Autopoiesis *resembles the dynamics of a non-equilibrium system; that is, organized states (sometimes also called dissipative structures) that remain stable for long periods of time despite matter and energy continually flowing through them.* – Wikipedia

Introduction to *Self-Making: Autopoiesis of Woman*

Walking the Talk

A pioneer in the field of mathematics and religion, I've spent half my professional life as a math teacher and the other half as a minister. In the process, I've identified ways to use metaphors drawn from mathematics (or mathaphors) to help people expand their spiritual lives. Now, in ***Self-Making:*** *Autopoiesis of Woman*, I offer something that has never before been attempted: I use characteristics of chaos theory to structure reflections about one single life. Chaos theorists will likely be interested, but so, too, will many others who care nothing at all about the mathematical theory involved, for the story told herein is one with which many contemporary women will identify: the emergence of an individuated woman in a world which favors men. By using mathematical concepts to write about the autopoiesis ("self-making") of a woman, I am (as my adult son put it) "walking the talk," that is, I am using a mathaphor to share my own life journey.

The Beast and the Beauty: A Few Definitions and Clarifications

"Autopoiesis" (rhymes with "thesis") is chaos theory applied to life. Each of the nine chapters of this book reflects a different characteristic of the autopoietic process. The beast in this approach is that I don't want to belabor the mathematics, but I do want to provide sufficient clues for the non-mathematician to get a feel for the theory. I've experienced precisely this problem time and again in my effort to identify the interface between math and religion. I've found that solutions only emerge as I work through the process, which, of course, is precisely the way it should be.

The term "autopoiesis" comes from two Greek words meaning "self" and "making." Self-making, self-emergent behavior, and self-organizing systems are all phrases associated with the same concept. Chaos theory has even more names, each with slightly different interpretations: the mathematics of complexity, systems dynamics, nonlinear dynamics, and nonlinear dynamic systems theory. This lack of standardization can make the theory seem confusing. But the theory is not so much *confusing* as it is *emerging*. The fact that the theory is evolving rather than fully established makes my project a beast of a task. That same fact also makes it a beauty.

A Mini Math History

The start of chaos theory can be traced back to 1963 when Edward Lorenz, a meteorologist working for IBM, designed a mathematical model which he hoped would help predict weather. Lorenz' model consisted of three coupled nonlinear equations.[1] An equation may be thought of as a formula, like the famous $E = mc^2$. As with all formulas, if you plug in certain numerical values and "do the math," you obtain a predictable numerical result.

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[1]Somewhat over-simplistically, a non-linear equation is one that, when you graph it, turns out *not* to look like a straight *line*.

Iteration is an important mathematical term in chaos theory; it refers to what happens when you take the result you obtained after "doing the math" and plug that result back into the equation to get a second result, and then you take that second result and use it to get a third result and on and on until you have "iterated" the result for a long, long time. Most humans have little patience with that sort of process, so they just don't do it.

When computers were invented, however, mathematical iteration became simple. When printed out in color, the iterated results of such a mathematical process (repeatedly plugging answers back into a given equation) often show repeating designs that pop up amidst otherwise wild, erratic graphics. Similar patterns appear over and over on various scales so that if you "zoom in" for a magnified view, you find the same design (previously hidden) all over again. Order appears in the midst of disorder, and disorder appears in the midst of order. The technical term for an area of such colorful, ordered patterns is a "strange attractor."[2] A strange attractor is sometimes described as an island of relative stability within a sea of chaos.

One day Lorenz accidentally plugged two slightly different numbers into his weather-modeling equations, and he obtained noticeably different results. For instance, the numbers 1.23456789 and 1.2345678 differ only by the elimination of the eighth digit after the decimal in the second. For most everyday purposes, this difference is negligible. It's like working with a calculator which truncates the numbers after the decimal whenever they have more than 9 digits; when you are balancing your check book, who cares?

In mathematics it's amazingly simple to find two numbers which have an even tinier difference – just think of two numbers that have long strings of identical digits after the decimal – strings which are hundreds of times longer than the ones above – yet they still differ only in the very last digit. These seemingly insignificant tiny differences lead to radically different and often very complex results in the outcome of a process of iteration. On computer printouts, the patterns show major, totally unexpected and unpredictable differences. Mathematicians describe this (chaotic) process by saying that minute changes in initial conditions will lead over time to dramatic consequences that defy long-range prediction.

Lorenz wasn't particularly interested in the mathematics. He was trying to predict the weather, and so he found a mathematical model which he thought might display predictable outcomes that matched what happens with weather patterns. What he unintentionally discovered has been loosely described as the butterfly effect. Simply put, if a butterfly moves its wings slightly in China, the end result might be a terrible thunderstorm in Kansas. The butterfly effect is one of characteristics of chaotic systems in general, and of autopoietic (i.e., "living") systems in particular.

Lorenz "discovered" chaos theory the year I was graduated from high school. In the decades since then, chaos theory has led to a general understanding of mathematics that focuses on quality and patterns rather than on quantity and formulas.

How Each Chapter Reflects Autopoiesis

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[2]There are different types of attractors; "strange" attractors occur if the mathematical system involved has non-integer dimension or if the dynamics on it are chaotic. Examples of strange attractors include the Hénon, Rössler, Tamari, and Lorenz attractors. The last one is sometimes nicknamed the Butterfly attractor, both because of the quality of its behavior and also because the ordered pattern it produces somewhat resembles the wings of a butterfly.

I draw on the image of the "butterfly effect" in the first chapter of this book by telling stories about my "initial conditions," then setting these early stories into a skeleton outline of my basic life path: born to X and Y, school days, marriage, children, parents' deaths, career, ill health, divorce, remarriage, new career, and so forth. This technique mimics the algorithmic process a mathematician might undertake when plugging a specific numerical value (*cf.* a new-born baby) into a given equation (*cf.* an anticipated life path), and then "calculating" the result. The chapter ends with an emphasis on how small perturbations early on in our lives turn into patterns of love or rejection, or both (garlic and cinnamon).

In Chapter 2, I use aspects of my ministry to focus on the unpredictability that inevitably accompanies the autopoietic process. Here I also repeat (with greater detail) topics which I mentioned in the opening chapter. I intentionally use this repetitive technique throughout the remainder of the book: it is meant to foreshadow and reinforce the fractal nature of chaos theory (addressed more explicitly in Chapter 7).

The third chapter introduces areas to which I am drawn "like a bee to flowers": fantasy, spaces and places, specific social issues, family and other individuals, self-feedback, feedback from others, and so on. Collectively, these "attractors" provide an ordered stability, bringing clarity and meaning to life.

A chaotic bifurcation is that point where, as Robert Frost put it, two paths diverge. In my story the catalyst for that point is "a devil in priest's garb." Chapter 4 shows how this relationship emerged, and how it changed my life forever.

In Chapter 5, I draw on my many years of therapy to illustrate the importance of feedback and reiteration, a fifth characteristic of the autopoietic process. In Chapter 6, I offer a geometric image as a way to illustrate the impossibility of fragmenting a whole, then apply the notion to seemingly separate images of my "self." Chapter 7 illustrates the fractal nature of life. In this chapter, as in Chapter 1, I take a rapid ride through my life, but this one is scored by a medley of tunes. The chapter concludes with a story designed to show that the fractal nature of one person's life reappears in what the ancient Greeks called the "Music of the Spheres," *i.e.*, in the cosmos as a whole.

The underlying premise of Chapter 8 is that our dreams are where our lives most often exist in that sloppy, irrational, messy, often dark state known in mathematics as the edge of chaos. The edge of chaos is understood mathaphorically as a birthplace of creativity. Some claim that the most fundamental act of creativity is the sexual act. In this chapter, I couple my "dream-world" with stories from my "real" life in order to explore my ultimate growth as a sexual, passionate woman.

In Chapter 9, my reflections are those of a woman of senior years. Coming to terms with the disappointments and struggles in life, I emerge as a woman who truly values the "self" I've "made." Of course, "made" is only a momentary interlude. Like every other living creature, I am always changing, always in process, always "making" myself. How, for instance, will the actual completion of this manuscript impact the woman I am becoming? I cannot say. No one can say, for the impact is always in the making, and therein lies the perpetual mystery and charm of life. I am but grateful for the experience!

Post Scripts

For Mathaphobes: Aside from this introduction, the mathematics included in this manuscript is minimal, user-friendly, and largely limited to quotations at the beginning of each

chapter.

For Literary Control Freaks: This manuscript begins with my early life, but time-wise it is far from linear. The sometimes discordant jumps in scene and year are intended to suggest the chaotic process.

For Nitpickers: Although I worked hard in this autobiography to match my memory to historical facts, I couldn't always find the facts, and my memory sometimes mixes up dates, times, places, and other things, so there are undoubtedly inaccuracies herein. The first time I wrote it, I wrote it "straight." Then I changed names of everyone but members of my family, whom I trusted would love me anyway. After my husband read it, however, I decided to change the family names, too. He figured someone might sue me if I didn't. I had the distinct feeling it might be him.

For Anyone Else: There are many people who have helped me with this manuscript. One said that it is a book of substance. Others who have read it have uttered something about "brilliant." Substance and brilliancy. I think that's a fine reward for candor.

And, Finally

Several strong sub-themes accompany these reflections: healing, resilience, contemporary mysticism, and, of course, all the issues which could affect a bright, but insecure, farm girl from Ohio who made her way through an explosion of feminism which she once thought wouldn't affect her at all. And, yes, that would be me, Capa Sue Handerson Fox, a.k.a. Sarah Voss.

Contents