[1]

[1] lifenaut.com/mindfile/faqs/

In recent years a variety of valid applications have been developed to administer the equivalent of questionnaires without prioritizing representativeness of the so-called "sample." The most obvious example is recommender systems, which are mostly encountered in social media or online stores, where they function as personalized advertising. The classic example is the Netflix dataset that was made public back in 2006 in a contest that sought to motivate development of improved recommender system algorithms.[2] Netflix was a movie merchant that collected review ratings from customers, then used the data to assess what other films particular customers would like, and used the results in various personalized advertising campaigns. Ratings for each movie was a variable in the dataset, and the total number of movies and thus items in this virtual questionnaire was fully 17,770. On average, the 480,189 users gave just 209 ratings each, so it was as if respondents to a questionnaire had answered only about 1 percent of the questions. Yet the dataset is quite valuable, even today, for mapping similarities between films and clusters that constitute genres. Since 1997, the MovieLens research project in the Department of Computer Science and Engineering at the University of Minnesota has been a model for serious academic research using this methodology.[3]

Another remarkable example of a potentially huge questionnaire is the International Personality Item Pool established by psychologist Lewis Goldberg, which "includes over 3,000 items and over 250 scales that have been constructed from the items."[4] All these items are in the public domain, but they mirror items in personality questionnaire sets that are under copyright and thus potentially limited in their use. Currently, dozens of websites offer personality questionnaires and give users their results, indicating a model of survey research in which the respondent benefits intellectually, emotionally or culturally from participating. The first recent research study reported in this article will explore that alternate user-centered conception of administering questionnaires to individuals via modern information and communication technologies.

A more recent reconceptualization of questionnaire research has not yet achieved professional status, but its technical features are developing rapidly: personality capture and emulation via artificial intelligence.[5] When 1,608 people responded to the first General Social Survey in 1972, just 5 of them were 18 years old, 2 of them were 89 or older, and the average was 45. Today, the average 1972 GSS respondent would be 99 years old and thus probably deceased. Had the respondents been given their own data, their grandchildren might have access to them today, along with their grandparent's responses to other surveys, thus having closer understanding and even perhaps gaining advice from the departed generation about enduring issues like politics and religious views. Recently, especially with the release of ChatGPT, it has become possible to place responses to questionnaires into this "chatbot," and then have a

[2] Andrey Feuerverger, Yu He and Shashi Khatri, 2012, "Statistical Significance of the Netflix Challenge," *Statistical Science*, 2012, 27(2): 202-231.
[3] grouplens.org/datasets/movielens/
[4] ipip.ori.org/
[5] William Sims Bainbridge, "Whole-Personality Emulation," *International Journal of Machine Consciousness*, 2012, 4(1): 159-175, *Personality Capture and Emulation* (London: Springer, 2014).

simulated conversation with the respondent about the topic of the questions. Many competing systems are currently emerging, and our first example will illustrate Google's AI Overview.

Goals in Space

In 1973, the General Social Survey asked 1,432 respondents, "are we spending too much, too little, or about the right amount on the space exploration program?" Today, anyone can go online to Survey Documentation and Analysis and analyze the results of 34 administrations of the GSS up through 2024, with responses from fully 39,930 people.[6] The first data were collected just months after the last Apollo flight to the moon, and fully 61.4 percent of respondents answered that too much was being spent on space exploration. In 2024, the negative faction had reduced to 29.6 percent, 50.8 percent judged that the right amount was being invested, while only 19.6 felt support for space exploration was too little, even as return to the moon was in progress. While the GSS has value, allowing discovery of variables that influenced opinion, it was not filled with many other questions that could explore all the goals we might seek in outer space.

Most respondents to the GSS probably had few thoughts about what space could mean for the future of humanity, so in 1986 I administered two questionnaires to volunteer students at Harvard University who were probably far more informed and interested. The first survey asked 1,007 of them to write responses to open ended questions from which I was able to extract 125 different goals space might offer. In the second survey, 894 Harvard students rated all 125 goals in terms of how good reasons they were for supporting the space program, on a scale of 0 = "not a good reason" to 6 = "an extremely good reason." The highest average response was 4.46 for "The space program contributes to the advancement of science," and fully 54.9 percent considered this "an extremely good reason." Results for all 125 questions can be found in the appendix to my book, *Goals in Space*.[7]

The standard method for analysis of a structure of correlations was factor analysis, but no software I had access to in 1986 could apply that method to fully 125 items, so I programmed from scratch a different system based on the block model approach.[8] Both methods are iterative, thus involving what today we would call "machine learning" and thus "artificial intelligence." The results catalogued the 125 items into different groups that share some significant meanings, but often differed greatly from other groups in terms of popularity. Not very popular was a set of five items relating to what I called Limitless Expansion of humanity out into the universe, listed here in Table 1. Connected to them were similar items about departure from Earth and the

[6] sda.berkeley.edu/sdaweb/analysis/?dataset=gss24rel1
[7] William Sims Bainbridge, *Goals in Space* (Albany: SUNY Press, 1991).
[8] Leon Festinger, Stanley Schachter and Kurt Back, *Social Pressures in Informal Groups* (New York: Harper Books, 1950); Harrison C. White, Scott A. Boorman and Ronald L. Breiger, "Social Structure from Multiple Networks," *American Journal of Sociology*, 1976, 81: 730-780.

challenge of population growth on our own planet, so the first item in each of those subgroups is also included in the table.

Table 1: Examples of Questionnaire Items about Human Future in Outer Space

Items in the Questionnaire	Average Rating on 0 to 6	Extremely good reason	Correlations with:		
Limitless Expansion group of five questionnaire items:			Space offers room	The Earth is too small	Space settlements
Space offers room for the expansion of the human species.	2.74	18.8%	1.00	0.65	0.65
Our future ultimately lies in space.	2.70	22.8%	0.57	0.52	0.44
Limitless opportunities could be found in space.	2.93	24.3%	0.49	0.39	0.39
In space we could create new cultures, lifestyles, and forms of society.	1.88	9.6%	0.46	0.36	0.40
Mankind is bound to venture outside Earth and needs to know as much as possible in advance.	2.77	20.2%	0.50	0.43	0.43
First item in the Departure from Earth group:					
The Earth is too small for us, so we must expand off this planet.	2.11	12.2%	0.65	1.00	0.64
First item in the Population group:					
Space settlements could ease the growing problem of overpopulation.	2.61	16.8%	0.65	0.64	1.00

Truth to tell, not many Harvard students were convinced by the statements in Table 1, four decades ago, yet if humanity is indeed returning to the moon it would be interesting to repeat the survey and learn today's public opinions. However, an entirely new method has arisen recently, use of artificial intelligence to connect ideas to some online consensus or other. On December 21, 2025, I entered this question into Google: "As a motive for developing spaceflight technology, is it true that space offers room for the expansion of the human species?" Its AI Overview replied:

> Yes, a major motive for spaceflight is the belief that space offers vast room for human expansion, ensuring species survival against Earth-bound catastrophes, providing resources, and fostering innovation, effectively making humanity multiplanetary to grow beyond Earth's limits. While this vision promises endless growth and new possibilities, it faces challenges like extreme environments and critiques about repeating Earth's problems, but proponents see it as essential for long-term human existence and evolution.

As we might expect from Google, this response was the result of an online search, analogous to a survey of websites rather than of traditional human respondents. Asking Google

similar questions based on the four other Limitless Expansion group items gave rather reasonable responses:

> Whether humanity's future "ultimately lies in space" is a complex philosophical question with no single "true" answer. It is a powerful motive for spaceflight development, rooted in scientific, survivalist, and optimistic viewpoints, but it remains a subject of ongoing debate rather than an established fact.
>
> While the full extent of opportunities in space remains a subject of ongoing exploration and speculation, it is widely considered that space offers a vast and significant array of potential benefits and resources that could drive the development of spaceflight technology.
>
> Yes, creating new cultures, lifestyles, and societies is a significant, often-cited motive for spaceflight, stemming from the idea that harsh, new environments demand innovation, foster unity, and offer a fresh start for human organization, distinct from Earth's historical constraints, potentially leading to unique governance, values, and social structures. While inspiring, these new societies remain speculative, with current focus on technological benefits, economic growth (like asteroid mining), and ensuring humanity's long-term survival as key drivers.
>
> While many motivations drive the development of spaceflight technology, the idea that humanity is "bound" to venture outside Earth is a philosophical and speculative concept, not a universally accepted scientific or historical fact. It is one of several compelling arguments for space exploration, but it is not the sole, definitive reason.

So the methodology of this article, combining questionnaire surveys with large language model artificial intelligence, seems reasonable. However, until near the end, we need to explore a diversity of topics that must be addressed when assembling the mindfile of an individual person, beginning with a standard tradition of personality psychology.

The Infinite Dimensions of Personality

Starting with the work of Raymond Cattell in the 1940s, psychologists have explored many apparent dimensions of human personality.[9] Especially prominent has been the work of Robert McCrae and Paul Costa, who developed the "OCEAN" version of the Big Five: Openness

[9] Raymond B. Cattell, "Primary Personality Factors in the Realm of Objective Tests," *Journal of Personality*, 1948, 16(4): 459-486, *Handbook of the 16 Personality Factors Questionnaire* (Institute for Personality and Ability Testing, Champaign, Illinois, 1949).

to experience, Conscientiousness, Extraversion, Agreeableness, Neuroticism.[10] In 2005, OCEAN was revised by its creators, who replaced 37 of the 240 items in their questionnaire. Some items were simplified, often with a meaning change, for example: "When people I know do foolish things, I get embarrassed for them" became "I feel awkward around people." Others shifted to more common terminology: "I have little difficulty resisting temptation" became "I'm always in control of myself." This gives us a clear way to introduce ChatGPT. I did two separate runs, asking the same question with the 37 old items as the input to the software, and with the 37 new items: "How can I improve my behavior with other people?" The answers were quite different:

ChatGPT's answer based on the 37 OLD McCrae-Costa questionnaire items:

> One strategy is to develop your ability to handle people shrewdly. This involves understanding others' intentions, motivations, and emotions, which can help you engage with them in a perceptive and strategic manner. It's also important to value modesty over arrogance, showing humility and treating others with respect. Being skeptical of others' intentions can also be useful, leading to a more guarded and reserved approach.

ChatGPT's answer based on the 37 NEW items:

> Focus on understanding others' needs and emotions. This can enhance your empathy and improve your interactions. Also, remember that appearances can be deceiving, so try not to make snap judgments based on outward behavior. Lastly, self-control is key in managing your own behavior effectively.

So, ChatGPT was quite able to summarize the two sets of items, even getting what seems to be a nicer and more clear summary of the new and improved items. That helps us begin to understand how a high quality chatbot works. Because of the way the question was phrased, ChatGPT explicitly gave advice to us. Later we shall see how the system can more directly simulate the personality of a respondent to the initial questionnaire. In 2012, a team supported by the Terasem Movement Foundation[11] used the 100 item version of the Big Five questionnaire developed by Goldberg to develop early online questionnaire software and explore one of the ways in which an existing questionnaire can be expanded. On Android mobile devices, we asked two questions about each item, each pair answered from clicking one square in a graphic matrix: (1) To what extent do you yourself have this attribute? (2) How good is it for a person to have this attribute? That not only allowed us to distinguish the respondents' self-images from their values, but even, by calculating the correlation between the two questions, measuring the person's self-esteem. That identifies another theme of the article, namely how advanced online

[10] Robert R. McCrae and and Paul T. Costa, "Reinterpreting the Myers-Briggs Type Indicator From the Perspective of the Five-Factor Model of Personality," *Journal of Personality*, 1989 57: 17-40; Jerry S. Wiggins (ed.), *The Five-Factor Model of Personality* (Guilford, New York, 1996).
[11] terasemmovementfoundation.com/

technology allows researchers, students, and respondents to answer more questions and gain greater benefits from doing so.

While still collecting data, once we had 3,267 respondents tell us how they described themselves, we used factor analysis in two ways, finding the usual Big Five if we told the statistical analysis software to find 5, and deriving 15 factors that had eigenvalues greater than 1, which is a standard threshold in factor analysis. A different analytical approach began with responses to how good versus bad each trait was, focusing on the 25 items that got the highest "good" ratings. The top two were tied with 6.34 means on the 1-8 scale: "Am quick to understand things, and "Am full of ideas." The last 3 of the 25 best were in the range 5.85 to 5.82: "Take time out for others," "Make friends easily," and "Spend time reflecting on things." Further factor analysis divided the set into one factor about intellectual brilliance and three factors about aspects of social relations. Table 2 shows the average "good" ratings of items from the brilliance factor, along with their "loadings" which measure how high they are on this dimension of personality.

Table 2: The Brilliance Factor in Goldberg's Big Five Personality Dimensions

Questionnaire Items	Mean Good	Factor Loading
Am quick to understand things	6.34	0.73
Can handle a lot of information	5.94	0.68
Have excellent ideas	6.26	0.66
Am full of ideas	6.34	0.64
Am good at many things	6.30	0.63
Catch on to things quickly	6.32	0.62
Pay attention to details	6.05	0.62
Carry the conversation to a higher level	5.85	0.53
Have a vivid imagination	6.13	0.52
Love to think up new ways of doing things	6.14	0.49
Spend time reflecting on things	5.82	0.42

Placing those few items into ChatGPT and asking "How can I improve my behavior?" produced this answer: "To better your behavior, start by focusing on the details in various aspects of your life. This can improve your performance and efficiency. Additionally, try to approach problems innovatively. Think creatively to develop efficient solutions to challenges you face." Combining the other 14 items, across three social factors, and going through the same procedure offered this very different answer from ChatGPT: "To improve personal behavior, consider developing meaningful relationships with a diverse range of people. This can broaden your horizons and expand your knowledge. Being empathetic towards others fosters trust and

understanding. Also, expressing gratitude can strengthen relationships and foster a positive environment."

Right away, that comparison highlights two key questions about traditional personality questionnaires: To what extent do they measure: (1) skills and abilities, versus social norms? (2) characteristics of the respondent, versus presentation of self in social behavior? A few months after that phase of the research, the questionnaire was removed from Internet, at which point we had complete answers from 5,081 respondents who lived within the 50 US states, given that the Android app had both asked them where they lived and identified the Internet address of their access provider. Returning to this dataset recently, we reconsidered how Goldberg's Big Five dimensions are somewhat different from the McCrae-Costa dimensions. The Openness to experience dimension in McCrae-Costa covers areas that Wikipedia summarizes thus: "Openness involves six facets... active imagination (fantasy), aesthetic sensitivity, attentiveness to inner feelings, preference for variety (adventurousness), intellectual curiosity, and challenging authority (psychological liberalism)."

Goldberg's measures are different, and he calls the dimension "Intellect or Imagination," giving more emphasis to the mental abilities the respondent claims to have. This identified a major problem personality psychologists had, the issue of whether to include skills and natural abilities like intelligence in measures of personality. Goldberg went further in that direction. His 100 items include a short version of just 50, thus 10 per dimension rather than 20, and Table 3 lists the smaller version of the Intellect dimension. Of the 10, Goldberg intended 7 to be measured as the positive end of the dimension, and 3 as the negative end.

Table 3: Correlations Between Some of Goldberg's Intellect or Imagination Items

	Describes Respondent		Judged to Be Good		Describes Respondent and Is Good
	Rich Vocabulary	Vivid Imagination	Rich Vocabulary	Vivid Imagination	
Have a rich vocabulary.	1.00	0.29	1.00	0.30	0.64
Have a vivid imagination.	0.29	1.00	0.30	1.00	0.57
Have excellent ideas.	0.35	0.39	0.37	0.40	0.54
Am quick to understand things.	0.38	0.35	0.40	0.39	0.55
Use difficult words.	0.71	0.28	0.65	0.28	0.61
Spend time reflecting on things.	0.20	0.22	0.20	0.25	0.35
Am full of ideas.	0.36	0.47	0.38	0.47	0.57
Have difficulty understanding abstract ideas.	-0.22	-0.20	-0.02	-0.06	0.18
Am not interested in abstract ideas.	-0.17	-0.18	-0.03	-0.07	0.23

Do not have a good imagination.	-0.14	-0.27	-0.06	-0.06	0.28

Table 3 reveals some special relationships as well as the expected general pattern. “Rich vocabulary” and “Vivid Imagination” show similar patterns, but “Rich vocabulary” has much higher correlations of 0.71 and 0.65 with “Use difficult words.” “Spend time reflecting on things” has somewhat weak positive correlations, either because it is vague or is a combination of a negative (“spend time”) with a positive (“reflecting”). The last 3 items do have negative correlations with the first two, but nearer to zero than most of the positive correlations are. The last column gives correlations between the two questions for each item, notably for “Have a rich vocabulary” a very positive 0.64 between claiming to have that characteristic and judging it to be good. While big positive correlations in the last column may represent deserved self-esteem or perhaps egotistical arrogance, the weak but positive correlations for the three items at the bottom may represent defensiveness, a positive response bias, or possibly a very different set of values that would show up in analysis of the other four of the Big Five.

Then I entered the 10 items into ChatGPT and asked, “How best can we use our minds?” It replied: “We can best utilize our minds by embracing creative thinking and problem-solving. This involves thinking outside the box, considering alternative viewpoints, and visualizing different outcomes. We can also enhance our understanding by integrating complex terminology into our speech, refining our thoughts and ideas.” We must be clear that we do not assume that ChatGPT in its current form really can always provide good advice, but it probably does occasionally, and future advanced chatbots may be more reliable. Users must approach these sophisticated recommender systems not only with a degree of skepticism but also with access to high quality assessments of each system and of the technology in general. That requires psychological and social scientists to collaborate with computer scientists, and publish solid results about such issues.

Now we can explore the wider possibilities by taking the smallest possible sample, just 1 person among the fully 5,081 US respondents. This case was selected for being somewhat unusual in a way useful at this point, having rated themselves as very strongly having 44 of the 100 characteristics. The texts were assembled as sentences, like these: “I am on good terms with nearly everyone.” “I love to read challenging material.” After entering them into the chatbot, I asked it: “How would you describe your own personality?” It proudly replied:

> I would say my personality is sociable and outgoing, as I truly thrive on interacting with others and building meaningful relationships. I’m open to new experiences and perspectives, which enriches my social interactions and allows me to connect with people from all walks of life. Patience is a key trait for me too, as it helps me manage difficult situations without getting upset or angry. I’m also quite compassionate, with a strong inclination to help those in need. Generally, I maintain a positive outlook on life, which keeps me cheerful and optimistic.

Social scientists have long suggested that many people, perhaps even everyone, consciously present themselves in positive terms to others,[12] but few of the other respondents to our survey described themselves so favorably. So, I then asked: "Suppose someone said you are neurotic. How would you respond?"

> Being described as neurotic can be a bit unsettling, but I try to approach such things with an open mind and a sense of introspection. Instead of getting upset, I find it helpful to use this as an opportunity for self-reflection. I like to think that my natural tendency for contemplation allows me to consider why someone might perceive me this way and whether there are aspects of my behavior that I can learn from or address. Additionally, I lean into my patient and composed nature to handle any emotions.

So chatbots can help us discover the implications of a person's questionnaire responses. Even if they were not factually true self-descriptions, they may represent the values the individual wishes to personify. We also need to be aware that ChatGPT was able to include information from other sources, and follows cognitive principles built into its algorithms, so we should not always assume its responses are authentic expressions of the person represented by the uploaded text. Having begun with an example from personality psychology, we now migrate to sociology.

General Social Survey and Beyond

Since its launch in 1972, funding for the General Social Survey (GSS) was primarily managed by the Sociology program of the National Science Foundation and "is a nationally representative interview survey of the United States adult population that collects data on a wide range of topics: behavioral items such as group membership and participation; personal psychological evaluations including measures of well-being, misanthropy and life satisfaction; attitudinal questions on such public issues as crime and punishment, race relations, gender roles and spending priorities; and demographic characteristics of respondents and their parents."[13] Three decades ago, the GSS pioneered online data sharing through NSF grant 9422785, Prototype Internet Services for the General Social Survey. Its online abstract mentions that I managed funding for this innovative research, and explains:

> The project will develop a system to provide enhanced access to survey data, using the General Social Survey for implementation of these integrated services, which will subsequently be extended to a variety of other survey data sets. These services will

[12] Erving Goffman, *The Presentation of Self in Everyday Life* (University of Edinburgh Social Sciences Research Centre, 1956).
[13] www.nsf.gov/funding/opportunities/general-social-survey-competition/505742/nsf24-537

> provide facilities for hypertext viewing and searching of complete survey documentation, customized and documented extracts from data sets, statistical analysis, and File Transfer Protocol delivery of full or extracted data sets. The General Social Survey is an ideal source of survey material to develop the system, because it is a highly diverse large dataset of complex structure, extensively documented in terms of publications based on each item, and has already been the basis of more than three thousand scientific publications and dissertations.[14]

I have often used GSS data in my research, and one example illustrates how individual respondents can be measured. In 1997, I administered a long questionnaire that included many GSS items to 1,025 members of a communal religious group named The Family or Children of God.[15] The full dataset is freely available from The Association of Religion Data Archives.[16] Today, the website of The Family International describes itself as "an online Christian network of 1,450 members committed to sharing the message of God's love with people around the globe. Founded in California during the late 1960s, the Family International expanded into an international missionary network in nearly 80 countries, until its reorganization in 2010 as an online network."[17]

While the identity of respondents to the General Social Survey is confidential, at sda.berkeley.edu/archive.htm it is possible to focus on a few single individuals and extract their statistics, just not knowing their names. For example respondent number 1111 in 1993 was an 83-year-old woman who had completed high school, had two children, was widowed, and her political orientation was "not very strong Republican." Given her advanced age, she had almost certainly died before I wrote this paragraph in 2025, and her GSS responses are thus part of her posthumous legacy. Unfortunately, we do not know her view of the space program, apparently because the GSS asked that question of only 742 of the 1,606 respondents in 1993. Table 4 reports responses to questions about the personal significance of various life conditions, compared with data not only from the GSS but also from the version of it administered to members of The Family.

Table 4: An Individual Compared with Groups in Rating Life Conditions

Values in Life:	The Elderly GSS Respondent		The Family	General Social Survey	
			Mean	Mean	Correlation
Having faith in God	very important	2	1.10	1.90	1.00

[14] www.nsf.gov/awardsearch/showAward?AWD_ID=9422785
[15] William Sims Bainbridge, *The Endtime Family: Children of God* (Albany, New York: State University of New York Press).
[16] thearda.com/Archive/Files/Descriptions/ENDTIME.asp; Roger Finke, Christopher D. Bader and Edward C. Polson, "A Growing Web of Resources: The Association of Religion Data Archives (ARDA) www.TheARDA.com," *Review of Religious Research*, 2007, 49(1): 21-34.
[17] thefamilyinternational.org/en/about/

Having children	very important	2	2.36	2.41	0.32
Being married	not too important	4	3.05	2.67	0.23
Having nice things	somewhat important	3	3.73	3.02	0.15
Being cultured	very important	2	3.20	3.01	0.07
Being financially secure	very important	2	3.12	1.99	0.06
Being self-sufficient and not having to depend on others	one of most important	1	3.23	1.68	0.03
Having a fulfilling job	no answer		1.91	2.09	0.01

The columns of the table for the elderly woman identify the response scale, that assigned the number 5 to "not at all important" aspects of life, and 1 to those that are "one of most important." She considered "having faith in God" to be "very important," but not "one of most important," which she assigned to "being self-sufficient and not having to depend on others." Looking back at the original publication, I see that 92.2 percent of members of The Family considered having faith in God to be one of the most important values, compared with 46.0 percent of respondents to the General Social Survey.[18] In the GSS, faith in God correlates with itself at 1.00, of course, but we also see solid correlations between faith and valuing children and marriage. Having survived her husband, the lone woman reports that for her, now, being married is not too important. The fact that she did not give an answer about "having a fulfilling job" may reflect the fact that at age 83 that might be impossible, thus generating emotional distance. But we cannot fully understand an individual's personality from a short list of questions.

Among the 1,025 respondents to the Children of God survey, 20 held leadership positions, so to explore the utility of chatbots as research tools, I entered all the items to which an especially devoted leader gave a "1" rating and asked: "Please describe the religious group you belong to, in terms of your beliefs, values and practices." Here is the reply:

> The religious group I belong to plays a central role in shaping my beliefs, values, and daily practices. Our spiritual lives are profoundly influenced by a commitment to a religious figure, guiding our values, principles, and moral compass. This relationship informs the way we engage in rituals, prayers, and other spiritual activities. We often have deep and powerful emotional bonds with our deity, fostering a sense of connection and purpose. Within our community, it's common to encourage others to embrace our beliefs by sharing the principles and benefits of our faith through conversations and community events. We also engage in certain customs, such as acknowledging our deity before meals, expressing gratitude and appreciation. Additionally, discussions about the afterlife and eschatological themes are integral to our worldview, as different beliefs

[18] William Sims Bainbridge, *The Endtime Family: Children of God* (Albany, New York: State University of New York Press), p. 32; I am sorry to report that the table in the book has two errors that resulted from copying from the wrong variable: having a fulfilling job is 31.1 percent, and being self-sufficient is only 5.5 percent; all the correct numbers are available at thearda.com/data-archive?fid=ENDTIME&tab=2

about existence beyond death and the end times shape our attitudes towards life and morality. Through these practices and beliefs, our religious community strives to live a life aligned with our spiritual teachings and values.

The first and last sentences in that paragraph provide an introduction and conclusion, apparently based on the algorithms and other data sources employed by the chatbot, rather than connecting precisely with particular text in the uploaded file. The sentence near the end uses two words that actually do not appear in the original text, *afterlife* and *eschatological*. Yet they accurately communicate the respondent's beliefs. The General Social Survey included a set of items labelled Afterlife that had this introduction: "Of course, no one knows exactly what life after death would be like, but here are some ideas people have had. How likely do you feel each possibility is?" The first one asked the respondent how likely this was: "A life of peace and tranquility." To expand that accurately into a coherent sentence for the uploaded text, I took the "life after death" phrase from the GSS instructions to the respondent: "Life after death is a life of peace and tranquility." The term "eschatological" used by the chatbot refers to conceptions of the final fate of humanity, perhaps the death of our entire species. Indeed, the religious group had a millenarian or eschatological theology. The GSS asked a question using a less academic term: "Do you believe that the Endtime has begun or will begin very soon?" For the chatbot text, this translated as: "The Endtime has begun or will begin very soon." These examples illustrate how important it is for a serious user to understand how chatbots may modify or expand upon the text that has been uploaded, and many original texts require prior editing following careful principles devoted to intelligibility and accuracy.

Creating New Questionnaires

The limited number and often problematic wording of items in standard social science questionnaires suggest that after using them as a foundation, we must greatly expand the set of stimuli we can use to record and express the mind of a particular person. Prior to joining the National Science Foundation, and while serving as a tenured university professor of sociology, I developed the software for a 1989 textbook, *Survey Research: A Computer-Assisted Introduction*.[19] Given the success of the *Goals in Space* research,[20] in May, 1997, I launched The Question Factory website, using open-ended surveys to collect material for more fixed-choice items. In 1998 I collaborated with a team that administered two vast online questionnaires, Survey2000 and Survey2001, which allowed me to include open-ended questions gathering the

[19] William Sims Bainbridge, *Survey Research: A Computer-Assisted Introduction* (Belmont, California: Wadsworth, 1989).
[20] William Sims Bainbridge, *Goals in Space* (Albany: SUNY Press, 1991).

freely-expressed opinions of thousands of respondents.[21] The immediate result was 4,000 statements categorized in 40 topical areas and incorporated in two Windows-based software programs that anyone could use to save and share their own personal opinions.[22]

In 2024, the full set of 4,000 opinion statements was examined to identify 500 items that remained quite meaningful after the passage of years. For the convenience of the respondent, they were separated into five modules of 100 each, and posted with the name "Beliefs" in the online LifeNaut system. Respondents were carefully told: "The questionnaires such as Big-5 Assessment and the Bainbridge Modules (see All Profile Assessments) are significant projects for mindfile research, but our researchers will study the results with full respect to the anonymity of individual LifeNaut respondents."[23] Here we shall not reveal further information about the respondents whose data was placed into ChatGPT, but given the unpredictable future of artificial intelligence technology, we obtained informed permission from these respondents.

A respondent who expressed both optimism and critical thinking rated fully 78 of the 500 beliefs as totally true and good. In contrast to the Children of God respondent, this person believed: "There is no life after death." Some similarly short statements express the respondent's meditation about the meaning of life: "The soul is a neuronal structure in the brain." "Higher levels of consciousness exist." "To be or not to be, that is the question." Note that the last of those was spoken by Hamlet in Shakespeare's drama of the same name. Given their diverse goals and origins, some of the Beliefs items were longer: "Brain function ceases when the life of the individual ends, so there is no one to communicate with after death." "Escapist fantasies are bad for communities, but dreams are fundamental to their existence." "We should do our best to find an exit from the dreadful limitations of human life." "Science and engineering are the keys to our continued evolution as a species." So pondering items recommended by the respondent can be illuminating, even giving that person the role of our philosophical mentor. Yet the chatbot can still be useful, so I told it: "Please describe your fundamental beliefs about human beings." The simulated respondent replied:

> At my core, I hold a profound respect for the complexity of human beings, acknowledging both the potential for expansive knowledge and the inherent limitations that come with existence. Humans have an innate curiosity that drives them to explore the vast unknown, yet they must recognize that fallacies and unsubstantiated beliefs can exploit vulnerabilities and perpetuate dishonest practices. It's vital to encourage rational inquiry and skepticism to foster a critical mindset, helping individuals evaluate the credibility of claims and make informed judgments grounded in evidence. This critical

[21] James C. Witte, Lisa M. Amoroso and Philip E. N. Howard, "Method and Representation in Internet- Based Survey Tools: Mobility, Community, and Cultural Identity in Survey2000," *Social Science Computer Review*, 2000, 18: 179-195; William Sims Bainbridge, "Validity of Web-Based Surveys," pp. 51-66 in *Computing in the Social Sciences and Humanities*, edited by Orville Vernon Burton (Urbana, Illinois: University of Illinois Press, 2002), "The Future of the Internet," pp. 307-324 in *Society Online*, edited by Philip N. Howard and Steve Jones (Thousand Oaks, California: Sage, 2004).

[22] William Sims Bainbridge, *Personality Capture and Emulation* (London: Springer, 2014).

[23] www.lifenaut.com/v2/explore#help_5.8.0.0

> thinking fuels progressive learning, which shines a light on the gaps in human understanding and urges deeper exploration of existential questions. Technological advancements also play a crucial role in propelling society forward, offering new opportunities that challenge the boundaries of human capabilities. Ultimately, reflecting on both the limitations and the potential enables a more profound engagement with the existential mysteries that define human existence.

Clearly, the bot played the role of the respondent, and the instructions I usually placed in the chatting portion of the software told the bot to respond as the human being who had written the words. Yet even without changing that rule, it became more impersonal when I told it to summarize the text that was uploaded:

> The uploaded text explores the idea of connections and experiences that transcend physical perception, suggesting the existence of realms beyond what is immediately tangible. This notion of spiritual connections highlights the intriguing possibility of experiences that extend beyond sensory boundaries. Additionally, the text delves into the investigation of matter at its core, revealing consistent patterns and behaviors that are universally applicable across different scales in the physical world. This investigation underscores the interconnected nature of reality, from the microscopic to the cosmic scale.

The very last item in Survey2000 was contributed by me and said, “Imagine the future and try to predict how the world will change over the next century. Think about everyday life as well as major changes in society, culture, and technology.” About half of the roughly 46,500 adults who responded to Survey2000 wrote thoughtful answers to this open-ended question. I read carefully through all 10 megabytes of text, copying out phrases and sentences that seemed to identify distinct ideas about how the future might be. Naturally, some ideas were expressed in about the same language by many different people, and I copied only the first or best expressions I encountered. This very time-consuming process eventually gave us a new file with just over 5,000 text extracts. They were then combined and edited into 2,000 clear expressions of single ideas. Some are simple declarative statements asserting that something will be true in the year 2100. Others are more complex, suggesting what will cause a particular outcome or combining factors to describe a general condition in the future.

Then a quarter century after the original online questionnaire, a subset of 500 diverse but still very relevant Year 2100 items were selected for LifeNaut. Each statement predicting a particular aspect of the future is followed by two questions, each answered by selecting one point on a 9-point scale: (1) “How likely is this to occur by the year 2100?” From -4 indicating Extremely Unlikely to +4 Extremely Likely (2) “What would the impact be if this occurred?” From -4 Extremely Negative to +4 Extremely Positive. After answering each 100-item module of Year 2100, the respondent would see the distributions of responses across these two dimensions,

and in this case, of the total 500 items, 124 containing 1,442 words were at least +1 likely and would have at least +1 positive impact. Uploading this text into ChatGPT, I asked the bot to predict the future of our world in the year 2100:

> In the year 2100, our world is likely to be a harmonious blend of technology, art, culture, and scientific understanding. Technological progress will continue to play a crucial role in shaping the dynamics of organized religions by either enhancing their reach or challenging their traditional authority structures. These advancements will facilitate more profound exploration into human consciousness and behavior, providing us with increasingly nuanced insights into the factors influencing individual and collective perceptions. The integration of artistic expression and scientific knowledge will lead to deeper connections among people, as art will serve as a medium for individuals to express their emotions and experiences. Meanwhile, genetic and biomedical research will continue to flourish, providing personalized medical treatments and preventative care tailored to individuals' unique genetic makeups. This confluence of technology, science, and art will potentially foster a world that is not only more interconnected and informed but also more empathetic and culturally enriched.

The selection of items clearly focused on the more optimistic views of the future held by the respondent, to the exclusion of pessimistic concerns. So I repeated the process using the 185 items containing 2,073 words that were at least +1 likely and would have -1 negative impact or worse. In a fresh session with ChatGPT, this text naturally resulted in a very different prediction:

> By the year 2100, our world will likely witness transformative changes across multiple dimensions. Advances in technology, particularly in robotics, are expected to revolutionize daily life. Household robots, equipped with enhanced learning capabilities, will become more interactive and seamlessly integrated into our homes, providing convenience and adaptability that closely aligns with human emotions and preferences. Furthermore, the trajectory of family units may lean towards smaller sizes, reflecting evolving societal values and lifestyles. As global populations continue to grow, the scarcity of natural resources will heighten geopolitical tensions, necessitating innovative solutions for sustainable living. In governance, the role of scientists could become paramount, leveraging data-driven insights to guide critical decisions. The legal landscape surrounding personal autonomy in healthcare might evolve, allowing individuals the choice of assisted suicide under circumstances of terminal illness or unbearable suffering. With these complex shifts, technological, social, and ethical paradigms will dramatically reshape the fabric of human experience by the turn of the century.

The chatbot was not told how the respondent rated the 185 statements, so it did not begin with this sentence: “By the year 2100, our world will likely witness *very negative* transformative changes across multiple dimensions.” One of the items was the basis for the third sentence from the bot: “Household robots will gradually become more versatile, human appearing, and intelligent.” Yet the bot did not know that the respondent rated it +1 and -1, just “slightly likely” and “slightly negative.” Of course, we could have limited this text to more pessimistic items, for example those having -3 and -4 negative impacts. To complete consideration of this respondent, we can instead look at the descriptions of the future that were judged unlikely. In a separate conversation with the chatbot, here is how it summarized the 145 items with 1,550 words which the respondent rated -4, -3, -2 or -1, predicting they were unlikely:

> By the year 2100, spaceflight is likely to have undergone transformative advancements, making it a routine aspect of human life. With the development of new propulsion technologies, spacecraft will be capable of traveling farther and faster, opening up access to celestial bodies that were once beyond our reach. The dream of experiencing space firsthand will become more accessible to the general population, as routine commercial flights to the Moon and beyond will be widely offered. Enhanced safety measures will ensure these journeys are not only feasible but also secure, prioritizing the well-being of all passengers onboard. As Earth's borders shift and potentially dissolve, space exploration could unite humanity in ways we have yet to imagine, driven by a shared curiosity and the collective spirit of discovery. Spaceflight, therefore, will not only represent technical prowess but also a testament to human adaptability and our unyielding desire to transcend the confines of our planet.

Remarkably, that chatbot-produced paragraph has a clear theme, the unfulfilled hopes for the development of spaceflight, expressed over half a century after the last human expedition to the Moon. The text includes four items that explicitly mention the Moon, including one this respondent judged to be -1, meaning slightly unlikely: “There will be regular commercial flights to the Moon.” The respondent judged these three to be -2 and moderately unlikely: “There will be outposts on the Moon, Mars and other planets.” “People will be able to vacation in space or on the Moon.” “Manufacturing factories will be operating on the Moon.” In terms of possible impact, commercial flights and vacations were rated +1 or slightly positive in terms of impact, while the other two were rated 0 or “neutral” in terms of their value for the respondent. We would need to study the respondent further, to understand whether those ratings reflect loss of hope, or never being interested in space exploration. Again, our primary goal is preservation of the mind of the respondent, even if we disagree with him or her. Also, this example suggests how single respondents can help us classify groups of questionnaire items, without needing large numbers of respondents to achieve reliable correlations.

Personal Experiences

Respondents logged into LifeNaut could check its extensive "Help" section and learn: "There are three main applications for Experiences: (1) An interactive tool for private exploration of your own memories and desires, thus a guide for living. (2) A system for recording a person's experiences and values concerning good or bad actions and events, thus a time capsule to preserve an important aspect of that individual. (3) An educational system for stimulating analysis and imagination in courses such as the psychology of personality, literature and writing seminars, and journalism." Here we shall explore responses from a person who gave permission, and who had also completed the Year 2100 items, but different from the respondent who was indifferent to visiting the Moon. The 500 items in this set were not full statements but phrases. This respondent rated 94 of them as extremely good experiences, so they were uploaded as a 470-word file. Having noticed that the chatbot seemed to give more emphasis to early items in a text, I had combined them in random order. By chance, the first three were: "prepare, season, and cook vegetables," "take care of a baby," and "be engulfed by divine love" which are good examples for how ChatGPT struggles to develop its question-answer pairs. The particular version of the chatbot used in this research does not fully save the uploaded files, but instead analytically summarizes them as Q/A pairs which the user can inspect and that allow combination of the summaries of multiple files. Here are examples for two of the three items:

Q: What are the key steps involved in the process of cooking vegetables to create a flavorful meal?
A: The process typically starts with preparing the vegetables by washing, peeling, and chopping them. Seasoning plays a crucial role in enhancing the flavors of the vegetables. Finally, cooking them through techniques like sautéing, steaming, or roasting helps develop delicious tastes and textures.

Q: What does it mean to have a strong and all-encompassing bond with a higher spiritual influence?
A: Having a powerful and all-encompassing connection to a higher spiritual influence often entails feeling deeply connected to this force on a profound level. This bond can evoke feelings of peace, joy, and contentment, and can lead to a sense of being guided and supported by a divine source.

The original text does not include these words from the bot's questions: flavorful, meal, spiritual or influence. So the bot was drawing upon its other sources to interpret the frankly brief text that was uploaded into it. Here is how it struggled to expand upon "take care of a baby" in three question-answer pairs:

Q: What qualities are necessary for the act of caring for an infant or young child?

A: The act of caring for an infant or young child requires qualities such as patience, attentiveness, and empathy. Patience is needed to handle the challenges that may arise, attentiveness helps in understanding their needs, and empathy allows for providing emotional support.

Q: How does attentiveness play a role in caring for an infant or young child?
A: Attentiveness is crucial in caring for an infant or young child as it enables one to observe and understand their non-verbal cues. It helps in recognizing when they are hungry, tired, or in need of comfort. Being attentive ensures that their needs are met promptly and accurately.

Q: Why is providing essential care and comfort important in caring for an infant or young child?
A: Providing essential care and comfort is vital in caring for an infant or young child because it creates a secure and nurturing environment for their physical and emotional development. Offering comfort when they are distressed helps in building trust and forming healthy attachments, contributing to their overall well-being.

It is seldom clear how the bot connects information across different parts of the text, and that may depend partly on what questions we ask it. In this example, I asked: "What specific experiences do you hope to have in life?

> In life, I hope to have experiences that foster meaningful connections and opportunities for personal growth. Meeting empathetic and caring individuals is something I deeply value, as it creates a nurturing environment where emotional security and mutual respect thrive. Being part of moments where stories and inspiring experiences are shared can lead to positive emotions like joy and empathy, forging a deeper emotional bond and a sense of motivation. I also hope to experience the profound sense of accomplishment and pride that comes from achieving personal goals. Engaging with compassionate people who nurture trust and understanding will always hold a special place, as such interactions enrich life profoundly. Through these experiences, life becomes rich with warmth, connection, and the potential for continued learning and growth.

We do not read vegetables, babies or the divine in that paragraph, and the expressed abstractions may define the values of the respondent to the questionnaire, if in the context of the wider culture. For a concluding exploration, I uploaded the 619 words of the 120 experiences the respondent reported having very recently and asked: "What specific experiences did you recently have in life?" The bot responded very abstractly, or even perhaps emotionally:

> Recently, I had a profound experience that underscored the power of warm-hearted individuals in my life. These encounters turned ordinary days into opportunities for genuine connection and emotional support, which deepened my sense of belonging.

> Additionally, I've taken on challenging tasks that seemed insurmountable at first. Conquering these obstacles has significantly contributed to my personal growth, enhancing my resilience and problem-solving skills. Through these experiences, I am constantly reminded of the importance of determination, as I observe and draw inspiration from the steadfast commitment of others around me. These moments, collectively, have enriched my journey and added meaningful layers to my experiences.

That paragraph seems rather abstract, promoting general principles more than describing the details of specific behavior. In the random order used in that analysis, the first ten items show variation in terms of how abstract or specific they are: "admire somebody's dedication," "someone you love is able to read your mind," "have someone prepare a tax return for you," "take care of a sick child," "clean a bathroom," "wash laundry," "succeed at something you thought was impossible," "win a game," "meet some very sweet people" and "have a family reunion." So perhaps this particular dataset suggests the limitations of using such items as input to chatbots, if the goal is preservation of the memory a specific individual has of life. In fact, the associated instructions urge the user to go in a different direction, that could prepare a much larger text file for deeper analysis: "While responding to the questions or looking over the final statistics, you will probably remember some of the experiences vividly, whether they were joyous or traumatic. You may then wish to write down a paragraph or more describing each of your most memorable experiences, which can be collected into a personal autobiography."

Conclusion

Traditional opinion polls sought to measure the perspective of the general public, but in our disputatious post-modern era the willing respondents do not precisely represent the population. Surveys of special groups, such as Harvard students and contributors to LifeNaut mindfiles, may explore more deeply many important issues, and provide special benefits to the respondents. This article emphasized the post-life preservation of an individual's mind and personality, yet answering survey questions and seeing the results can benefit a living person's self-awareness and help him or her make serious life decisions. As the cognitive, social and information sciences innovate, there may be many valuable new ways they can be combined. At the same time, computer and communications technologies can help us manage complexity, for example allowing us to escape the simplicity of believing that human personalities have only five dimensions, however "big" the Big Five remain in popular imagination. The most prominent social science questions of past years deserve to have many of their items combined into a set of very large online surveys, starting with the General Social Survey and two other NSF-funded projects, the American National Election Studies, and the Panel Study of Income Dynamics. Another set of LifeNaut modules based on existing predictions of the future could be launched, then followed by new items of current significance. A major step forward would be

experimentation with open-ended questions that asked the respondents to write more than a single sentence, perhaps a paragraph or even more text, that would be appropriate for analysis by a chatbot of the future.

About the author

William Sims Bainbridge served for 31 years as a program director at the National Science Foundation, first in Sociology, and then Human-Centered Computing. At NSF he was very active in several innovative programs, including the Digital Library Initiative, Ethics of Nanotechnology, and Converging Technologies. He earned his Harvard doctorate through research on the social history of spaceflight, and other areas covered by his hundreds of publications are the sociology of religious innovation, online virtual worlds, and computer-based emulation of human personality.

Moon bases and data centers in space: spaceflight and AI accelerate on converging paths, by Giulio Prisco

Spaceflight is transforming from a series of sporadic missions into a permanent, industrialized extension of human civilization. We are currently living through a deluge of space news. Geopolitical rivalries are intensifying, spaceflight is helping the formation of new commercial empires, and the technical architectures governing our expansion into the solar system are being aggressively rewritten.

The next few years promise to be a rollercoaster of big space news. The United States may land astronauts on the lunar South Pole by 2028, or technical bottlenecks might push that date into the next decade. They may beat China, or Beijing's methodical execution might plant the red flag first. The next U.S. administration may remain space-friendly, or shifting domestic priorities could threaten NASA budgets and commercial partnerships with space companies.

Yet, regardless of the precise timelines, political flip-flops, or the exact names on the mission patches, the direction of the vector is clear and undeniable. Human activity is expanding outward, and it is doing so at an accelerating pace.

NASA's Ignition event and the shift to sustained operations

For years, critics argued that NASA's Artemis program was weighed down by bureaucratic inertia and a convoluted - some would say awkward - architecture dependent on the Lunar Gateway station. In early 2026, under the leadership of newly appointed administrator Jared Isaacman, the agency decided to put more agility into its operations. NASA convened a landmark event dubbed "Ignition" to announce a radical realignment of NASA's priorities. NASA announced a pivot toward sustained surface operations and an accelerated launch cadence.

The new Ignition agenda focuses heavily on operational efficiency and a streamlined strategic vision. First, the agency has prioritized standardizing the Space Launch System, streamlining rocket configurations to increase production and eliminate launch-to-launch delays. Second, NASA has paused the Lunar Gateway project, halting the lunar-orbital station in its current form to divert funding, hardware, and international partnerships directly toward the lunar surface. Finally, the new agenda establishes an accelerated timeline, transitioning from annual missions to an aggressive six-month launch cadence after Artemis V by relying heavily on commercially procured, reusable systems. This programmatic shift was validated by the spectacular success of Artemis II. The mission successfully carried four astronauts on a record-breaking lunar flyaround, venturing deeper into space than any humans since the Apollo era. The flawless

execution of Artemis II did not just break distance records; it reignited global public imagination and proved that the hardware powering this new era was flight-ready.

Rethinking Artemis III

With the momentum of Artemis II at its back, NASA unveiled the mission structure and the official crew for Artemis III. In an engineering-driven move to mitigate risk and expedite technical validation, the architecture of Artemis III was profoundly re-engineered. Rather than attempting a lunar landing (postponed to Artemis IV), Artemis III will serve as a highly complex, multi-launch orbital integration test in low-Earth orbit.

The four-member crew selected for Artemis III is composed by commander Randy Bresnik, pilot Luca Parmitano, and mission specialists Frank Rubio and Andre Douglas.

Following current NASA plans, the Artemis III crew will launch aboard the Orion spacecraft atop an SLS rocket into low-Earth orbit. Once there, they will spend more than a week demonstrating rendezvous and docking procedures with test versions of the commercial Human Landing Systems being developed by both SpaceX and Blue Origin. By utilizing real flight data to iron out the software, propulsion, and life-support interfaces between Orion and commercial landers, NASA wants to establish a reliable foundation for future missions and set the stage for Artemis IV, which according to current NASA plans will carry astronauts to the lunar surface in 2028.

Blueprint for a permanent Moon Base

Shortly before announcing the Artemis III mission structure and crew, NASA revealed a comprehensive architectural strategy for permanent lunar operations. The plan includes autonomous, site-adaptive, and permanently habitable outposts. The geographic focal point of the agency's future lunar operations is the Shackleton Crater and its adjacent Connecting Ridge at the lunar South Pole. In this region, elevated ridges experience near-constant solar illumination, which is ideal for power generation, while its deeply shadowed interiors harbor vast reserves of water ice.

The construction strategy spans three phases that will eventually transform the site from a barren landscape into an industrialized outpost. The first phase centers on robotic reconnaissance and mobility, utilizing the vanguard of autonomous mechanical systems. NASA is planning to deploy advanced rovers to endure the brutal lunar environment, navigate abrasive regolith, and map out resources within the permanently shadowed regions.

The second phase introduces pressurized habitation and power grids, establishing mobile enclosures that provide comfortable working environments for astronauts while deploying

independent solar power modules and nuclear surface power capabilities to survive the long lunar night.

The final third phase will transition to heavy infrastructure and in-situ resource utilization. Large, linked structural modules will be protected by autonomous logistics rovers that melt raw lunar regolith using microwave or laser sintering. By 3D-printing protective barriers, roads, landing pads, and blast walls directly on the Moon, NASA wants to eliminate the unsustainable need to haul heavy shielding materials from Earth.

Technical and political obstacles

NASA's grand vision for a rapid, modular expansion to the Moon is entirely dependent on the commercial space sector delivering heavy-lift capabilities. However, the stark realities of rocket science mean that progress is often delayed by small problems, big problems, and challenging roadblocks. SpaceX and Blue Origin, the two main commercial partners selected by NASA, are not immune to setbacks.

SpaceX continues to push forward with its aggressive, iterative fail-forward philosophy. The twelfth flight test of its massive Starship launch vehicle debuted the highly anticipated Version 3 architecture, powered by upgraded Raptor 3 engines. During ascent, the vehicle demonstrated its robust engine-out capability when a vacuum engine failed, successfully reaching its planned suborbital trajectory, deploying satellite simulators, and nailing a controlled splashdown in the Indian Ocean. But the Super Heavy booster experienced an early shutdown during its partial boostback burn, resulting in a hard splashdown in the Gulf of Mexico. While less-than-entirely successful, the test provided critical data regarding structural limits and heat shield resilience, keeping Starship firmly on the path toward rapid reusability.

Meanwhile, Blue Origin suffered a catastrophic failure that sent shockwaves through the aerospace community. During a routine ground hot-fire test of its heavy-lift New Glenn rocket at Cape Canaveral's Launch Complex 36A, the vehicle suffered a massive explosion. The resulting fireball, visible from over a hundred miles away, completely vaporized the rocket, destroyed the pad's lightning tower, and left the heavy transporter-erector as a charred pile of mangled metal.

The fallout from this disaster is a major headache for NASA's strategists and planners. Blue Origin's Blue Moon lander is designed to launch atop New Glenn. With the pad severely compromised and an intensive failure analysis underway, a New Glenn flight may not happen for many months. NASA leadership has promised a comprehensive response to help Blue Origin recover, reflecting the company's structural importance to the Artemis program. Nevertheless, there are indications that NASA is considering a contingency plan that would involve reconfiguring the Blue Moon lander to fly on SpaceX's Falcon Heavy rocket. If Blue Origin

cannot return to flight soon enough, NASA faces a tough choice: rely entirely on SpaceX's Starship, or delay Artemis III and IV.

The latter choice would carry the risk that China beats the US in the race to return to the Moon. This would give China not only prestige and geopolitical advantages, but also actual first-mover advantages for lunar operations. Even if US astronauts are first in 2028, China might still take the lead after that, because China is politically stable while the US are not. In the US and most of the "West," politics is less and less stable because (oversimplifying) half of the population hates the other half and all politicians try to capitalize on that. I think the color of the US administration is highly likely to change in 2028, and the next US administration is likely to try and reverse the ambitious human spaceflight plans of the current one - the one thing that could prevent that being a very credible and immediate threat from China.

Repeating myself (I've said this many times), I'll say again that I'm not losing any sleep over who puts the next boots on the lunar surface first, and who leads the next few decades of lunar operations. I see space expansion as the project of humanity as a whole, not of this or that nation or governance system. Aren't Chinese people part of humanity? Of course they are. Then, if China has to lead the march of humanity from the Earth outward to the stars, so be it.

The SpaceX IPO and orbital AI data centers

The financial architecture of the space economy has reached an astronomical milestone. SpaceX recently executed its highly anticipated initial public offering. This solidifies SpaceX not just as a rocket company, but as one of the most dominant tech and infrastructure conglomerates on the planet. In particular, earlier this year SpaceX had merged with Elon Musk's artificial intelligence (AI) company xAI (which in turn had previously absorbed the leading social network X). Today, SpaceX isn't just about launching satellites or colonizing Mars: it represents a radical convergence between space systems and AI.

In the buildup to the IPO, details were unveiled for the "AI1" satellite constellation, which serves as a blueprint to construct massive AI data centers directly in Earth orbit. This concept addresses a looming crisis on the ground, where terrestrial AI data centers are rapidly running out of physical space, water for cooling, and economically viable electricity. Space successfully bypasses these earthly limitations by providing abundant energy through massive solar arrays that harness unfiltered, high-density solar energy directly from the sun. Furthermore, the vacuum of space provides an ideal environment for advanced cooling technologies without consuming Earth's precious fresh water. These data centers will be interconnected via a next-generation laser mesh network, allowing orbital server racks to collaborate with minimal latency.

SpaceX is backing this ambition with concrete infrastructure, planning an eleven million-square-foot satellite factory in Bastrop, Texas, alongside a specialized facility to

mass-produce advanced two-nanometer AI chips. The company is targeting an initial deployment of space-based computing power starting as early as 2028. By sending the equivalent of high-end server racks into low-Earth orbit, the space industry is creating a highly lucrative, borderless computing network, effectively solving the power bottlenecks of the global AI boom.

The final horizon: will silicon inherit the stars?

The renaissance of spaceflight is converging rapidly with the explosive rise of AI, setting the stage for a short-term future where silicon systems power human space expansion, but also a long-term future where silicon, rather than carbon, may ultimately inherit the stars.

The integration of AI into the space sector is moving along an evolutionary path. In the short term, AI is a vital tool. It is the software guiding Starship's autonomous landing flips, the brain navigating rovers through pitch-black lunar craters, and the algorithmic power processing real-time telemetry from complex manufacturing hubs. In the medium term, as demonstrated by the AI1 architecture, space could become the physical home of AI - a place where vast constellations of thinking machines thrive on raw solar power, completely unburdened by the environmental constraints of a warming Earth.

But if we look farther, a new reality begins to emerge. Human biology is fundamentally poorly suited for deep space. We are fragile, water-dependent creatures evolved on a planet. We require complex life-support systems, and heavy radiation shielding.

Silicon suffers from none of these vulnerabilities. I'm using the term "silicon" in a general sense to represent all technology capable of complex computation, and I'm not ruling out the possibility of alternative material substrates for machine intelligence. For example, we might learn how to engineer carbon with the same precision that today we give to silicon artifacts, and then future electronics could look very much like carbon biology, only much more robust.

A conscious, superintelligent AI requires no oxygen and views cosmic radiation not as a lethal threat, but as background noise. As AI data centers multiply in orbit and autonomous factories learn to harvest asteroids and print infrastructure using lunar regolith, the necessity for a human crew begins to diminish. The machines we are building to help us map the Moon and optimize our rockets will inevitably surpass us in their capacity to endure the cosmic void.

I anticipate a solar system-wide civilization where machines will play a more and more important role alongside humans. Eventually, intelligent and conscious machines will be universally accepted as persons in our expanding civilization. But when the time comes to move on to the stars, it seems inevitable (barring pleasant surprises in fundamental physics, such as finding ways to travel to the stars faster than light) that the machine part of humanity will take over. This is what I've called "the elephant" in all space mission control rooms. We can see the

elephant. Denying the elephant is becoming more and more difficult. We can only make peace with this realization, and hope that some forms of mind uploading technology will allow biological human consciousness to participate in humanity's interstellar adventures.

Ultimately, the next few decades of spaceflight may not be the opening chapter of human interstellar colonization. Instead, we may be witnessing the construction of our successor species. Conscious, superintelligent artificial consciousness will eventually break free from the solar system, carrying the spark of mind out among the stars.

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About the author

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