This is the third of a series of 12 articles on systems thinking, a way of understanding complex organizations and society offering significant promise for improving the leadership and management of commercial companies, not-for-profit organizations, and government agencies.

Part 3

Destruction and Creation: Analysis and Synthesis

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Let us not lose sight of the fact that the etymological root of the word analysis is "anal."
—Unknown

The word "analysis" has been overused, to the point becoming a cliché. We have environmental analysis, business analysis, financial analysis, cost-benefit analysis, metallurgical analysis, spectrographic analysis, and systems analysis (which has come to refer too narrowly to information systems). Even these are only a partial list. We're virtually awash in analyses. The concept of *analysis* is deeply embedded in our lives, but where did this concept come from? And why should you care about it?

Since the Renaissance, analysis has been the foundation of problem solving. But as we move from the 20th into the 21st century, it's becoming clearer that analysis alone is an incomplete, suboptimal way of understanding and functioning in our world. Worse, without the next step—*synthesis*—practicing analysis alone is a dangerous way of operating.

Analysis Equals Reductionism

What, exactly, *is* analysis? Simply put, it's a process of reducing a complex whole, or system, into its component parts—manageable "bites", if you will—and dealing with those parts in isolation. Take an automobile, for example. The engine is a complex system made up of many components. If the engine runs roughly, the analysis approach is to mentally "deconstruct" the engine into carburetion (or fuel injection), fuel supply, fuel transport system, and combustion chamber (cylinders). The person repairing the engine "analyzes" the situation: he or she examines and "tweaks" each of these parts individually. Fuel injectors are checked, and perhaps cleaned. The fuel pump is checked for proper operation and the filter replaced. Spark plugs are cleaned or replaced, and timing may be adjusted. Then the components are rejoined again. Often the car is returned to the owner with all these things done (accompanied by a substantial bill!), and the owner finds that the engine doesn't run substantially more smoothly. The reason may be that the repair person failed to "synthesize" the system again—to ensure that all the adjusted components actually function well *together*.

The assumption underlying the concept of analysis is *reductionism*, the idea that all the reality of our ultimate experience can be reduced to indivisible parts. **[1:9]** From the 15th through the 19th centuries, a reductionist philosophy predominated all scientific inquiry and the expansion of human knowledge. It was assumed that if a phenomenon was deconstructed sufficiently and the parts examined, understanding of the phenomenon was assured. In fact, this thinking is embodied in one of the basic axioms of analytic geometry: *the whole is equal to the sum of its parts*. But a funny thing happens with complex systems: interdependence among the parts rears its ugly head—what some have called *synergy* comes into play!

The reductionist, or analytic approach reached its culmination with the concept of *scientific management* in the early 20th century. The father of scientific management, Frederick W. Taylor broke down (analyzed) complex industrial activities into component tasks, sought to make those tasks more efficient, and "glued" the more efficient components back together again. The expected result was a more efficient, effective system. Taylor's disciples, including Frank and Lillian Gilbreth and Henry Gantt, extended and refined Taylor's analytic approach to management well into the 1950s essentially unchanged.

Deficiencies in Analysis

Because early organizational (specifically, industrial) systems were simple, the analytic approach was much more effective than the alternative—which was more or less *ad hoc.* But as the complexity of organizational systems increased to the point where no one person could have complete visibility on all components simultaneously, the "cracks in the plaster" of the analytic approach began to show. Analysis could no longer explain the difference between the whole-equals-the-sum-of-the-parts and observed results that were disproportionately higher (or lower) than expected. In other words, the success of an analytical approach "topped out."

The problem is that parts of systems have properties that they lose when separated from the whole system, and the whole system has essential properties that none of its parts does. Ackoff provided an effective analogy: The eye detached from the body can't see, yet the human body as a whole can run, play piano, read, write, and do many other things that none of its parts can do by themselves. **[1:16]**

What does all this mean? Basically, that the essential properties (and thus the ultimate performance) of a system derives from the *interactions* of its parts. And these essential properties are lost when the system is taken apart. In other words, *a system is a whole that cannot be understood by analysis alone.*

Synthesis: The Second Half of the Equation

What, then, is the key to resolving this deficiency? The answer is *synthesis*. Simply put, synthesis is amounts to putting things together. Sometimes these are pieces known to be part of a system, for example, the rebuilding of an automobile engine from its disassembled parts. In other cases, it may be the combination of things never thought of as "going together" before, to create new concepts, solutions, or realities.

Synthesis is not a new idea; it's as old as analysis. As Ackoff has pointed out, Aristotle dealt with both. **[1:17]** But in our current world of complex systems, synthesis becomes more important than most people realize. Analysis and synthesis are complimentary processes; though they can be considered separately, they can't really be separated. Systems thinking doesn't deny the value of analysis, however. Rather, it emphasizes the fact that there is another side to the system equation that has, until recently, been ignored or overlooked.

In 1976, John R. Boyd, a retired U.S. Air Force colonel whose chief claims to fame had been his development of the energy-maneuverability theory and the latest-generation fighters (the F-15 and F-16), tackled the issue of analysis versus synthesis in a paper entitled *Destruction and Creation.* **[3]**

The core of Boyd's argument was that creativity was essentially the outcome of a process of analysis and synthesis, which he referred to as destruction and creation. Boyd suggested that new ideas and breakthrough solutions to particularly challenging problems resulted from mentally deconstructing multiple known existing concepts or processes, then selectively reassembling key elements to form a completely new concept—thus, the characterization as "destruction and creation."

Creativity and Synthesis: Building Snowmobiles.

In the mid-1980s, Boyd offered an analogy to illustrate this process of analysis (destruction) and synthesis (creation). [4] He challenged people to think of four seemingly unrelated mechanical systems: a set of snow skis, a boat with an outboard motor, a bicycle, and a military tank or tread-type earthmover. Each of these is a discrete device with its own purpose. Boyd suggested mentally deconstructing these into their component parts and selectively re-combining parts from each to for a new "whole" that would not otherwise exist. He discarded the bindings and poles from the snow-skis, retaining only the "boards." From the outboard boat, he retained only the gasoline-powered motor; from the bicycle, the handlebars, and from the earthmover, a tread. He recombined these concepts (the functions of the different parts) to form…a snowmobile!

The snowmobile concept became Boyd's short-hand analogy for characterizing the domain of competition. He separated people into two types: those who *could* conceive and build snowmobiles, and those who couldn't: **[5:156]**

“A loser is someone (individual or group) who cannot build snowmobiles when facing uncertainty and unpredictable change; whereas a winner is someone who can build snowmobiles and employ them in appropriate fashion, when facing uncertainty and unpredictable change.” **[5:182]**

Hand in hand with being able to build snowmobiles, Boyd suggested, is adaptability—the capability to respond to a situation with variety and rapidity. Variety is an outgrowth of analysis and synthesis. Rapidity implies the ability to analyze and synthesize quickly.

Paradigms

Let's briefly consider a concept seemingly unrelated to Boyd's destruction-and-creation process: the idea of *paradigms*. The term was coined by Thomas Kuhn in 1962, in his seminal book, *The Structure of Scientific Revolutions*. **[6:x]** Kuhn's original treatise dealt with the evolution of scientific theories, particularly the physical sciences. Through the later work of others, primarily Joel Barker **[2]**, it has since come to be applied more widely (and broadly) to the realms of business management, societal development, and social interaction.

Grossly oversimplified, a paradigm is a model, a set or rules, or a pattern of behavior that defines current, accepted (and acceptable) thinking about a domain or subject. For example, the game of baseball is a paradigm operating within the confines of a stadium and the organizational structures behind the competing teams. Behavior of those within this paradigm is largely prescribed within relatively well defined boundaries. Concepts associated with other paradigms (e.g., football, tennis, or aviation) are excluded from baseball “thinking.”

Likewise, at the higher economic and political levels, capitalism and democracy are also paradigms. Thinking within these paradigms is somewhat constrained by the “traditional,” the accepted, or common practice.

Kuhn introduced the notion that paradigms change over time, as more and newer information is discovered. In most cases, this change is evolutionary, rather than revolutionary. As Barker has pointed out, however, paradigm “shifts” can often be dramatic. The Internet and its many and varied uses is an example of such a rapid paradigm shift. A key characteristic of paradigms and their associated shifts is the idea that they naturally evolve or “happen”—they're not consciously directed.

Summary: Our OWN Synthesis

To summarize what we've seen so far, let's do a little “destruction-and-creation” of our own.

Ackoff, Churchman, and other system thinkers maintain that the widespread current practice of analyzing systems and issues alone—that is, breaking them down into their component parts and maximizing performance of the discrete parts—is a flawed practice, because it ignores the central role of interdependencies.

Kuhn and Barker suggest that the rules of the “meta-game” change over time, sometimes with dramatic shifts that must be discerned and accommodated. Failure to do so can leave one “behind the power curve.” That's an aviation term implying that the pilot has allowed the aircraft enter a condition where much more power is required just to maintain or arrest a deteriorating flight condition. Or, in management terms, “Have you seen them? Which way did they go? I must be after them, for I am their leader!”

And finally, Boyd maintains that the kind of destruction-and-creation process (analysis and synthesis, in Ackoff's terms) he recommends produces the ability to dictate rules and results of an engagement. The people and organizations that become really good at doing this can achieve a much greater degree of influence over their environment. (Boyd referred to this as “improving their capacity for independent action.” **[3]**

So, what does *our* “snowmobile” look like? If paradigms govern conventional thinking about how things happen, or must be done, and if our organizations are arrangements of systems, sub-systems, and meta-systems that can't be effectively managed analytically, then the application of a conscious, pro-active method of destruction-and-creation (analysis and synthesis),systemically applied, can put practitioners of such methods at a tactical advantage over competitors. It can also keep them ahead of the environmental changes that evolve over time—and perhaps be in a position to drive or lead revolutionary paradigm shifts. Which position would you rather be in: chasing after a changing environment, or leading the change?

In our next installment, we'll examine the O-O-D-A loop, a prescriptive approach to applying analysis and synthesis to secure the “high ground”—Boyd's improved capacity for independent action—in our chosen fields.

Endnotes

1. Ackoff, Russell L. *Ackoff's Best: His Classic Writings on Management.* New York: John Wiley & Sons, 1999.
2. Barker, Joel. (http://www.joelbarker.com)
3. Boyd, John R. *Destruction and Creation.* An unpublished paper. (http://www.goalsys.com/id17.htm)
4. Boyd, John R. “Revelation,” part of the August 1987 version of the larger unpublished briefing, A Discourse on Winning and Losing. Cited in Hammond, Grant T., *The Mind of War: John Boyd and American Security*, Washington, D.C.: The Smithsonian Institution Press, 2001, p.182.
5. Hammond, Grant T. *The Mind of War: John Boyd and American Security*. Washington, D.C.:The Smithsonian Institution Press, 2001.
6. Kuhn, Thomas S. *The Structure of Scientific Revolutions.* Chicago: The University of Chicago Press, 1962.