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Confronting Complexity, Valuing Elegance

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Our theme this year is "confronting complexity," and it is the meaning of that theme that I would like to explore with you this morning. One interpretation of what our Program Co-Chairs thought in selecting the theme of confronting complexity is that the world is different than it was, that it is more complex and that this complexity requires that we as scholars and policy advisors approach the world's challenges in a different manner as well.

A quick perusal of the titles to the panels this year would suggest the world is indeed full of complexity. But how do we know that which we encounter is in fact a complexity? And even more, if we identify that we are in fact confronted with a complexity, what then?

Thus I define my happy task over the next few minutes as first, exploring with you what it means for something to be a complexity and second, suggesting how we as scholars and advisors should pursue something that does not come naturally to lawyers, namely that we should pursue elegance in the face of complexity.

Definitions

We have a sense of the word "complexity." The climate and weather that drives a wind is complex. The quality of life running through a tree is complex. And perhaps even the supple movement of a tree in the wind is complex. We have a sense of what complexity is, but can we tease out what that sense is.

Being international lawyers, we might -- following article 31 of the Vienna Convention -- inquire into the ordinary meaning of the word. But as in most arbitrations, we would find that the ordinary definition is not particularly helpful:

Complexity (n)

1. the state or quality of being intricate or complex;
2. something intricate or complex; complication.

I thought everyone had the same second grade teacher who insisted that you not use the word being defined to define the word. So I have given thought to this word "complexity," and let me offer five propositions about it.

1. Complexity is Not Too Hot, Not Too Cold

Since we have a sense, and the ordinary meaning is not particularly helpful, perhaps we can rule out that which is not a complexity.

First, for example, a rock is not a complexity. Nor are several rocks a complexity. So the sheer number is not the characteristic of complexity. What if the several rocks were to fall several feet at once? That is perhaps more complex, but it is not a complexity either.

Think of a painting attempting to depict chaos. Assuming such a thing as chaos is possible, I think our sense is that chaos is not a complexity either. Hence the title to my first proposition: the rocks are too cold, and chaos is too hot.

The reason I think that neither the rocks nor chaos present a complexity is that complexity implies not obvious relationships between elements of that which we confront. Remember chaos. True chaos implies that its motion is beyond human understanding—it is beyond reason, it is an image of madness. There is no relationship. Similarly, many rocks do not make up a complexity because they are not tied to one another, there is no relationship, unless you wish to count the very small gravitational pull each places on one another.

Indeed, if the ordinary meaning failed us, the specialized meaning does not:

> Complexity (n)
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> > In science, the field of study devoted to the process of self-organization. The basic concept of complexity is that all things tend to organize themselves into patterns, e.g., ant colonies, immune systems, and human cultures; further, they go through cycles of growth, mass extinction, regeneration, and evolution. Complexity looks for the mathematical equations that describe the middle ground between equilibrium (see statics) and chaos (see chaos theory), such as the interplay between supply and demand in an economy or the relationship among living organisms in an ecosystem.

Complexity theory had its beginning with American mathematician Norbert Wiener's development of cybernetics, Canadian biologist Ludwig von Bertalanffy's development of general system theory, and American mathematician John H. Holland's development of a computerized artificial life simulation. And much of the progress in the field can be attributed to advances in nonlinear dynamics, in the power of computers and in adaptive programs and fuzzy logic.

Thus let me restate my first point: complexities lie between statics and chaos and are marked by not obvious relationships between parts.

2. A Footnote: What We Regard as a Complexity Reflects Something about Us

An important implication tucked away in that first observation is that complexity is tied to human understanding. Perhaps a group of rocks does present a complexity, but we just have not confronted it yet. Nature was simply a mysterious force in the past, but now it is more often seen as a complexity. As Bill McKibben wrote, "To see human's effect on climate is to end man's primeval relationship with nature."[1]

3. Complexity is Ernö Rubik's Cube, Not Rube Goldberg's Machine

Again, our sense of complexity is that Rubik's cube is a complexity, while Goldberg's machine is less so, if at all. And the reason I would suggest is that the non-obvious relationships in the cube are multiple, simultaneous and looping, where every move can have

[1] Bill McKibben, The End of Nature (Random House, 1989).

several implications at once, while Goldberg's machine in a way is a complicated version of the falling rocks, in the end simply a string of linear causation. Indeed, it may be that complexities are more like puzzles than like machines.

Thus, complexity is marked by multiple simultaneous, possibly looping, non-obvious relationships, not simple linear causation.

4. All Complexities are Not Equal. They Differ in How Fixed are Their Boundaries and How "Tight" are the Non-Obvious Relationships.

Robert Yarger's Gordian Knot Puzzlebox is made up of 130 intricately cut exotic pieces of wood that take 33 moves, at best, to reach the hidden cabinet in the middle. This is very fixed. We know the boundary of this complexity. It will not change; it will not become more complicated; and the interconnectedness is very tight.

I raise this to highlight that the complexities we face are much harder. They are harder because the boundaries are not fixed, nor is the complexity fixed. The climate system is a difficult one, but if we develop a new form of emission, that complexity will have evolved, the puzzle will have become harder.

Nor is the tightness the same. Last night Jan Kellenberger spoke to us of the relationships between war, crime and drought. We agree that those are related forces, but the force to be ascribed, the tightness of the relationships, is not so clear.

That observation leads me to my last proposition—that there are basically three types of complexity that we can think about as we go through our program this week and these three types may be combined in any given complexity we encounter.

5. Three Types of Complexity Confront Us: Natural, Anthropogenic and Transformational

This proposition captures the work of a scholar, David Christian, whom I fortuitously met in a shared car ride two months ago. Professor Christian's question was, how is it that in a world of entropy we have complexity? His end conclusion was that over time there in fact have been 8 eight thresholds of complexity:

1. The Big Bang
2. The Stars Light Up
3. New Chemical Elements
4. Earth and the Solar System
5. Life on Earth
6. Collective learning
7. Agriculture
8. The Modern Revolution

First, I want to point to thresholds four and five for a moment. Those are the complexities of our natural world. And they are things that we, through our actions and our technologies, have gained the capacity to touch, to unravel, to complicate even more. The natural world of climate, we have found that we can touch. Life itself in the fifth threshold, we have found that we can touch. And these are puzzle boxes that far exceed anything we could devise.

Second, there are the complexities that *we* devise, that *we* build, and these I would put mostly at complexity threshold eight—things of the modern world that we have constructed, things that we sense are not as resilient, as redundant or as beautiful as the complexities of the natural world. Rather they invoke the image of the tower of Babel reaching too high, too certain, not sufficiently cautious.

And here I wish to introduce a particular concept from a really marvelous work by Joseph Tainter (long before Jared Diamond's recent work) on the collapse of complex societies:

> Two concepts important to understanding the nature of complexity are inequality and heterogeneity.[2]

The word I would focus on here is 'heterogeneity.' What Tainter points out is that the more complex that human complexities become, the more specialization and heterogeneity are required in the structure. And it is this heterogeneity that may collapse, that may fall back, to a more homogenous, decomposed original state.

So You Have Confronted Complexity, Now What?

Even if we are clear on what it means to confront complexity, we have left unstated what it is we are to do once we have confronted that reality. I cannot begin to address this question in the few moments I have, but let me offer a few concluding remarks to consider during our deliberations over the next few days.

Complexity Presents a Multi-Dimensional Problem, Advocacy Privileges a One-Dimensional View

First, in confronting complexity, I would suggest our law training, so often touted as making us good problem solvers, also presents some disadvantages. In particular, whether you are a scholar, an attorney or a policy advisor we have all been deeply exposed to advocacy, and advocacy is not necessarily helpful in approaching a complexity. I would argue that this is the case because ironically the work of the advocate purposefully turns a blind eye to complexity. Advocacy is about privileging one aspect above others. There is a sense of this, for example, in the saying that Justice must be done even if the heavens should fall.

Complexity is multi-dimensional; the advocate has the luxury of being one-dimensional. This does not mean the advocate's role is misplaced; it is to say her purpose is different. There are many ways for a complexity to be approached, and by stressing a particular dimension the advocate ensures that the choice of approach respects the dimension that is advocated. But that value is distinct from approaching complexity itself.

An Elegant Solution in Law is a Solution that Takes Responsibility for the Consequences of It

Second, an interesting question, in my view, asks why elegance is not discussed in the law. It is discussed in so many disciplines as an essential concept, far beyond the areas of fashion or architecture. Not only as an aesthetic, but as a central value in mathematics, in physics, in engineering, and in computer science. Yet it is not something the legal academy openly values.

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[2] Joseph A. Tainter, The Collapse of Complex Societies (Cambridge University Press, 1988).

Alain de Botton, writing in The Architecture of Happiness,[3] has a section on elegance where he compares the Salginatobel Bridge in Switzerland to the Clifton Suspension Bridge in Bristol. He writes:

> [The suspension bridge] construction has something to it of a stocky middle-aged man who hoists his trousers and loudly solicits the attention of others before making a jump between two points, whereas Maillart's bridge resembles a lithe athlete who leaps without ceremony and bows demurely to his audience before leaving the stage. Both bridges accomplish daring feats, but Maillart's possesses the added virtue of making its achievement look effortless—and because we sense it isn't, we wonder at it and admire it all the more. The bridge is endowed with a subcategory of beauty we can refer to as elegance.

Yet one computer science commentator[4] writes:

> Elegance is not about aesthetics. Rather, aesthetics is about elegance. Ostentation lacks aesthetic appeal, and is inelegant, because it's gratuitous. Simplicity is often not elegant either: if something is too simple, it is nonfunctional, and fails to achieve its aim. What makes something beautiful is not strictly simplicity, symmetry, complexity, or any other such characteristic. Instead, what makes something beautiful is that its characteristics are all appropriate to its purpose. Complexity can be exceedingly beautiful, as long as it's not gratuitous complexity, which is just chaos and confusion. Likewise, simplicity can be exceedingly beautiful, but if you make something gratuitously simple, you get dullness rather than beauty. Gratuitous simplicity is merely boring.

This sense of elegance resonates with its understanding in the sciences. In mathematics, the proof of a mathematical theorem exhibits mathematical elegance if it is surprisingly simple yet effective and constructive.[5] In engineering, a solution may be considered elegant if it uses a non-obvious method to produce a solution that is highly effective and simple. An elegant solution may solve multiple problems at once, especially problems not thought to be inter-related.

The French aviator, adventurer, and author Antoine de Saint-Exupéry, probably best known for his classic children's book *The Little Prince*, was also an aircraft designer. He gave us perhaps the best definition of engineering elegance when he said "A designer knows he has achieved perfection not when there is nothing left to add, but when there is nothing left to take away."

What it would mean for a law to be elegant? I would suggest that one value of elegance is it suggests that we need consider the entirety of the complexity with which we are confronted, that we take not only pride in the gains from our proposals but also take responsibility for its costs, its consequences.

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[3] Alain de Botton, The Architecture of Happiness (Pantheon Books, 2006).

[4] Chad Perrin, *ITLOG Import: Elegance*, Chad Perrin: SOB, 16 Aug. 2006, http://sob.apotheon.org/?p=113.

[5] Ibid

My suggestion to you concerning the immediate punch of elegance as a value in law is it argues that we take responsibility for the costs of law and for the workability for our proposals in the face of complexity.

My intuition is that a complex solution to a complexity is incorrect and cannot be stable. As C.A.R. Hoare wrote, "There are two ways of constructing a software design. One way is to make it so simple that there are obviously no deficiencies. And the other way is to make it so complicated that there are no obvious deficiencies."[6] The first method is far more difficult. It demands the same skill, devotion, insight, and even inspiration as the discovery of the simple physical laws that underlie the complex phenomena of nature.

Complexity and Elegance

For me the difficulty of complexity and value of elegance suggests four things. First, even as we seek to understand the dynamics of a complexity so that we might address it, we must recognize that we cannot understand it entirely. Second, we should anticipate that the complexities we face will change and thus our approach need be able to adapt and to learn. Third, we should anticipate that part of a solution is to prepare for the unexpected, to prepare for occasional collapse. We thus need to build resilience. Fourth, we should distrust complex solutions to complex problems and rather seek those that are elegant.

A complexity in physics and mathematics on which some progress has been made in just the last few years is turbulence. It is a phenomenon that resists all attempts at modeling. But if one backs up from turbulence you can nonetheless see the shape and direction of the current that contains it.

Perhaps we can approach our current condition similarly. The world seems to be populated by a number of complexities, some very tight, some possibly related to other complexities. And if we step back it appears we are presented with mixed signals. There are many curves that show great change, some are positive, others negative. They suggest possible futures that are both promising and disastrous.

For me, leadership—and here I mean not only political leadership but also intellectual leadership—is fundamentally the work of bridging the present with the best of possible futures. That is a task for all disciplines but it is a task in which we, and our Society, will play no small part.

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[6] C.A.R. Hoare, *The Emperor's Old Clothes,* COMMUNICTATIONS OF THE ACM 24 (2), 75-83 (1981).