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Systems:

Schools of Thought and Traditions of Practice

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Systems: Schools of Thought and Traditions of Practice

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Systems: Schools of Thought and Traditions of Practice

How can we create better social worlds, and improve the social worlds in which we live? How can we act into specific situations effectively?

How should we understand the universe? With what conceptual tools should we attempt to comprehend both the vastness of space and the minuteness of the subatomic world? Who are we, anyway, who think that we can – or should -- understand the universe? Who are we who presume to judge between "better" and "worse" social worlds? Who are we who presume to act intentionally to make the worlds that we desire?

If we take on the tasks signaled by the questions in the preceding paragraphs, should we begin by proposing answers or by reflecting on the questions? If we assume that the way we pose the questions prefigures what we will recognize as answers, for what kinds of answers should we aspire? How might we decide whether these are the right questions and, if so, are posed in the right sequence?[1]

This paper is a story – and it is my story because others would tell it differently – about the development of ideas and practices that I have found particularly useful while wrestling with questions such as these.[2] The cluster of ideas that I am labeling "systems" is not just "a set of techniques for solving problems arising in conventional frameworks of thought" but are the drivers behind "the development of profoundly new outlooks."[3] These outlooks function as "mental models" or worldviews;[4] they frame both the

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[1] Despite their great variety, the myths of all peoples around the world, according to Joseph Campbell, provide answers to four questions: who am I? Who are we? What is the nature of the world around us? And What is the nature of questions such as these? However, the relative importance of the questions and the relations among them, not only the specific answers given, differ among various societies, and these differences provide the context for very different ways of being human. See Joseph Campbell, The Masks of God: Primitive Mythology. New York: Viking Press, 1959. For an appreciative extension of these ideas, see W. Barnett Pearce, Communication and the Human Condition. Carbondale: Southern Illinois University Press, 1989, chapters 4-10.

[2] For example, my story is influenced by developments in natural sciences which, at least with the development of General Systems Theory, look for common properties of systems regardless of size or substance. The story would be told differently by those drawing on social theorists concerned with large systems – that is, cultures, societies, organizations – because they are large. The former looks for common properties of all systems; the latter are interested in the unique qualities of large social systems.

[3] Anatol Rapoport, ""Modern Systems Theory – An Outlook for Coping With Change," General Systems Yearbook, XV, 1970.

[4]Like all terms, "mental models" and "worldviews" are simultaneously useful and require clarification, qualification, and a certain distance. For example, "worldview" seems to attach us to the "ocular" model of knowledge, whose limitations are well documented by Richard Rorty, Philosophy and the Mirror or Nature. Princeton: Princeton University Press, 1979. Peter Senge popularized the term "mental models." He said, "We do not 'have' mental models. We 'are' our mental models. They are the medium through which we and the world interact. They are inextricably woven into our personal life history and sense of who we are." Peter Senge, The Fifth Discipline: The Art and Practice of the Learning Organization. New York: Doubleday, 1990. The quotation is from the "Introduction to the Paperback Edition" p. xv. As I read Senge, he has in mind mental models in the minds of individuals – a practice that many would say isn't very systemic! What would be lost and gained if this concept were translated into a vocabulary of coordinated social action?

questions we choose to pose at the beginning of papers like this and what we recognize as answers to them.

Painting with very large brush strokes, the story that I will tell consists of a set of movements in the way we think about and act into the world. There are several ways of depicting these movements.

From the strategy of "science" to "system." Starting with developments in the 17^{th} century that produced "mechanistic materialism," the strategy for understanding the world has shifted from analysis to pattern-recognition and description of process.

The etymological root of "science" is to cut apart or separate; it is the process of identifying a thing in terms of its parts. The word itself is kin to schism and schizophrenic, both of which refer to "splitting apart." On the other hand, the term "system" is comprised of two roots, one of which means "together" and the other "to cause to stand." In the original Greek, "systematic" referred to things combined in one whole. The term "system" was first used in English in 1619 to refer to "an arrangement" and "systemic" was first used in 1803, in a medical dictionary, with the meaning of "belonging to, supplying, or affecting the body as a whole."[5]

From the metaphor of "clocks" to "clouds." Clocks are orderly and predictable; clouds are neither. Those who have set themselves the task of understanding the world around us have always had to deal with the issue of change and variation, and this issue has been cast in different ways at different times. In the 17^{th} century, there was a concerted effort to see the world (well, all the "important" bits of it anyway) as clocklike, no matter how cloudy it might appear. As one nontrivial consequence, those bits that successfully resisted being treated like clocks were defined as unimportant (the term of choice was "immaterial"). One way of thinking about systems thinking is that it has turned its attention toward cloudy things, and developed surprisingly powerful tools for describing and understanding them. As one nontrivial consequence, even clocks now appear far more cloudy than they did before.

This issue is sufficiently important that a couple of other data points might be added. Rather than "clouds and clocks," the philosophers of the Classical period referred to it as the difference between "reality" (which was assumed to be immutable and eternal) and the "appearances" (in which no two instances of the same thing are exactly alike and in which things change). A standard was set by geometry: the hypotenuse of a right triangle in "reality" not only is always equal to the square root of the sum of the squares of the other two sides, but must be. To suggest that it is not is to betray one's ignorance of geometry. In the world of appearances, however, we know that a sufficiently large triangle will be distorted by the curvature of space created by the mass of large objects (such as the sun) and that any particular triangle is likely to contain distortions or errors introduced by the size of the pen with which it was drawn or the unsteadiness of the hand that held it.

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[5] Robert Barnhart (Ed.), The Barnhart Dictionary of Etymology. Wilson, 1988, p. 1107.

Consider the famous argument between the Sophist Gorgias and the philosopher Plato. Plato ran a school where, through a process of dialectical reasoning, students were enabled to achieve enlightenment, understanding "reality." Plato strongly disapproved of those who ran other schools who had (what he clearly saw as) "lesser" goals. For example, the Sophists taught people how to give persuasive speeches, and thus become more effective in business, law, and politics. Plato accused these schools of teaching a "knack, like "cookery" rather than "knowledge." Plato's complaint was not that students didn't learn how to be more effective, but that the whole process was immoral because it was inferior. Without proper discipline (that is, the philosophic cultivation of character), the students in these schools learned "how to make the worse appear to be the better."

In response, Gorgias made a curious argument which seems absurd on first hearing. He said, "Nothing exists. If it did exist, we could not know it. If we could know it, we could not communicate it." Recall that the Sophists reveled in wordplay and had an affinity for paradox. They believed that words both reveal and conceal reality, and that what we say both makes and describes the world in which we live. Whatever Gorgias meant, it is not likely to be grasped by a literal reading. Here's one possible interpretation. Note the sequence: first, existence (ontology), second, what we know (epistemology), and, third, what we say and do with each other (communication). This is clearly the sequence that Plato followed: first making important assumptions about characteristics of what is "real," he then determined how to know it, and then gave some attention to how we might communicate. It's possible that the outrageous absurdity of Gorgias' statement is intended as a critique of this sequence, saying that if we follow it, then whatever we come up with is absurd. Gorgias might be understood as arguing that we should reverse the sequence, starting with what we say and do (and "observe"), then moving to epistemology, and finally to ontology.

Whether or not this is what Gorgias intended, and if we don't push the analogy too far, this movement is just what has happened in the progress of systems thinking: it has moved from the question "what is it?" to "how is it organized?" and then to "how does it behave."

From a preoccupation with things as they are to a more reflexive concept of things as we perceive them, describe them and act upon them. Nineteenth-century science and the philosophy of science has been called "mechanistic materialism;" it was a worldview that only physical things existed, and they were related in webs of linear causality.[6]

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[6] "With the rapid growth of the sciences, the astronomical discoveries of COPERNICUS the theories of GALILEO, and the systematic conception of nature in the physical theory of Isaac NEWTON, naturalistic interpretations of a variety of phenomena became more and more prevalent. This scientifically founded picture of reality lent greater plausibility to the principles of materialistic theory. The astronomer and mathematician Pierre Laplace (1749-1827) produced a sophisticated astronomical theory that, he thought, illustrated that a supermind, knowing all the states and conditions of every existing entity, could predict the total state of the cosmos in the next moment. When Napoleon I was shown a copy of Laplace's work, he is supposed to have commented on the absence of any mention of God. Laplace replied, 'I have no need of that hypothesis'. Laplace's mechanistic materialism became, in the hands of many thinkers, the definitive explanatory principle of all events." George J. Stack, "Materialism," Routledge Encyclopedia of

In the 20th century, however, there was a movement away from such a simple worldview. Heisenberg's "uncertainty principle" was one of several defining moments in physics.[7] Simply stated, "The more precisely the position is determined, the less precisely the momentum is known in this instant, and vice versa." One implication is that the choice made by the observer, whether in this case to focus on position or momentum, determines what is seen.

In intellectual circles that extended beyond physics, a development occurred known in retrospect as "the linguistic turn." Although this has taken many forms, it is grounded in the realization that the language we use is not a passive instrument, but that our use of language is an active part of creating the worlds in which we live. Whatever we know about the world "out there" is at least a product of our choices, our linguistic habits and abilities, and the patterns of social interaction in which we take part. For example, Rom Harré said, "Conversation is to be thought of as creating a social world just as causality generates a physical one." [8]

Toward increasingly complex explanations of how things are related. I have a strong sense that this part of the story is unfinished, but it has come quite a long way. If we take Newton's laws of motion as a starting point, each unit of mass was related to each other as a function of force and inertia. This portrait of a lifeless set of colliding lumps was marginally improved by the development of thermodynamics, particularly the famous 2nd law about entropy. The general statement is that the universe has a mathematically describable and unavoidable tendency toward disorder, and this concept has entered into popular culture as the notion that more sophisticated systems will decay into less sophisticated systems, until everything is uniform. General Systems Theory was taken by the concept of wholeness, and celebrated the way systems resisted entropy by maintaining equilibrium. As people began studying systems-in-action, they saw that systems took "purposeful" actions in order to achieve and maintain a goal-state, and called this cybernetics. Others noted that the characteristics of sufficiently complex systems actually emerge; they are autopoetic or self-organizing. This generated a wave of work often called second-order cybernetics. Still others found systems whose normal state was far from equilibrium or dissipative systems. Focusing on how very complex systems are created by many iterations of actions following relatively simple rules, others developed the whole vocabulary of chaos, fractals, and attractors. And still others began studying how complex systems adapt to their environments, and these environments are constituted by other complex systems adapting to them, and the worlds in which we live are produced by unpredictable patterns of mutual adaptation and co-evolution. The general term for this is complex adaptive systems, or CAS.

These ideas are not just increasingly detailed. In some cases, the more recent ones have affirmed properties of systems that contradict those of earlier forms of systems

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Philosophy, ed. Edward Craig. 1998., New York, retrieved on April 9, 2002, from: http://members.aol.com/NeoNoetics/Materialism.html.

[7] Retrieved from http://www.aip.org/history/heisenberg/p08.htm on April 9, 2002.

[8] Personal Being. Oxford: Blackwell, 1983, p. 65.

thinking. One needs to keep straight what flavor of systems thinking one is doing at any given point.

From a view of nature as dead to a view of life as the natural order of things. It would be easy to overstate this point, but at least some systems theorists believe that the natural tendency is toward increased order; that life will find a way to develop. To the extent that this view is affirmed, it is a powerful alternative to the idea that inertia and entropy are the fate of the universe.

Implications for ethics, efficacy, and epistemology. To say that the systems view of the world is a radically different worldview than that developed by the scientists and philosophers of the 17th century is almost too obvious to belabor. But the implications of these new developments for the way we live, act, and engage with the world around us are far from obvious. And these implications differ significantly depending on which systems view one takes.

My work as a communication theorist is inextricably wound up with systemic thinking.[9] It just isn't possible to map my theory (the "coordinated management of meaning" or CMM) onto concepts of discrete individuals operating within a world of linear causality. CMM requires a much more complex, fluid concept of the universe, of the place of humans in it, and of how it works. But traditions of systemic practice have been at least as important to me as schools of thought about systems. I first came into contact with systemic family therapy over twenty years ago (both it and I have changed a good bit in the interval!) and was immediately taken by its elegance and power as a way of dealing with otherwise daunting social issues. I am convinced that we need to develop unconventional ways of dealing with the challenges of contemporary realities – from globalization to conflict resolution – and that these traditions of practice are useful.

There are now several schools of thought and several traditions of practice, all using the term "systems" and embracing various aspects of a family of concepts. By teasing out and exploring some of the differences among these schools and traditions, I am continuing my own learning and inviting others to join me, in a process of exploring how to enrich, extend, and improve systemic thinking and traditions of practice.

PART I: THE DEVELOPMENT OF SYSTEMS THINKING

About 300 years ago, Western culture took a sharp turn. One way of describing it was from a dialectical tension between dogmatism and skeptical humanism to a new culture dominated by the mechanistic materialism of science. This complex, aggressive cluster of beliefs and practices, in the larger sense often called "modernity," has been a very successful cultural form, leading to scientific advancement, improved standards of living, and cultural hegemony. However, modernity has its dark sides as well, provoking a number of dissenting voices.

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[9] For more information, see "An Introduction to CMM" and "Using CMM" at http://webboard.fsc.edu:8080/~cmm/login

During the twentieth century, some of these dissenting voices have found new power. Under the imprecise name "postmodernity," movements in art, music, architecture, literature, and scholarship have set themselves up as alternatives to modernity. While fascinating, these movements are peripheral to the story I've chosen to tell here. More precisely, they enter into some small corners of systemic work fairly late under the rubrics of "social constructionism," communication theory, and narrative.

The story of systems thinking is less flamboyant in its opposition to modernity, although many of the seminal writings start with a contrast between the allegedly outmoded worldview of mechanistic materialism and the new worldview of systems. These contrasts, however, tend to be grounded not so much in a romantic rejection of modernity but on the accumulation of knowledge produced by science. That is, the dominant narrative in systems theory is that scientists of the 17th, 18th, and 19th century, although they often used reductionistic methods and presupposed simplistic concepts of causation, generated a basis of knowledge that provides the building-blocks of a new, richer worldview that is neither reductionistic nor simplistic.

THE DIALECTIC OF DOGMATISM AND SKEPTICAL HUMANISM IN THE 16th and 17TH CENTURY

Once upon a time,[10] the leading thinkers of the age entertained some very different notions about how the universe worked. Sometimes these different notions pitted one group of people against others; sometimes individuals internalized the contradictions by sorting different domains of applicability, such as political authority, religious beliefs, and knowledge of the natural world.

One of the dominant traditions was religious dogmatism It envisioned a universe that was whole (the Kingdom of God), hierarchical (the so-called "great chain of being" from the most perfect at the top and the least perfect at the bottom),[11] and should be in harmony. A uniform faith was thought to be the means of achieving harmony – hence the political and theological institutions were inextricably mixed in what was sometimes called "Christendom." Both Church and State (although these were not nearly so separate as seen by those who live under the United States' constitution) worked to define and enforce dogmatic unity.

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[10] The late Renaissance, to be precise. For reasons that will become clear in subsequent paragraphs, I'm thinking of France in the period of 1598 (in which Henry IV issued the Edict of Nantes and 1618, the outbreak of the Thirty Years' War. I'm also telling this story within the Western intellectual tradition; it would be considerably richer-- and much longer – by including other cultural histories.

[11] See http://www.earlham.edu/~peters/courses/re/chain.htm for a logical development of the idea and, for a graphic representation, http://www.stanford.edu/class/engl174b/chain.html. For a contemporary use of the idea, see http://www.cacradicalgrace.org/great%20chain%20of%20being.htm. This concept is similar to some systems ideas; the authors of this website associate it with deep ecology and creation spirituality. They quote the classic text: Arthur Lovejoy, The Great Chain of Being. Harvard University Press, 1936, which said, "The essential and unbreakable links in the chain include the Divine Creator, the angelic heavenly, the human, the animal, the world of plants and vegetation, and the planet Earth itself with its minerals and waters. In themselves, and in their union together, they proclaim the glory of God (Psalm 104) and the inherent dignity of all things. This image became the basis for calling anything and everything "sacred."

The trial of Galileo provided a defining moment of the juxtaposition of the dogmatic worldview with those who challenged its commitment to orthodoxy. The dogmatic tradition claimed that the Church possessed truth and that the proper response of individuals was to submit their doubts to the dogma of the Church. Galileo's astronomical observations deviated from the Church's teaching. As the statement that he was forced to sign (by being threatened with torture) clearly shows, his crime was not so much in believing one thing or another but in defying the Church. In the statement, he "cursed and detested" his heresies because they differed from the teaching of the Church.[12]

In the late 16th century, life for dogmatists was made considerably more difficult by the fact that there were several groups, each of which claimed to have the "right" dogma. In 1520, Martin Luther attempted to reform the Church and ended up establishing both a new Church and setting an example for others to follow.[13] Because faith was attached to political authority (see below), this led to temporarily effective compromises that allowed Lutheranism to be the dominant dogma in some territories and Catholicism in others. However, once the door was opened (by Luther's famous "Here I stand; I can do no other!"), other people of equal passion and conviction decided to take their own stand – but not quite at the same places. And when you've already carved up the map of Europe to allow two contending dogmas (Lutheranism and Catholicism), where do you put the Calvinists, Anabaptists, Huguenots, etc., etc.? The stage was set for social and political strife among groups similarly committed to dogmatism, but differing in the content of that dogma.

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[12] Galileo's troubles with the Church began in 1612. He defended himself in Rome in 1614 and was "admonished" by Pope Bellarmino in 1616. The text of his confession in 1636 states: "I, Galileo, son of the late Vincenzo Galilei of Florence, being 70 years old [...], swear that I have always believed, believe now and, with God's help, will in the future believe all that the Holy Catholic and Apostolic Church doth hold, preach and teach. But since, after having been admonished by this Holy Office entirely to abandon the false opinion that the sun is the centre of the Universe and immovable, and that the Earth is not the centre of the same and that it moves, and that I was neither to hold, defend, nor teach in any manner whatsoever, either orally or in writing, the said false doctrine; and after having received a notification that the said doctrine is contrary to Holy Writ, I wrote and published a book in which I treat this condemned doctrine and bring forward very persuasive arguments in its favour without answering them: I have been judged vehemently suspected of heresy, that is of having held and believed that the Sun is at the centre of the Universe and immovable, and that the Earth is not at the centre and that it moves. Therefore, wishing to remove from the minds of your Eminences and all faithful Christians this vehement suspicion reasonably conceived against me, I abjure with a sincere heart and unfeigned faith these errors and heresies, and I curse and detest them as well as any other error, heresy or sect contrary to the Holy Catholic Church. And I swear that for the future I shall neither say nor assert orally or in writing such things as may bring upon me similar suspicions; and if I know any heretic, or one suspected of heresy, I will denounce him to this Holy Office, or to the Inquisitor or Ordinary of the place in which I may be." See: http://galileo.imss.firenze.it/museo/a/eabiura.html. A few years ago, I visited the Vatican, and was surprised to find an ornate room in which Galileo's work was displayed, including the telescope through which he made the observations that he was forced to "curse and detest." Things – even dogma – change.

[13] During the 16th century, "reformations" became a growth industry. See: http://www.mun.ca/rels/hrollmann/reform/reform.html.

The other dominant tradition was humanistic. For several reasons,[14] there had been a resurgence of study of classical documents. One consequence was the popularity of a certain kind of skepticism – one that has less to do with a sophomoric rebellion against authority than a principled commitment to tolerance and pluralism. This position takes on particular significance, of course, when affirmed in a context that includes rival groups affirming different dogmas.

The term skeptic comes from a Greek word meaning "to examine carefully." The second century Roman Sextus Empiricus explained that there were three positions about knowledge: [15]

- some thought that they had found the truth (Sextus called them "Dogmatists");
- some thought that truth was unknowable and abandoned the effort to find it (this is the "relativist" position which many people seem to fear although few have ever endorsed it and still fewer have ever practiced it[16]); and,
- some – the Skeptics -- "suspended judgment" because they were "unable to resolve the contrary attitudes, opinions and arguments that characterized the debated topics of philosophy, hence unable to arrive at a definitive position of [their] own on any of them. Instead of adhering to some standard philosophical position, the skeptic therefore described himself as someone who continues to investigate -- a "zetetic."

From the perspective of the Dogmatics, it is hard to differentiate between relativism and skeptics – and from this hangs many a tale, most of them tragedies.

To understand this period as a neat dialectic between dogmatists and skeptics is too simplistic. For example, Erasmus[17] used skeptical arguments to defend the Roman Catholic Church against Reformer's attacks, as well as to critique the Church for its superstitions. However, "once the force of skeptical arguments is acknowledged, they cannot easily be prevented from spreading doubt to all areas of life, including the new sciences."[18]

The spread of skepticism (whether in the guise of humanism, tolerance, or intellectual or political or religious pluralism) made political rulers nervous. They were committed to the notion that political unity was only possible if there were unity of

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[14] These reasons included the invention of the printing press in 1436 that democratized (well, relatively…) access to manuscripts from the classical Greek and Roman periods.

[15] Stanford Encyclopedia. See: http://plato.stanford.edu/entries/skepticism-ancient/#Sce. There is an interesting parallel between this analysis and Richard Bernstein's in Beyond Objectivism and Relativism. However, Bernstein is a pragmatist rather than a skeptic, and instead of "suspended judgment," he calls for the creation of a particular kind of relationship: "dialogue." See "Pragmatism, Pluralism, and the Healing of Wounds," pp. 323-340 in Richard Bernstein, The New Constellation: The Ethical-Political Horizons of Modernity/Postmodernity, Cambridge: MIT Press, 1992.

[16] I have in mind a wonderful essay by Clifford Geertz, "Anti Anti-Relativism." in Krausz, Michael, ed. (1989). Relativism. Interpretation and Confrontation. University of Notre Dame Press, South Bend.

[17] http://www.utm.edu/research/iep/e/erasmus.htm

[18] http://www.xrefer.com/entry.jsp?xrefid=553461

religion within the state.[19] That is, within the context of politics, the dogmatists ruled the day.

King Henry IV of France (a.k.a., Henry of Navarre) was an exception. Born a Protestant, he converted to Catholicism and married a Catholic.[20] He had first-hand experience with religious-based violence. Among other things, many of the Protestants who attended his wedding in Paris were killed in what has become known as the "Massacre of Saint Bartholomew." When he became King, he issued the "Edict of Nantes"[21] that specifically permitted Protestants the right to worship in their "Reformed" manner without molestation and established them as eligible to participate in certain government offices.

Given the political realities of France at the time, there seemed to be only three options:

- the Catholics would suppress the Protestant heresy;
- the Protestant Huguenots might become the dominant majority; or
- a compromise solution would be reached that decoupled national loyalties from religious affiliations.

"Henry of Navarre aimed at the third solution. In his time…it was a daring innovation, open only to a ruler who combined personal self-confidence with an urbane and relaxed tolerance."[22]

Henry's tolerance was the political expression of skeptical philosophy. It stood in sharp contrast with the dogmatic philosophy that insisted that political and religious entities were inextricably coupled. As Toulmin noted, "Centuries later, it is hard to see why for so long people resisted the notion that a loyal citizen of France might be a devout Protestant rather than a Catholic, or the other way around."[23]

On May 14, 1610, Henry was assassinated. Like any event, this one could have been construed in many ways. In this specific instance, however, "Henry's murder carried to people in France and Europe the simple message, 'A policy of religious toleration was tried, and failed.'"[24]

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[19] The Catholic Encyclopedia's entry on the Counter-Reformation states that one of the "abuses" committed by the Protestant reformation was "the subservience of Church to State" (others were marriage of the clergy and unspecified doctrinal errors). http://www.newadvent.org/cathen/04437a.htm. It seems that the range of opinion within the "dogmatic" camp, whether Protestant or Catholic, was which – church or state – should be dominant. The idea of a religiously pluralistic state was "outside the box" of the thinking for most people on both sides. The Anabaptists and Mennonites might be exceptions to the rule but, having no armies to rally to their cause (!), were in a relatively powerless position.

[20] For more about Henry IV, see: http://www.bartleby.com/65/he/Henry4Fr.html

[21] To read the text, see: http://www.stetson.edu/~psteeves/classes/edictnantes.html

[22] Stephen Toulmin. Cosmopolis: The Hidden Agenda of Modernity. Chicago: University of Chicago Press, 1990, p. 50.

[23] Toulmin, p. 29.

[24] Toulmin, p. 53.

The repudiation of political pluralism carried with it the rejection of philosophical skepticism. In the political realm, this left the rival dogmatists with little recourse except to try to settle in battle what they could not resolve with debate. The resulting Thirty Years War raged over Europe from 1618 until 1648.[25] "Whether for pay or from conviction, there were many who would kill and burn in the name of theological doctrines that no one could give any conclusive reasons for accepting. The intellectual debate between Protestant Reformers and their Counter-Reformation opponents had collapsed, and there was no alternative to the sword and the torch. Yet, the more brutal the warfare became, the more firmly convinced the proponents of each religious system were that their doctrines *must be* proved correct, and that their opponents were stupid, malicious, or both."[26]

In the intellectual realm, skepticism was considered the devil to be defeated. "If uncertainty, ambiguity, and the acceptance of pluralism led, in practice, only to an intensification of the religious war, the time had come to discover some *rational method* for demonstrating the essential correctness or incorrectness of philosophical, scientific, or theological doctrines."[27]

DEFEATING SKEPTICISM WITHOUT DOGMA: THE SECULAR SEARCH FOR FIRM FOUNDATIONS

Rene Descartes was one of those who accepted this challenge. "Descartes set out to provide secure foundations for science, metaphysics, and religion by defeating skepticism. This required him to formulate and overcome the strongest possible skeptical arguments. Rather than appealing to particular challenges, particular contrasting appearances, to question each opinion he considered, he needed systematic doubts which put all our beliefs into question."[28] Through a more complicated path than I will describe here, Descartes put into motion a series of developments that created an unprecedented string of scientific and technological successes and a period "of intellectual confidence and optimism, a conviction that we had finally discovered the secure path for philosophy, the right 'method' for making genuine intellectual progress, for turning philosophy into a discipline that would yield knowledge (*episteme*), instead of being the endless battleground for competing and shifting opinions (*doxai*)."[29]

Descartes' contribution came less from his conclusions than from the way he framed the issues. "Few philosophers since Descartes have accepted his substantive claims, but there can be little doubt that the problems, metaphors, and questions that he bequeathed to us have been at the very center of philosophy since Descartes."[30] Among these are the separation of mind and body ("dualism"), the separation of science from

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[25] For a description, see: http://mars.wnec.edu/~grempel/courses/wc2/lectures/30yearswar.html and http://mars.wnec.edu/~grempel/courses/wc2/lectures/30yearswar.html

[26] Toulmin, p. 54.

[27] Toulmin, p. 55.

[28] For a fuller account, see: http://www.utm.edu/research/iep/d/descarte.htm

[29] Richard Bernstein. Beyond Objectivism and Relativism: Science, Hermeneutics, and Praxis. Philadelphia: University of Pennsylvania Press, 1983, p. 3.

[30] Bernstein, p. 17.

theology and philosophy, a mechanistic view of the physical world, and a certain attitude. This attitude can be expressed positively as a passion for intellectual certainty and an exclusive preference for ideas that are "clear and distinct." With more attention to its dark side, it can also be described as a neurosis; in Bernstein's phrase, a "Cartesian anxiety" that anything less than absolute certainty is no better than and no different from having no certainty at all. Descartes' Meditations confront us "with an apparent and ineluctable necessity to a grand and seductive Either/Or. *Either* there is some support for our being, a fixed foundation for our knowledge, *or* we cannot escape the forces of darkness that envelop us with madness, with intellectual and moral chaos."[31]

The "Cartesian anxiety" poses the issue as a choice between as "objectivism" (a search for certainty, grounded on some indubitable foundation, and proceeding by a method designed to eliminate doubt) and "relativism" (not quite the principled, pluralistic skepticism discussed above). Recall my comment that, from the perspective of someone afflicted by the "Cartesian anxiety," it is difficult or impossible to distinguish between a rootless relativism and a principled pluralism. That is, to say "there are many truths " seems to the person seeking an indubitable foundation no different from saying "there is no truth."[32] Bernstein (1983) urges us not to try to settle this controversy but instead to be "cured" of our "Cartesian anxiety" and get on with life. This advice from a philosopher is echoed by – for example –contemporary consultants who counsel managers to work on the "edge of uncertainty" and make peace with chaos.

But the choice overwhelmingly made in the 17th century was to search for unassailable "foundations" on which to build a complete and immutable edifice of knowledge. The subsequent history of thought might be described as powered by the reciprocal critiques of the adequacy of other people's "foundations" for grounding their thought and by erecting successive defenses of their own foundational commitments. Descartes' cogito ergo sum inspired others to find similarly clear and distinct foundations, each of which were quickly critiqued and replaced in a series of substitutions as the conversation continued.[33]

However, for several centuries, many people thought that they found in science a sufficient, self-correcting "method" of discovering truth that was equally compelling, no matter what was one's religious or political tradition. Catholics and Protestants might still have difficulty sharing a political structure, but at least they could agree about physics, chemistry, etc.

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[31] Bernstein, p. 18.

[32] There is an equivocation in the use of "truth" in these statements. In the first, "truth" refers to a claim that is "true" in the context of the lived experience of the person asserting it; within this perspective, it meets all the relevant criteria.; the second refers to a statement that corresponds to reality. As Jeffry Stout (Ethics After Babel: The Languages of Morals and their Discontents. Boston: Beacon, 1988) notes, when a person says "I know that lying is wrong" and there is nothing that can call that belief into question, the persistent probing of the skeptical interviewer, "well, how do you know?" is better seen as an invitation to shift into a different vocabulary (in this case, to become an amateur philosopher) rather than a meaningful inquiry into the truth or falsity of the statement.

[33] For an excellent review of the rise and fall of "foundationalisms," see Richard Rorty, Philosophy and the Mirror of Nature. Princeton: Princeton University Press, 1979; and Bernstein, Beyond Objectivity and Relativitism.

In hindsight, it seems important to distinguish between two kinds of certainty. One might be that of a person trying to solve a puzzle. In this case, the puzzle-solver is certain that there is an answer, even though he or she might not know it at the moment, and is confident that if sufficient research is done, the answer will appear. This is contrasted with those who assert that there is no single "answer" – more specifically, that prediction is impossible in principle and/or in practice – and that we live in a more fluid, complex universe that is capable of continually surprising us.[34]

The early scientists were convinced that their work consisted of puzzle-solving. In fact, by the end of the 19th century, some thought they had attained a degree of knowledge that amounted to an empirically-grounded new dogma. In an address to physicists at the British Association for the Advancement of Science in 1900, Lord Kelvin (himself a leading physicist) stated, "There is nothing new to be discovered in physics now. All that remains is more and more precise measurement."[35] Subsequent history has made this -- and other similarly sweeping statements, such as Kelvin's 1895 pronouncement to the Australian Institute of Physics that "heavier-than-air flying machines are impossible" – seem absurd.[36] Many contemporary systems thinkers have no such illusions and speak much more cautiously.

Newtonian physics. There was good reason for the scientists to be flushed with success. As Isaac Newton's integration of physics and astronomy was seen as the prototype of successful science. Kepler had developed some formula describing the movement of the planets. Newton not only corrected them, but also showed that the same "laws," expressed as mathematical formula, applied on earth as well as in the heavens. Not only that, but it only takes a few laws and a few concepts (such as mass, inertia, and force) to account for the uncountable variety of movements no matter what it is that is moving. And more than that, these relationships were the same relationships that occur in mathematics; so calculations, whether on one's fingers or on a supercomputer, is a way of mapping the universe. This was a stupendous, liberating, empowering concept![37]

I want to include Newton's three laws of motion[38] here in part to display their elegance and simplicity.

> 1. An object at rest tends to stay at rest and an object in motion tends to stay in motion with the same speed and in the same direction unless acted upon by an unbalanced force. This is called the law of "inertia."

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[34] My ability to draw this distinction owes much to Ludwig Wittgenstein, On Certainty. New York: Harper and Row, 1969, and John Dewey, The Quest for Certainty, 1929.

[35] While Kelvin was making these pronouncements, 21-year-old Albert Einstein received his diploma from the Federal Institute of Technology in Zurich. He published the special theory of relativity and other paradigm-shattering papers five years later.

[36] http://www.treasure-troves.com/bios/Kelvin.html

[37] My appreciation for Newton's accomplishment was heightened by reading Arthur Koestler, The Sleepwalkers: A History of Man's Changing Vision of the Universe. 1959. After some hundreds of pages of false starts, dead ends, and hesitant plunges into the unknown, Koestler's brief description of Newton's invention seems absolutely stunning.

[38] For a high school level tutorial, see: http://www.glenbrook.k12.il.us/gbssci/phys/Class/newtlaws/newtltoc.html

2. The acceleration of an object as produced by a net force is directly proportional to the magnitude of the net force, in the same direction as the net force, and inversely proportional to the mass of the object. This may be represented by the equation:

$$F_{net} = m * a$$

Where F = force; m = mass; and a = acceleration

3. For every action, there is an equal and opposite reaction.

The laws of motion were not Newton's only accomplishments, and you should be aware of the scale of the impact that his work generated. Poets lauded him: Alexander Pope wrote:

Nature and Nature's laws lay hidden in the night;
Then God said, "Let Newton be," and all was light!

He was knighted: address him as Sir Isaac Newton, if you please. He was buried in a prominent place in Westminster Cathedral. Etc. Etc.[39]

Why was there such an overwhelming response to Newton? The answer takes advantage of Karl Popper's useful metaphor. He said that all systems can be thought of along a continuum from "clouds" to "clocks." Clocks are "regular, orderly, and highly predictable in their behavior" while, by contrast, clouds are "highly irregular, disorderly, and more or less unpredictable."[40] Applying the metaphor, Popper said:

> There are lots of things, natural processes and natural phenomena, which we may place between these two extremes - the clouds on the left, and the clocks on the right. The changing seasons are somewhat unreliable clocks, and may therefore be put somewhere towards the right, though not too far. I suppose we shall easily agree to put animals not too far from the clouds on the left, and plants somewhat nearer to the clocks. Among the animals, a young puppy will have to be placed further to the left than an old dog. Motor cars, too, will find their place somewhere in our arrangement, according to their reliability … Perhaps furthest to the right should be placed the solar system.[41]

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[39] Perhaps you have noticed that such honors are not commonly given to academic scribblers. I'm still waiting for my sonnet and have given up hope for being made a knight! Oh well, maybe its for the best. My once-shining armor has gotten rusty and might take too much work to clean up…

[40] Karl Popper. Objective Knowledge: An Evolutionary Approach. London: Oxford University Press. 1972, p. 207. Of course, this metaphor conveniently ignores the difficulty in making a clock work so well. Just because we now have the technology to do so should not make us forget what an achievement it was. For a fascinating account, see: See Dava Sobel, Longitude: The True Story of a Lone Genius who Solved the Greatest Scientific Problem of His Time. Walker: 1995.

[41] Popper, p. 208.

To put it simply: Newton was acclaimed because it looked like he had proven that it is possible to *treat all "clouds" as if they were "clocks."*

Newtonian physics presumes a homogeneous universe, in which the elements are dead and respond only to forces that have been set in motion. But if this is the case, is everything predetermined? And if so, should we expect the universe to remain in a steady state, to speed up, or to run down?

Entropy. The second law of thermodynamics gave a clear answer to these questions: Time flows in one direction, and as it flows, things have a tendency to move in the direction of disorder. Life, organization, structure, and all the rest are temporary obstructions to the force of entropy. When these have run their course, heat and energy will be equally distributed throughout the universe, and nothing will be alive.

Despite the fact that this law, along with the others of which it is a part, worked very well to explain lots of things, it is a profoundly disturbing mental model. For example, Ralph Reed, President of the Christian Coalition, has led public protests aimed at having it eliminated from physics textbooks because it contradicts his belief that Christianity teaches that the world will get better and better.[42]

Excluding the immaterial. Well, it didn't take long to notice (paraphrasing a much later observer) that not all "clouds" were equal. When some were treated as clocks, good things happened. I'm thinking of the Pasteurization of milk, discovery of penicillin, harnessing of electricity and all the rest that has made our lives safer, healthier, and in many ways more pleasant. But other aspects of life did not fare so well when treated as clocks. In fact, what Newton and those who acclaimed him were actually doing was to treat *many but not all* clouds as clocks. But what about "other" clouds? Those that did not do well when treated as clock-like?

They were defined as unimportant and "immaterial."

Toulmin described the science of the 17th – 19th century in terms of four movements.

- From the oral to the written;

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[42] http://www.theonion.com/onion3631/christian_right_lobbies.html. "What do these scientists want us teaching our children? That the universe will continue to expand until it reaches eventual heat death?" asked Christian Coalition president Ralph Reed, speaking at a rally protesting a recent Kansas Board Of Education decision upholding the law. "That's hardly an optimistic view of a world the Lord created for mankind. The American people are sending a strong message here: We don't like the implications of this law, and we will not rest until it has been reversed in the courts." The controversial law of nature, which asserts that matter continually breaks down as disorder increases and heat is lost, has long been decried by Christian fundamentalists as running counter to their religion's doctrine of Divine grace and eternal salvation. "Why can't disorder decrease over time instead of everything decaying?" asked Jim Muldoon of Emporia, KS. "Is that too much to ask? This is our children's future we're talking about."

- From the particular to the universal;
- From the local to the general; and,
- From the timely to the timeless.[43]

The de-emphasis on things that could not be treated as clock-like has cast a long shadow. Some of its consequences persist even after the rationale for it has been superceded by subsequent developments. Here are some personal examples of situations in which the written, universal, general, and timeless are prized:

- Some people and most university structures differentiate *science* (that is, the "natural sciences" or "hard sciences" where real knowledge is possible) from the *arts* (where murky things happen). Social sciences are a mystery to both; some consider them a contradiction in terms.
- The President's strategy for development of a university at which I once worked was described as "support the (natural) sciences and hire a string quartet." The priorities reflected in this statement (and the absence of the College of Social and Behavioral Science, where I had my appointment!) are not hard to discern.
- A colleague in my academic discipline distinguished between what she would read during the workweek (reports of quantitative empirical studies) from, in her term, "weekend reads." She told me of this distinction as a way of explaining that she did not take my work seriously.
- Another colleague ended a conversation by asking if I knew a particular statistical procedure. When I said that I did not, he replied, "the language of science is mathematics, and I deeply distrust those who do not speak it."

Back to the 17th century: John Locke and the British empiricists distinguished between material and immaterial things (that was their version of Descartes' dualism; others agreed that there was a dualism but drew the lines at different points). Material things could be studied scientifically and were important; immaterial things did not lend themselves to "a secure, permanent body of human knowledge using rationally validated methods that relied on working from formal logic, applying general principles and abstract axioms."[44]

My own work as a communication theorist has often felt the shadow of Locke's legacy. Unless it had to do with "media," many of my colleagues in other disciplines (and, surprisingly, in my own!) have followed Locke by treating communication as "immaterial" and thus relegated to secondary status. That is, communication "worked" as

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[43] Toulmin, pp. 30-33.
[44] Robyn Penman. Reconstructing Communicating. Mahway, New Jersey: Lawrence Erlbaum Associates, 2000, pp. 20-21.

an odorless, colorless, tasteless means of conveying thoughts. It was important only when noticed, and noticed only when it failed to function transparently -- which it was prone to do, because language changes, words have multiple meanings, we seldom say all that we expect to be heard as having said, there is connotative as well as denotative meaning, etc. From Hobbes' Leviathan[45] to Russell and Whitehead's Principia Mathematica,[46] Anatol Rapoport's Operational Philosophy,[47] the development of Esperanto and the "Basic English movement," concerted efforts were made "to purge language of all ambiguity, expel metaphor, outlaw new phrasings and reduce language to a rational system of signs."[48] Those of us in my discipline who argue that communication does matter (the pun is deliberate) continue to run against the prejudice that one should look "through" communication rather than "at" it.

The Romantic counter-culture. Whatever else it might be, the "romantic" movement can be seen as a form of resistance to the attempt to dismiss anything that cannot be treated as sufficiently clock-like for scientific study. For example, compare the spirit of this quotation from Goethe to the totalizing worldview of Newton:

> "Nature! We are enveloped and embraced by her, incapable of emerging from her and incapable of entering her more deeply. Unbidden and unwarned, she receives us into the circuits of her dance, drifting onward with us herself, until we grow tired and drop from her arms."[49]

Marshall Berman interprets Goethe's Faust as a sustained criticism of modernity, in which Faust points to the costs – both personal and social – of modernity.[50]

The humanistic counter-culture. Another movement might be named the "human sciences" or "hermeneutical." I would place in this movement those who rejected the assumption that human beings and social groups could be treated as "clocks." One of the

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[45] Published in 1660. See chapter 4 "Of Speech" in which Hobbes defines "naming" as the appropriate function of speech, and lists four "abuses" of speech: "inconstancy" (by which he means a gap between what one means and what words were spoken), speaking metaphorically, lying, and "grieving" another person ("unless it be one whom we are obliged to govern; and then it is not to grieve, but to correct and amend"). See also chapter 7, "Of the Ends and Resolutions of Discourse." In my reading, he equates good discourse –that which results in knowledge rather than mere opinion—with logic. It should start with definitions, move to generalizations, put those into syllogisms and then draw conclusions.

[46] Alfred North Whitehead and Bertrand Russell. Principia Mathematica, 3 vols, Cambridge: Cambridge University Press: 1910, 1912, 1913. The title places this in the tradition of Newton's Principia. Whitehead and Russell wanted to develop a system which integrated mathematics (the language of science) and logic (the purified form of natural languages).

[47] In this book, Rapoport says that there are only four types of sentences: "true" (those in which all terms have been operationally defined and the stipulated relations among them have been supported by empirical test); "false" (those in which all terms have been operationally defined but the stipulated relations among them were disproved by empirical test); "indeterminate" (those in which all terms have been operationally defined but empirical tests have not been conducted); and "meaningless" (those which include terms that are not operationally defined). By this criterion, most of life occurs in the context of "meaningless" statements.

[48] Penman, p. 21.

[49] http://www.aspirennies.com/private/SiteBody/Romance/Poetry/Goethe/Goethe_quotes1.shtml

[50] http://www.npq.org/issues/v82/p35.html

most prominent of these was GiambattistaVico,[51] who in 1725 proposed "a new science" based on the idea that all human action is based on imagination and memory as well as reason. Another is Wilhelm Dilthey. In 1883, he argued that the "human sciences" should be separate from the natural sciences: "the principles of the *human world* falls within that world itself, and the human sciences form an independent system."[52]

Social Macrotheories. Perhaps the development of "macrotheories" of society and economics should be seen as a productive counterpoint to the reductionism of the dominant paradigm. The earliest of these seem to me to retain some component of the Newtonian worldview while changing some other. For example, the so-called Father of Positivism, Auguste Comte (1798-1857**)**, retained the notion of a perfectly knowable world but applied his thinking to society itself.

> Positivism is a philosophical system of thought maintaining that the goal of knowledge is simply to describe the phenomena experienced, not to question whether it exists or not. Comte sought to apply the methods of observation and experimentation, as was beginning to be used in the hard sciences, to a field that we now know as sociology. He believed that the solution of persistent social problems might be had by the application of certain hierarchical rules; he believed in the progress of mankind toward a superior state of civilization by means of the science of sociology, itself.[53]

Karl Marx (1818 – 1883) was profoundly critical of the social effects of the economic applications of modernity. His theory was explicitly materialistic. Instead of following Newton and others in their attempts to explain phenomena by means of efficient causation, however, he drew on the philosopher Hegel's notion of "dialectics." He applied this way of thinking to the conflict between classes in early modern society (in which technology alienated the worker from the products of his work, and the work of laborers was accumulated by owners in the form of capital, and to the historical sequence of societies. Politically, the Communist Manifesto was a call for revolution; intellectually, what became known as Marxism retained the notion of determinism while jettisoning reductionism and efficient causation.

Finally, the immense shadow of Charles Darwin (1809-1882) should be seen as a counterweight to the Newtonian universe – perhaps explaining that while Darwin, like Newton, is buried at Westminster Cathedral, he is not known as Sir Charles. Darwin was aware that his theory (published as Origin of the Species by Means of Natural Selection in 1859) would undercut what most of his contemporaries saw as the flimsy reed of faith that provided the semblance of social order in mid-19th century England, his work also broadened the realm of science from physics (the movement of inanimate objects) to biology (pushing the acknowledged natural history of the world much further back;

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[51] http://www.connix.com/~gapinton/
[52] http://www.marxists.org/reference/subject/philosophy/works/ge/dilthey.htm
[53] http://www.blupete.com/Literature/Biographies/Philosophy/Comte.htm

showing connections among all forms of life) and introducing yet another concept of causality (natural selection).

One interesting aspect of evolution is its irreversibility. The ability to predict or retrodict, for example, the precise temperature on a day in the far future or distant past, if only sufficient information was possessed, was a corollary of positivism. This implied a series of reversible, linear causal connections. Darwin's theory called to mind more complex patterns of interrelations among the members of species with each other, with other species, and with the environment. The "survival of the fit" was the result of complex patterns, and resulted in changing the environment as the process of evolution continued.

Another interesting aspect of evolution was the idea that "higher" species – those with more organization – emerged. Life itself, as well as the evolution of higher species, seemed to run counter to the notion of entropy. Particularly as expressed by Herbert Spencer, the notion of "progress" was in the opposite direction of entropy: from the less differentiated to the more; from the homogeneous to the heterogeneous. Further, Spencer argued that this directional movement occurred in all things:

> "Whether it be in the development of the Earth, in the development of Life upon its surface, the development of Society, of Government, of Manufactures, of Commerce, of Language, Literature, Science, Art, this same evolution of the simple into the complex, through a process of continuous differentiation, holds throughout. From the earliest traceable cosmical changes down to the latest results of civilization, we shall find that the transformation of the homogeneous into the heterogeneous, is that in which Progress essentially consists...."[54]

For our purposes, the details of "social Darwinism" is less important than the fact that it presented yet another mental model for looking at the way things are related.

The work of other social theorists such as Durkheim and Weber – and particularly the development of anthropology -- may be seen in this context as further stretching the unit of analysis (from the smallest possible to larger, complex wholes) and enriching the notion of "necessity" (that is, those things posited as explaining why things happen). But the worldview of mechanistic materialism was struck a last, most damaging blow by a historian of science.

Thomas Kuhn's <u>The Structure of Scientific Revolutions</u>, published in 1962, made two claims, both of which struck deeply at the worldview of mechanistic materialism. First, he claimed that science is "paradigmatic." That is, rather than being an unobstructed view of the universe, it consists of a set of disciplinary assumptions and

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[54] Herbert Spencer: "Progress: Its Law and Causes", <u>The Westminster Review</u>, Vol 67 (April 1857), pp 445-447.

research exemplars. Second, he claimed that there have been changes in paradigms, and that these changes occur by the means of persuasion, not (only) reason.[55]

Based on Kuhn's thinking, Rorty proclaimed the "necessity for bad argument" when changing paradigms or attempting to persuade someone in a different paradigm. That is, what sounds like a "good argument" depends on the paradigm in which it occurs.[56] But this raises the question of how one makes a good argument to change from the current paradigm to another. The answer, according to Rorty, is that one argues as best one may within the existing paradigm for the change to a new paradigm, even if knowing that, from the perspective of the new paradigm, those arguments will look at best clumsy if not fallacious. To complete the process of arguing against the Cartesian tradition, Rorty shows that Descartes himself practiced just such "unconscious sleight-of-hand" in his argumentation.[57]

SYSTEMS VIEWS OF THE WORLD

Systems thinkers have a sense of a disjunctive change from the worldviews from which they came. They refer to the "new science"[58] and use terms in ways that transform their meaning. For example, Dora Fried Schnitman called attention to the way that the "relation between order and disorder" has been reconceptualized:

> …[they were] traditionally seen as opposites. Order was that which could be classified, analyzed and incorporated within rational discourse; disorder was associated with chaos and, by definition, could not be expressed, except through statistical generalizations. The past 20 years have witnessed a radical reevaluation of this perspective because contemporary science, culture, and therapy have conceptualized chaos, disorder, and crisis as complex information rather than the absence of order…Chaos can lead to order, as it does in self-organizing systems… The world, such as it is seen by chaos theory, is rich in unpredictable developments, full of complex forms and turbulent fluxes, characterized by nonlinear relationships between cause and effect, and broken up among multiple scales of varying magnitudes that make globalization precarious. Clouds and waterfalls are turbulent metaphors, unpredictable, irregular, and infinitely variable Small fluctuations expand into large-scale changes.[59]

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[55] Toulmin, p. 84, notes the irony that Kuhn's book was originally published as an annex to the Encyclopedia of Unified Science – what must have been one of the last attempts to pull all the sciences together into one, integrated scheme. In that sense, Kuhn's book was a "Trojan horse" put inside the Encyclopedia but containing arguments that belied its whole purpose.

[56] Toulmin had already developed this concept as "field-dependent logic." See Steven Toulmin, The Uses of Argument,

[57] Rorty, p. 58n.

[58] See James Gleick, Chaos: Making a New Science. New York: Penguin, 1988; and Margaret Wheatley, Leadership and the New Science: Learning about Organization from an Orderly Universe. San Francisco: Barrett-Koehler, 1994.

[59] Dora Fried Schnitman, "Introduction: Science, Culture and Subjectivity," in Dora Fried Schnitman and Jorge Schnitman (Eds.) New Paradigms, Culture and Subjectivity. Cresskill, N. J.: Hampton Press, 2002, p. 5.

Many of the things dismissed by Locke as "immaterial" and thus unimportant because not appropriate for scientific study have emerged as the central features of systemic ways of thinking. Recall that the triumph of Newton derived from his discovery that lots of cloud-like things could profitably be treated as clocks. In that context, we get the sense that we are in a different paradigm when we read James Gleick's book Chaos: Making a New Science, and find him beginning with the story of Mitchell Feigenbaum who studied, of all things, clouds, or find Nobel Laurate physicist Ilya Prigogine describing his work as moving "From Clocks to Clouds"![60] As Gleick put it, "Clouds represented a side of nature that the mainstream of physics had passed by, a side that was at once fuzzy and detailed, structured and unpredictable."

> **W**here chaos begins, classical science stops. For as long as the world has had physicists inquiring into the laws of nature, it has suffered a special ignorance about disorder in the atmosphere, in the turbulent sea, in the fluctuations of wildlife populations, in the oscillations of the heart and the brain. The irregular side of nature, the discontinuous and erratic side---these have been puzzles to science, or worse, monstrosities.[61]

The worldview that systems set aside envisioned "laws of nature." – statement of relationships to which nature is obliged to submit. Prigogine noted that this is "the most original concept of western science" and emerged gradually.

> Many historians believed that an essential role has been played by the Christian God conceived as an omnipotent legislator. For God, everything is given. Novelty, choice, or spontaneous actions are relative to our human point of view. The discovery of nature's unchanging laws was thus bringing human knowledge closer to a divine, temporal point of view.[62]

Just this view of deterministic and time-reversible laws, however, has been a casualty in the shift to the systems paradigm. As Prigogine put it, "our concept of laws of nature have to be revised to include probability and irreversibility. In this sense, we come to the end of conventional science, but we are also at the privileged moment of the emergence of a new vision of nature. We are only at the beginning. Much remains to be done."[63]

Prigogine's excitement about being part of the emergence of a new vision of nature was paralleled by Sir James Lighthill's apology for misleading the public. In 1986, while President of the International Union of Theoretical and Applied Mechanics, and

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[60] Ilya Prigogine, "From Clocks to Clouds," pp. 303-318 in Dora Fried Schnitman and Jorge Schnitman (Eds.) New Paradigms, Culture and Subjectivity. Cresskill, N. J.: Hampton Press, 2002.
[61] http://www.around.com/chaos.html
[62] Ilya Prigogine, "The End of Science?" in Dora Fried Schnitman and Jorge Schnitman (Eds.) New Paradigms, Culture and Subjectivity. Cresskill, N. J.: Hampton Press, 2002, p. 22. See also Ilya Prigogine and I. Stengers, Order out of Chaos. New York: Bantam, 1984, and G. Nicolis and I. Prigogine, Exploring Complexity. New York: Freeman, 1989.
[63] Prigogine, "The End of Science?", p. 23.

deliberately speaking “on behalf of the broad global fraternity of practitioners of mechanics,” he said:

> We are all deeply conscious today that the enthusiasm of our forbearers for the marvelous achievements of Newtonian mechanics led them to make generalizations in this area of predictability, which indeed we may generally have tended to believe before 1960, but which we now recognize were false. We collectively wish to apologize for having misled the generally educated public by spreading ideas about the determinism of systems satisfying Newton’s laws of motion, that after 1960 were to be proved incorrect.[64]

Laszlo found nine points of useful contrast between the “classical sciences” (he means those starting in the 17th century) and “the systems view of the world:”[65]

- The worldview of the classical sciences conceptualized nature as a giant machine composed of intricate but replaceable machine-like parts. The new systems sciences look at nature as an organism endowed with irreplaceable elements and an innate but non-deterministic purpose for choice, for flow, for spontaneity.

- The classical worldview was atomistic and individualistic; it view objects as separate from their environments and people as separate from each other and from their surroundings. The systems view perceives connections and communications between people, and between people and nature, and emphasizes community and integrity in both the natural and the human world.

- The classical worldview was materialistic, viewing all things as distinct and measurable material entities. The systems view gives a new meaning to the notion of matter, as a configuration of energies that flow and interact, and allows for probabilistic process, for self-creativity, a well as for unpredictability.

- In its application to everyday affairs, the classical worldview extolled the accumulation of material goods and promoted a power hungry, compete-to-win ethos. The new vision emphasizes the important of information and hence of education, communication, and human services over the accumulation of material goods and the acquisition of raw power.

- The classical worldview saw growth in the material sphere as the pinnacle of socioeconomic progress and promoted greater and greater use (and indirectly of waste) of energies, raw materials, and other resources. The systems view, looking first of all to the whole formed by social and economic parts, insists on sustainable development through flexibility and accommodation among cooperative and interactive parts.

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[64] James Lighthill, Proceedings of the Royal Society of London A, 1986, p. 35.
[65] Ervin Laszlo, The Systems View of the World: A Holistic Vision for Our Time. Cresskill, N. J.: Hampton Press, 1996, pp. 10-12.

- The classical worldview was Eurocentric, taking Western industrialized societies as the paradigms of progress and development. The holistic vision takes in the diversity of human cultures and societies and sees all of them as equally valid, ranking them only in regard to sustainability and the satisfaction they provide for their members.

- The classical worldview was also anthropocentric, perceiving human beings as mastering and controlling nature for their own ends. The systems view sees humans as organic parts within a self-maintaining and self-evolving whole that is the context and the precondition of life on this planet.

- When the classical worldview was applied to social science, the dominant notions turned out to be struggle for survival, the profit of the individual, with at best an assumed automatic coincidence of individual and societal good (through Adam Smith's "invisible hand"). When the systemic vision inspires the theories of social science, the values of competition are mitigated by those of cooperation, and the emphasis on individualistic work ethos is tempered with a tolerance of diversity and of experimentation with institutions and practices that foster man-man and man-nature adaptation and harmony.

- When the classical worldview was applied to medical science, the human body appeared to be a machine frequently in need of repair by factual and impersonal interventions and treatments. The problems of the mind were seen to be separable from those of the body and hence to be separately treated. When the systems view is the basis of a diagnosis the body is seen as a system of interacting parts, and body and mind are not separable. It is the health of the whole system that is to be maintained by attention to psychic and interpersonal as much as to physical and physiological factors.

Like the 17th century scientists, at least many of those interested in systems share a common temperament. But instead of the Cartesian anxiety:

> They had an eye for pattern, especially pattern that appeared on different scales at the same time. They had a taste for randomness and complexity, for jagged edges and sudden leaps. Believers in chaos--and they sometimes call themselves believers, or converts, or evangelists--speculate about determinism and free will, about evolution, about the nature of conscious intelligence. They feel that they are turning back a trend in science toward reductionism, the analysis of systems in terms of their constituent parts: quarks, chromosomes, or neurons. They believe that they are looking for the whole.[66]

Many of the most sacred propositions and dearest commitments of systems thinkers are nonsensical in Newton's universe and contradict it. For example:

[66] Gleick, http://www.around.com/chaos.html

Organization is the difference between a "heap" and a "system." (In a systems view, the pattern is what is deemed important.)

A system is its own best explanation. (That is, because systems act according to their own structure, a description of that system – rather than the action of outside forces – is the best explanation of how the system works.)

If you push against a system, a system will push back. (This is rather different from the third law, which posits that all forces come in pairs. To the contrary, this stipulates that systems are structured in such as way that they maintain their own organization, and outside forces provoke internal responses to negate the ostensible effect.)

Systems are disproportionately sensitive to initial conditions. (In the Newtonian world, the relationship between forces and their effects were linear. Systems are much more varied, and time plays a different function.)

The whole is greater than the sum of the parts. (In a Newtonian universe, this is nonsense. In a systemic universe, this is axiomatic – although a more precise statement is that the whole is different from the sum of the parts (it may be greater or lesser) and the difference is accounted for by the organization of the system.)

Systems are structurally determined. (In a Newtonian universe, for every "effect" there is a "cause." In a systemic worldview, the notion of causes and effects tends to disappear, not only because every cause is also an effect within complex networks of interconnections, but because there are more complicated patterns such as equifinality and multifinality.)

Fritjof Capra summarized systems thinking like this:

1. A shift from the parts to the whole: "Cartesian science believed that in any complex system the behavior of the whole could be analyzed in terms of the properties of its parts. Systems science shows that living systems cannot be understood by analysis."[67]

    1) It is useful to apply the same concepts to different systems levels

    2) In general, different systems levels represent different degrees of complexity

    3) Contextual thinking: explanation by describing the environment

    4) A shift from objects to relationships: "In the systems view we realize that the objects themselves are networks of relationships, embedded in

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[67] Capra, The Web of Life, p. 37.

> larger networks. For the systems thinker the relationships are primary."[68]

2. The ability to shift attention back and forth between systems levels

3. The metaphor of knowledge as a network of concepts and models in which there are no foundations. "The material universe is seen as a dynamic web of interrelated events. None of the properties of any part of this web is fundamental; they all follow from the properties of the other parts, and the overall consistency of their interrelations determines the structure of the entire web."[69]

PART II: SCHOOLS OF THOUGHT IN SYSTEMS THINKING

When compared to the scientific view of the world, systems views are distinctive**.** But systemic thinkers are not all alike. I suspect that many would cringe at some of the characterizations that Laszlo made of the systems view of the world, and I know many who would disagree with specific parts of the lengthy quote above. I believe that, even if they agreed with Capra's summary of the systems view of the world, some of the terms Capra used would be understood differently by people taking a General Systems approach, a cybernetic approach, a second-order cybernetic approach, or a chaos approach. Some of these terms include: wholes, relationship, complexity, and web.

This Part of the paper reviews some of the the different schools of thought, all of which are systemic.

PROCESS PHILOSOPHY

"Process philosophy" is the name given to the later work of Alfred North Whitehead, who may be said to have had three careers. At Cambridge University, he worked on logic and mathematics; later in London, he dealt with philosophy of science, and finally at Harvard University, he developed a distinctive philosophical perspective in which he wanted to set aside an atomistic, mechanistic view of reality in favor of one focusing on change and pattern. In his view, science itself developed knowledge that calls into question its own primary assumptions, resulting in a change to thinking about process "conceived as a complex of activity with internal relations between its various factors" rather than thinking about *substances* (e.g., space and matter).[70]

For scientific reasons -- influenced by Einstein's relativity and other developments – he claimed that each of these principles of the common sense view of nature, which sees "nature as a self-sufficient, meaningless complex of facts,**"** have been shown to be false:[71]

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[68] Capra, The Web of Life, p. 37.
[69] Capra, The Web of Life, p. 39.
[70] Alfred North Whitehead, Modes of Thought. New York: Macmillan, 1938, p. 145.
[71] Modes of Thought, 1938, pp. 131-133.

> [1] There are bits of matter, enduring self-identically in space that is otherwise empty.
>
> [2] Each bit of matter occupies a definite limited region.
>
> [3] Each such particle of matter has its own private qualifications, such as its shape, its motion, its mass, its colour, its scent.
>
> [4] Some of these qualifications change, others are persistent.
>
> [5] The essential relationship between bits of matter is purely spatial.
>
> [6] Space itself is . . . unchanging, always including in itself this capacity for the relationship of bits of matter.

Whitehead was motivated to write by the gap he perceived between the view of reality to which (some) scientists had come and the “common sense” view of most people who had not been scientifically trained. This gap, he said, “is a complete muddle in scientific thought, in philosophic cosmology, and in epistemology.”[72] His attempt to articulate a more satisfactory view of reality was summarized by Sheela Pawar like this:[73]

> Whitehead … [thought] of individual entities as series of moments of experience instead of as masses of static substance. Within each moment, an entity is influenced by others, creates its own identity and propels itself into further experiences. Because of the involvement of all moments of experience with each other, Whitehead conceived of the entire cosmos as an organic whole. Just as all the cells in our bodies are interrelated, all elements of the universe -- from the light waves of a distant star to a human being living in Boise, Idaho -- are interrelated. These relationships are not all equal: a single skin cell on a person's toe does not affect his or her life as much as does a nerve cell in the brain. Complex groups of cells, such as the nervous system, have a greater influence on the person than single cells. Analogously, social groups are more effective than single individuals, and individuals are more effective than single cells. People living in the United States are affected by particles released from a volcano in the Philippines. Business practices in Japan affect the global community. Individual elements that have little effect in themselves, such as a molecule of carbon monoxide, are often greatly effective in large numbers, as ecological effects of large amounts of carbon monoxide pollution attest. Relativity is descriptive of sub-atomic particles, social groups, as well as planetary systems.

Described in this way, “process philosophy” sounds remarkably like the writing of systems theorists who came later. In particular, his view that nature is alive – an organic whole -- anticipated ideas that resonate much more strongly at the beginning of

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[72] Modes of Thought, 1938, p. 132.
[73] http://www.ctr4process.org/WHATISPRCS/basintro.html

the 21st century than they did the 20th. However, Whitehead's work does not loom large in the reference lists of most systems thinkers, and I do not know to what extent he directly affected them. Surely his articulation of the ideas of the universe as an organic whole and of looking at patterns of interconnections among all aspects of life were part of the intellectual milieu in which others developed ideas more closely linked to systems theory.

His most relevant books include:

- The Concept of Nature, Cambridge: Cambridge University Press, 1920.
- Science and the Modern World, Cambridge: Cambridge University Press, 1925.
- Process and Reality, New York: Macmillan, 1929.
- Modes of Thought, New York: Macmillan, 1938.

The American philosopher and theologian Charles Hartshorne studied with Whitehead, and both introduced his work to a new generation of students and extended it, particularly to theology.[74] This work has led to a movement designed to think about social issues and theology holistically.[75]

GENERAL SYSTEMS THEORY

General Systems Theory is generally attributed to the work of Ludwig von Bertalanffy in the 1940s.[76] In my view, GST (as it is sometimes known) attempts to achieve the goal desired by what Laszlo called "classical science" (that is, a unified body of knowledge about which we can be certain) by a different means (focusing on recurring patterns in various systems of differing size and substance). The shift is from an atomistic, reductionistic approach to one that takes wholes as the appropriate unit of analysis. Bertalanffy believed "that there are models, principles, and laws that apply to generalized systems or their subclasses, irrespective of their particular kind, the nature of their component elements, or the relations of 'forces' between them. It seems legitimate, therefore, to postulate a theory, not of systems of a more or less special kind, but of universal principles applying to systems in general."[77]

Boulding described General Systems Theory as providing a content-free "skeleton" of science, and proposed two approaches to achieve this goal.[78] The first is empirical: "to look over the empirical universe and to pick out certain general phenomena which are found in many different disciplines, and to seek to build up general theoretical models relevant to these phenomena." Examples include the way populations (of whatever) maintain themselves; the interaction of "individual" members of whatever population with its environment; growth; and communication. To be more specific:

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[74] For a brief discussion of Hartshorne, see: http://www.ctr4process.org/WHATISPRCS/Hartshorne.htm
[75] See for example: The Center for Process Studies at http://www.ctr4process.org/
[76] Ludwig von Bertalanffy, General Systems Theory: Foundations, Development, Applications. George Braziller, Revised edition, 1976.
[77] Ludwig von Bertalanffy, "General System Theory," General Systems Yearbook, Vol. I., 1956
[78] Kenneth Boulding, "General Systems Theory – The Skeleton of Science," Management Science, 2, 1956, 197-208.

Boulding suggests that the behavior of each individual member of any population can be "explained" (emphasis in the original) by describing "the structure and arrangement of the lower individuals of which it is composed [that is, by its "parts"], or by certain principles of equilibrium or homeostasis according to which certain 'states' of the individual are 'preferred'."

The second approach to building science is "to arrange the empirical fields in a hierarchy of complexity of organization of their basic 'individual' or unit of behavior, and to try to develop a level of abstraction appropriate to each." Moving from the more simple to the more complex, he suggests:

1. Frameworks: the level of static structures, or "the geography and anatomy of the universe – the patterns of electrons around a nucleus, the pattern of atoms in a molecular formula…"
2. Clockworks: the level of simple dynamic systems with predetermined, necessary motion. For example, the solar system, levers and pulleys, steam engines, etc. "The greater part of the theoretical structure of physics, chemistry, and even of economics falls into this category."
3. Thermostat: the level of the control mechanism or cybernetic system. These systems involve "the transmission and interpretation of information" so that the system can maintain equilibrium within limits.
4. Open system: the level of self-maintaining structure. "This is the level at which life begins to differentiate itself from not-life; it might be called the level of the *cell*." Simple examples include flames and rivers; more sophisticated open systems are able to reproduce and maintain themselves, and clearly merit the designation "life."
5. Genetic-social level: systems at this level display a division of labor among their parts and "a sharp differentiation between the genotype and the phenotype, associated with the phenomenon of equifinal or 'blueprinted' growth." Trees, flowers and other plants are examples.
6. Animal: systems at this level are characterized by increased mobility, teleological behavior, and self-awareness. These systems are difficult to predict because they have specialized organs for receiving and processing information; they develop "images" which intervene between stimulus and response.
7. Human: "that is of the individual human being considered as a system." In addition to the characteristics of the animal level, humans possess self-consciousness and self-reflexivity, the capacity for speech and ability to produce, absorb and interpret symbols, and an elaborated notion of time and relationships. "Man exists not only in time and space but in history, and his behavior is profoundly affected by his view of the time process in which he stands."
8. Social organizations: the unit of analysis is not the person but the role, and "at this level we must concern ourselves with the content and meaning of meassages, the nature and dimensions of value systems, the transcription of images into a historical record, the subtle symbolizations of art, music, and poetry, and the complex gamut of human emotion."
9. "The ultimates and absolutes and the inescapable unknowables:" Boulding says that these, too, "exhibit systematic structure and relationship" and observes that

> "it will be a sad day for man when nobody is allowed to ask questions that do not have any answers."

After more than 50 years, the name "General Systems Theory" has continued although no such theory has been developed. However, this approach has developed a number of concepts that are not so much "a set of techniques for solving problems arising in conventional frameworks of thought…but …a harbinger of a new outlook, one that is better equipped to cope with the accelerating rate of historical change."

Some of the key insights developed by this school of thought include:

- Thinking in terms of connections within complexity rather than looking for simple "cause-effect" relationships. While this is a common commitment of all systems thinkers, Russell Ackoff developed ways of applying these ideas to organizations, particularly while he was on the faculty of the Wharton School of Business. He started with the ideas that organizations are systems in which all the essential parts are interrelated, and that any change that is made to one part will inevitably change the rest.[79]

- Focusing on the structure of systems, rather than or in addition to their component parts. One spoke of the boundaries between the system and its environment, and distinguished between open and closed systems. For example, rather than try to understand a particular phenomenon in isolation (the strategy of analysis), systemic thinkers would look for the pattern of which it is a part. Take the fluctuating population of foxes. A reductionistic approach would ask what characteristics of foxes produce fluctuations in their numbers. A systemic approach might look at the fluctuations of numbers of rabbits, noting that there is a pattern. The explanation of the population of foxes may have nothing to do with foxes, except for their reliance on rabbits as a primary food source, and everything to do with the pattern of the way the ratios of foxes to rabbits change over time. Following this, systems thinkers treat particular phenomena of interest, from personality characteristics of individuals to the wealth of nations, less as things in themselves than as symptoms of the state of the system.

- Attention to the process by which systems maintained themselves. Systems theorists were sensitive to inputs, outputs, process (including flow-through), and the state of the system.

- Consideration of the relationship among parts and wholes. One key idea is that all systems are both comprised of organized components and a component of yet larger systems. Arthur Koestler invented the term "holon" to describe a unit of analysis that would be seen simultaneously as a whole and as a part of a larger whole.[80] Some General Systems Theorists seemed to think that the universe was a

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[79] For bibliography, see: http://www.systemsthinking.com/russ_ackoff.html

[80] Arthur Koestler, The Ghost in the Machine, Hutchinson & Co, 1967. For an instance of the contemporary use of this concept, see http://hms.ifw.uni-hannover.de/public/Concepts/concepts.htm.

single system in which everything was a part of a hierarchy of component systems (in Koestler's term, a holarchy). One useful aspect of this idea was the realization that systems at various levels in the hierarchy might have very different organizational principles. For example, Newton's laws of motion are sufficient to account for the movement of balls on a pool table, but if we see that as just one system level, we realize that very different principles are needed to explain "larger" systems. The game of pool is very different from the movement of the pool balls; the dynamics in a pool hall are very different from the game of pool; and the role of a pool hall in a community is different still.[81]

- An awareness of emergent properties. Reductionism can be described as the tendency to look at a whole and say that it is "nothing but" a combination of smaller units. General Systems Theory, to the contrary, looked for those emergent properties that develop after a certain level of complexity is reached.

- Isomorphisms. The term "morph" means, roughly, "shape," and the term "iso" means "same." One of the generative stories of General Systems Theory is of a conference in which two presenters mixed up the slides for their presentations. As they tried to sort them out, they found that they were both presenting the same structure although they were dealing with systems of vastly different size and substance. This is a prototype for General Systems Theory analysis of the commonality of structure in different systems and leads them to feel comfortable moving across academic disciplines. To unsympathetic outsiders, it seemed as if those within the GST paradigm claimed to know everything.

CYBERNETICS

The term "cybernetics" stems from the Greek word for the person who steers a boat. The preoccupation of cybernetics with "control" is clearly indicated in the title of two books by Norbert Weiner (1894-1964), who is generally regarded as the "father" of cybernetics. In 1948, he published Cybernetics: or, Control and Communication in the Animal and the Machine; and in 1950, The Human Use of Human Beings. A cybernetic system is one that learns on the basis of feedback ("learning" and "feedback" are distinctive, technical terms in cybernetics). In the paradigm case, a system acts, observes the result of that action, compares that result to some pre-determined criterion state, and acts again in a way to move the system even closer to the desired state. Two examples capture the idea. One is a thermostatic system in which a thermometer with a "desired goal state" (say, a temperature between 65 and 70 degrees) is connected to either a heating and air-conditioning devices. If the temperature exceeds 70 and the air conditioning is connected, it is activated until the temperature drops below 65, and so on.[82] The second example, on which Weiner worked during World War II, is radar-

[81] I owe this example to a conversation with Rom Harré, to whom I say "thanks" for this and many other learnings. This particular concept was eye-opening for me.

[82] I am being so specific here because I want to establish the groundwork for some complexity later. What if both air conditioning and heating are connected? When the temperature drops to 65, does the heater kick on until 70 degrees are reached again? If so, the owner will pay an extraordinarily high energy bill, because

controlled anti-aircraft gunnery, in which the radar measures the distance of the "error" (that is, by how far and in what directions a shot missed) and adjusts the aim of the gun.

If Newton's first impulse had been to draw a straight line, a cyberneticist's would be to draw a circle. The notion of circularity, of recursivity in the pursuit of a machine's purpose or goal state, is the underlying template.[83]

Ross Ashby's An Introduction to Cybernetics is perhaps the most accessible book on cybernetics.[84] In chapter 1, "What is New," Ashby notes that cybernetics is about machines. As Newton showed that one could accomplish a great deal by treating all clouds as clocks, Weiner, Ashby and other cyberneticists showed that one could accomplish quite a lot by treating all clouds as machines. By the mid-twentieth century, that had a lot of appeal. However, Ashby insisted that this equation worked only if one took a very different notion of what a "machine" was – and it is this shift in perspective that makes all the rest coherent as well as making the distinctive contribution.

In cybernetics, a machine is not a thing made of cogs and levers. Rather, it is something that acts. The essential cybernetic question is "what does it do?" Cybernetics "is very interested in a statement such as 'this variable is undergoing a simple harmonic oscillation," and is much less concerned about whether the variable is the position of a point on a wheel, or a potential in an electrical circuit."[85] Comparing cybernetics' interest in a machine to the relation of geometry to the actual shapes and things of the physical world, Ashby notes that the subject-matter of cybernetics is "all possible machines" and is only "secondarily interested" if told that a particular machine exists.[86] By focusing on all possibilities of machines and their behaviors, cybernetics deals with a very different set of questions than the sciences that preceded it. For example, rather than asking "how an ovum becomes a rabbit?" and giving an account of growth and development, cybernetics would take for granted that growth and development will occur (that is, energy exists) and ask how the ovum keeps from becoming a dog or cat or fish instead of a rabbit. Cybernetic questions involve determining and controlling factors. Ashby offers this definition: cybernetics might be defined "as the study of systems that are open to energy but closed to information and control – systems that are 'information-tight.'"[87]

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one or the other will be running all the time. And what if the contractor cross-wires adjacent apartments? If the heater in one apartment is connected to the thermometer in the other, and vice versa, when the heater in one apartment drives the temperature in the other above 70 degrees, the signal will turn on the air condition in the "other" apartment, making it even colder and thus keeping the heater running no matter how hot it gets in the second apartment. As the temperature climbs in the second apartment, the air conditioner is signaled to continue running in the first. Not only will the owners have an enormous energy bill, but life itself in the two apartments will be challenged by the extremes of temperature. My question is which of these models – the well-installed system or the cross-wired system – is the better model for "real life"?

[83] I'm drawing here from Hienz von Forster, "Ethics and Second-Order Cybernetics." This paper is available at: http://www.stanford.edu/group/SHR/4-2/text/foerster.html

[84] Introduction to Cybernetics is available for downloading in Adobe Acrobat at http://pespmc1.vub.ac.be/books/IntroCyb.pdf

[85] Ashby, p. 3.

[86] Ashby, p. 4.

[87] Ashby, p. 4.

This perspective allows the vision of what G. Spencer Brown called “laws of form.”[88] That is, natural laws in which the necessity has to do with configurations of pattern rather than simply recurrence of behavior. Or as Ashby would put it, determining and controlling conditions rather than merely what actually occurs. One entry in this category is the “law of requisite variety:”

> "That the available control variety must be equal to or greater than the disturbance variety for control to be possible"

It would be consistent with the élan of cybernetics to apply this “law” to the movement of waves in a lake, persons in a crowd, and ideas through a culture.

Ashby claimed that cybernetics offered a way of dealing with systems more complex than those amenable to analysis and study by reductionism. Ironically, the study of cybernetics showed that its own orientation was too simplistic. It was limited by its practice of posing the observer outside the system being studied. We return to this under the heading “second-order cybernetics.”

INFORMATION THEORY

“Information theory” can be traced to a single person at a single time: Claude Shannon in 1948.[89] The basic concept is that “information” can be measured as the amount of uncertainty that is reduced by a signal. For example, if you have to find out which of the numbers between 1 and 8 is the right one, and you get a signal telling you that the desired number is greater than 4, your uncertainty has been reduced by half. The extension of this concept is that the organization of anything can be represented by bits of information. A photograph can be digital: translated into a set of dots, each containing only the information 1 or 0.

Information is a measure of the degree of organization; it is consistent with the notion of entropy. The more highly organized an entity, the more information is contained in a signal.

The practical implications of this concept have been enormous, and we see it on television, hear it on telephones, and use it in our computers. The conceptual implications have been to provide a computational basis for cybernetics’ knack of looking not at actual machines but at the possibilities of all imaginable machines.[90]

There are two aspects of information theory: the computation of information and the model of communication that underlies it. The first has been of incalculable use; the

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[88] G. Spencer Brown, Laws of Form. 1969.
[89] C. E. Shannon, ``A mathematical theory of communication," Bell System Technical Journal, vol. 27, pp. 379-423 and 623-656, July and October, 1948. The more accessible version is Claude Shannon and Warren Weaver, The Mathematical Theory of Communication. 1949.
[90] A very accessible discussion is John Robinson Pierce, An Introduction to Information Theory: Symbols, Signals and Noise. Dover: 1980. Second edition.

second has really been a nuisance. The model of communication fits the telegraph and the notion of a simple cybernetic machine. It is a linear model of a Source who Encodes a Message that is Transmitted through a particular Channel to a Receiver and then Decoded by the Recipient who may give Feedback. Arrange the first eight of the underscored words in the previous sentence in a straight line with little linear arrows between them and you'll have the basic model. Now draw a curved line from "recipient" back to "source" and label it "feedback" and you are almost finished. Now add Noise somewhere on the page and draw a line from it to "message" and the model is complete.

This model has some advantages. Like other cybernetics, it is capable of being applied to any form of communication. It has been the basis of many people's thinking about communication. And it terribly under-represents the complexity of what is going on.[91]

SECOND-ORDER CYBERNETICS

The difference between cybernetics and second-order cybernetics is the difference between an observed system and an observing system. Another way of saying this is the recognition that any observed system includes the observer. This led to all sorts of interesting implications.

Constructivists such as von Foerster, von Glasersfeld, and Maturana noted that the system-as-perceived had only the characteristics of the entity that perceived (or "constructed") it. Maturana said that observing systems are "structurally determined," when they are "perturbed" by the environment, they respond in ways determined by their own structure. Others noted a fully reflexive loop between observers and that which is observed. Hienz von Foerster said that cyberneticists began to see themselves "inside" the systems and :

> … something strange evolved among the philosophers, the epistemologists and the theoreticians: they began to see themselves more and more as being themselves included in a larger circularity, maybe within the circularity of their family, or that of their society and culture, or being included in a circularity of even cosmic proportions.[92]

The first reaction to reflexivity was to fear it because it took the form of a familiar logical structure -- the self-referential paradox – that logicians and philosophers had warned us against. For example, you meet a person who says that he is from Crete and tells you "All Cretans are liars." If he is telling the truth, you would expect him to be lying.

[91] In a very influential book, The Process of Communication, 1960, David Berlo spent several chapters laying out a systems view of the world, and then proposed the SMCR model of communication (Source-Message-Channel-Receiver), which is linear and based on information theory. In my humble judgment, this model failed to fulfill the promise of the first chapters.

[92] Von Foerster, "Ethics and Second Order Cybernetics," 1994, available at: http://www.stanford.edu/group/SHR/4-2/text/foerster.html and http://www.flec.kvl.dk/sbr/Cyber/cybernetics/vol1/v1-1hvf.htm

In contexts more important than introductory classes in logic, cyberneticists wondered what could be found in situations in which observers caused systems to change by the act of observing (and thus “joining”) them, and were themselves affected (as part of the system) by those changes. Fully-reflexive systems are very cloud-like, fluid, and unpredictable. Lines of causality begin to get all mixed up.

Ilya Prigogine’s studies of “dissipative systems” that are “far from equilibrium” provided a basis for conceptualizing systems as “self-organizing” or “autopoetic.” Technically, “self-organization is the spontaneous emergence of new structures and new forms of behavior in open systems far from equilibrium, characterized by internal feedback loops and described mathematically by nonlinear equations.”[93] In classical thermodynamics, the dissipation of energy was always thought of as “waste.” “Prigogine’s cocept of a dissipative structure introduced a radical change in this view by showing that in open systems dissipation becomes a source of order…dissipative structures not only maintain themselves in a stable state far from equilibrium, but may even evolve. When the flow of energy and matter through them increases, they may go through new instabilities and transform themselves into new structures of increased complexity.”[94]

One implication of dissipative structures has to do with “positive feedback loops.” In information theory and first-order cybernetics, positive feedback was considered, respectively, uninformative or destructive. However, in dissipative systems, positive feedback loops are understood as a source of new order and complexity as the system develops new patterns and organizes itself. Some consultants have used this idea to talk about “problem-created systems.” That is, to look at the “system” created by a particular problem, and to understand a problem less as something to do with, for example, an adolescent failing in school, and more to do with the complex pattern of relationships among the adolescent, his or her family, the school, various professional groups such as social workers and truant officers, the legal system that permits or does not permit adolescents to work, etc., etc.

Compared to the older idea that something must be wrong with the adolescent, the idea that these systems can be self-organizing and that new and complex patterns of organization will emerge, provides a radically different way of thinking about and entering into the situation. For example, if the system organized by the adolescent’s “problem” is self-organizing, what work does the system do to prevent the adolescent from “losing” his or her problem and thus disorganizing the system? Or can the system continue to function quite will even though the adolescent has moved on or no longer has the problem? If the adolescent is “cured,” will the system produce someone else who has a “problem”?

The concepts of second-order cybernetics call into question profound assumptions about observers – that is, “us” – as well as about that which is “observed. In a celebrated

[93] Capra, The Web of Life, p. 85.
[94] Capra, The Web of Life, p. 89.

lecture, Von Foerster said that second-order cybernetics forces us to pose two questions, which have important implications for both epistemology and ethics:

> *Am I apart from the universe?*
>
> That is, whenever I look I am looking as through a peephole upon an unfolding universe.
>
> or
>
> *Am I part of the universe?*
>
> That is, whenever I act, I am changing myself and the universe as well.
>
> Whenever I reflect upon these two alternatives, I am surprised again and again by the depth of the abyss that separates the two fundamentally different worlds that can be created by such choices.
>
> Either to see myself as a citizen of an independent universe, whose regularities, rules and customs I may eventually discover, or to see myself as the participant of a conspiracy, whose customs, rules, and regulations we are now inventing.[95]

The implications of self-organizing systems generated a novel way for biologist Humberto Maturana to understand living systems. In a theory of "autopoeisis" that has been applied in many contexts, he started with the assumptions that:

- Everything said is said by an observer
- All knowing is doing, and all doing is knowing

This is a complicated theory that develops and defines many new terms. An excellent tutorial by Randall Whitaker is available on-line at: http://www.enolagaia.com/Tutorial1.html

A fear of losing any foundation for knowledge and action was one response to the circularity implied in second-order cybernetics. However, others grasped it as a powerful way of understanding complex patterns.[96] For example, some systemic family therapists began to understand the dynamics of families as the result of embracing paradoxical rules for meaning and action. As the family system attempted to follow these rules, instead of regulating deviations to achieve and maintain some equilibrium, they would amplify the deviations, producing the patterns that are all too familiar – psychotic symptoms, violence, unwanted repetitive patterns, and the apparent impossibility of continuing to live together.[97]

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[95] Von Forster, "Ethics and Second Order Cybernetics," 1994.
[96] See Fred Steier, Research and Reflexivity. London: Sage, 1991.
[97] There are many examples here. Among the most lucid are Mony Elkaim, "At the Boundaries of the Systemic Perspective in Psychotherapy," pp. 235 – 244 in Dora Fried Schnitman and Jorge Schnitman

The Kensington Consultation Centre in London has been the site of much good thinking about how to apply second-order cybernetic ideas in the practice of therapy, organizational consultation, conflict resolution, and management. In their description of the training courses they offer, they post "Two important headlines" that express the positive use of reflexivity:

> WHEN WE TELL STORIES, WE ARE DOING MORE THAN DESCRIBING - WE ARE *CO-CREATING WITH OTHERS* THE REALITIES AND FACTS WE LIVE BY.
>
> ALL RELATIONSHIPS, THE WAYS WE LIVE WITH THEM, THE REALITIES WE CREATE THROUGH THE STORIES WE TELL ABOUT THEM, EXIST IN A CONTEXT: THE CONTEXT GIVES MEANING![98]

CHAOS THEORY

As Gleick tells the story, Edward Lorenz got the idea of chaos theory accidentally – appropriately enough! – in 1961 while developing a computer simulation of the weather. His computer program included twelve "laws" that represented Newtonian physics, and each minute, the computer simulated – and printed out information about the "weather" – a new day. Although this was a simplified system,

> Lorenz's printouts seemed to behave in a recognizable earthly way. They matched his cherished intuition about the weather, his sense that it repeated itself, displaying familiar patterns over time, pressure rising and falling, the airstream swinging north and south. He discovered that when a line went from high to low without a bump, a double bump would come next, and he said, "That's the kind of rule a forecaster could use." But the repetitions were never quite exact. There was pattern, with disturbances. An orderly disorder.[99]

Wanting to study a particular pattern in greater detail, Lorenz decided to re-start it at the point it reached halfway through a simulated series of days. He typed in the values at a certain day, and applied the same "laws" – and was surprised to find that the "weather" in this simulation differed greatly from what he had obtained in his first run.

(Eds.) New Paradigms, Culture and Subjectivity. Cresskill, N. J.: Hampton Press, 2002, and "Gianfranco Cecchin, "Social Constructionism and Therapeutic Irreverence," pp. 251-263 in Dora Fried Schnitman and Jorge Schnitman (Eds.) New Paradigms, Culture and Subjectivity. Cresskill, N. J.: Hampton Press, 2002.

[98] http://www.kcc-international.com/courses/the_scho.htm#Towards. For more on second-order cybernetics, see the work of Gregory Bateson (http://www.oikos.org/baten.htm) and Ernst von Glasersfeld (http://www.oikos.org/vonen.htm).

[99] Gleick, Chaos, p. 15.

After checking to see if there was some mistake or mechanical failure, he realized that he had rounded off the numbers he had inserted, using only three decimal places instead of the six in the first run. Even though the differences were less than one part in 1,000, equivalent to the slightest puff of wind on a sunny day, it was sufficient to change the weather significantly.

In addition to the implications for long-range weather forecasting (it is impossible), these findings pointed up a problem in an assumption required by Newtonian physics – that inherent errors in measurement can be dismissed as unimportant. Newtonian physics might be understood as saying that "given an approximate knowledge of a system's initial conditions and an understanding of natural law, one can calculate the approximate behavior of the system…As on theoretician liked to tell his students: "The basic idea of Western science is that you don't have to take into account the falling of a leaf on some planet in another galaxy when you're trying to account for the motion of a billiard ball on a pool table on earth. Very small influences can be neglected. There's a convergence in the way things works, and arbitrarily small influences don't blow up to have arbitrarily large effects."[100] Directly contradicting this assumption, chaos theorists proposed the "Butterfly Effect" as a way of describing how an apparently insignificant factor generates uncertainties that cascade upward through the system as it goes through successive iterations of its functions, until it is, although deterministic in principle, unpredictable in practice.

During the 1980s, there was a concerted effort not only to predict the weather but to control it. Lorenz interpreted his data as showing that this was an impossible ambition. "Yes, you could change the weather. You could make it do something different from what it would otherwise have done. But if you did, then you would never know what it would otherwise have done. It would be like giving an extra shuffle to an already well-shuffled pack of cards. You know it will change your luck, but you don't know whether for better or worse."[101]

Chaos comes into focus when one shifts perspective. The shift moves <u>from</u> thinking of systems as wholes, who's dynamic involves maintaining or crossing boundaries (open vs. closed systems) or cycles of acting – monitoring – interpreting feedback – acting again (cybernetics) and <u>to</u> thinking of systems as reproducing themselves in each new moment iteratively, engaging in repeated actions following a set of rules. In this perspective, the language of homeostasis and equilibrium are set aside in favor of a vocabulary describing emerging patterns: bifurcation points, attractors, fractals, etc.

Greg Daneke said that the term "complexity" is a misnomer; that what chaos theorists are really saying is "simplicity;" the claim that complex systems are produced by the iterative following of simple rules.[102] In Gleick's summary, the ideas that unite chaos theorists are:

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[100] Gleick, <u>Chaos</u>, p. 15.
[101] Gleick, <u>Chaos</u>., p. 21.
[102] Personal communication.

- Simple systems give rise to complex behavior.
- Complex systems give rise to simple behavior.
- The laws of complexity hold universally, regardless of the details of a system's constituent atoms.[103]

COMPLEX ADAPTIVE SYSTEMS

The New England Complex Systems Institute describes their interest in this way: "Complex systems have multiple interacting components whose collective behavior cannot be simply inferred from the behavior of components. The recognition that understanding the parts cannot explain collective behavior has led to various new concepts and methodologies that are affecting all fields of science and engineering, and are being applied to technology, business and even social policy."[104]

Just as chaos theory involves a shift in perspective from the worldview of General Systems theory, so the worldview of complex adaptive systems requires another shift. In this case, the shift is from attention to a single chaotic system to a universe containing many such systems, each of which is part of the environment to which the others respond. It is the shift from looking at how a system is made to how it behaves.[105] John Holland described this worldview like this:

1. Each complex adaptive system (CAS) is a network of many "agents" acting in parallel. "Each agent finds itself in an environment produced by its interactions with the other agents in the system. It is constantly acting and reacting to what the other agents are doing. And because of that, essentially nothing in in its environment is fixed." As a result, control is dispersed. "If there is to be any coherent behavior in the system, it has to arise from competition and cooperation among the agents themselves."

2. A CAS has many levels of organization, with agents at any level serving as the building blocks for agents at a higher level. However, they are constantly revising and rearranging their building blocks as they gain experience, so that learning, evolution, and adaptation are, at some level, the same.

3. All CASs anticipate the future. Its structure can be seen as an active internal model of the future, and it responds to environmental conditions in ways prefigured by this structure. Of course, this structure can be tested, refined, and rearranged as the system gains experience.

4. CASs typically have many niches, each of which can be exploited by an agent adapted to fill that niche. And, since the act of filling a niche opens up more

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[103] Gleick, Chaos, p. 304.
[104] http://necsi.org/index.html. Retrieved April 9, 2002.
[105] M. Mitchell Waldrop, Complexity: the Emerging Science at the Edge of Order and Chaos. New York: Touchstone, 1993, p. 2923

> niches, new opportunities are always being created by the system. "And that, in turn, means that it's essentially meaningless to talk about a complex adaptive system being in equilibrium: the system can never get there. It is always unfolding, always in transition. In fact, if the system ever does reach equilibrium, it isn't just stable. It's dead."[106]

Among its other implications, CAS theory confirms and extends some other important systemic ideas. One is the chaos theory concept that the universe could have been and still might become something other than what it is. Ilya Prigogine said that his research has led him to view science as "the expression of astonishment."[107] Part of the astonishment comes from the finding that the laws of the universe are nondeterministic and temporally irreversible.

> Even the universe is not a closed system! It is embedded in the quantum vacuum; therefore, the law of the increase of entropy, as formulated for isolated systems, does not apply to the universe.
>
> The universe is not doomed to die. Its future is determined only if one believes in a stable world….The world at its birth is like a newborn child, who may become a carpenter, a musician, or a lawyer, but not all at the same time. The laws of physics refer to 'possibilities." Obviously, the realization of the world, as we know it, with its genetic code and human brain is one of those possibilities. Nothing says that other realizations would not have been compatible with the laws of quantum gravity near the time of the 'Big Bang.'
>
> The main conclusion is that we have to reject the temptation of the eternal…science is always a dialogue with nature, not a monologue that we can pursue at our will. Therefore it is always a difficult decision to judge whether we have to continue more work or to change the subject…
>
> …We keep the idea of laws, but we also introduce that of events. This vision integrates novelty, be it in art, science, or society…This involves a reformulation of scientific rationality and therefore also of the laws of nature. It involves an opening to the new, to the unexpected.[108]

The systems view radically re-positions us from the objective observer stance of Descartes or Newton. Like second-order cybernetics, it frames us as "inside" a self-organizing universe, one of the emergent properties that we hope to understand. As Stuart Kauffman said, "we make the world we live in with one another. We're participants in the story as it unfolds. We aren't victims and we aren't outsiders. We are part of the universe, you and me, and the goldfish. We make our world with one another."[109]

PART III: TRADITIONS OF PRACTICE IN SYSTEMIC WORK

[106] M. Mitchell Waldrop, Complexity: the Emerging Science at the Edge of Order and Chaos. New York: Touchstone, 1993., pp. 145-147.
[107] Ilya Prigogine, "From Clocks to Clouds," in Schnitman and Schnitman, (Eds.), New Paradigms, Culture and Subjectivity, 2001, p. 314.
[108] Prigogine, "From Clocks to Clouds," pp. 313-315.
[109] Quoted in Waldrop, Complexity, p. 321.

One story about schools of thought in systems is that they enjoyed a lot of prestige in the middle 20th century, virtually died out because they had not produced important lines of work, and then revived with the development of chaos, and complex adaptive systems theory. Like many stories, there's something right about this one AND it leaves a lot out. In 1978, Robert Lilienfeld concluded his book, The Rise of Systems Theory, with the critique that there is "No evidence that systems theory has been used to achieve the solution of any substantive problem in any field whatsoever…"[110] As Capra noted, "the last part of this critique is definitely no longer justified…"[111]

There are a number of traditions of practice grounded in systems theory. I've found it difficult to describe a tradition of practice in ways that its practitioners find sufficiently rich. While finding a way of describing traditions of practice remains a goal, in this paper, I'll only indicate some "snapshots" of these traditions here. A better way to learn them is by observation and coached practice.

It seems important to me to make a distinction between the first two traditions of practice and the third. The first two treat the system observed as if the observer was external to it. In this way, these traditions ignore (for the moment; as part of their method) the major contribution of second-order cybernetics. The third tradition positively celebrates the reflexivity and circularity that comes from envisioning the observer as an observing system and part of the system observed. One way of teasing out these differences is to say that the first two represent ways of "thinking about systems from the outside" and the third ways of "thinking and acting systemically from inside" the system.

Computer simulation

This is the method of choice for exploring chaotic systems and complex adaptive systems. The game consists of writing the fewest, simplest set of rules that will produce a simulation with the characteristic of the system being studied. Of the traditions of practice reviewed here, this is the one that I am least familiar with, so will leave this for now as a place marker for my own continuing education.

In the meantime, to explore some simulations, go to: http://serendip.brynmawr.edu/chaos/home.html, http://www.ang-physik.uni-kiel.de/~stephan/OdeControl.html and http://www.isima.fr/ecosim/simul/simul.html.

Modeling Feedback Loops

The idea of cybernetics has given rise to the practice of modeling the complexity of systems by exploring the ways in which various elements of a system affect each other through feedback loops. In the following paragraphs, I'll summarize two versions of this: "systems thinking" and "systems dynamics."

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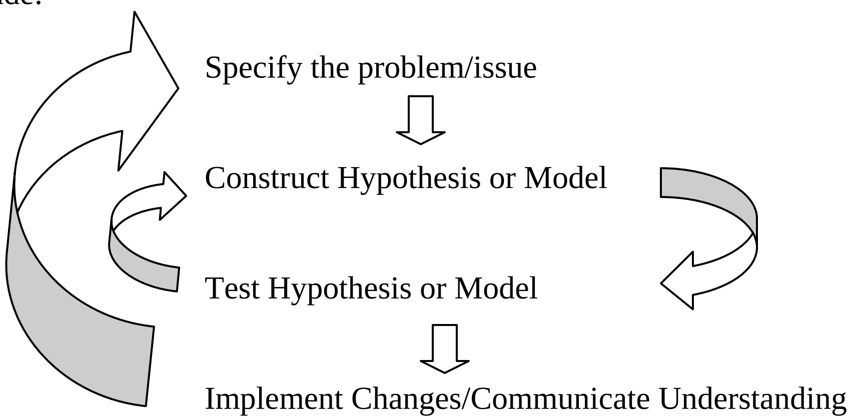
[110] Quoted in Capra, Web of Life, p. 78.
[111] Capra, Web of Life, p. 78.

Systems thinking.

Barry Richmond offers a formulation of seven thinking skills involved in a four-step "systems thinking method." To describe the method, he said, "Begin by specifying the problem you want to address. Then construct hypotheses, or models, to explain the problem. Test your hypotheses by simulating them. Only when you have an entertainable understanding of the situation should you begin to implement change."[112] Graphically, the steps include:



The first three skills apply to step 1, specifying the problem. Dynamic thinking focuses on patterns of behavior over time. It contrasts with static thinking that focuses on particular events. Systems thinkers are advised to draw behavior-over-time (BOT) graphs and, when someone suggests a course of action, to ask "over what time frame will that occur?" System-as-cause thinking is the answer to the question "in what ways are we 'doing it to ourselves?' This contrasts with system-as-effect thinking that focuses on external forces that are seen as causal. "Because external variables are by definition beyond your control, there's no benefit to be gained from including them in the model." Forest thinking is the view "from 10,000 meters;" it looks at the "on average" configuration of the organization. This way of thinking contrasts with tree-by-tree thinking that is very large, very detailed, and characterized by obsession with numerical accuracy. To use forest thinking, systemic thinkers are advised to practice clumping or clustering data.

A second set of three skills apply to step 2, constructing hypotheses or models. Operational thinking seeks to get at causality. It is differentiated from factors thinking that produces a list of things that correlate with or influence something. Steven Covey's list of "Seven Habits of Highly Effective People" is cited as a prime example of factors thinking. On the contrary, systems thinkers are advised to inquire about the activities that define the process being explored. Operational thinking "captures the nature of the …process by describing its structure." Closed-loop thinking depicts causality as ongoing, interdependent process, rather than a one-time, one-directional event caused by independent factors. Richmond contrasts it with straight-line thinking. Quantitative

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[112] Barry Richmond, The 'Thinking" in Systems Thinking: Seven Essential Skills. Williston, VT: Pegasus Communications, Inc., 2000, p. 4.

thinking involves making judgments of more and less without being bound to things that are measurable. This opens the way to include those "soft" factors that are important but which cannot be measured with any degree of exactness. Systems thinkers are advised to take any analysis and ask, "what key 'soft' variables have been omitted?"

The seventh skill is associated with step 3 in the process, testing the hypothesis or model. Scientific thinking involves discarding falsehoods, not in ascertaining "truth." It consists of torture-testing their models to see how robust they are rather than trying to make them more-and-more accurate. Richmond contrasts it with proving-truth thinking. Systemic thinkers are advised to start with a working computer model and then "shock" it by changing the values of some of the parameters drastically, then observing how the model performs.[113]

Systems dynamics:

"System dynamics is a methodology for studying and managing complex feedback systems, such as one finds in business and other social systems. In fact it has been used to address practically every sort of feedback system. While the word system has been applied to all sorts of situations, feedback is the differentiating descriptor here. Feedback refers to the situation of X affecting Y and Y in turn affecting X perhaps through a chain of causes and effects. One cannot study the link between X and Y and, independently, the link between Y and X and predict how the system will behave. Only the study of the whole system as a feedback system will lead to correct results."

The methodology

- identifies a problem,
- develops a dynamic hypothesis explaining the cause of the problem,
- builds a computer simulation model of the system at the root of the problem,
- tests the model to be certain that it reproduces the behavior seen in the real world,
- devises and tests in the model alternative policies that alleviate the problem, and
- implements this solution.

"Rarely, is one able to proceed through these steps without reviewing and refining an earlier step. For instance, the first problem identified may only be a symptom of a still greater problem."[114]

Working systemically

In the 1950's, a number of psychotherapists began thinking systemically about the problems they were presented by their patients. Among other things, they began interviewing whole families rather than just single members of the family. The "weak"

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[113] Richmond, The "Thinking" in Systems Thinking, pp. 4-9.
[114] http://www.albany.edu/cpr/sds/. Retrieved April 9, 2002.

rationale for what was called "family therapy" or "conjoint therapy" was that the family was the social context in which the patient lived, and if she or he were to be helped, the new behaviors (that is, those without the pathological symptoms) would have to occur after the therapy session and with the family rather than with the therapist. The "strong" rationale took on the systemic perspective that the "designated patient" and the "presenting problem" could most usefully be viewed as symptoms of the structure of the family system. That is, the "presenting problem" is almost certainly not the "cause" of the difficulties the family or the patient is experiencing, and the "designated patient" is almost certainly not the only or even primary source of those difficulties.

The strong version of this work was given a boost by Gregory Bateson, himself better known as an anthropologist, who brought into this work ideas from the theory of logical types,[115] information theory, and the concept of an extrasomatic, social "mind."[116] One of the results was the theory that psychological problems are caused by attempts to act out of paradoxical beliefs, the prototype of which is the "double bind."[117]

Bateson then began working with a group of therapists at the Mental Research Institute in Palo Alto, California, and together they developed what Paul Watzlawick called "the interactional view"[118] and an approach known as "brief strategic therapy."[119] One significant feature of this way of working was the idea of using the confusion of paradox to bring about positive change. The strategy was to "prescribe the symptom." A teaching example features an insomniac seeking therapy. After listening to the story, the therapist says, "I'll see you again one week from now, but you've got to stay awake between now and then. Don't forget; you must not sleep." A week later, the therapist begins the session by asking the patient if he was successful in staying awake. "No, I just couldn't do it." Expressing disappointment, the therapist instructs him to try harder…and so on, until both therapist and patient realize that the patient is "cured" of insomnia.

A group of therapists in Milan, Italy, developed their own form of practice.[120] After consulting with Watzlawick, they decided to make an intensive study of Bateson's

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[115] http://pespmc1.vub.ac.be/ASC/THEORY_TYPES.html and http://www.california.com/~rathbone/types.htm .

[116] Bateson's term of choice was "mind." See his books Steps to an Ecology of Mind and Mind and Nature. For a complete bibliography, essays, and more, see: http://www.oikos.org/baten.htm

[117] http://pespmc1.vub.ac.be/ASC/DOUBLE_BIND.html

[118] Using the systemic idea of focusing on relationships rather than things, this procedure shifted the attention from single messages to adjacent pairs of messages, noting that that which preceded and followed it determines the meaning of any message. For information, see: Paul Watzlawick and John Weakland (Eds.) The Interactional View. New York: Norton, 1977, and http://www.colorado.edu/communication/meta-discourses/Theory/interactional_view.htm and http://www.usm.maine.edu/com/INTERACT/

[119] The MRI website has a great deal of current as well as historical information. See: http://www.mri.org/

[120] Luigi Boscolo, Geanfranco Cecchin, Lynn Hoffman, and Peggy Penn, Milan Systemic Family therapy: Conversations in Theory and Practice. New York: Basic Books, 1987; Mara Silvini-Palazzoli, Guiliana Prata, Luigi Boscolo, and Gianfranco Cecchin, "Hypothesizing – Circularity – Neutrality: Three Guidelines for the Conductor of the Session," Family Process, 19 (1980), 2-13.

writings and developed a distinctive way of working with families, it is called "systemic family therapy."[121]

Systemic practice has changed since its development in the 1970's. The major trajectories of these changes reflect integration of newer systemic ideas. For example, at first the therapeutic team thought of themselves as in a power-struggle with the family, and sought to remain "neutral." With the insights of second-order cybernetics, they began thinking of themselves as co-constructing a new system with the family that included the therapists. Among other things, this involved taking a newly intensive look at themselves and what they were doing as they interacted with the family.[122] Adding to this some of the insights from constructivism, social constructionism, and communication theory, they see themselves as joining the family in a process of co-constructing new stories that enable them to deal better with the circumstances they confront.

In this kind of relationship, the terms "patient" and "therapist" have dysfunctional connotations, so systemic therapists began thinking of themselves as "consulting" with a "client." From this is was a short step to thinking about systemic work in other contexts, including organizational consulting,[123] social work,[124] and public institutions and policies.[125]

To describe this tradition of practice, I'll use two techniques. First, I'll identify three distinctive practices, and then report some research on instances in which practitioners define others' actions as "not sufficiently systemic."

One distinctive practice is positively connoting the system. In comparison with strategic therapy's practice of prescribing the symptom, this consists of identifying the strength of the system as a whole. For example, a family with recurrent conflicts might be described as very strongly attached to each other, so much so that they have remained together to work through their differences. Among other things, this positive connotation creates a paradoxical situation. A family in therapy has already decided (or been told by a referring authority) that it has a "problem" or is dysfunctional in some way. If they believe the therapist when he or she says that they are strong and have the resources to move forward in a productive way, this contradicts that diagnosis and creates a paradoxical situation that opens a space for movement.[126] More recently, systemic

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[121] http://www.behavenet.com/capsules/treatments/famsys/systemictherapy.htm

[122] For a good description of this movement, see Gianfranco Cecchin, "Constructing Therapeutic Possibilities," pp. 86-95 in Sheila McNamee and Kenneth Gergen (Eds.), Therapy as Social Construction. London: Sage, 1992. See also an interview with Cecchin: http://www.newtherapist.com/cecchin.html

[123] For example, David Campbell, Tim Coldicott, and Keith Kinsella, Systemic Work with Organizations: A New Model for Managers and Change Agents. London: Karnac Books, 1994.

[124] For example: Dave Evans and Jeremy Kearney, Working in Social Care: A Systemic Approach. Aldershot, UK: Arena, 1996.

[125] For example: Laura Fruggeri, Umberta Telfner, Anna Castellucci, Maurizio Marzari, and Massimo Matteini, New Systemic Ideas from the Italian Mental Health Movement. London: Karnac Books, 1991.

[126] This was part of our analysis in Vernon E. Cronen and W. Barnett Pearce, "Toward an Explanation of How the Milan Method Works: An Invitation to a Systemic Epistemology and the Evolution of Family Systems," pp. 69-86 in David Campbell and Rosalind Draper, eds., Applications of Systemic Family Therapy: The Milan Approach. London: Grune & Stratton, 1985.

practice has taken on board significant aspects of social constructionism, including the understanding of the different social worlds created by the use of deficit and appreciative language. Viewed from this perspective, the Milan tradition of systemic therapy (and consulting) was working appreciatively from the beginning.

Perhaps the most widely adopted aspect of this tradition of practice has been circular questioning.[127] Based on Bateson's notion that "news of difference" is an impetus toward change and the notion that social life occurs within human systems, this form of questioning explores the relationship among all parts of the system. This form of questioning is "circular" in several ways. First, it explores circular rather than linear connections within relationships. Second, the questioning itself circulates around all the people in the group. The consultants ask first one and then another person for their perspective on the same issue. Finally, the questioning often seeks to produce what is called "gossiping in the presence of the other." One person is asked how a second person thinks about a third, and so on. This line of questioning makes visible the circular, systemic relationships that comprise the human system.

The Milan group took heed of Bateson's observation that human communication occurs in a domain of information, not energy, and that information is based on the perception of "difference." Circular questions target perceptions of difference and relations, not "facts." For example, if John describes Father as impatient, the consultant might ask something like this:

- *To whom does Father show his impatience?* (by carefully avoiding the verb "to be" the consultant invites John – and the other members of the family who are listening – to think of "impatience" as something that is "done" or "shown" in a specific relationship rather than something that Father "is" or "has.")
- *Who first noticed Father's impatience? Who was the last to notice?* (These questions invite John – and the others – to think about the differences among the relationships within the family; to notice the varied texture of this human system.)
- *When did you first notice his impatience?* (this invites John to compare "before" and "after" and to identify impatience as located in specific events)
- *Other than Father, who is the next most impatient member of your family? Who is the least impatient?* (this invites John to compare "more" or "less.")
- *When Father shows impatience, who gets most upset? Who gets least upset? Who enjoys it most?* (This question invites John – and the others, including Father – to notice the function of displays of impatience.)

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[127] Like any form of practice, circular questioning is better shown than described. I produced a videotape called "Styles of Interviewing" that includes a discussion and demonstration of circular questioning by Peter Lang, co-Principal of Kensington Consultation Centre. For a copy, contact the Administrative Secretary, Department of Communication, Loyola University Chicago, 6525 North Sheridan Road, Chicago, IL 60626. The price for the set of four tapes is $90. To read about circular questioning, see Peggy Penn, "Feed-Forward: Future Questions, Future Maps," Family Process, 24 (1985), 299-310; Karl Tomm. Interventive Interviewing: Part I. Strategizing as a Fourth Guideline for the Therapist. Family Process, 26 (1987): 3-13; Karl Tomm. Interventive Interviewing: Part II. Reflexive Questioning as a Means to Enable Self-Healing. Family Process, 26 (1987): 167-183; Karl Tomm. Interventive Interviewing: Part III. Intending to ask lineal, circular,strategic or reflexive questions. Family Process, 27 (1988): 1-15; and Lynn Hoffman. Foundations of Family Therapy. New York: Basic Books, 1981. Chapter 15.

- *Who would miss Father's impatience the most, if he were to stop showing it? What would be different in your family?* (This question invites the family to consider the structure of their system to see if the impatience is serving an important function. Simply the idea that it might be purposeful or useful is often sufficient to create an opening for the development of a new story.)

Note that this line of questioning is directed at each member of the family, usually starting with the youngest, in the presence of the father before the father is asked to comment. In fact, the consultant will structure the conversation in such as way as to relieve the father of the necessity of responding, giving him the chance to listen and hear things that he would not have heard in the family's normal patterns of communication.

While these sample questions give a sense of the form of circular questions, the dynamic is much more fluid. As Peter Lang says, part of the circularity is between the persons asking and answering the questions. He said that he does not really listen to the content of their answers; he listens to the vocabulary and grammar and uses that in his next question. If the person answering uses a power word (such as naming an emotion or making an attribution about someone), he will use that word as the stem of his next question.[128]

A third distinctive characteristic is reflecting. In early Milan practice, the consultant would leave the client to consult with a team of colleagues who had been observing through a one-way mirror.[129] The function of this team included helping the consultant remain neutral and to assist in developing what they called an "orgy" of hypotheses about what was going on. These hypotheses both guided the next phase of the interview and provided the consultant the basis for offering his or her part of the co-construction of a new story.[130] Many of us noted that this orgy of hypothesizing was an enriching experience, as we explored the many different ways in which the family system could be understood and might become. Tom Anderson developed the process by which this richness was brought into the room with the client.[131] After talking with the client, the consultant might turn to the reflecting team and ask them for their observations. In the presence of the client, but not addressing them, the team might start by describing what they noted (the term of choice is "I was struck by…"), then start making some systemic

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[128] See the videotape "Styles of Interviewing."

[129] In the early days, consultants always worked in teams of two or more. In some situations, a telephone would be connected into the room so that the observing team could call the interviewer and make suggestions; at other times, the observers would knock on the door to summon the interviewer to a conference. As the idea of second order cybernetics was translated into practice, the observing team began trading places with the family, so that the family could watch them do their conference with the interviewer, and later the observing team came into the room with the client and were a part of the entire consultation, although keeping their conversation separate from that with the client.

[130] Early Milan practice included "prescriptions" and the construction of elaborate "counter-paradoxical interventions." With experience, these features tended to drop out as it was discovered that circular questioning and reflecting were usually sufficiently powerful to initiate co-construction of a new story.

[131] For information on reflecting as systemic practice, see: Tom Anderson, "Reflections on Reflecting with Families," pp. 54-68 in Sheila McNamee and Ken Gergen, Therapy as Social Construction, London: Sage, 1992; and http://www.dulwichcentre.com.au/reflecting.html, http://www.california.com/~rathbone/reflecting.htm

connections (something like "when John said…, I thought of what Mother said…. and wondered….). In this discussion, the reflecting team carefully avoids evaluative phrases ("good" or "bad") and agreements ("right!" "I agree" or "I disagree). The purpose is to create a rich array of possibilities in a spirit of curiosity as a gift to the client.[132]

Another way of describing a tradition of practice is to notice what is going on when practitioners say "this is <u>not</u> what we do." I noticed that systemic practitioners often said of other people that they were "not sufficiently systemic." With two colleagues, I conducted focus group interviews exploring the contexts in which this comment was made.[133] We found seven situations and, with deliberate playfulness, called these the "seven systemic sins." Systemic practitioners say that others are "not sufficiently systemic:"

- *When the other's actions hinders work with the client.* Examples include "diagnosing" a problem using a medical model of intervention and using a linear notion of cause and effect.
- *When the other focuses on components of systems rather than on the patterns of connections that comprise the system.* The most frequent example was defining a component of the system as "the problem" as if changing that component would change the system.
- *When the other treats aspects of the system as 'found' rather than as 'made.'* For example, treating a presenting system (depression; low morale; lack of trust) as if it were an entity rather than a symptom of the system.
- *When they orient towards "explanations" of the family or organization rather than toward ways of working with it.* Systemic practitioners refer to "falling in love with a hypothesis" and note that this blocks their ability to work with the client. The classic case of this occurs when the consultant tries to persuade the client that the consultant's interpretation of what is going on is correct. In contrast, systemic practitioners strive to take the "not-knowing" perspective and to display curiosity.
- *When a therapist or consultant thinks of him/herself as responsible for making changes in the client*. This reflects a very limited appreciation of the integrity of the client's system. Systemic practitioners describe themselves as "perturbing" the system (in Maturana's term) or "joining with" the clients to co-construct new stories; they do not see themselves as "causing" effects on the system.
- *When therapists or consultants treat connections and distinctions within a system as closed.* The first systemic move was to focus on relations rather than on components, but even relations are in the context of other relations, in a never-ending pattern. Systemic practitioners strive to be mindful of the system they

[132] Working in this manner, my partner and I offered a client a dozen mutually contradictory hypotheses about the organizational challenge they were confronting. When we finished, we asked if the client wanted to say anything. He said, "you've hit the nail precisely on the head! I know exactly what to do…" I never did find out – nor was it necessary for me to know – which of the dozen hypotheses has crystallized his thinking.
[133] W. Barnett Pearce, Eduardo Villar Concha, and Elspeth McAdam, "'Not Sufficiently Systemic:' An Exercise in Curiosity," <u>Human Systems</u>, 3 (1992), 75-87.

have "in view" and not to forget that this system is part of many other systems as well.

- *When the consultant forgets that she/he is part of the system being co-created in the moment.* For systemic practitioners, reflexivity and self-referential paradoxes are the normal conditions of life, not just a subset of logic. Consultants are tempted to say that clients are uncooperative or trying to manipulate them. Systemic practitioners use Bateson's notion of "double description" to remind themselves that they are simultaneously eliciting and responding to the actions of the clients, and vice versa.

PART IV: CONCLUSION

I began this paper by posing questions about the nature of the universe, our place in it, and our opportunities and openings for acting effectively in it. In my opinion, the development of schools of thought and traditions of practice have significantly impacted all three sets of those questions.

The systems view of the world has enriched our concept of the universe – it is a far less certain and much more interesting place than the scientific orthodoxy of the 17^{th} – 19^{th} centuries imagined. In fact, the scientists of the 20^{th} century have been among the most daring and creative cosmologists of all time. Although Ralph Reed and the Christian Coalition might be cited as a textbook case of mixing discourses when they called upon the Kansas state legislature to repeal the 2^{nd} law of thermodynamics, it appears that they might have been "right" in their resistance to the then-current interpretation of entropy. For quite different reasons than theirs, Nobel winner Ilya Prigogine has said that his studies of dissipative systems suggest that the universe will not fade and die; that entropy does not apply to the universe as a whole. More to the point, we do not know just what will happen, because the universe is likely to engage in self-organization. And as part of the universe, our actions will be part of the systemic structure – perhaps one of those "Butterfly Effects" – that have an impact all out of proportion to the size of the action itself.

The systemic view of the world has enhanced our concept of our place in this universe. The developments of 17^{th} – 19^{th} century science tended to diminish "our" importance. We went from being "a little lower than the angels" at the center of the universe to the descendents of the apes on the third planet of a minor star toward the edge of one of innumerable galaxies all flying apart at tremendous speed with nothing to look forward to except the great cold and dark as entropy finally wins. Now we see ourselves as made of "star stuff" (in Carl Sagan's phrase) and "at home in the universe" (as Stuart Kauffman put it). We are participants in the evolution of the universe. While we cannot control that evolution, our observations of it and our actions in it are a part of its evolution toward an uncertain future.

The effects of systemic thinking for effective action are complicated. We no longer can allow ourselves to be seduced by the twin temptations of linear causality – to think that we can be sufficiently powerful “causes” as to make the world resemble our fond imaginings or to think that we are sufficiently weak so that we are absolved from responsibility. Instead of these polar opposites – one seen as arrogance, the other as moral abdication – we must find ways of seeing ourselves as a part of a larger “mind” (to use Bateson’s term) or “ecology,” required by the possession of self-awareness to act responsibly. The implications of this worldview for our ethics as well as for our practices in personal and public life still in the process of being worked out, and we have much yet to do. For example, the United States’ Constitution is based on an Enlightenment concept of individuality that most systemic thinkers have set aside; what would the Constitution look like if it were based on systemic thinking? Our system of laws are equally individualistic. What would the legal system -- and our daily practices of accountability – look like if we were to re-work them so that they were “sufficiently systemic”?

Traditions of practice provide the proving grounds and experimental laboratories for working out ways of acting into the world conceived systemically. And this is the place where I am most dissatisfied with this paper. It is difficult to describe a tradition of practice. These are among the challenges that I am aware of:

- we lack powerful vocabularies for making perspicacious distinctions;
- practices evolve and this evolution is spurred by descriptions of them, so any description is victim to its own reflexive effect on that which it describes;
- like the grammar of any language, there are idiomatic practices that do not follow the rules, irregularities that are accepted by practitioners; and different levels or registers of practice, some of which allow slang and other deviant practices;
- contact with other traditions that produce pidgins and creoles as well as polyglossia and eclecticism.

I’m reminded of Marvin Harris’ article titled “Why knowing all the rules a native knows does not enable you to speak like a native”! And yet it is possible to learn to speak like a native, and it is possible to act like a proficient practitioner. The problem is not with the practice, but with the description of practice.

I have a hunch that traditions of practice informed by systemic thinking provide the surest way for us to act responsibly and effectively. And the best way of learning what that means is by joining one or more of these traditions, submitting to the discipline of coached practice and reflective learning, and -- in so doing -- becoming that which we envision but can only imperfectly describe.