The Simplicity Cycle

continued ▸

by Dan Ward

HI, I'M DAN. WELCOME TO MY MANIFESTO.

Fig. 1

I'd like to take you on a trip, exploring something I call **The Simplicity Cycle**. On this excursion, we'll spend a little time exploring a diagram I invented. We'll wander through four distinct regions, we'll slide along three different slopes, and we'll briefly talk about an unreachable fifth region where nobody lives. But before we begin, we need to set the stage.

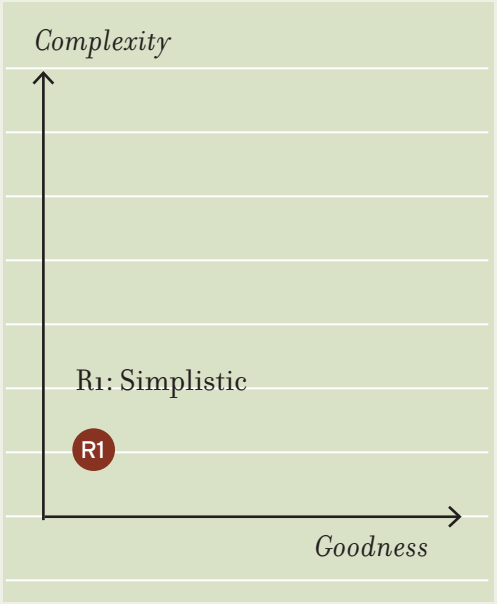
Let's start with a blank x-y chart (figure 1). **Complexity** increases along the vertical y-axis, and **Goodness** increases along the horizontal x-axis. The term "complexity" is ironically straightforward. It means a large quantity of interconnected or associated parts. "Goodness," on the other hand, requires a bit of explanation.

In the Simplicity Cycle, goodness is a general term that means slightly different things depending on the application and context and, as you will see, this Cycle applies to a wide variety of contexts. If we are talking about a particular piece of technology, goodness represents *operational functionality* or *utility*; for an academic discipline, it represents increased *understanding*; and for system design, it reflects *design maturity*. If the context is art, maybe goodness means *beauty* or some other measure of *artistic merit*.

Now that we've established the playing field, let's take a look around.

Region 1: The Region of the Simplistic

Fig. 2



One, two, buckle my shoe.
— Traditional nursery rhyme

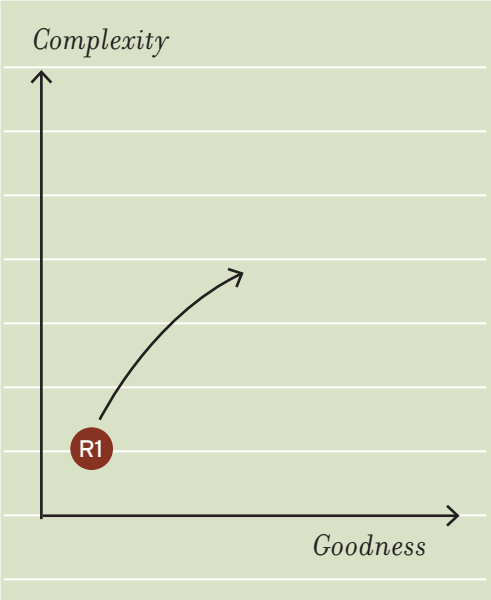
Our journey begins in the lower left quadrant of the x–y chart (figure 2). This is the **Region of the Simplistic**. Here, complexity and goodness are both low.

In mathematics, this is where we discover numbers and encounter things like 1+1=2. In aircraft design, it's where we make paper airplanes. In art, we draw lines and stick figures.

In other words, this region is where a **foundation** is laid for all the progress and work that follows. But it is a pretty boring place to hang out, so **we usually don't stay here very long**. Instead, we begin to travel along The Complexity Slope.

The Complexity Slope

Fig. 3



The path out of Region 1 involves moving towards the middle of the chart. Movement in this direction—up and to the right—involves increases in goodness and complexity (see figure 3). Progress along this slope can be described as learning and creating. In a word, the slope is about **genesis**.

For mathematicians, our use of numbers and simple addition grows to include things like multiplication, division, and algebra. Now, rather than 1+1=2, we are working with Y=mX+b, which requires (among other things) the introduction of elements beyond numbers. This means the complexity of our output has increased. The goodness has also increased because we can do things with algebra that we can't easily do with arithmetic.

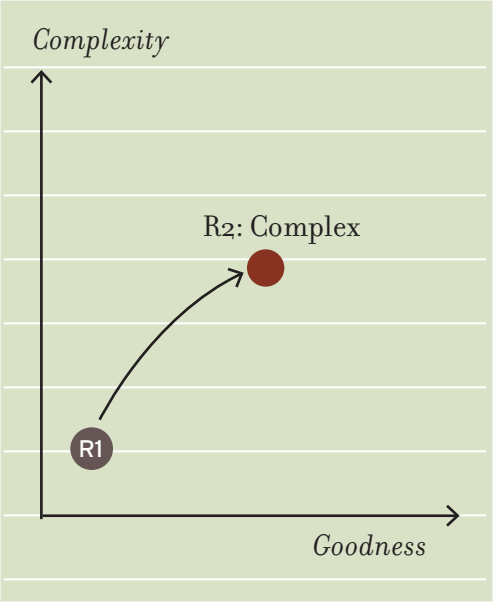
For system designers, travel along this path involves **adding new pieces, parts, and functions**. Aircraft designers leave paper airplanes behind and move on to scale models, wind tunnels, and operational prototypes. The transition from paper airplane to operational prototype requires increased complexity and results in the ability to do more, whether that be to fly farther and higher, carry more weight, or simply land without crashing.

It is reasonable to conclude that increased goodness is largely the result of increased complexity. At first, this is probably true. However, we are now facing one of the primary **myths of complexity**—a common but erroneous belief that an increase along one axis equates to an increase along the other.

To be more precise, there is a misperception that increased complexity always causes increased goodness. Everyone who worships at the Church Of Complexity will think I am a heretic when I say this, but the truth is, **complexity and goodness are not always directly proportional. [Gasp!]**

As we have already seen, the proportional relationship between these attributes is partially and initially true—but does not extend indefinitely. Eventually we arrive at the second region and our trajectory will change, whether we want it to or not.

Fig. 4



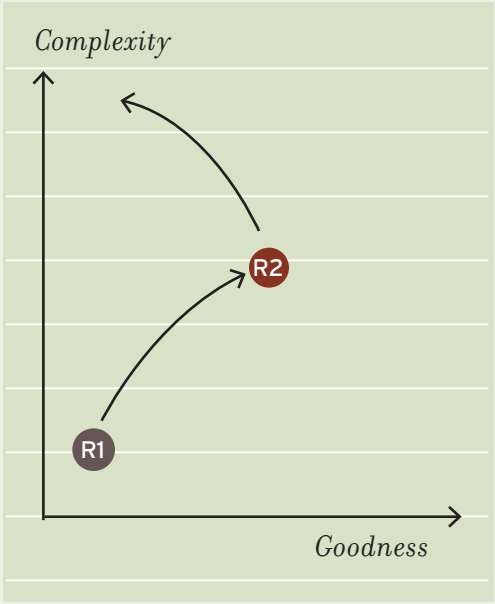
Region 2: The Region of the Complex

A complex system that works is invariably found to have evolved from a simple system that works.
— John Gaule

The second region is located in the center of the graph (figure 4). This is the **Region of the Complex**, a place where complexity and goodness have achieved a critical mass. In practical terms, the number of elements involved have substantially increased beyond the original simplistic situation and a meaningful degree of functionality and maturity (a.k.a. goodness) has been demonstrated.

To continue building on the aircraft example, the first **Wright Flyer** fits in this category quite well. It was a rather complex machine and required a fair amount of effort and maintenance to keep it aloft. Its creation was primarily the product of genesis and learning, as **new information** was produced and **new functions** and elements were added.

Fig. 5



The first Wright Flyer also demonstrated **an entirely new ability**: manned flight in a heavier-than-air vehicle. Thus, it can be said to have a moderate degree of both complexity and goodness. Looking back, it didn't go very far or very fast and couldn't carry much weight (which isn't to say it wasn't an impressive feat!).

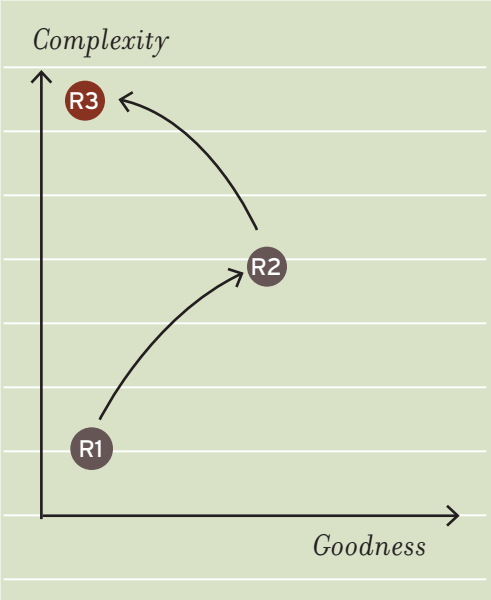
Operations in Region 2 typically involve a nontrivial amount of **effort and strain**. Significant resources—mental, physical or both—are usually required. If you are working hard to create a design, solve a mathematical problem, or perform a similar task, chances are you're here.

There are actually two paths out of this region, and neither follows the earlier trajectory of increases to both complexity and goodness. From this point on, any substantial increase in goodness actually requires a decrease in complexity. That is, improved utility or increased understanding requires some amount of **simplification**—represented by downward movement along the y-axis.

One pitfall that designers, engineers, and academicians may fall prey to in this region is the belief that a continual increase in complexity—an activity that moved us from Region 1 to Region 2 —will continue to produce increases in goodness. That belief leads us along the Complication Slope, to the upper left quadrant of the chart (see figure 5).

Region 3: The Region of the Complicated

Fig. 6



Something of true value does not become more valuable because it becomes complicated. — Donald Curtis

"Complex" and "complicated" may sound similar, but they are in fact two very different beasts. Complexity is often essential. Certain topics, issues, activities and missions are inherently complex and there's nothing wrong with that. But **complicatedness involves unnecessary complexity**. It's caused by the addition of non-value-added parts, of gears that turn without reason or grind against other gears.

Generating new-and-necessary elements moved us into the previous region (the Region of the Complex). Generating too many parts leads to the **Region of the Complicated** (see R3, figure 6).

Increasing complexity beyond the degree required to reach Region 2 actually represents a decrease in understanding, design maturity, and functional utility—a decrease in goodness. It's a step backwards along the x-axis, though some people may take misguided comfort in the positive movement along the y-axis. Think of it as achieving "the complexity on the other side of understanding," often caused by overthinking a problem.

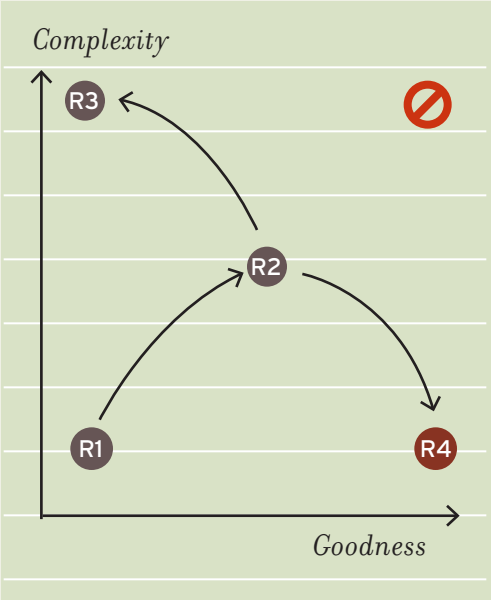
A brilliant young lady of my acquaintance described this region as "**the smarter you are, the dumber you get**." That absolutely nails it because it highlights the illusion that complexity

and goodness are always directly proportional. Moving in this direction (toward the upper-left quadrant of our chart) is not a question of getting smarter—it is a question of simply producing a more complicated output. This is what the authors of the U.S. Army's *Operation Iraqi Freedom Report* had in mind when they wrote **"Complexity reduces systems to irrelevancy."**

Here we find the learned academician who everyone assumes is brilliant because no one can understand a word he says. In fact, his academics may simply be overcomplicated and have very limited goodness.

Many of you have probably already figured out that the upper right quadrant of the xy chart is unreachable (see figure 7). **An extremely high level of complexity and an optimized degree of goodness are simply not compatible**. A system, process, design, or discipline that appears to be in this no-man's land probably resides in the Region of the Complex (center of the chart), and has the potential to increase its goodness only by decreasing its complexity.

Fig. 7



The Other Side of the Mountain: The Simplification Slope

Making the simple complicated is commonplace; making the complicated simple, awesomely simple, that's creativity.

— Charles Mingus

The ideal path out of Region 2 (The Region of the Complex) is down and to the right, in the direction of increased goodness and decreased complexity. Remember, increasing complexity is a means to an end. **Increasing goodness is the actual objective**.

To begin moving in this direction, we must learn gain a few new skills and forget some old ones. In place of learning and genesis, which served us well on the trip between Simplisticness and Complexity, we must now master a skillset that includes things like **unlearning** and **synthesis**.

At this point in the journey, the necessary tasks do not involve creation of new elements, but rather the integration of existing elements and the removal of unnecessary ones. The process requires the **abandonment** of certain behaviors, principles, and activities that brought about the current level of goodness; to continue these would be counterproductive.

The idea is to prune and pare down the design, **reducing it to the essential components.** Each of which is able to freely operate with minimal friction and maximum contribution. As software guru Eric Raymond explains in *The Cathedral and The Bazaar*, "Perfection [in design] is achieved not when there is nothing more to add, but rather **when there is nothing more to take away**" (emphasis added). Thus, the way to progress along the Simplification Slope is to work on taking things away.

For a more academically rigorous approach, we can look to Genrich Altshuller's *Theory of Inventive Problem Solving*, which identified something called the **Law of Ideality**. This law states that as systems mature, they tend to become more reliable, simpler, and more effective—more ideal. This law goes onto explain that the amount of complexity in a system is a measure of how far away it is from its ideal state.

Interestingly, Altshuller postulates that upon reaching perfect ideality, the mechanism itself no longer exists. Only the *function* remains; the various components have been simplified to zero. This path to maturity describes movement along the Simplification Slope towards Region 4: The Region of the Simple.

Region 4: The Region of the Simple

Out of intense complexities,
intense simplicities emerge.

— Winston Churchill

Elegant, streamlined solutions are to be found in the bottom right quadrant of our graph, the *Region of the Simple*. Einstein's famous $E = mc^2$ equation is an example of life in this fourth region. There is tremendous complexity behind it, but the equation itself is at once profound and **breathtakingly simple**.

There is something Zen-like about the goings-on in this region and the individuals who abide here tend to have many **attributes of Jedi masters**. They grasp the gestalt of the discipline, design, or art form and present it to the world with previously undiscovered grace.

This is the region most great artists, teachers, students, writers, and system designers aspire to enter. However, the simplicity in this region is built upon an essential foundation of earlier complexity. One cannot usually jump directly from simplistic to simple, skipping complexity entirely. The initial increase in complexity is as crucial to maximizing goodness as the later decrease in complexity.

We have now replaced what Albert Schweitzer called "naive simplicity" with a "**profound simplicity**." This is done by pursuing synthesis rather than genesis and goodness rather than complexity.

What Comes Around, Goes Around

> Complexity is another word for simplicity unfolding in time.
> — Cliff Crego

There is an old **Zen koan** that poses the following question: "How do you proceed from the top of a 100-foot pole?" That is the question we must ask upon reaching Region 4. As good as it is to be here, we can not stay in this region indefinitely.

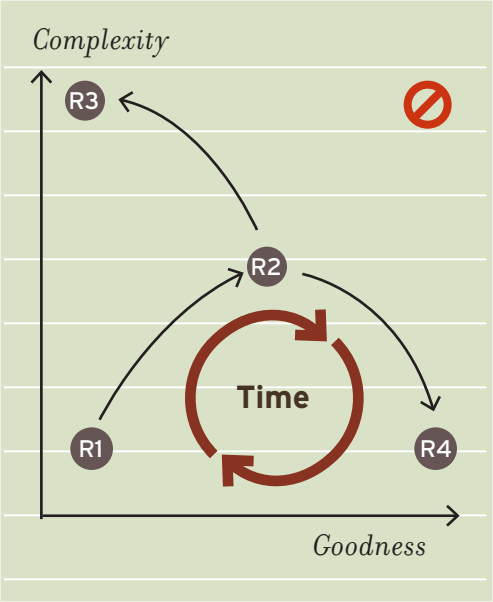
The optimal path out of this region involves yet another trajectory change and involves traveling along a slope that runs parallel to the earlier complexity slope. This means **increasing complexity** as a means of establishing a corresponding increase in goodness. However, we must avoid the orthogonal Complication Slope, which would take us up and to the left and merely increase complexity while decreasing goodness.

At this point, we are once again using the opposite of the activities that moved us along the previous slope. We are **back to genesis**, rather than synthesis. The trick is to avoid complex-

ity for complexity's sake and to accept only those additional elements that provide a corresponding bump in goodness. This activity increases both complexity and goodness until a critical mass is again achieved and yet **another trajectory change** is required.

We might portray this as a sinewave leaving the Region of the Simple and extending out to the right. More simply, we can imagine **the arrow of time** relentlessly pushing towards the left, in the direction of decreased goodness, as **yesterday's breakthrough becomes today's commodity** (see figure 8). To maintain a positive momentum along the x-axis requires continuous movement and change, as complexity increases and decreases like the tide. Where does it stop? I'm not sure it ever does.

Fig. 8



Elementary, My Dear Watson!

Seek simplicity, and distrust it.
— Alfred North Whitehead

Mere simplicity, defined as a state of low complexity, is seldom adequate for the academic, systemic, operational, artistic, and organizational activities we pursue each day. Yet, simplicity in speech, design, understanding, and operations is **essential to optimal performance**. Once we are able to see the distinctions between simplisticness and simplicity and how they relate to complexity and complicatedness, this is no paradox.

A journey of design, creation, or expression—like any journey of discovery—involves both genesis and synthesis, learning and unlearning. True mastery comes from discovering "the simplicity on the other side of complexity" and then understanding that continual forward progress in the area of goodness requires a series of increases and decreases in complexity.

IT'S JUST THAT SIMPLE.

NOTE: Portions of this Manifesto appeared in the Nov./Dec. '05 issue of *Defense AT&L*. They are reprinted here by permission of the Defense Acquisition University.

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ABOUT THE AUTHOR

Dan Ward is a punk-rocking electrical engineer who writes children's stories, a radical military officer who juggles flaming torches, a published poet, a performing magician, a popular public speaker, and a self-taught fire eater. He is a charter member of the Precarious and Impulsive Fellowship of Liveliness, and serves as Editor-In-Chief of Rogue Project Leader.com, a more-than-slightly subversive online program management journal he founded.

He is a prolific contributor to the Defense Acquisition University's flagship journal *Defense AT&L*, and his articles have also appeared in *Harpers* and *Gilbert*. His books include *The Radical Elements of Radical Success*, a non-fiction book about doing stuff that matters, and *Meet the Boomer Sisters*, a kid's novel. You can find his books at Rogue Press and Amazon. You can usually find his body in Central New York state, where he lives with his wife and two daughters. www.RogueProjectLeader.com

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