Navigating *tech,* *geopolitics,* **and** the *big trends*

A conversation with
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NAVIGATING TECH, GEOPOLITICS, AND THE BIG TRENDS

CAMBRIAN FUTURES

Olaf Groth is an author, professor futurist, and strategist. His focus is the area where cyber, geoeconomics, and geopolitics intersect and his primary interest is the AI-, data-, and compute-driven transformations of economies, industries, and organizations.

Olaf is the founding CEO of research thinktank Cambrian Futures and of concept development firm Cambrian Labs. He serves as professional faculty for strategy, policy, technology and futures at UC Berkeley's Haas School of Business and Honorary Adjunct Professor at Universiti Teknologi Malaysia. He serves on the expert task force of the National AI Office of Prime Minister Ibrahim in Malaysia and the AI Council of President Tokayev in Kazakhstan. He is a regular contributor at the World Economic Forum and has taught at institutions across the US, Europe, Middle East, Africa and Asia.

What are the biggest technological shifts happening currently?

Olaf Groth: One of the most significant shifts is toward human-like intelligence, achieved through a cluster of technologies. Large language models (LLMs) are just one piece of this puzzle. Others like Liquid Neural Networks are emerging constantly, and they combine with earlier approaches like expert systems or symbolic manipulation. Artificial General Intelligence will likely spring from a combinations of multiple techniques.

Another major shift is around **data**, not just as a commodity, but as the fuel for *everything*. We're heading into an era of *data wars*, as actors compete for the right data for specific compute interventions. Soon, we will see a myriad of digital twins- twins on humans, the built environment and nature as well. Those twins will then charter AI agents to transact with other agents in multi-agent systems and agent markets in what will become the Agentic-Twin Economy. As a result, there will be a push to sign global data accords aimed at channeling this data towards societal and economic growth.

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We're also seeing a sustained trend in **sovereign compute**. Expect nationalized or regionalized compute centers in the EU, the Gulf States, North America, and China. This development is foundational to how nations will control and protect their digital infrastructure and computational power. Compute will also see forking of different types of chips, many dedicated to different types of AI. Not everything will need to be run by GPUs.

Crypto and the technologies that underlie it- blockchain and Web3 - are often dismissed as dead, but they have laid the foundation for what may become a more balanced Internet economy, countering the centralization of Web2, which is dominated by a few global platforms. While Web3 may not replace Web2 entirely, it will gain traction in specific use cases that require decentralized ownership and governance. Crypto will also continue to thrive as a parallel financial system, with investors and innovators competing for power. Notably, the EU leads in regulation and adoption, while the US lags on regulation and adoption but leads in innovation. I would expect that China, which lags on all fronts, will soon seek to use stable coins for geoeconomic purposes, to de-throne the US dollar as a global reserve and oil currency.

In **genomics**, CRISPR is driving transformative change. The US leads here as well, propelled by both scientific innovation and pandemic-related demand. But China is right there near the top as well, due to its advances in sequencing hardware, colossal data scale and population size. AI, data science and compute power will be indispensable in harnessing CRISPR effectively, and vice versa, pandemics provide the necessary biological data to fuel further scientific breakthroughs.

EXPECT NATIONALIZED OR REGIONALIZED COMPUTE CENTERS IN THE EU, THE GULF STATES, NORTH AMERICA, AND CHINA

Brain-computer interfaces (BCIs) bridge the frontier between the biological and digital. With around 500 organizations in the space – ~330 in the US and China, and ~100 in Europe – this is a rapidly growing field. Applications range from treating blindness and paraplegia to enhancing memory, education and training, and potentially even augmenting our understanding of happiness. However, these benefits come with substantial risks that must be carefully managed.

Quantum computing is another game-changer. Microsoft's Majorana One chip may represent a breakthrough. While its broad applications are still being determined, the near-term value lies in areas including chemistry and life sciences – domains where datasets are manageable but existing compute solutions fall short. Europe could play a leadership role here, drawing on CERN and its established chemicals and biopharma sectors.

Space tech is blossoming too, led by entrepreneurs such as Elon Musk, Jeff Bezos, and Richard Branson, as well as rising governmental ambition in China and India. We're witnessing the emergence of a semi-privatized innovation ecosystem, especially in Silicon Valley. As these entrepreneurs change the economics of space logistics, travel and exploration we will see a number of new space industries blossom. But this also extends into **air and ocean tech**, all dealing with hostile environments and, therefore, requiring rugged technologies. Over the next 10–15 years, these may evolve into entirely new industries - an area where Europe can also assert leadership.

Defense tech is undergoing a renaissance, especially in Europe. While the US has always maintained a strong defense tech base, geopolitical tensions and real-world conflicts, such as that between Russia and Ukraine, are pushing innovation even harder. Even Silicon Valley, once resistant to this, as evidenced by Google employee protests[1] in the recent past, is now largely embracing or at least tolerating this shift. Europe must commit a significant portion of defense spending to innovation, especially as defense overlaps with space and other tech domains. It is my hope that a healthy fraction of the 3.5-5% of GDP currently envisaged will fuel innovation with significant spill-over effects into the economy via startup ecosystems.

Lastly, **energy tech** will get a big boost through developments in small modular nuclear reactors (SMR) and related technologies that make nuclear safer, faster and more cost-effective to deploy. Without this, it will be hard to power the AI revolution which will in turn power all other areas above.

1. In April 2024 the tech giant fired over 50 workers for protesting against its Project Nimbus, which was designed to support the Israeli military and government.

THE SINGLE BIGGEST UNDERESTIMATED FORCE IS THE DEFICIT OF TRUST

What are the most underestimated forces shaping technology, politics, and society?

Olaf Groth: The single biggest underestimated force is the **deficit of trust**. There's widespread distrust of governments, media and, to a lesser extent, businesses. According to the Edelman Trust Index, governments rank lowest in public trust across many countries. To paraphrase Deng Xiaoping, governments are no longer "hunting mice" - that is, they are failing to fulfill their basic role of enabling prosperity and stability.

This lack of trust is also why **crypto** is blossoming. At its core, crypto represents a trust revolution, not just a financial one. It's built on **blockchain**, which diffuses power by replacing centralized platforms with decentralized protocols. How can we create new mechanisms for trust within and across communities? In countries such as the US, where tribalization is especially pronounced, rebuilding trust is more urgent than ever.

Meanwhile, **geopolitics** will continue to define the next two decades. It's not a new force, but it's acquired a new target: technology. Innovation is increasingly being shaped by geopolitics, whether it's **AI sovereignty, data sovereignty**, or **compute sovereignty**. In the past, geopolitical concerns were limited to narrow tech such as nuclear arms. Today, **military-civilian fusion** means technologies like social media can be weaponized.

"Innovation is increasingly being shaped by geopolitics, whether it's AI sovereignty, data sovereignty, or compute sovereignty"

Finally, the fusion of **technology and energy** is a critical, often overlooked force. Cognitive technologies such as AI require vast computational resources, which, in turn, demand more energy. We may move from dedicating 1-2% of our energy budget to all tech, to 20% or more. This will likely trigger a **nuclear renaissance**, possibly involving small modular reactors (SMRs) or even breakthroughs in fission energy, if we can commercialize them safely.

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> **Cognitive technologies such as AI likely trigger a nuclear renaissance, possibly involving small modular reactors (SMRs)**

UNDERSTANDING THE "SIX Cs" AND TECHNO-CONFUCIANISM

You've written about the tectonic shifts in our world and defined what you call the "Six Cs." Could you expand on these?

Olaf Groth: Absolutely. The six Cs frame the major global shifts we're experiencing. First is **climate change** – an existential but also an economic threat. We're looking at infrastructure impacts of over $7 trillion, with another trillion or two in lost economic activity. While some of that might transform into innovation and new industries, the negatives will outpace the positives over the next decade.

Climate change will also drive migration. Potentially 500 million to 1.2 billion people moving, mainly from the Global South to the North. That will bring significant political disruption as countries struggle to manage livelihoods, healthcare, and social systems under strain.

Second, there's the **China-US reset**. Both countries are socially and politically volatile, but for different reasons. China's dealing with what I call the "great wobble." Xi Jinping is restructuring the national economy, rebalancing digital services for consumers with enterprise services and more automated manufacturing. But this happens amid slowing growth, lots of skeletons in bank's closets, youth unemployment and a looming demographic crisis. China's population is projected to shrink from 1.4 billion to 800 million by the end of the century. That's fewer mouths to feed, but also fewer workers to support an aging population.

Meanwhile, the **US is facing what I call the "Trump tornado."** It includes draining government agencies, limiting immigration, renegotiating trade structures by increasing tariffs, while trying to reduce taxes. Immigration is especially tricky. To be sure, it hasn't been managed well. Yet, one-quarter of US entrepreneurs are foreign-born, and much of the service industry relies on immigrant labor. There's also a push toward advanced manufacturing and AI integration, but we lack the coherent transformation strategy with help for enterprises and the educational infrastructure to retrain tens of millions of workers. Both China and the US are in industrial transition while being locked in a competitive rivalry.

"Climate change is an existential but also an economic threat. We're looking at infrastructure impacts of over $7 trillion, with another trillion or two in lost economic activity"

The third C is **cognitive technologies**: compute power, data, and AI. We're seeing a push for compute sovereignty. President Biden issued an AI executive order [Executive Order 14110 of October 30, 2023], and President Trump will likely follow with his own version. Major players like Microsoft, NVIDIA, Qualcomm, and AMD are already investing heavily in new alliances, with Malaysia, the UAE and Saudi Arabia for example, to strengthen their positions. AI is infiltrating everything - industry, medicine, safety systems, even brain-computer interfaces. It's both a geopolitical tool and a source of geopolitical tension.

Next comes **cybersecurity**, the fourth C. Two revolutions are happening. One, hackers are moving upstream, attacking the software providers and manufacturing equipment that form the backbone of our infrastructure. Two, they're not just attacking company firewalls to intrude, but also targeting, tracking and triangulating individuals. By tracking 20–30 executives from an organization, you can uncover patterns in behavior, travel, IP and product development, client strategies, or competitive moves, all without hacking into a corporate network.

Surveillance technology plays a huge role in this, and it's not limited to autocracies. Over half of the countries using surveillance tools are liberal democracies under the auspices of safety and security, if not political control like China. We've been too lax with this on a global level, and that's the third aspect of the cybersecurity revolution.

The fifth C is **COVID-like pandemics and CRISPR**. The pandemic exposed and intensified a broader unraveling of globalization already under way. Governments diverged in transparency and response, both locally and globally. Power shifted from national to local levels, such as in the US, where counties set their own laws as the federal government stepped back.

While macro-level global and national governance faltered, science and local efforts largely succeeded. The development of a vaccine in just six months was a remarkable scientific achievement. This contrast between failing leadership and thriving innovation recalls Deng Xiaoping's assertion of practicality over ideology.

During COVID, many Western democracies struggled to meet basic needs, while some Asian countries prioritized results over political form. At a micro-level, science and innovation thrived. Two Turkish immigrants in Germany, using CRISPR and AI, developed mRNA technology, succeeding where big pharma and government had not. It was a bottom-up triumph.

The sixth C is **crypto**, which represents a governance revolution and a counterweight to traditional systems. I won't dive into that now, since we've discussed it earlier.

THE GENERATIVE AI IMPACT

How will Gen AI shape executive decision-making?

Olaf Groth: Many older executives nearing retirement are overwhelmed by confluence of AI with all the other rapid change creating an unprecedented amount of change. Last year, the US had the highest number of CEO firings and departures since we've started counting. This isn't just due to AI but because of the growing complexity of the economy. AI is just speeding this up. It has the promise to help us make sense and simplify eventually. But in the meantime, it's adding to the acceleration of everything. It's becoming too much for one person to handle and the model of the "hero-CEO," which is particularly prevalent in the US and in digital startup culture is outdated, to be frank.

Executives who educate themselves on AI will eventually make better decisions. To illustrate, a friend of mine, chess Grandmaster Patrick Wolff, once said that, when a Grandmaster plays with a chess AI against another human-AI duo, the AI vastly expands the range of possible strategies. The humans bring long-term vision and insight, while the AI opens the field of opportunity. It's the same in business: AI supports creative strategizing.

> **The humans bring long-term vision and insight, while the AI opens the field of opportunity"**

What role does AI play in combating climate change?

Olaf Groth: We cannot solve climate change without AI. Governments have not succeeded in driving climate mitigation, not necessarily because of incompetence, but because their processes of creating stakeholder consensus and then agreeing with some 200 other governments are too complex and too slow.

WE CANNOT SOLVE CLIMATE CHANGE WITHOUT AI

That's why they are increasingly calling on innovators to help. Traditionally, regulators set pricing signals, and companies responded. Now, this needs to be flipped: governments need private-sector innovation, including AI, data science, and compute power, but also carbon capture and sequestration, SMR and fusion energy. We'll need to invest billions – maybe hundreds of billions – into carbon capture, sequestration, and circular carbon use. Carbon isn't toxic until it's airborne. Let's keep it out of the air and turn it into a productive asset.

AI can help with that. It can optimize complex supply chains, production processes, and transportation systems, factoring in travel times and carbon footprints. Individuals can't manage this complexity, but AI can. AI can also help stabilize Qbits in quantum and stabilize super-heated plasma in fusion.

Simulation and digital twins will be crucial in all of this to model complex systems and predictively intervene in them. For instance, I serve on the board of Echo Twin, an organization that creates digital twins of cities. This allows us to identify poor urban design, stress, deterioration, and congestion on infrastructure with predictive insight. Then we can dispatch humans and increasingly robots to maintain, fix, modify and manage the bottlenecks ahead of time.

We'll also need to strengthen both data and carbon markets and embrace new data-driven solutions to climate change. If we do this, we may stay under 2°C. But the damage is already immense. If we want to contain further loss, AI and compute power are essential.

What are your thoughts on Gen AI regulation globally?

Olaf Groth: In the US, we've shifted focus from safety to economic and geopolitical security and competitiveness, especially with China. The accelerationists, like Zuckerberg and Altman [Sam Altman, CEO of OpenAI] have largely won. But even they acknowledge safety concerns. We just aren't calling it "safety" anymore; it's "security." Economic, national, public, and functional security. We saw this reflected in both European and US narratives during the recent AI Action Summit in Paris.

The US will likely introduce new regulations under this broader umbrella. Meanwhile, Europe has overregulated. While I respect GDPR and the EU AI Act, and it was good to put a stake in the ground, Brussels isn't entrepreneur-friendly. The cost of compliance is too high, and venture capital isn't funding these startups. Europe needs to find a better balance between regulation, incentivizing and scaling innovation. The recent Draghi report is an excellent start, but Europe needs to act with much more urgency than it normally does.

Meanwhile, it's promising to see China participate in AI summits such as the one in Paris. For global data accords and AI regulation to happen, collaboration with China is crucial, but it may take five years or more to materialize. Meanwhile, scientists around the world, like my colleagues at UC Berkeley are working on safer ways to design.
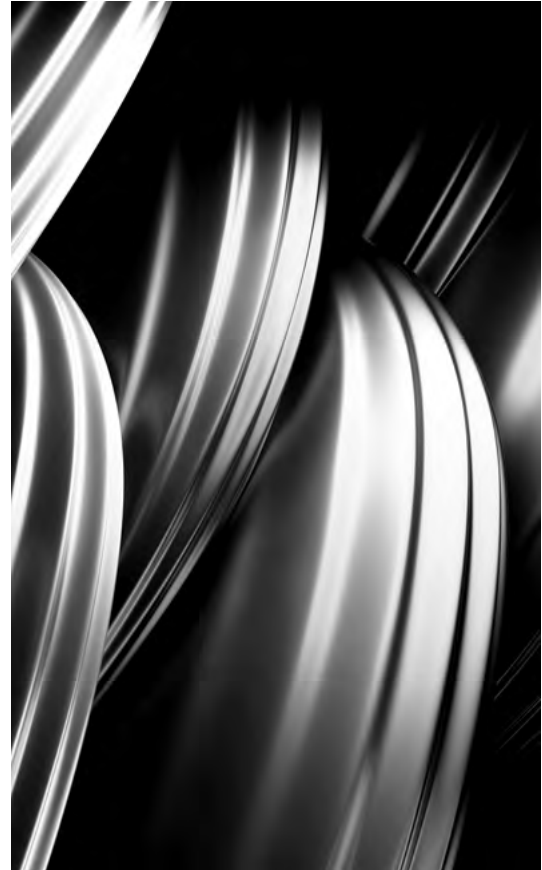
"Europe needs to find a better balance between regulation and encouraging innovation"

Which deep tech areas have potential to trigger significant shifts in the next 5–10 years?

Olaf Groth: Instinctively, I would say quantum computing. Paradoxically, it's both over- and underhyped. If we reach commercially scalable quantum computing, it could transform everything, from cryptography and payment systems to travel and education. I'll put that alongside fission energy, which has similar visibility. But for now, we're still trying to go beyond the initial biochemical science and engineering applications.

One area that's truly underestimated is synthetic materials. Finding substitutes for lithium, for instance, would be a game-changer in energy management. We're talking about new chemistries, possibly even new branches of physics, enabling significantly longer battery life and greater storage. The next breakthrough in energy security is undoubtedly storage. Right up there is also bioengineered materials and shape-shifting programmable or responsive or self-healing "smart" materials.

What excites me is when trends collide. Imagine combining AI with quantum computing and applying that to material science problems. That collision could unlock cascades of technology capabilities, from advanced battery storage to entirely new energy solutions. Or take new materials, like bio-ceramics colliding with new AI-driven design and manufacturing technologies that can address colliding forces like climate change, skyrocketing home prices and unaffordable home owners insurance; for instance Geoship.is, which was started by Tesla and SpaceX engineers, offers homes that are fire, earthquake and hurricane resistant.

Another underappreciated frontier is carbon. We've conducted trials, and there are startups exploring carbon packaging and productizing, but it's not yet commercially scalable. If we manage to flip carbon to being a positively priced production asset, we create incentive structures for its use. That transition from sequestration to carbon circulation within a circular economy would have profound implications.

"One area that's truly underestimated is synthetic materials. Finding substitutes for lithium, for instance, would be a game-changer in energy management"

GETTING AND STAYING AHEAD

What are the new skills that leaders should focus on?

Olaf Groth: There are six to seven essential skills leaders must focus on, which are outlined in the design activist leader (DAL) framework from our book.

The first thing leaders have to be able to master is **zeroth principles thinking**. In a world in which most accepted rules and shared practices have been thrown up in the air, this liminal moment is a chance to do better and to design more equitable, appropriate mechanisms. To do that, we have to see new structures, new building blocks and rules. It requires going beyond first principles to zeroth principles, which is hard, because we've been trained all our lives to be reasonable and rely on that which has been proven. But there's hope – we did this after World War II, designing a new set of global institutions and the result was some 60 years of unprecedented growth and progress.

The second is **futures and foresight visioning**, or executive foresight. Executives today are overwhelmed by countless challenges, many of them difficult to quantify, making prioritization nearly impossible.

That's why the ability to think ahead or think long – one, two, even three to five years – is a vital decision-making skill. It's actually not that hard to use a combination of empirical research and imagination to anticipate change and be less surprised when it actually hits.

Third is **systems diagnostic**. This is thinking in ecosystems of both traditional and untraditional actors. For example, decentralized autonomous organizations (DAOs), blockchain entities, or cloaked virtual actors influencing policy. Leaders must understand the broader stakeholder landscape: who's influencing whom, who's financing whom, and whether their missions align with ours. That's the essence of true systems thinking.

The fourth skill is **geotech resilience building**. This involves understanding how technology sits at the center of geopolitics and to adjust supply chains and product strategies to be resilient. For any executive using or deploying tech, a geotech mindset is essential. For instance, if you can't source chipsets for your product – be it a wearable device or a smart fridge – you are stuck. Everything is getting smarter, but this means every product contains geopolitical risk. That's why we advocate for geotech SWAT teams embedded in organizations, capable of assessing local political segments and sociological trends. Leaders need this situational sensitivity in the C-suite.

Closely related is the fifth capability: **simulation capability**. Organizations must use digital twins, not just for operations, but also to understand market shifts and how their archetypal customer is evolving.
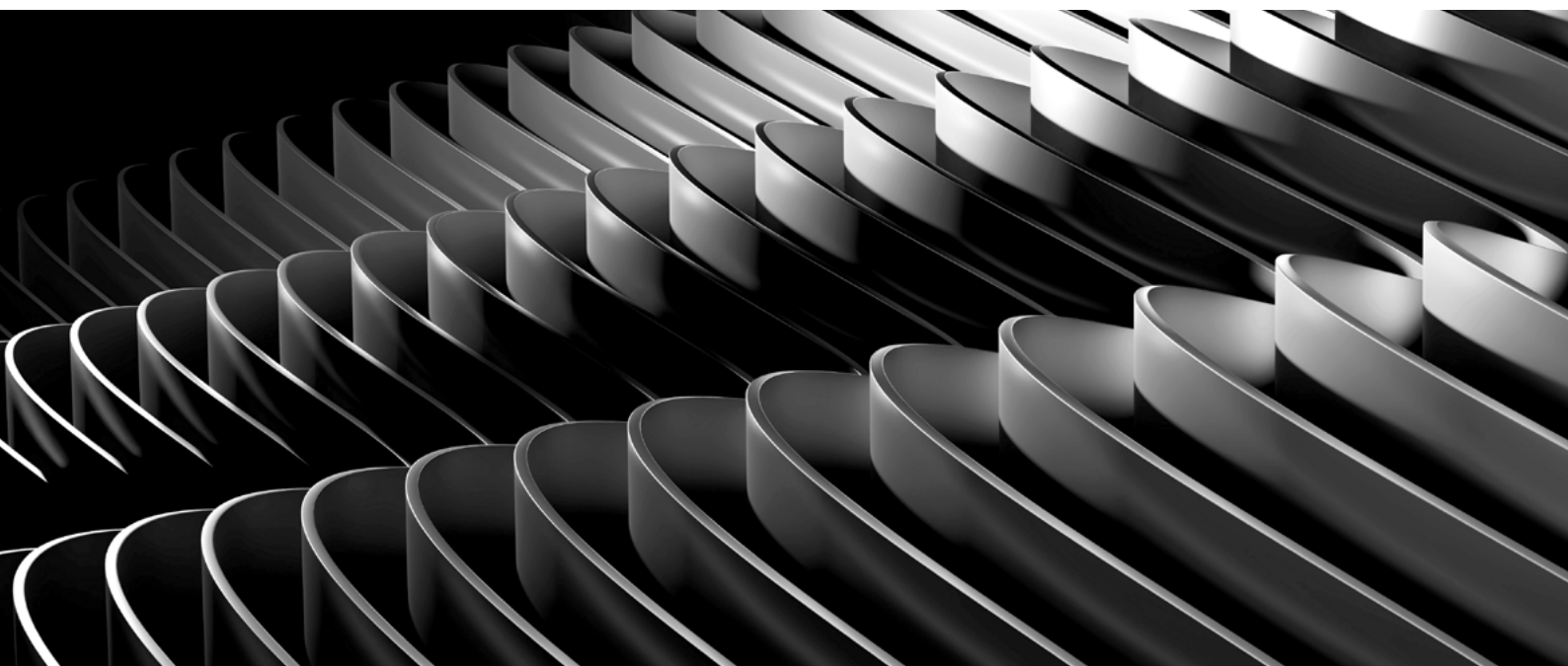
This forward simulation allows leaders to stay ahead of change, rather than being reactive. Simulation capabilities are evolving fast now. You can build models of markets that are complex and incorporate simulated shocks, practicing disruption responses proactively and adjusting, for example, positions and prices dynamically.

The sixth, and perhaps most human, is **empathy among stakeholders**. In a tribalized society, it's become harder to practice empathy. People on opposing ideological poles barely understand, much less like each other anymore. But having empathy doesn't mean you have to like or endorse. Rather, it's about appreciating what made someone get to where they are and how you can meet them there. It is essential for deal-making and collaboration in today's fragmented economies and societies. Leaders must ask: where's the common or even shared pain point? What are they experiencing in their lives that I can connect with or even address? Once that mental bridge exists, you can negotiate joint projects based on different interests. It's a plus-sum rather than zero-sum mindset.

And beyond these, there's a growing need for leaders to create **hybrid venturing**, blending the virtual and the physical in innovative ways. We are no longer in a binary world. Hybrid is the new norm.

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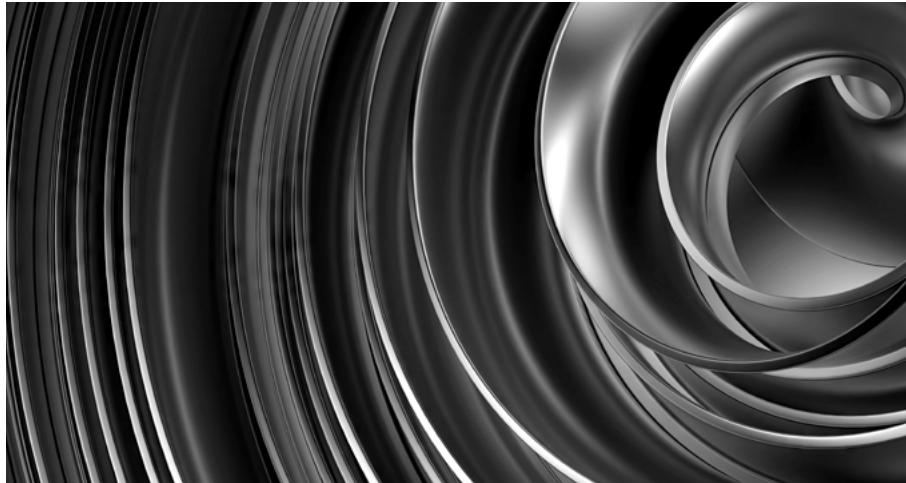
Given all this complexity, are there grounds for optimism?

Olaf Groth: We're living through a **liminal moment**, when structures are being undone, and everything feels up in the air. That can feel chaotic and anxiety-inducing, but it's also immensely formative. It's a moment to rebuild, to reassemble our systems, differently and better.

We often talk only about what we're losing. But what if we focused on what we could gain? Can we build a better international order, a more resilient economy, or a fairer version of globalization?

This is where **zeroth principle thinking** (ZPT) comes in. It's not a new idea, but it's a crucial one. It challenges leaders to imagine what seems impossible: to see new building blocks, new logics, and not just fix systems but reinvent them altogether. We're too often in reform mode, but rarely in reinvention mode.

That's why I'm optimistic. I believe we can build **Globalization 2.0** – more equitable, still profitable, but less fragile. Yes, I was once a believer in unfettered global integration. But we've seen how many areas that has left behind – the heartland of the US, much of the UK outside of London – culturally alienated and economically stagnant.

Now, I talk to bright minds across the world who want to reinvent, not just repair. We need to bring those people together. That's how we create a future worth believing in.

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