

KABBALAH AND COMPLEXITY: TWO ROUTES TO ONE REALITY

Neil D. Theise, MD

Departments of Pathology and Medicine (Division of Digestive Diseases)

Beth Israel Medical Center of Albert Einstein College of Medicine

New York, New York

We may encounter and perceive the world in two ways. The first is common to everyone, we extend our senses outward to register the world and organize the incoming sense data for comprehension. The second is only pursued by mystics and contemplatives from diverse traditions who doggedly train and quiet the mind, in the interior stillness discerning characteristics of absolute reality or, in the formula of our Jewish tradition, the nature of G'd.

In our modern times, these two approaches are divided between investigational sciences and spiritual practices, modes of exploration that are now often understood as not only socially, ethically and politically separate, but even antagonistic. At best, for spiritually inclined scientists and scientifically inclined spiritual seekers, it is safest to say that these approaches are complementary, but certainly not identical.

Yet this division is strange. After all, if scientists and contemplatives both are evaluating the True Nature of reality, how is it that we have two True Natures, rather than one? Through recent studies of adult stem cell behavior and the applications of complexity theory to explain some of the experimental results, I now find that this divide may be narrowing to the point of extinction.

To my surprise, the logical extension of a complexity theory analysis of physics, chemistry, and biology precisely echoes Kabbalistic notions regarding the creation of the world and Buddhist metaphysics (which I have treated elsewhere). Moreover, the aspects of creation mirrored by complexity include *the* Creation, b'reishit, as well as the continual renewal of creation in each discrete, present moment. In particular, I would suggest that a complexity analysis clarifies the paradoxical notions of the Sefer Yetzirah and elaborations deriving from the school of Yitzhak Luria: how the *sefirot* link us and our world as creations to the *Ein Sof* – the indescribable, infinite, Absolute Source from which the world emerges – while simultaneously distancing us from that Source, a separation necessary for us to exist in our differentiated world.

It is unlikely that many readers of this essay will be familiar with concepts important to understanding both the kabbalah and complexity. Therefore, I will start with relatively brief introductions to both systems of thought.

A Kabbalah primer

Many people are familiar with at least the most common diagram of the sefirot. Essentially there are ten of these structures, linked by criss-crossing lines in a descending path or “tree” from top to bottom. In fact, there are many metaphorical and schematic approaches to describing the sefirot. For example, they have been called vessels, filters, attributes of the Divine, limbs of Adam’s primordial body. While these descriptions may be informed by poetic imagination, they represent struggles to describe contemplation derived perceptions of the world. The only available language was poetic, rich in connotations, but poor in specificity.

In the Beginning, the *Ein Sof*, unfathomable and indescribable, moved to create the world, setting all things in motion by an act of *tzimtzum*, contraction, to create a “space” in

which to project its light, which, pure and intense, could not itself comprise a differentiated world because it was essentially undifferentiated. It therefore had to flow through filters or cascade down through vessels which reduced its intensity and also imparted differentiation, i.e. describable attributes, distinguishing this quality from that quality and, ultimately, this created being from that created being. In the process, in Luria's twist, the light was still too intense and the vessels shattered, leaving sparks trapped amongst their shards, introducing shadow where there had been light and leaving us the work of *tikkun*, the reparation of the link from our differentiated world back to the undifferentiated Ein Sof.

While the metaphor of the sparks trapped in broken shards is particularly vivid, the difficult aspect of the metaphor is the paradox that while we and the rest of the created world emerge directly from the Ein Sof, we are also separated from the Ein Sof by that which makes us possible. Inherent in creation is separation and separation arises from the act of creation itself.

How to understand these concepts in a deep sense, rather than a slippery metaphorical one? This mythic formulation is good poetry that can lend a mystical, magical sparkle to otherwise potentially dry observances. But how does one truly, directly perceive the world's unfolding through the levels of the sefirot?

Enter complexity theory. Bear with me as we shift gears from the medieval to the modern.

A complexity primer

Complexity theory considers how groups of interacting individuals that fulfill certain simple criteria, so called "complex systems", can self-organize into large scale patterns of communal behavior which are quite complex, though, despite appearances to the contrary, are

never planned. Or, more simply, it describes how many large scale structures arise spontaneously from smaller things. These higher level structures are referred to as *emergent* phenomena and they can change and adapt to a changing environment, hence the full name: complex *adaptive* systems. A familiar and clear example is the ant colony.

Ant colonies are elaborately structured societies. Lines of ants carry food into the colony and others carry out refuse to a dump and corpses to a cemetery. These are remarkably sophisticated structures: for example the distances between the colony, the dump, and the cemetery are maximized – an exceedingly complex mathematical calculation – though there is no central planner. It seems like a reasonable community impulse (who wants their friends and family buried next to a landfill?), however, the solution occurs not from the top down, by conscious design, but from the bottom up, as emergent self-organization.

Indeed, if one computer models the behaviors and interactions of individual ants, the same structures emerge, but without having been programmed. Even though the computer programmer does not write code for these emergent structures, the virtual ants self-organize into an emergent virtual colony much like a natural one.

The four criteria which, if fulfilled, lead to emergence are simple:

1. There must be many individuals. How many are necessary varies with different types of groups. We know that a twenty or so ants are sufficient to self-organize into food lines in the kind of ant colony advertised in comic books. Furthermore, different numbers of individuals will self-organize in different ways; thus, a village is different from a city is different from a megalopolis.

2. There must be a dominance of negative over positive *feedback loops* in which interactions between individuals. Thermostats provide an example of negative feedback: an air-

conditioned room cools until a set, low temperature and the air-conditioner turns off. The room then warms until the air conditioner turns on. A positive feedback loop would be if the colder it got the more the room would be cooled. Systems dominated by positive feedback loops, may well emergently self-organize, but they are energy expending, for example, tornados, hurricanes, cancer, that, rather than adapting, rapidly burn out.

3. There is no global sensing; no individual is monitoring the system as a whole. There is no ant checking to see if the colony has too little or too much food. Instead, each individual just pays attention and reacts to what happens in its local vicinity.

4. There is *quenched disorder* in the system, meaning that there is a small degree of randomness. Too much disorder and one has chaos, too little and one has a rigid system which can't adapt to a changing environment. In the ant colony, food lines always look like straight lines of ants going to and fro. However, there are always a few ants that aren't following the line, who look as though they are not fulfilling their function though in fact they are vital to the colony's adaptive behavior. If one interrupts the food line with one's foot, these divergent ants rapidly establish the fastest way around your foot; if the food runs out, these are ants likely to already be finding a new food source, ready to establish a new line.

This last criterion is what led me to become familiar with complexity theory. Collaborating with British artist Jane Prophet, I explained some of our experimental findings regarding the so called *plasticity* of adult stem cells. My collaborators and I were among the groups that first reported this surprising adult stem cell flexibility, suggesting that they might have as much potential as embryonic stem cells. Critics of this work often pointed out, however, that many of our findings happened at very low levels, of at most a few percentage points. It was Jane who first suggested that these low level events sounded like quenched disorder in the

system, the implication being that cells themselves were members of a complex system giving rise emergently to the tissues and organs of our own bodies.

Hierarchies of emergence: where complexity meets Kabbalah

Thus, the ability of complex systems to exist in hierarchies suddenly leapt to the fore. After all, while an ant colony arises from self organizing ants, these ants are arising from the cells of their bodies. This laddered hierarchy reveals an interesting aspect of the nature of *things*. Individual things may appear solid and unitary from a distance, but up close they are not: from a distance, an ant colony looks like a thing, a solid, dark mass, but moving in more closely, one sees that this *thing* is no thing at all; rather, it is a large group of scurrying, interacting smaller things, the ants themselves.

If one moves to the microscopic level, ant bodies (like your body, dear Reader) also cease to be things, but instead are revealed to be ever shifting organization of smaller things, the cells of which they are made. If one extends the analysis still further down in scale, we find that cells are made of biomolecules fulfilling all the same criteria. These molecules, in turn, are self-organizing atoms, which in turn are self-organizing subatomic particles, and so on, down the scale to the smallest possible units of existence.

The precise nature of these smallest units of existence is as yet unclear. A leading hypothesis is that they are tiny, vibrating strings (hence, “string theory”). But whatever their nature, there is general agreement amongst physicists that there can be nothing smaller and that these smallest entities come and go, in and out of a “generative void”, like a “quantum foam”, that is essentially indefinable, beyond description.

And suddenly, the physics begins to sound like Kabbalah.

Now let's play the film backward, instead of descending downward through levels of scale, let's start from this ground of Being and move upward. The smallest elements of physical existence pop in and out of the void and then, interacting, they self-organize into different sub-atomic particles which then self-organize into still larger sub-atomic particles, and then, in turn, into atoms, then into biomolecules, cells, bodies, communities (of all kinds: villages, cultures, ecosystems, Gaia). All of existence, then, is simply the emergent self-organization of whatever arises from the Ground of Being.

And thus, we have a scientific correlate to the Kabbalistic description of creation. The first emergence of the world according to the big bang theory occurs in just this manner, the earliest manifestations of matter and energy self-organizing, moment by moment, as the universe cools, into larger and more complex structures. As the self-organizing emergence continued, historically, through ever changing conditions, the world as we know it emerged.

But it was not only emergence ex-nihilo at the point of B'reishit, it is also the maintenance of the world, even this very moment in which you read this sentence. After all, if the smallest elements are constantly popping in and out of existence, in that quantum foam, then the self-organizing is constantly renewing itself from the very bottom upward. Each and every moment is a new creation, reflecting the original Creation.

As for the sefirot: they seem to correspond to these levels of emergence, from the smallest scale of being to our own day to day scale of being and beyond. Each level of existence arises from those lower down and self organizes into those higher up. At each level, every entity has an appearance of being complete and unified, a *thing*, but each level of scale downward, that appearance of solidity dissolves into a complex dance of smaller things. Each level of scale thus

obscures the levels farther down, just as sequential sefirot distance us further and further from those which precede them.

In order for us to exist and function within our world, we arise through successive levels of self-organization from the Absolute, but our functional existence depends on that *organizational* distance from the Absolute. As long as we keep our senses focused on our ordinary level of scale our world has meaning. But the meaning can only manifest at that level. Descending back downward leads to dissolution of the Self and all the possible moral ambiguities of the mystical world.

An example: an iron atom vibrating at a red hot temperature. At the atomic scale there is no moral value to such vibration. But at our daily scale, is that atom part of the shrapnel of a suicide bomber or part of a beautiful, wrought iron form being shaped by an artist? Moral value, then, depends on the scale of observation. The further downward we go, the less differentiated and the more neutral things appear. The Tree of Knowledge of Good and Evil, of distinctions, provides a view that is scale dependent. The view from the Absolute is different than that of our day to day world. Thus, the Talmud describes dangers in exploring this mystical Garden: only Akiva returned from such awareness able to balance both views, the other Rabbis could not return or did so with more confusion than clarity.

So, hierarchies of emergence are perhaps a scientific correlate to the aspects of the world described by the mystics as sequentially unfolding sefirot, both the direct connection to and emergence from the Divine at the same time as the necessary distance from the Source which allows us to act in the phenomenal world.

In conclusion, the best contemporary formulation of the nature of reality, obtained from our most sophisticated sensing tools and computational methods, reveals a fundamental structure

of the world that is precisely reminiscent of the discoveries provided by inward explorations of the mystics. Science and contemplation, physics and metaphysics, can now be seen concretely as two different roads to the same destination: a single and verifiable True Nature of reality.