

The Logic of Logic and the Logic of Dreams
2006 Winter Chaos Conference
Snowflake Forum
Pittsburgh, February 2006
Thomas E. Malloy
University of Utah

I. Introduction

A Flock

E. B. White (of Strunk & White)

Paraphrase: Ideas fly past in great flocks and writing is like hunting; all you can do is bring a few of them down.

Stream of Consciousness

“Consciousness, then, ...flows. A 'river' or a 'stream' are the metaphors by which it is most naturally described. *In talking of it hereafter, let us call it the stream of thought, of consciousness, or of subjective life.*” William James, *The Stream of Consciousness, Psychology*, Chapter XI

Stream versus flock:

Stream versus discrete chunks like links in a chain (different metaphor) as others have proposed (perhaps a flock or swarm of birds).

A dream Tuesday Morning January 31, 2006

I am driving in a rich wild ecology which is simultaneously the landscape northeast of my childhood mid-western home in Lisle and the landscape northeast of Salt Lake City. Rich and wild and beautiful I see that it is being (this is quite recent) torn up by construction; large swaths of earth are bare and whole hills are torn away except on thin side which is left standing green and tall but are only fronts like the buildings on a movie set. Above and to the left, perched high on a peak is a modern castle of glass, beautiful in its architectural innovation. Upon seeing it I desire to join the rush to build a second home out here in wild, to take advantage of the enormous investment opportunities that come for buying early in a rural area before the land rush.

Analogy (Metaphor) in Plausible Reasoning

George Polya (*Mathematics and Plausible Reasoning*)

“Analogy is a sort of similarity. It is, we could say, similarity on more definite and conceptual level...”

“Comparing a young woman to a flower, poets feel some similarity, I hope, but usually they do not contemplate analogy. In fact, they scarcely intend to leave the

emotional level or reduce that comparison to something measurable or conceptually definable.

“Looking in a natural history museum at the skeletons of various mammals, you may find them all frightening. If this is all the similarity you can find between them, you do not see much analogy. Yet you may perceive a wonderfully suggestive if you consider the hand of a man, the paw of a cat, the foreleg of a horse, the fin of a whale, and the wing of a bat, these organs so differently used, as composed of similar parts similarly related to each other.

“The last example illustrates the most typical case of clarified analogy; two systems are analogous, if they *agree in clearly definable relations of their respective parts.*” Vol. I, p. 13.

Bateson points out that this mapping of formal relations among parts is a building block of Evolutionary Theory: **phylogenetic homology** (also **serial homology**)

SCIENTIFIC EXPLANATION.

For Bateson explanation is the mapping of description onto tautology. “An explanation has to provide something more than a description provides, and in the end, an explanation appeals to a *tautology*, which as I have defined it, is a body of propositions so linked together that the links *between the propositions* are necessarily valid. A tautology in its simplest form is ‘If P is true, then P is true.’” Tautologies can be very elaborate including, for example, systems of nonlinear dynamical equations. Descriptions include all the data (field notes and measurements) that scientists take when studying some phenomena. This mapping of formal models onto observable data can yield powerful insights and is what Bateson defines as explanation. The tautological relations within the mathematical model are mapped to relations observed in nature.

Mapping Scientific Descriptions to Mathematical Models

Measures of falling objects ==> $S = 1/2gt^2$

Stream flow data ==> Dynamic Systems Equations

Plausible Reasoning: Verification of a Consequence

George Polya (*Mathematics and Plausible Reasoning*) Vol. II

A implies B	If has rained then the sidewalk is wet
B is true	The sidewalk is wet.
A is more plausible	It is more plausible that it has rained

Elimination of competing hypotheses

A implies B	If the sprinklers ran then the sidewalk is wet
B is true	The sidewalk is wet.
A is more plausible	It is also plausible that the sprinklers ran.

BUT!

The sprinklers are broken!! (Which eliminates the competing hypothesis)
Makes "It has rained" more plausible.

Verification of many consequences

Clouds in sky
Tree leaves are wet
etc.

All make "It has rained" more plausible

Another Example

All observed crows are black.
Therefore all crows are black.

But not proved!!

Logical Error of Affirming the Consequent from Wikipedia

If [Stephen King](#) wrote the [Bible](#) (P), then Stephen King is a good writer (Q).
Stephen King is a good writer (Q).
Therefore, Stephen King wrote the Bible (P).

If someone is human (P), then she is mortal (Q).
Anna is mortal (Q).
Therefore Anna is human (P).

But in fact Anna can be a cat; very much a mortal, but not a human one.

The Chasm

In John Gardner's version of the Beowulf myth, *Grendel*, Grendel, the anti-hero whose requisite role in the metaphor is to be defeated by the warrior-conqueror, is speaking to a dragon, a dragon of vast intelligence and great age, a dragon who has watched for many eons as many species have come and gone; the dragon says:

"Man," he said, then left a long pause, letting scorn build up in the cave like venom in his breath... "Counters, measurers, theory-makers... Games, games, games!" he snorted fire. "They only think that they think. No total vision, total system, merely schemes with a vague family resemblance, no more identity than bridges and, say, spiderwebs. But they rush across chasms on spiderwebs, and sometimes they make it, and that, they think, settles that!"

I'll proceed on the principle that whenever we take a running leap across a chasm it is at least worth noticing that we are doing so; many discussions of nonlinear dynamic

systems (or of the general linear model for that matter) make such leaps without warning and without notice.

A chasm? What might be the two sides of the chasm?

Two sides of the Chasm

One side: Scientific Descriptions **and** Other side: Mathematical Tautologies
Once side: Scientific Descriptions **and** Other side: other Scientific Descriptions
Relations between bird wing **and** human arm

This mapping

Involves plausible reasoning

Verification of a consequence

If $S = 1/2gt^2$ is true the measurement should X

The measurement is X

Therefore the law of gravity is more plausible.

And it involves:

Mapping of sets of relations to each other:

Relations among measures of moving bodies

can be related to (**on the other side of the chasm**)

Relations among Newton's laws of motion

II. The Logic of Logic and the Logic of Dreams

Gregory Bateson distinguished between two logics, the logic of logic and the logic of dreams. Within the latter he included unconscious processes, poetry, metaphor, and, I will argue, scientific modeling.

THE LOGIC OF LOGIC

Bateson exemplified this logic with the classic example of a syllogism (the Syllogism in Barbara) from logic textbooks:

All people die.

I am a person.

I will die.

Logic of Logic Builds the Tautologies:

Mathematics in general, including of course dynamic systems models, is included in the logic of logic. In short by the logic of logic we can build elaborate systems of logic.

THE LOGIC OF DREAMS AND METAPHORS

Bateson called this the Logic of Metaphor but applied it to dreams. I happen to like the phrase “the logic of dreams” and will use it instead. This is also the logic of metaphor, of art, and of poetry. Bateson admits that he is oversimplifying the logic of metaphors when he reduces it to his “syllogism in grass:”

Syllogism in Grass:

“The syllogisms of metaphor are quite different, and go like this:

Grass dies;
Men die;
Men are grass.

[In order to talk about this kind of syllogism and compare it to the "syllogism in Barbara," we can nickname it the "syllogism in grass."] I understand that teachers of classical logic strongly disapprove of this way of arguing and call it "affirming the consequent," and, of course, this pedantic condemnation is justified if what they condemn is confusion between one type of syllogism and the other.”

More Fully: Mapping of sets of relations

Comparing a crab and lobster:

"So they looked at the crab. And first of all, they came up with the observation that it is *symmetrical*; that is, the right side resembles the left.

Then they observed that one claw was bigger than the other. So it was *not* symmetrical. ...

Going back to symmetry, somebody said that "*yes, one claw is bigger than the other, but both claws are made of the same parts.*"

Ah! What a beautiful and noble statement that is,

how the speaker politely flung into the trash can the idea that size could be of primary or profound importance and went after the *pattern which connects*. He discarded an asymmetry in size in favor of a deeper symmetry in formal relations."

Mind & Nature: A Necessary Unity

2. Serial Homology

"Later, it appeared that not only are the two claws built on the same "ground plan," (i.e., upon corresponding sets of relations between corresponding parts) but that these relations between corresponding parts extend down the series of the walking legs.

We could recognize in every leg piece that corresponded to the pieces in the claw.

And in your own body, of course, the same sort of thing is true. Humerus in the upper arm corresponds to femur in the thigh, and radius-ulna corresponds to tibia-fibula; the carpals in the wrist correspond to tarsals in the foot; fingers correspond to toes.

The anatomy of the crab is repetitive and rhythmical. It is, like music, repetitive with modulation. Indeed the direction from head toward tail corresponds to a sequence in time:

In embryology,

the head is older than the tail.

A flow of information is possible from front to rear."

Mind & Nature: A Necessary Unity

3. Phylogenetic Homology

"Professional biologists talk about phylogenetic *homology* for that *class* of facts of which one example is the formal resemblance between my limb bones and those of a horse. Another example is the formal resemblances between the appendages of a crab and those of a lobster."

Mind & Nature: A Necessary Unity

Human Information Processing as an Example

As a trivial example, Human Information Processing is (or originally was when Broadbent wrote his 1958 book) the mapping of relational functions from computational theory to psychological theory. In this sense it is like dreams (in my mine and Bateson's approach) in that a relational pattern is mapped in a way that the relata change (only in dreams the change of the relata seems more "random"). A syllogism in grass for Human Information Processing as a paradigm might be:

Computers buffer information

Human Iconic memory buffers information

Humans process information like computers process information

Bateson, again, Leaf and Stem: "Now Goethe discovered that a "leaf" is defined as that which grows on a stem and has a bud in its angle; what then comes out of that angle (out of that bud) is again a stem. The correct units of description are not leaf and stem but the relations between them.

These correspondences allow you to look at another flowering plant -- a potato, for instance -- and recognize that the part that you eat in fact corresponds to a stem."

For poetical and existential reasons I want to put the two forms together because I think they work together, in an integrated way, for all of us

(so long as we don't forbid one or the other, as a particular artist may prohibit logic or a particular logician may prohibit art).

Barbara:

- 1. All life dies**
- 2. I am alive**
- 3. I will die** (?Western Existentialism?)

Grass

- 1. All life dies**
- 3. I will die**
- 4. I am life** (?Eastern Existentialism?)

Grass: An identity based on identity of relationship

Dreams

Very briefly for the moment, dreams from my own and Bateson's perspective are a purely relational nexus in which the RELATA (that which is related, the arguments of the functions) are scrambled. If you pay attention to the relata then, yes, the dreams are impossible; in contrast, if you examine the relations among the relata (possibly replacing them with several other sets of relata until you get a tow hold on what the relations are in the dream) the relations may be a powerfully useful description of (even isomorphic to) context-specific relational patterns experienced by a person in the waking world.

There is no dream interpretation in this approach, not in the sense of these dreams "means" X. There is only the experiencing of relationships outside the normal (wakeful) contextual relata that usually accompany those relationships. Very briefly, once again, metaphor is the mapping of a set of relations from one realm to another (changing the relata to be contextually specific to the second realm).

The Dance of Science and Art

A poet dares be just so clear and no clearer... He unzips the veil from beauty, but does not remove it. A poet utterly clear is a trifle glaring.

[E. B. White](#)

Analyzing humor is like dissecting a frog. Few people are interested and the frog dies of it.

[E. B. White](#) **BUT....**

Scientists seek to be explicit and clear.
Clarity of mapping is a virtue.
Refer back to Polya's argument

III. THE LEAP ACROSS THE CHASM

My Dream

Group Discussion

The Porsche story?

Final Thoughts

Bateson's adaptation of Browning:

**“A man's reach should exceed his grasp,
Or what's a meta for?”**

Malloy's adaptation of Coleridge:

What if you slept?
And what if In your sleep You dreamed?
And what if In your dream You went to a garden?
And there plucked a strange and beautiful flower
And what if When you awoke You had that flower in you hand?
Ah, what then?