CONFUCIAN ORDER AT THE EDGE OF CHAOS: THE SCIENCE OF COMPLEXITY AND ANCIENT WISDOM

by David Jones and John Culliney

Abstract.   Many academics extol chaos theory and the science of complexity as significant scientific advances with application in such diverse fields as biology, anthropology, economics, and history. In this paper we focus our attention on structure-within-chaos and the dynamic self-organization of complex systems in the context of social philosophy. Although the modern formulation of the science of complexity has developed out of late-twentieth-century physics and computational mathematics, its roots may extend much deeper into classical thinking. We argue here that the essential ideas and predictions of the science of complexity are found within the social ordering principle of *li* (the rites) in Confucius's *Analects*.

Keywords: complex systems; Dao; edge of chaos; emergence; *li*; order for free; *ren*.

> *. . . dans tout esprit humain, quel qu'en soît*
> *le développément intellectuel, subsiste un fond*
> *indéracinable de mentalité primitive.*[1]
>
> —Lucien Lévy-Bruhl, Preface, Dodds 1951.

E. R. Dodds, the famous Greek classicist, developed what might be called the *agglomerative* view of both self and culture (Dodds 1951).[2] In this view, Dodds asserts that the earlier experiences of the individual and the previous practices of a society remain hidden, yet still operative, in the continual processes of the self and the collective self. For Dodds, the reassertion of what is essentially a Freudian model, which was adapted by such noted anthropologists as Lucien Lévy-Bruhl, proved an invaluable mechanism for his profound understanding of ancient Greek culture,

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religion, art, and philosophy. If we accept the models of Sigmund Freud, Lucien Lévy-Bruhl, and Dodds, then we can assert that many of our current ideas were prefigured by our intellectual forebears.

One current theory that has previously been adumbrated in various ways at different times and in disparate traditions, even in the ancient past, is the new scientific theory called the science of complexity. Complexity theory is a recent development emerging in part from chaos theory (Waldrop 1992, 12).[3] What makes the science of complexity so appealing and interesting to nonscientists is that by its nature it is much more inclusive of other disciplines than most other scientific theories. Among the disciplines most commonly discussed by complexity theorists are history and economics. However, what has been sorely lacking in the work of complexity theorists is discussion of the theory's relation to philosophy and religion. What follows is an exposition of Confucius's thought with special attention given to his emphasis on *li* and *ren*. These aspects of Confucius's thought are presented as possible precursors to complexity theory as extended and applied to society.

THE SCIENCE OF COMPLEXITY: A PRIMER

All complex systems are made up of many interacting units and subsystems of units. A system may be defined as an entity consisting of parts that produce a composite but definitive structure and that connect or interact within the structure to produce a particular range of activity or behavior. Examples of complex systems include national and global economies, governments, big cities, and other manifestations of society; nonhuman entities such as animals, plants, and other organisms, ecosystems, and the biosphere are also examples of complex systems. Interacting units within complex systems are as various as protein molecules, living cells, people and human institutions, and the myriad species in the biosphere. Within a given system, unit interactions (or transactions) can be thought of as forms of communication, or information exchange, even in cases of simple chemical and physical interaction (e.g., molecular collisions and chemical reactions).

One characteristic feature of complex systems is their nonlinear behavior; that is, interactions of units within a complex system typically have consequences that are not simply additive in nature. Multiplicative or synergistic effects commonly emerge from relatively simple interactions in complex systems; sometimes there are qualitative jumps that are beyond imagining, such as the dawning of consciousness at some critical threshold of structural development and neuronal interaction in a nervous system. Evolutionary change in a system that cannot be predicted from measurements of activity or behavior that led to the change is termed emergent—in other words, this is a case where the whole becomes more

than the sum of its parts. The phenomenon of emergence (and its inverse —in the sense of unpredictable collapse in a system) is itself a common, perhaps inevitable, manifestation of complex activity. The evolution of life and the development of a global economy seem to be examples of synergistic surges and radical deconstructions in complex-system activity.

Another property of complex systems, and more generally of all systems exhibiting some degree of chaos, is known as sensitive dependence on initial conditions. The classic example involves the weather. In modeling weather patterns on supercomputers, meteorologists establish a set of initial conditions—temperature, humidity, barometric pressure, and so forth—and then let the weather system evolve. In any subsequent model with simulations that allow even the slightest changes in initial conditions, wildly different virtual weather patterns emerge in a short time. This phenomenon was first named the seagull effect by meteorologist and theoretical physicist Edward Lorenz, whose pioneering 1963 computer simulations forever dashed the hopes of the then-reigning reductionist school of weather forecasting (Gleick 1988, 23). Prior to Lorenz's experiments, it was thought that small imbalances or disturbances in weather factors would always just damp out and disappear into a larger, predictable unfolding pattern. The discovery of sensitive dependence on initial conditions in meteorology was later christened the "butterfly effect" to emphasize its extreme sensitivity. In reality, it may be true that a butterfly flapping its wings in Beijing may set off a tornado three days later in Taipei.

A kind of spontaneous evolution seems to be characteristic of complex systems. They evolve from simple precursors that may be haphazardly or weakly interactive, without sustainable structure, in the direction of greater complexity and eventually reach a state that has been termed "the edge of chaos" (Langton 1991, 35). The theoretical biologist Stuart Kauffman has called this evolutionary process and sorting out that occurs spontaneously among interacting units "order for free" (Kauffman 1995, 71). Ultimately there arises a condition of maximal information flow or communication potential among the system's units within which the system can maintain an ordered yet precarious existence. A high-volume, diversified global economy or an ecosystem rich in species is thought to approach the edge of chaos. In this state, volatility and richness of interaction are at a sustainable peak, but the system's high state of order is always at risk. What is more important, there is the potential of innovative mutation and selection among its component units and subsystems that can lead to emergence. It may be important to note that in complexity science, creativity is defined as if a creator—an emergent engine or principle —were inherent in a given system, and this capacity for creativity is at a maximum at the edge of chaos. Beyond the edge lies a disorderly realm of

turbulence into which a system may fall or be pushed; in many physical examples this happens after additions or subtractions of interactive units or following sudden surges of energy as a system dwells on the cusp between stability and instability. The edge of chaos is a metaphorical cliff. After a fall from the edge, much of the structure, sustainability, orderly flow of information, and creativity of the system are lost, whether the system has been lost in chaos—or frozen into complete stability, i.e. stasis. Mass extinctions happen; units disappear.

CONFUCIAN ORDER AND THE MAGIC OF *LI*

Herbert Fingarette has correctly pointed out the magical element of Confucius's thought. In *Confucius—The Secular as Sacred*, Fingarette says that "the magical element always involves great effects produced effortlessly, marvelously, with an irresistible power that is itself intangible, invisible, unmanifest" (Fingarette 1972, 4). There is indeed a magical element to Confucius's teachings that extends far beyond the original meaning of *li* as "holy rite." It is not only the "effortless," "marvelous," and "irresistibly powerful" effects of *li* that make it so magical but the "intangible," "invisible," and "unmanifest" power of human interactions that makes the emergence of *li* possible, on the one hand, and permits its continuity, on the other. The continuity and (re)generation of *li* is necessary for "maintaining institutional and cultural continuity with a minimum of conscious intervention" (Hall and Ames 1987, 22). Our social conventions and customs are complex systems comprising the connections of many interacting units. All persons in a society have their own individual needs, desires, aspirations, ideas, and so on. Unlike democratic systems of government and social organization that base their development and structure on serving those needs of the atomic individual, Confucian society ordered itself on the principle of the community being greater than any individual part or the sum of its parts. Therefore society is an organic community emerging from the interaction of all its units. The community was a complex system that was not so much created by any individual —even Confucius himself—but emerged as a result of individual transactions.

Confucius did not invent *li*, nor did he actually design a society based on its principles (although he did try to influence rulers so that his philosophy was a means of gaining social and political order). What makes Confucius such an important social thinker is that he merely affirmed and articulated a natural development of the emergence of order from the possibility of chaos and the possible slip of society over the precipice of that very chaos. Arising spontaneously, *li* "defines the conventionally accepted *style* of actions, i.e., the form and possibility of moral achievement within the cultural setting" (Cua 1971, 44). Historically, no social group

consciously decides its conventions—there is no convening. For example, conscious decisions are never made to be either a bowing culture or a handshaking culture. Depending upon the inherent interactions of the participants in any given social system, certain customs will emerge as a natural consequence of those interactions and transactions within the system. This emergent *li* will be an expression of the values of the system. Again, Confucius did not make this up; he merely looked at the interactions and the resulting manifestations of *li* and affirmed that the process was essential to the establishment of human social order. In fact, for Confucius nothing was more important than *li* because any participant in society should "not look unless it was in accordance with the rites; . . . not listen unless it is accordance to the rites; . . . not speak unless it is in accordance to the rites; . . . [and] not move unless it is accordance with the rites" (Lau 1979, 112).[4]

In Confucius's thought there is an awareness that *li* has an organic aspect, that is, it has the inherent potential for growth or diminution over time.[5] The structure, sustainability, and orderly flow of information within the system could and would change. Confucius suggests that observance and affirmation of this orderly flow was crucial to the preservation of society. If the social system's *li* did not respond to the changing needs of society, stability would be lost. Once stability was lost, society's fragile fabric would come one step closer to losing its pattern of order. Confucius knew that this step was a movement toward the extinction of the social system and would lead to another unknown species of social organism. Therefore it was in the system's best interest to be adaptive; the alternative was chaotic extinction, or authoritarianism. Confucius thus allowed for variation in *li* over time, but this variance had to be in harmony with the emergent order of the system:[6] "A ceremonial cap of linen is what is prescribed by the rites. Today black silk is used instead. This is more frugal and I follow the majority. To prostrate oneself before ascending the steps is what is prescribed by the rites. Today one does so after having ascended them. This is casual and, though going against the majority, I follow the practice of doing so before ascending" (Lau 1979, 96). Fortuitous or forced changes—those changes that did not affirm the sustainability of the system or appropriate the emergent spontaneity inherent within the system—would cast the system into unforeseen consequences, into chaos. Similarly, neither following the party line nor consistently rebelling against it without an appropriate reason, which was in harmony with the orderly flow of information flow within the system, was acceptable. Changes that were not reasonable for the continuance, sustainability, and subsequent growth of Confucius's social system would pollute the system and subsequently cause its orderly flow of information to be disrupted, sending the system into the spiral of destructive change,

extinction, and the emergence of a new order. As Fingarette has noted, "The Confucian commitment to a single, definite order is also evident when we note what Confucius sees as the alternative to rightly treading the true Path: it is to walk crookedly, to get lost or to abandon the Path. That is, the only 'alternative' to the one Order is disorder, chaos" (Fingarette 1972, 20). This commitment to a single, definite order is an appropriation of the emergent spontaneity immanent in the process of becoming *li*, which will mutate at the proper time for its—and the social organism's—survival. Ultimately the survival of *li* is dependent on the continued life of its interacting cells, of cultured human beings, and the continuous life of human beings depends on the progression of *li*. Any system, biological or social, seeks one constant goal: to perpetuate itself in the face of extinction.[7] There are, however, forces at work in the system that are more self-promoting, selfishly motivated, and chaos driven.

A convergence of Confucius and Daoism[8] would realize this emergent sense of order vis-à-vis the chaos-driven forces, but in a fundamentally different way. Daoists would affirm the natural order because of the interplay of yin and yang, where polarity is requisite for emergence. Neither Confucius nor most subsequent Confucians nor the Daoists would impose an outside transcendent power in their respective approaches. Their virtue was in the realization of the unknown immanent force that seeks emergence and order for free and makes all life, not just human life (both biological and social), possible. For the Daoists, this immanent force would necessarily create order from all the intersecting interactions of chaotic reactions, and if this principle is applied to Confucius, we find that "order is realized, not instantiated" (Hall and Ames 1987, 16).

DAO AS POSSIBILITY

The term *Dao* had been in Chinese thought long before Confucius and has a variety of meanings. For Confucius, it can mean the way of being human and the way of government; Confucius is best seen as an artificer of *Dao*, one who skillfully crafts the way of natural phenomena into human propriety.[9] Because of their reverence for natural cycles, the Daoists used the term to incorporate the way of the natural world and the patterns created by the continual ellipses of the sun, the waxing and waning of the moon, the seasonal changes, and so forth, into an intelligible unity, a complex natural system. Often the antipathy of the Confucian and Daoist notions of Dao is affirmed. However, both Confucius and the Daoists looked at the world and its interactions from their own perspectives and saw what the complexity theorists are now calling "order for free" at "the edge of chaos." Confucius looked at the weakly interactive connectivity of his fellow beings, some of which probably appeared

arbitrarily impulsive to him, and designed his philosophy of *li*. From the perspective of complexity theory, we can view the emergent order he saw, remembered, or wished for as a conditioned maximal information exchange, or the potential for that change, in the form of *li*. It was through the interactions and transactions of the human beings of the dissolved Chou Empire that Confucius came to understand the need for societal order. Confucius was the first thinker to realize that human harmony could be achieved only when there was an appropriate vehicle through which it could gain expression. The vehicle is the "authentic tradition and reasonable conventions of society" (Fingarette 1972, 6). This emergent vehicle is the creative force within the system; the force is *li*.

Confucius was an astute observer when he regarded the interactions of his fellow human beings. The exchanges he witnessed were very subtle in nature. The flow of communication was not obvious, but it was present in a very distinct and profound way. Any resulting harmony from acting through *li* had less to do with the content of the act than with the action of the act. In other words, the vehicle for expression had already been unconsciously convened as the meaning for interaction. Any failure to respond appropriately within the context of the vehicle would violate the natural order of social relations and be one step beyond the edge of chaos. Either the imposition of excessive authoritarian control or the explosion of freewheeling impulsivity would pull back from the edge or go over the edge. For Confucius, *li* occupied a narrow zone between failing to appropriately perceive the boundary and pressing one's own advantage. Hence, Confucius was very concerned that *li* should be performed appropriately and with discipline. As a model figure for others, Confucius "did not eat food that was not properly prepared nor did he eat except at proper times. He did not eat food that was not properly cut up, nor did he eat unless proper sauce was available" (Lau 1979, 103).

Perturbations to complex systems, including social systems, need not be large to have an immense impact; potentially the addition or loss of a grain of sand may bring a mountain down. Similarly, casual, nonchalant, awkward, and unauthentic performances or denials of *li* can have devastating effects. One need only look at contemporary society to see a plethora of examples of how chaos is rising in contemporary culture. We have forgotten how to apologize, express our gratitude, or show respect for our fellow beings, which are emergent values of our *li*.[10] Moreover, we need only look at our arbitrary contemporary sense of community: planned retirement, apartment, and condominium "communities" with swimming pools, golf courses, handy minimarts, and so forth, that bring us together in artificial ways that have been introduced by an extraneous (transcendent) source of economic development and population growth. Any number of possibilities existed for the development of *li* in China,

but the various constituent parts of Chinese society interacted in a way that ordered the apparent chaos to express itself in the way described by Confucius.

THE DAO OF *REN*

The notion of *ren* that emerges from *li* is one of the most important aspects of Confucian thought. *Ren* is best translated as "human-heartedness" and has the connotation of authenticity.[11] Originally the word referred to the freemen of the tribe in contradistinction to the *min* or subjects. The *min* were considered much like what the ancient Greeks meant by their term *barbaros*, which meant one who could not speak Greek. The ability to speak one's language (another form of a complex system) and possessing the qualities of one's social group, indicate a sense of harmony and orderliness. Over time, *ren* was used as a commendation for those who possessed the qualities of the tribe. In time, *ren* evolved to be associated with a human being as opposed to an animal (Graham 1989, 19, 136). This point in the evolution of the word is an important one for understanding the importance of Confucius's philosophy with regard to complexity theory. To become human, that is, to emerge from the less ordered realm of the animal, to find order in chaos either through personification or in the sophisticated sense of *li* that Confucius sought, is to make order in the apparent chaos.

Thus, it was important for Confucius to add an existential dimension to the performance of *li*. This existential dimension is *ren*.[12] In the *Analects*, *ren* has a specialized sense of authenticity and goodness and relates to the necessity of moral striving to become *ren*. To engage in *li* without *ren* does not affirm the necessity and importance of the emergent complex system to which we belong and prevents us from being well balanced on the edge of chaos. This seems to be the reason why Confucius held the achievement of *ren* as an asymptotic ideal that only venerated mythic figures of the past could approach. He himself wisely denied having achieved this ideal state: "How dare I claim to be a sage or a [*ren*] man? Perhaps it might be said of me that I learn without flagging and teach without growing weary" (Lau 1979, 90). Confucius urges us to heed his call by both deed and action as we as a collective self continue to walk the narrow precipice between order and chaos. In chapter 8, verse 3 of the *Analects*, the Master quotes the *Songs*:

> In fear and trembling,
> With caution and care,
> As though on the brink of a chasm,
> As though treading on thin ice.

(Waley 1938, 133)

This ideal state of emergent order is where we find ourselves close to perdition, and we humans are dancing drunkenly, very ungodlike, on the precipice facing the ancient future. If we go over the edge, it may be comforting to some that the system will rise again, but the human part of the system that reflects on, participates in, and interprets its emergence—the gossamer human being—may be absent in the new order. Ultimately the ancestral component of the past, the present moment of ordered chaos, and the yet-to-be of the future moment would be lost. In other words, the absolute precarious perfection of the multiplicity that we have come to know as human being will float in the calm clear weather of this new world order like an overlay of cobwebs drifting in the remembrance of nothing.

NOTES

1. In every human spirit, whatever its intellectual development might be, subsists a foundation that cannot be uprooted from the primitive mentality.
2. Graham Parkes refers to the model under discussion here as an agglomerative one. We have borrowed this term from him.
3. We are, of course, making no direct connection, historical or otherwise, between complexity theory, chaos theory, and the thought of Confucius. We merely wish to demonstrate that Confucius's thinking coheres in complexity theory, and that the advances of complexity theorists have been circulating for some time.
4. All translations are taken from this source unless otherwise noted.
5. We certainly cannot know Confucius looked at the natural world and its processes and then developed his theory of social order. There is only one passage in the *Lun yü* where Confucius directly contemplates the nature of change: "What passes away is, perhaps, like this. Day and night it never lets up" (Lau 1979, 9/17). Waley (1938) and Legge (1895) in their translations refer the reader to sections of Mencius for further elucidation of this passage. Mencius restates 9/17, but not in the same wording: "The disciple Hsü said, 'Chung-n [Confucius] often praised water, saying, "O Water! O Water!" What did he find in water *to praise*?'" Mencius replied, 'There is a spring of water; how it gushes out! It rests not day or night. It fills up every hole, and then advances, flowing on to the four seas. Such is water having a spring! It was this which he found in it to praise'" (Legge 1895, 324). Mencius then describes the possibility of not having a source from which the water flows: "But suppose that the water has no spring.—In the seventh and eighth months when the rain falls abundantly, the channels in the fields are all filled, but their being dried up again may be expected in a short time." In the next sentence, Mencius extends this discussion of a natural phenomenon to the human level: "So a superior man is ashamed of a reputation beyond his merits." Without the source of the stream's spring, it would not be possible to channel the stream to human fields (Legge 1895, 325 n. 3). In the drier months, the fields would be without the potential to produce. Likewise, the consummate person's (*junzi*) reputation is similar to the source of the stream's spring. When the *junzi*'s reputation "dries up," the character of the common people will be unproductive and chaos prone. Although difficult to prove, it is arguable that this natural source is very much an ordering principle found in nature, and the consummate person is the human reflection of it. The consummate person is one who consciously affirms *li* and performs *li* in the proper spirit, the spirit of *ren*. However, it is still enough to say that Confucius's thought is consonant with and resonates in natural processes. Looking for the historical Confucius, or what he actually thought, is very difficult.
6. See Tu 1972, 194, where the author correctly addresses the problem of *li* as a process of humanization and "an authentic way of establishing human-relatedness," and therefore "*li* . . . is understood as movement instead of form." According to Tu, *li* had evolved from a "proper act of sacrifice to an authentic way of establishing human-relatedness," and "the emphasis is on its dynamic process rather than its static structure." Another article that arrives at similar conclusions is Hall and Ames 1984. The authors correctly focus their attention away from rigid and deterministic interpretations of Confucius.

7.   This assertion is not a claim that Confucius himself speaks of society's drive to perpetuate itself vis à vis extinction. In the *Analects*, we do not find this sort of discussion; however, it could be argued that it is implicit in and consistent with what Confucius does say. Confucius's idea about a well-ordered society in a prior golden age indicates that he is aware of the movement toward disorder that he saw in his society. This movement toward disorder was the movement toward the extinction of social life as he knew it. Otherwise, why imagine a return to a perfectly ordered society in some past golden age?

8.   Spelled *Taoism* in the Wade-Gilles romanization that once was standard English usage.

9.   This statement is made with the qualification that Confucius may not have been aware that he was replicating inherent natural processes in his more human-focused philosophy of social order.

10.   One could object that chaos is rising in our culture not because one person is failing to engage in *li*, but because so many are. While this is apparently true and can be given as an explanation for the disintegration of social order, it does not necessarily invalidate the point made earlier that a butterfly's flapping of a wing can drastically alter a system's performance to the point of bringing the system down. There are many butterflies and they repeatedly flap their wings. At one point, however, a flap of those wings alters whole weather patterns. Although many of us repeatedly forget to apologize, and so forth, there may be a time when one of us makes a small error that in fact sets off a cascade of consequences that finally overturns the social order. Another example often used by chaos and complexity theorists is the straw that broke the camel's back. Theoretically there must be a point when adding another piece of straw will destroy the camel's ability to sustain its load. Although this particular point may not be visible, or even measurable, it is a reality. Eventually, there will be a time when one more lack of observance of *li*, or its shabby performance, will cause social disintegration. Perhaps it will be undetectable, or will be detectable like an assassination, but it will nevertheless be real.

11.   This translation is owed to Roger Ames. Fung Yu-Lan also refers to the Confucian virtue of human-heartedness throughout his discussions of Confucian thought. See Fung 1948.

12.   The term *existential* is not being used in any particular philosophical way and should not necessarily invoke references to the movement in philosophy that is called existentialism. We use the term to refer to the humanizing quality present in our structured social interactions.

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