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When Science Ends, Design Begins

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The importance of Framing: Life-Centered Solutions

The environmental crisis of our time exposes a critical flaw in traditional problem-solving: viewing humans as separate from and above nature, rather than integral to ecological systems. Design must evolve from a human-centered to a life-centered approach, recognizing the intricate feedback loops between human activities, environmental dynamics, and systemic resilience.

Our historical scientific and design paradigms have often treated people as consumers, and the environment as a resource to be managed or exploited, rather than a complex, interdependent network of which humans are but one participant. Climate, biodiversity loss, and ecological disruption are not

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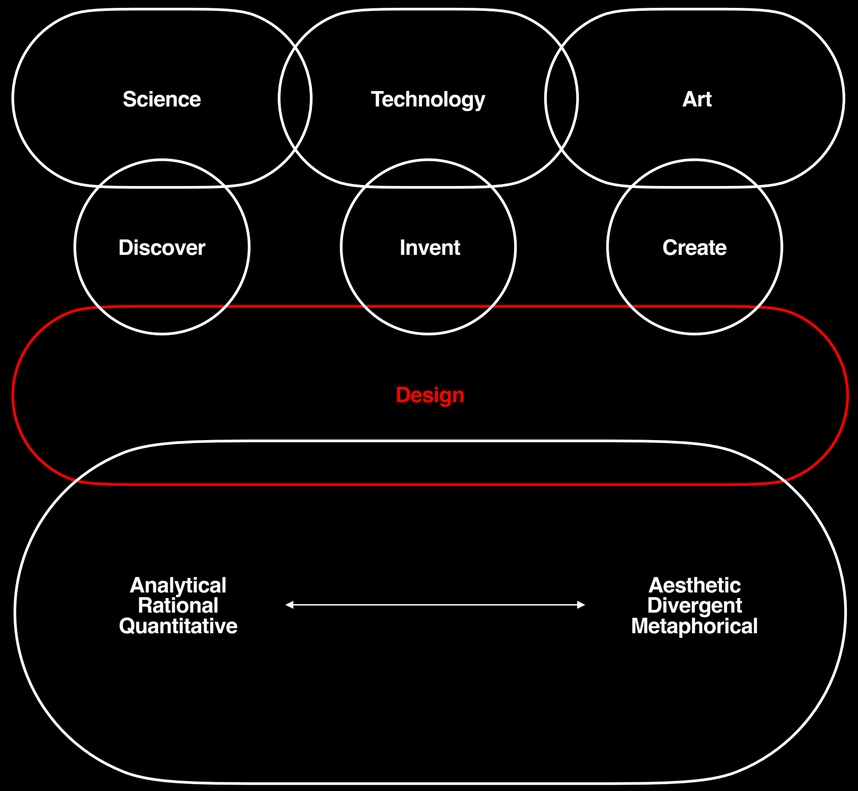
external challenges—they are symptoms of a fundamental misunderstanding of our relationship with life itself. A life-centered design approach demands that we see ourselves as part of, not apart from, the broader ecological web of life.

The fusion energy challenge, for instance, is not just about technological feasibility or human energy needs, but something that can affect everything, from micro-organisms to global climate patterns.

This perspective requires us to design with a holistic view—considering not just immediate human utility, but long-term systemic health, biodiversity preservation, and the intricate connections that sustain life in all its complexity. It's a profound shift from extraction to regeneration, from consumption to collaboration with living systems.

When science gets settled, design gets started

Science may have been one of the components that aided the technology that made it possible to put things



The Nexus of Science, Technology, and Art.

Science is all about discovery, the revelation of the universe that exists that we do not yet know.

Art is about creation, the human mind and spirit demonstrating the power of creativity.

Technology is about invention, putting things together in new ways to amplify human possibility.

Design is the synthesis of all three. Everything we do as designers is a technology (even the printed book is a technology), everything must be scientifically sound, but it only works if it touches people emotionally in the way that art does. Design is the common cultural practice that demands the full dynamic range of human creativity, from the analytic and quantitative, to the metaphorical and emotional.

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together, but it was not the only thing. We know how fusion works. The science is settled. A clean problem, with a clean question. But overcoming the massive engineering and societal challenges is the problem.

We have talked elsewhere about the distinction between systems that are complicated and contrasted them with those that are complex: Clocks, jetliners, tall buildings, and nuclear subs are complicated; ecological systems, cities, and our brains are complex. Complicated systems are designed with a blueprint; they do not evolve; complex systems do.

The distinction extends to problems.

Complicated problems may admit clear solutions; complex problems rarely do. The philosopher Karl Popper made a somewhat similar point in contrasting the unpredictable and amorphous nature of clouds with the regularity and precision of clocks, which are built to operate in a precise manner. Clock problems are complicated; but they can be broken down and analyzed piece by piece. Cloud problems are complex.

The challenge arises when we apply clock thinking and methods to understand and solve cloud problems.

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A Problem Typology: From Hard to Wicked

Problems come in different shapes and sizes with many kinds between complicated and complex. Our friend, Guru Madhavan, talks about a gradation of cloudiness that goes from hard, soft, and messy, to wicked problems. The fusion energy problem may be amazingly challenging but is an example of a “hard problem”, no human component to it; technical feasibility is a scientific question, but implementation is a cultural design challenge, addressing societal fears and myths. “Soft problems,” bring components of human behavior. Tackling traffic congestion may involve technology, psychology, and sociology. It is not a problem that can be declared to be completely solved; issues may reoccur. “Messy problems,” may involve more human, hard-to-quantify, components, value and belief systems, convictions, political

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ideologies. For instance, how to deal with Ebola outbreaks in Africa, when policies may conflict with burial practices, is a problem that falls in this category. A wicked problem emerges when hard, soft, and messy problems collide. There may be hardness nestled in soft problems, and hardness and softness buried within messy problems. Each wicked problem is unique. They do not repeat. And they cannot be reset. There may be pieces that could, in principle, be solved. But extracting a piece from a complex network rarely works – the "solution" cannot be plugged in – since the key to the problem resides in the interactions themselves — multiple and, sometimes, conflicting constraints based on costs, societal needs, environmental issues, value systems, and a myriad of uncertainties. Complexity reveals itself not in isolated components, but in the intricate interactions and unexpected patterns that emerge between components. It is hardly surprising that complexity emerges from complex interactions. But complexity can also emerge from seemingly simple rules.

The boundaries between disciplines are increasingly blurred, revealing design as a sophisticated choreography of knowledge and creativity.

Science is a Foundation

Science is critical, but only a component. The lens we use to see history does not extend enough into the past. In the relatively recent grand narrative of human problem-solving, the last hundred years or so, science has been celebrated as our primary lens for understanding the world. Yet, as we peel back the layers of complexity, we discover that scientific understanding is but the first step—a foundation upon which to design constructs for nuanced solutions. For most of history humans have been designing solutions to a myriad of problems long before scientific knowledge emerged as a crucial component.

Design embraces complexity

Scientific models are often reductive, while design embraces complexity. We see design as a trans-disciplinary practice. The boundaries between disciplines are increasingly blurred, revealing design as a sophisticated choreography of knowledge and

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creativity. No longer confined to only aesthetic considerations, design has emerged as a powerful approach to navigating the intricate landscapes of human challenges. If an example is needed, urban planning is the quintessential wicked design challenge that transcends pure scientific analysis. Life centered design allows for iterative, adaptive approaches to understanding emergent phenomena. With this approach we see the city as a living entity, and urban zoning as a DNA design code that predicts the growth, development and behavior of the city we are "planning." No city will ever be finished, complete, or perfect. Our urban plan is a vision of the future expressed in a design language that allows anyone to interpret and move towards the vision.

Design Leadership

To be a designer in this mode is like carving Jello with a chain saw. We can't expect to control the details. We have to lead by letting go of the classical control

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that is central to classical design practice, and instead think of the challenge more akin to designing a game. A game designer doesn't predict every possible move, but sets the rules for how the game is played, and the dynamic range that game play may explore.

Urban planning epitomizes this approach. The result is not simply an assemblage of infrastructure but a living, breathing ecosystem of human interactions, economic flows, and environmental constraints. Scientific data informs this understanding, but design translates it into livable, dynamic, beautiful spaces and experiences.

Purely scientific models of components of the system often falter when confronted with emergent behaviors and complex interactions. They may excel at understanding individual components but struggle to predict system-wide dynamics. Life Centered Design allows for iterative, adaptive approaches that acknowledge uncertainty and complexity.

The last significant innovation in firefighting was in the 1960's. We need a fundamental redesign of how we live with fire, and overcome it when we need to.

An Unfortunate Example: The Palisades

As we are writing this, over ten thousand structures have been destroyed by the wildfires across the city of Los Angeles. What has been made clear in the process is that we have ignored the signals of impending disaster for decades. At the same time, we may not have not evolved our approach to urban firefighting to meet the scale and complexity of the challenge.

The modern motorized fire truck was developed around 1910. From the 20's to the 50's we added new capacity and technologies. The last significant innovation was probably the 1960's, with the introduction of hydraulic ladders and aerial platforms. Since then we have added tools, like the Jaws of Life, but we haven't reimagined what a "fire truck" might become. Similarly, dropping water from airplanes and helicopters was innovated in the 1940's. Since then, we have made water bombers bigger and smarter, but fundamentally unchanged. During this time period of

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the last hundred years, our population has exploded, our climate has become hotter and hotter, and our engineering and technology have radically advanced, allowing us to move more and more into the flood plains and fire paths of the natural world. At the same time we have been moving away from a way of living connected to the natural cycles of life.

As a consequence, we put the lives of fire crews in danger by sending them out with outmoded strategies, equipment, and tools, facing a new scale of crisis that they are not fully equipped for. New thinking may be needed, to undertake a fundamental redesign of how we live with fire, and how we control it when we need to.

Our future will not be defined only by what we know, but by how creatively we use what we know to design solutions to challenges that defy simple resolution.

Conclusion: When Science Ends, Design Begins

Science illuminates the path, but design navigates the journey. In a world of increasing complexity, design emerges as our most sophisticated problem-solving tool. Scientific knowledge is not the solution; adaptation is. Design stands at the critical intersection where understanding transforms into action, where the elegant simplicity of scientific principles meets the nuanced creativity of human ingenuity.

Our future will not be defined only by what we know, but by how creatively we use what we know to design solutions to challenges that defy simple resolution. Understanding of science is not the endpoint, but a launching pad for creative design and adaptation. When science ends, design begins—and in that beginning lies our most profound potential for progress.