Smoke and Mirrors: Finding Order in a Chaotic World
Presented at [WILU 2005](#), University of Guelph, Ontario

Barbara Fister

This conference takes for its central image the kaleidoscope -- a toy that takes a handful of colored beads or chips of glass and, through the use of mirrors and motion, produces endlessly varied patterns. Arbitrary objects take on attributes of symmetry and beauty.

Of course, the kaleidoscope didn't start out as a toy. Invented by Sir David Brewster at the beginning of the nineteenth century, it was initially designed as a scientific instrument, one that he hoped would shed light on polarization. Whether it revealed much about the nature of light or not, it certainly caught people's imaginations. To quote the classic 9th edition of the *Encyclopaedia Britannica*, its popularity "arose from the extreme beauty of the forms which it presented, their endless variety and perfect symmetry, as well as the readiness with which one beautiful form could be converted into another." The article goes on to say "The general principle of the instrument will be easily understood from the following description and figures. Let OA, OB (fig 1) be the section of two plane mirrors placed perpendicular to the plane of the paper and inclined to each other at a right angle" etc., etc. -- which certainly takes the fun out of it. Yet actually, it was very simple instrument to construct, and for that reason poor Sir David never got much joy out of the patent he took out on it.

What is it that is so satisfying about patterns? There's something aesthetically pleasing about symmetry. Certainly, we find a great deal of symmetry in [natural](#) forms -- in the head of a sunflower, in the pattern of leaves on a branch, or in a sea urchin.

Most natural phenomena, and one could add almost all human behavior, defies simple measurements and formulas. Nonlinear dynamical systems are rich in those hard-to-predict variables that scientists prefer to leave out of their calculations because they make things messy. For example, it's impossible to predict with any accuracy something as mundane as the behavior of smoke as it rises using classical mathematics or physics, even though it takes a recognizable (if unpredictable) shape. "Clouds are not spheres," mathematician Benoit [Mandelbrot](#) was fond of pointing out. "Mountains are not cones. Lightning doesn't travel in a straight line." In the 1960s Edward Lorenz developed mathematically modeled weather using an early personal computer, one that took up half his office and involved lots of wires and vacuum tubes. He learned that, even limiting his equations governing his artificial weather system to twelve simple rules, the weather patterns it produced were unpredictable. Even when he retyped the exact same sequence of numbers, the results varied. The same apparent conditions didn't lead to the same effects. That's because, with the mathematics he was using, he couldn't put his finger on every possible space between two numbers. The smallest of differences led to significant changes, what mathematicians call "sensitive dependence on initial conditions" or, more evocatively, the "butterfly effect." Because in the real world initial conditions cannot be precisely known, cause and effect exist -- but determinism doesn't. The weather is not random: we know that winter is likely to be colder than summer in this hemisphere, that certain cloud formations spell rain, that a stiff wind is likely to precede a change in temperature. But we can't tell for certain whether it will rain tomorrow at 2:00 in the afternoon.

Physicists long ago got over Newton's notion that the universe was a complicated machine that simply needed a better instruction manual. The Uncertainty Principle acknowledged every measurement involves an interaction between the observer and the object being observed. In the microcosmos, the behavior of atomic particles, rather like that of teenagers, depended on who was watching -- and what the watchers were looking for. And because we couldn't be absolutely certain, we'd have to settle for probabilities. This notion that things were to some extent random by definition and permanently beyond our knowledge bothered Einstein, who famously protested "God doesn't play dice with the universe." In recent decades, chaos theory has offered a slightly different perspective: God plays dice with the universe, but the dice are loaded.

Chaos theory, contrary to its name, is all about order in systems that appear to be disordered. Fractal geometry

provides a mathematics for tackling nonlinear dynamical systems by accommodating those fuzzy spaces between integers. In James Gieick's words, it is "a geometry of the pitted, pocked, and broken up, the twisted, tangled and intertwined" (94). It looks for "regular irregularity" and acknowledges nature's complexity: it's not random, but it's not precisely predictable.

Take the length of a coastline. When Mandelbrot asked scientists "how long is the coastline of Britain?" they typically had one of two answers: "I don't know; it's not my field" or "How should I know? Look it up." The trouble was that encyclopedias gave answers that varied as much as twenty percent. Mandelbrot's conclusion: the length of the coastline of Britain is infinite. It all depends on how you measure it. The smaller the ruler, the more intricacies you can measure, and so the greater the sum of those measurements.

It happens that the order produced by fractal geometry parallels much of the "regular irregularity" of the natural world and enables people to get a glimpse of infinity without getting lost. Irregular patterns, it turns out, often have a quality of self-similarity: symmetry across scale. The "Mandelbrot set" fractal shape demonstrates this quality. Within each curling offshoot of the central shape, there are smaller sets, each with their own offshoots that contain even smaller sets. Mandelbrot was fond of quoting Jonathan Swift:

> So Nat'ralists observe, a Flea
> Hath smaller Fleas that on him prey
> And these have smaller Fleas to bite 'em
> And so proceed, ad infinitum.

Now, it happens Swift was actually talking about the ways poets treat one another. Mandelbrot typically left off the punch line:

> Thus every poet, in his kind,
> Is bit by him that comes behind.
> ("On Poetry," 1733)

Which, if you think about it, is just another way of saying what Newton said about standing on the shoulders of giants -- only instead of scientists, Swift is talking about back-biting critics. Which relates to what the physicists have been telling us all along: what you observe depends on what you're looking for. Peer review is either a good thing or a bad thing depending on how receptive your peers are.

You can see self-similarity at work in the shape of coastlines, in ferns (both real ferns, and those generated through computers running programs that generate fractal images), and in mountain ranges. As Mandelbrot said, mountains are not cones -- it turns out, they are fractals. Even entirely artificial images, like the view through a kaleidoscope, provide us with a certain sense of awe and pleasure, because in all that complexity, we see there really is a pattern.

The Fractal Library

Libraries are themselves perfect examples of that paradoxical balance of chaos and order that we see in fractal images. For the casual observer (or for the university administrator who hasn't actually used a library since he was an undergraduate in 1958), libraries appear to be orderly, traditional places, shrines to stability, remnants of the old Newtonian universe. In a world when news arrives every second, only to be debunked in the next, where you try to retrieve something you know you read yesterday but today has turned into a reproachful "404 error," in which nothing seems certain or durable, the library is a safe place where you can always find answers.

But, wait. It's in that plural -- *answers* -- that things get complicated. You can't find *the* answer, you'll find many, many answers, and they don't agree with each other. Like a fractal image, every time you look a little closer, more complexity reveals itself. You can't get to the bottom of it. All you find is more questions. And that is what is so subversive about libraries. They provide a seemingly orderly means of approaching that which resists fixity.

And the experienced researcher wouldn't have it any other way.

Of course, for the novice researcher, the order of the library is hardly obvious. Call numbers are a complete mystery, the catalog is . . . well, not at all like Amazon for some bizarre reason, and the hundred or so databases listed on the library's Web site have names that sound like old East European car models. Instead of Accura, Accord, and Lexus we have EbscoHost, InfoTrac, and . . . Lexis. They all sound alike, and they all sound dull. How about simply using which ever's easiest? Because, let's face it: our novice researcher doesn't see herself as a researcher at all, she's simply a student with an assignment due at the end of next week, the very same day as her chemistry exam. She has to get this task out of the way.

And she no doubt would have some very good questions for us. Why can't I put my topic into the library's catalog and find the sixteen books that actually have information about it? So, its scattered in different chapters, isn't that what the catalog is for, to find books? And why does the librarian tell me to use a database full of articles the library *doesn't even have?* Is she trying to torture me, or what?

And then there are the deeply contradictory messages in the assignment itself that make the entire enterprise seem perverse at best. *This is an opportunity to express your own ideas.* Don't use first person. *State an original thesis.* Make sure everything you say is backed up with a quote from someone who said it first. *Use five to ten sources*. Don't steal ideas or you will be severely punished.

And if you thought call numbers were bizarre, just wait until you try to follow the MLA rules for citing that full text article you printed off from some database, God knows which.

It should tell us something that students who spend hours creating properly-formatted lists of works cited cannot read them. The fine print at the end of a book or article -- isn't that just the ingredients label required by some obscure law? I won't waste money photocopying that. Students often don't realize this is a self-indexing of interrelated ideas, and even if they did, they wouldn't know to interpret those encoded messages to get those sources in their hands. All the work that goes into their endnotes, and they've missed the whole point. In the complexity of the task, the purpose is lost.

Now this is obviously not what we had in mind when we built our libraries and designed our courses. What we want is to nudge our students from the position of being outsiders, passively observing knowledge as if it is a fixed thing that's likely to be on the test, to becoming fully engaged in that ongoing conversation that constitutes this unfinished process of creating knowledge. And we all have seen that moment when they get it. We've each known a student who, in his first year, changed his topic because his idea was so original he couldn't find a source that said exactly what he wanted to say and he figured originality was against the rules. But by his junior year he can talk with excitement about the work he's doing, work that suddenly matters, work that he speaks about as *his*. And for that student, all of the stumbling blocks -- the baffling catalog, the puzzling way the journals are shelved, the interlibrary loan system, microfilm! -- none of that is a significant barrier any longer. Nor is he bothered by the fact that, no matter how deep he digs, more questions are always emerging. Though due dates might interfere with pursuing them, this student is not made anxious by the incompleteness of knowledge. He knows that within that unpredictability, that uncertainty, there are nevertheless recognizable patterns, and in that dizzying recognition that nothing will ever be totally determined and known, he senses excitement. And that sense of adventure is not something he plans to abandon when he's handed his diploma.

I think that's what we mean by being information literate.

Lets talk about that label for a minute. How many of you have an information literacy program of some kind as part of your library's mission? How many of you have a critical mass of faculty who actually know what you are talking about when you use the phrase "information literacy"? How many of you talk to your faculty about information literacy without using that phrase?

Christine Pawley has done a marvelous job of unpacking the problems with that phrase in her article "Information Literacy: A Contradictory Coupling." The word "information" commodifies the concept of knowledge,

treats it as small, discrete bits of stuff that can be acquired and traded without context or meaning. And literacy, while an unassailable concept -- who could possibly be against literacy? -- promises empowerment but has a strongly controlling flavor. You'll be empowered as soon as you learn to follow these rules.

Librarians were appalled when Dominic Basulto, in the pages of *Tech Central Station* not long ago, reacted to the announcement of a new standardized test for information literacy by portraying librarians as censors: "For the information literacy movement, the Internet is a black hole, an abyss that must be monitored, censored and screened by a trusted gatekeeper -- like a school librarian. Failure to do so will result in students randomly downloading documents after a ten-second Google search, trusting unreliable sources, and accessing information at cafes and pizza parlors rather than in ivy-covered academic libraries." This was deeply shocking. Not only are many of our libraries, for all practical purposes, cafes and pizza parlors these days, and it's a good thing too, the idea that we want to monitor and censor our patrons information habits is a reversal of our most deeply-held values.

Yet when we try to help our students by making complex things simple, when we describe mountains as cones and clouds as spheres, we often unwittingly promote hierarchies of value and authority based on oversimplified external signs, not on genuine critical thinking. And when we make claims that information *illiteracy* is a clear and present danger, we do so in terms that appeal to not to rationality but to anxiety, because anxiety works so much better in the construction of social agendas. Information is presented as a threat. It's exploding! We're drowning in it! Like some horrible cancer, it doubles every ten seconds! Without our expert intervention, our labor force will be ignorant, Western economies will falter, and civilization will lie in ruins. Of course, the underlying anxiety, the one we don't make public, is that if we don't make a stand, if we don't educate the public about the value of libraries and librarians, we will cease to exist.

When the Information Literacy Competency Standards for Higher Education first came out, in spite of the preponderance of unlovely words in its title I was encouraged. Finally, we were thinking about these issues as more than a process of finding and using information. Finally, we were acknowledging that this is a complex and iterative process that couldn't be addressed in a fifty minute library session, zipping through Boolean logic, truncation, and database design, with five minutes reserved for evaluation of sources. Finally, we would have to recognize we share the responsibility for teaching these things with other faculty, and that it may take years for a student to learn them. It seemed a move in the right direction.

Only two things happened. First, when I shared them with a group of faculty on our campus, ones committed to what we call information literacy, they were frankly appalled. Why isn't there any explicit mention of curiosity or creativity? Why are these standards using the word "product" and avoiding "originality"? And why, oh why, break it apart into so many tedious little bits like a Tayloristic time-and-motion study? These standards struck our faculty as both insufficiently ambitious and hopelessly mechanistic. Clearly, a student who could test well on the bits and pieces may still fail to put them together in a meaningful way. And a student who has written a brilliantly researched senior thesis could bomb on the small stuff. A colleague recently told me the librarians at her institution took the SAILS information literacy test, just to see what it was like. They all got Cs or worse. I rest my case.

The other thing seems even more disturbing. At ACRL last month I ran into multiple instances of librarians referring to the Standards with the same familiarity cops have with the criminal code. How do you prevent violations of three point two point six on your campus? This was not at all what the people who drafted the Standards intended. I fear (to use antiquated testing syntax) the Standards are to Information Literacy as AACR II is to locating books. In short, some of us have become so entranced with adhering to the rules we've forgotten our purpose -- rather like those students who can compose bibliographies but can't interpret them. And this does not bode well.

I'd like to return to what Christine Pawley said about the contradictions in the phrase "information literacy." She urges us to reject the positivist, technocratic impulses that have dominated our field and embrace the notion that knowledge is an ongoing and inclusive conversation. She suggests:

First, our information literacy courses should highlight, in addition to the tools and skills metaphor, the importance of learning about context and content in understanding how information "works." Second, we need to be both explicit about the moral and political commitment to flattening rather than reinforcing current information and literacy hierarchies. Third, we need to recognize that information "access" is not just about information consumerism, but also about individuals and groups of people actively shaping the world as knowledge producers in a way that renders the consumer-producer dichotomy irrelevant.

What a bracing set of recommendations!

Turning the Kaleidoscope

One way to approach what we really mean when we say "information literacy" is to examine how other disciplines look at it. The field of Communication Studies is involved in many senses in how information "works." It examines he entire process of creation, transmission, and reception of messages and acknowledges that these are not linear processes but interdependent, operating within a dynamic social context. If we were to give information literacy a Communication Studies twist, we would see information as messages constructed by various players: individuals, groups, different media. We could pay attention not to the object being passed hand to hand and its surface features, but to what happens as the speaker shapes a message for an audience, and how the audience influences the nature of that message.

Let's take another field and see what it can tell us about how people construct knowledge. Social scientists, according to Clifford Geertz, have finally freed themselves from the dream (or, more properly, the nightmare) of constructing a deterministic physics of social behavior. Now they can proceed with their vocation of "finding order in collective life" through interpretation and analogy. "The instruments of reasoning are changing and society is less and less represented as an elaborate machine or a quasi-organism and more as a serious game, a sidewalk drama, or a behavioral text."

Play, in fact, is serious business for anthropologists. As a social framing device, play makes allusion to the real world, transforming relationships through paradoxical logic. In the West play is defined primarily by what it is not: *not* work, *not* serious, *not* productive. In many other cultures play and ritual are deeply entwined, reflections of a cosmological consciousness that what we experience here on earth is illusion. Yet even in the West, play has an interpretive role. Carnival was a commentary on social hierarchies in the Middle Ages and Renaissance; today we have *The Daily Show* and *South Park*. This interpretive turn, this conception of play, relates as well to psychology, because play, after all, is how children learn.

In a recent *New York Times* article psychologist Alison Gopnik asked, "if toddlers can figure things out so easily, why can't schoolchildren?" Well, toddlers learn through imitation, through "playing at" the things they observe. She says, "Imagine if baseball were taught the way science is taught in most inner-city schools. Schoolchildren would get lectures about the history of the World Series. High school students would occasionally reproduce famous plays of the past. Nobody would get in the game themselves until graduate school."

But some learning can't be got at through play. Pretending to read doesn't help you connect visual symbols and sounds; the imaginative work can come only after a certain level of mastery. Mastering reading means doing it enough it becomes routine, effortless, freeing the child to put it into play. So Gopnik recommends a mixture of play and mastery in the schoolroom. All of which is echoed in a report from the National Research Council, *How People Learn*. Though its focus is science education, it has a lot to say to librarians, too. Among their findings: It takes time to learn complex subjects. Knowledge taught in a variety of contexts is more likely to support flexible transfer than knowledge taught in a single context. It otherwise becomes "context-bound" -- a wonderful argument for research across the curriculum. And learning with understanding requires the learner to engage with concepts, to "play" with them; testing recall of facts won't tell you anything about learning.

One more perspective from another field: humanistic geography. We have begun to rediscover the importance of place in libraries -- from the nifty new ways GIS technology enables us to see the world spatially to rethinking

the library itself as a place. Some years ago, a book by Yi Fu Tuan influenced my understanding of libraries and learning profoundly. In *Place and Space: The Perspective of Experience* Tuan describes how important having a sense of place is. That sensory experience of groundedness, of belonging, of orientation, is necessary for moving beyond a particular place to a wider sense of the world. "Place is security, space is freedom," he says. "We are attached to the one and long for the other." I used to be puzzled by a common problem our first year students had. We'd spend a fifty-minute session trying to squeeze in all the basics. And afterward most of them would complain, "But I still don't know where anything is." We had signs, floor plans, helpful people pointing the way, but that wasn't enough. Until they'd had the physical, sensory experience of finding books on the shelf, of exploring the stacks, of mapping the place for themselves, they couldn't make sense of the library or its tools. But once they felt at home, they were free to pursue all kinds of ideas -- including those beyond this small place where they've found a home. And yet, though we think of research as experiential learning, we don't typically consider the perspective of spatial experience as part of information literacy.

The rest of this conference will offer us all many different perspectives, many different twists of our kaleidoscopes, giving us opportunities to think about information literacy in new and challenging ways. We'll have opportunities to explore visual literacy, digital ethics, geographic information systems -- not how to make those pesky layers come out right, but how to think in spatial, cartographic terms. We'll explore cognitive theory, rhetorical perspectives, and the integration of media and information literacies. What I trust we'll all come out with in the end is not a confusing set of new demands ("How can I fit that in?") but a richer sense of the nature of the things we care about, a feel for the self-similarity and symmetry within the apparent chaos of different perspectives, as well as pleasure at the endless, unfolding richness of knowledge.

I'd like to close with a perspective from yet another discipline. Philosopher Michael Oakshott characterized knowledge as a particular kind of meeting-place: a place not for argument, not for an accumulation of information, but for a conversation, one that is simultaneously serious and playful.

> In a conversation, the participants are not engaged in an inquiry or a debate; there is no 'truth' to be discovered, no proposition to be proved, no conclusion sought. . . . [This conversation] is impossible in the absence of a diversity of voices: in it different universes of discourse meet, acknowledge each other and enjoy an oblique relationship which neither requires nor forecasts their being assimilated into one another. . . In its participation in the conversation each voice learns to be playful, learns to understand itself as a voice among voices. As with children, who are great conversationalists, the playfulness is serious and the seriousness in the end is only play. (489, 490, 493)

He further says:

> We are the inheritors, neither of an inquiry about ourselves and the world, nor of an accumulating body of information, but of a conversation, begun in the primeval forests and extended and made more articulate in the course of centuries. It is a conversation that goes on both in public and within each of ourselves . . . Education, properly speaking, is an initiation into the skill and partnership of this conversation in which we learn to recognize the voices, to distinguish the proper occasions of utterance, and in which we acquire the intellectual and moral habits appropriate to conversation. And it is this conversation which, in the end, gives place and character to every human activity and utterance. (490-1)

We're in exactly the sort of meeting-place Oakshott has described. Let's go have some seriously playful conversations.

Dominic Basulto. "A Little Bit Broken, a Little Bit Perfect," *Tech Central Station* 28 Jan. 2005.

Clifford Geertz. "Blurred Genres: The Refiguration of Social Thought."
Local Knowledge: Further Essays in Interpretive Anthropology. New York: Basic, 1983: 19-35.

James Gleick. *Chaos: Making a New Science.* New York: Viking, 1987.

Alison Gopnik. "How We Learn." *New York Times* Education Life Supplement, 16 January 2005: 26.

National Research Council. *How People Learn: Brain, Mind, Experience, and School.* Expanded ed.
Washington, DC: National Academies Press, 2000.

Michael Oakshott. "The Voice of Poetry in the Conversation of Mankind." *Rationalism in Politics and Other Essays*. New and expanded edition. Indianapolis: Liberty Press, 1991: 488-541.

Christine Pawley. "Information Literacy: A Contradictory Coupling." *Library Quarterly* 73.4 (2003): 422-452.

Helen B. Schwartzman. *Transformations: The Anthropology of Children's Play*. New York: Plenum, 1978.

Yi Fu Tuan. *Place and Space: The Perspective of Experience*. Minneapolis: University of Minnesota, 1977.

5/19/05