



AN ECOPOETICS OF BEAUTY AND MEANING

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In this paper I wish to refound the traditional humanistic concepts of beauty and meaning on a sound scientific basis, and thus secure them from the assault of recent postmodern criticism. I shall begin by summarizing the evolutionary and neurobiological description of the function and experience of beauty, as it is developed in earlier works of mine (Turner 1986, 1991A, 1991B, 1995). Building on this conceptual foundation, I shall attempt a neurobiological description of linguistic meaning in the later part of this paper, claiming that such a description dispels many of the traditional philosophical problems of reference that have served poststructuralist theorists as a justification for semantic skepticism.

All human societies possess the concept of beauty, often with a very precise vocabulary and a tradition of argument about it. People see (hear, touch, taste, smell) the beautiful, and recognize it by a natural intuition and a natural pleasure. Even animals do: antiphonal birdsong, the brilliant shapes and colors of flowers (what more precise record could there be of the esthetic preferences of bees?), and the gorgeous ritual mating garments of tropical fishes and birds of paradise, all attest to a more-than-utilitarian attraction in certain forms of organization.

This "natural intuition" is for us human beings activated, sensitized, and deepened by culture; that is, a natural capacity of the nervous system now incorporates a cultural feedback loop, and also uses the physical world, through art and science, as part of its own hardware. The theory of such a training or sensitization, the incorporation of this cultural feedback loop, the plugging of it in to the prepared places in our brains, is what I call "natural classicism." The foundation of the natural classical perspective is that the universe, and we, evolved. This fact entails two truths about beauty: a special evolutionary truth and a general evolutionary truth.

The special evolutionary truth is that our capacity to perceive and create beauty is a characteristic of an animal that evolved. Beauty is thus in some way a biological adaptation and a physiological reality: the experience of beauty

can be connected to the activity of actual neurotransmitters in the brain, endorphins and enkephalins. When we become addicted to a drug such as heroin or cocaine we do so because their molecular structure resembles that of the chemistries of joy that the brain feeds to itself.

What is the function of pleasure from an evolutionary point of view? The pleasure of eating is clearly a reward for the labor of getting ourselves something to eat. Certainly few would go to the extraordinary metabolic expense and aggravation of finding a willing member of the opposite sex and reproducing with him or her unless there were a very powerful inducement to do so. We are presented with this very great pleasure of beauty, for which artists will starve in garrets and for whose mimicked substitutes rats and addicts will happily neglect food and sex. What is it a reward for? What adaptive function does it serve, that is so much more important than immediate nourishment and even the immediate opportunity to reproduce the species?

To answer this question we need to know a little about the timing of human evolution, as it is becoming clear from the work of paleoanthropologists, paleolinguists, archeologists, and paleogeneticists. The crucial point is that there is a peculiar overlap between the last phases of human biological evolution and the beginnings of human cultural evolution, an overlap of one to five million years, depending on how the terms are defined. In any case, there was a long period during which human culture could exert a powerful, indeed dominant, selective pressure upon the genetic material of the species and thus upon the final form it has taken (if ours is the final form).

For over a million years the major genetic determinant in the environment of our genus was our own culture. A creature that is living under cultural constraints is a creature that is undergoing an intensive process of domestication. Consider wheat, dogs, apple trees, pigeons: how swiftly and how dramatically they have been changed by human selective breeding! But we domesticated ourselves. Imagine a mating ritual, which directly affects the reproductive success of the individuals within a species. Those who are neurologically capable and adept at the complex nuances of the ritual would have a much better chance of getting a mate and leaving

offspring. Now imagine that this ritual is being handed down from generation to generation not just by genetic inheritance, but also, increasingly, by cultural transmission: imitation, instruction, eventually language (did it evolve in order to facilitate this transmission?).

Genetic inheritance is the way in which an entire species learns about its environment and about itself. But it is a very slow process: the learning is being done at the genetic level, not at the social or mental level. However, in the thought-experiment that we have commenced, changes in the ritual can be handed down very quickly, in only one generation; and so the faster system of transmission will tend to drive and direct the slower system of transmission. That is, cultural modifications in the ritual will tend to confer a decisive selective advantage upon those members of the species that are genetically endowed with greater neural complexity, a superior capacity for learning the inner principles of the ritual which remain the same when its surface changes, for following and extending the ritual's subtleties, and for recognizing and embodying the values that the ritual creates. Cultural evolution will drive biological evolution. This species, of course, is ourselves: perhaps what created us as human beings was an improved lovesong. In the beginning, indeed, was the word.

In this scenario the idea of beauty clearly has a central place. The capacity for recognizing and creating beauty is a competence that we possess, a competence that was selected for by biocultural coevolution: it is both a power that the "mating ritual" of human and prehuman culture demanded and sharpened, and a value generated by that ritual that it was in our reproductive interest to be able to recognize and embody. To be, and to be able to recognize, a beautiful human being, and to desire to mix one's seed with his or hers, might be a survival strategy that drove the flowering of homo Sapiens.

What are the results of this coevolution in the neurobiology of esthetic experience? Simply to be able to ask this question--that it should be reasonable, indeed predicted by a solid theory, for beauty to have a pancultural neurobiological base--overturns modernist and most postmodernist esthetics. The evolutionary perspective suggests that we have inherited a number of related natural-classical genres or systems by which we generate,

recognize, and appreciate beauty. What are these genres?

The experimental neuropsychologist Ernst Poeppel and I have investigated one of them in some detail--poetic meter, or what we have called the neural lyre. All over the world human beings compose and recite poetry in poetic meter; all over the world the meter has a line-length of about three seconds, tuned to the three-second acoustic information-processing pulse in the human brain. Our acoustic present is three seconds long--we remember echoically and completely three seconds' worth of acoustic information, before it is passed on to a longer-term memory system, where it is drastically edited, organized for significant content, and pushed down to a less immediate level of consciousness.

If a natural brain rhythm, like the ten cycle per second alpha rhythm--or the three second audial present--is "driven" or amplified by an external rhythmic stimulus, the result can be large changes in brain state and brain chemistry, and consequently in the amount and kind of information that the brain can absorb, and in the kind of higher-level processing it can put to work. But poetry, unlike ritual chant or political slogan, does not just give us a repeated rhythmic line; instead, it establishes a steady meter but then varies upon it. The difference between the expected rhythm and the actual rhythm carries information, as a tune does, or as a line does in a drawing; and that information is processed and understood not with the linguistic left brain, but with the musical and spatial right brain. Thus unlike ordinary language, poetic language comes to us in a "stereo" neural mode, so to speak, and is capable of conveying feelings and ideas that are usually labeled nonverbal; the genre itself is a biocultural feedback loop that makes us able to use much more of our brain than we normally can.

We need not go into this kind of detail with the other genres, but they show the same kind of fascinating interplay between inherited biological and learned cultural factors. Let us just list a few of them.

1. The significant spacemaker. This operator creates architecture, diagrams, emblems and ideographs, and finally results in writing.

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2. The metrical "operator" of music, which is related to but different from the poetic metrical operator, and which also connects with dance. It is very highly developed in African drum rhythms.
3. The reflexive or dramatic operator, by which we are able to simulate other people's consciousness and point of view in imaginative models (containing miniature models of the other person's model of us, and so on), and set them into coherent theatrical interaction.
4. The narrative operator, that genre by which we give time a complex tense-structure, full of might-have-beens and should-be's, conditionals, subjunctives, branches, hopes and memories. Fundamentally the narrative operation constructs a series of events which have the curious property of being retrodictable (each one seems inevitable once it has happened) but not predictable (before it happens, we have no sound basis on which to foretell it); which is why we want to know what happens next. This operator comes with a large collection of archetypal myths and stories, such as The Swan Princess, which are fundamentally identical all over the world, because their seeds are in our genes.
5. The color-combination preferences that are associated with the so-called color wheel.
6. A similar visual detail-frequency preference system, which makes us prefer pictures and scenes with a complexly balanced hierarchy of high-frequency information (dense textures and small details) ranging through to low-frequency information (large general shapes and compositions). Consider, for instance, Japanese prints, or the arcadian landscape paintings of Poussin and Claude.
7. A representational operator (unique to human beings), whereby we can reverse the process of visual perception and use our motor system to represent what we see by drawing, painting, or sculpting.

8. Musical tonality and the inexhaustible language it opens up, from Chinese classical music, through Balinese gamelan, to the fugues and canons of Bach.

And many more. Researchers of great boldness and brilliance are working to clarify the neuropsychology and anthropology of these systems; their results so far are described in a recent book entitled *Beauty and the Brain*.

The forms of the arts are not arbitrary, but are rooted in our biological inheritance. To say this is not to imply that the natural classical genres are constraints, or limits upon the expressive powers of the arts. Quite the reverse; these systems, which incorporate a cultural feedback loop into the brain's processing, can enormously deepen and broaden its powers. Language itself may be one of the most comprehensive and earliest of them. They are not constraints any more than the possession of a hammer or a screwdriver is a constraint upon our carpentry; but their use must be learned. An esthetic education that assumes that genres are obstacles to creativity, and which thus does not bother to teach the old ones, deprives our children of their inheritance.

So much for the special evolutionary truth about beauty. Without the general evolutionary truth, it would be meaningful only in a practical sense, it would leave out that tremble of philosophical insight that we associate with beauty, and would ignore the beauty that we find in nature and in the laws of science. It is not enough, from an evolutionary point of view, that individuals within a species should be endowed with a species-specific sense of beauty related to co-operation and sexual selection, even if the selection favors big brains, sensitivity, and artistic grace. The whole species must benefit from possessing a sense of beauty. This could only be the case if beauty is a real characteristic of the universe, one that it would be useful--adaptive--to know. How might this be?

What I want to suggest is that the experience of beauty is a recognition of the deepest tendency or theme of the universe as a whole. This may seem a very strange thing to say; but there is a gathering movement across many of the sciences that indicates that the universe does have a deep theme or tendency, a leitmotif which we can begin very tentatively to describe, if not fully understand.

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Let us play with an idea of Kant's and see where we get if we treat the esthetic as something analogous to perception. Imagine dropping a rock on the floor. The rock reacts by bouncing and by making a noise, and perhaps undergoes some slight internal change; we would not imagine that it felt anything approaching a sensation.

Now imagine that you drop a worm on the floor; the impact might cause it to squirm, as well as merely to bounce and to produce a sound of impact. The worm, we would say, feels a sensation; but from the worm's point of view it is not a sensation of anything in particular; the worm does not construct, with its primitive nerve ganglia, anything as complex as an external world filled with objects like floors and experimenters.

Now imagine that you drop a guinea-pig. Clearly it would react, as the rock does, and also feel sensations, as the worm does. But we would say in addition that it perceives the floor, the large dangerous animal that has just released it, and the dark place under the table where it may be safe. Perception is as much beyond sensation as sensation is beyond mere physical reaction. Perception constructs a precise, individuated world of solid objects out there, endowed with color, shape, smell, and acoustic and tactile properties. It is generous to the outside world, giving it properties it did not necessarily possess until some advanced vertebrate was able, through its marvelously parsimonious cortical world-construction system, to provide them. Perception is both more global, more holistic, than sensation--because it takes into account an entire outside world--and more exact, more particular, because it recognizes individual objects and parts of objects.

Now if you were a dancer and the creature that you dropped were a human being, a yet more astonishing capacity comes into play. One could write a novel about how the dance-partners experience this drop, this gesture. Whole detailed worlds of implication, of past and future, of interpretive frames, come into being; and the table and the dancing-floor do not lose any of the guinea-pig's reality, but instead take on richesses, subtleties, significant details, held as they are within a context both vaster and more clearly understood. What is this awareness, that is

to perception what perception is to sensation, and sensation to reaction? The answer is: esthetic experience. Esthetic experience is as much more constructive, as much more generous to the outside world, as much more holistic, and as much more exact and particularizing than ordinary perception, as ordinary perception is than mere sensation. Thus by ratios we may ascend from the known to the very essence of the knower. Esthetic perception is not a vague and touchy-feely thing relative to ordinary perception; quite the reverse. This is why, given an infinite number of theories that will logically explain the facts, scientists will sensibly always choose the most beautiful theory. For good reason: this is the way the world works.

Beauty in this view is the highest integrative level of understanding and the most comprehensive capacity for effective action. It enables us to go with, rather than against, the deepest tendency or theme of the universe, to be able to model what will happen and adapt to or change it.

But this line of investigation has clearly brought us to a question which it seems audacious to ask in this anti-metaphysical age. Let us ask it anyway: what *is* the deepest tendency or theme of the universe?

Let us make another list, a list of descriptions or characteristics of that theme or tendency. We can always adjust or change the list if we want.

1. Unity in multiplicity--the universe does seem to be one, though it is full of an enormous variety and quantity of things. Our best knowledge about its beginning, if it had one, is that everything in the universe was contracted into a single hot dense atom.

2. Complexity within simplicity: the universe is very complicated, yet it was generated by very simple physical laws, like the laws of thermodynamics.

3. Generativeness and creativity: the universe generates a new moment every moment, and each moment has

genuine novelties. Its tendency or theme is that it should not just stop. As it cooled, it produced all the laws of chemistry, all the new species of animals and plants, and finally ourselves and our history.

4. Rhythmicity: the universe can be described as a gigantic, self-nested scale of vibrations, from the highest-frequency particles, which oscillate with an energy of ten million trillion giga-electron volts, to the slowest conceivable frequency (or deepest of all notes), which vibrates over a period sufficient for a single wave to cross the entire universe and return. Out of these vibrations, often in the most delicate and elaborate mixtures or harmonies of tone, everything is made.

5. Symmetry: shapes and forms are repeated or mirrored in all physical structures, whether at the subatomic, the atomic, the crystalline, the chemical, the biological, or the anthropological levels of reality. And the more complex and delicate the symmetry, the more opportunities it presents for symmetry-breaking, the readjustment of the system toward a new equilibrium, and thus adaptation toward even more comprehensive symmetries.

6. Hierarchical organization: big pieces of the universe contain, control, and depend on smaller pieces, and smaller pieces smaller pieces still, and so on.

7. Self-similarity: related to the hierarchical property is a marvelous property now being investigated by chaos theorists and fractal mathematicians: the smaller parts of the universe often resemble in shape and structure the larger parts of which they are components, and those larger parts in turn resemble the still larger systems that contain them.

Like Dante's Divine Comedy, in which the three-line stanza of its microcosm is echoed in the trinitarian theology of its middle-level organization and in the tripartite structure of the whole poem, so the universe tends to echo its themes at different scales, but with variations and interferences that give life to the whole. If you look at the branches of a tree you can see how the length of a twig stands in a similar--but not quite the same--relation to the

length of the small branches as the small branches stand to the large branches, and the large branches to the trunk. You can find this pattern in all kinds of phenomena--electrical discharges, frost-flowers, the annual patterns of rise and decline in competing animal populations, stock market fluctuations, weather formations and clouds, the bronchi of the lungs, corals, turbulent waters, and so on. And this harmonious yet dynamic relation of small to large is *beautiful* .

Now these descriptions would be immediately recognized by scientists in many fields as belonging to feedback processes and the structures that are generated by them. *The fundamental tendency or theme of the universe, in short, is reflexivity or feedback.* We are beginning to understand more and more clearly that the universe is a phenomenon of turbulence, the result of a nested set of feedback processes. Hence it is dynamic and open-ended: open-ended, moreover, precisely in and because of its continual attempt to come to closure, to fall to a stop. Moreover, as with any dynamic nonlinear open feedback process, the universe continually generates new frames and dimensions, new rules and constraints, and its future states are too complicated to be calculated by any conceivable computer made out of the universe as it is. It is retrodictable but not predictable, like a good--a beautiful--story.

The process of evolution itself is a prime example of a generative feedback process. Variation, selection, and heredity constitute a cycle, which when repeated over and over again produces out of this very simple algorithm the most extraordinarily complex and beautiful lifeforms. Variation is the novelty generator; selection is a set of alterable survival rules to choose out certain products of the novelty generator. And heredity, the conservative ratchet, preserves what is gained.

But evolution is only one of a class of processes that are characterized by various researchers in various ways: nonlinear, chaotic, dissipative, self-organizing. All such processes produce patterns with the familiar characteristics of branchiness, hierarchy, self-similarity, generativeness, unpredictability, and self-inclusiveness. To look at, they are like the lacy strands of sand and mud that Thoreau observed coming out of a melting sandbank

in *Walden*; they are filled with lovely leafdesigns, acanthus, chicory, ferns or ivies; or like Jacquard paisleys, the feathers of peacocks, the body-paint or tattoo designs of Maoris or Melanesians, the complexity of a great wine, the curlicues of Hiroshige seafoam or Haida ornamentation or seahorses or Mozart melodies.

The iterative feedback principle which is at the heart of all these processes is the deep theme or tendency of all of nature--nature, the creator of forms. It is the logos and eros of nature; and it is what we feel and intuit when we recognize beauty. Our own evolution is at the same time an example of the principle at work, the source of our capacity to perceive it in beautiful things, the guarantee of its validity (if it were not valid we would not have survived), and the origin of a reflective consciousness that can take the process into new depths of self-awareness and self-reference. As the most complex and reflexive product of the process that we know of in the universe, we are, I believe, charged with its continuance; and the way that we continue it is art.

If beauty is a real property of things and, though fertile of free and unpredictable developments, rooted in the physical universe, then the whole body of contemporary critical theory and practice is deeply in error and should be revised. The postmodern avant garde founds its criticism upon the principle that beauty is a socially or individually constructed illusion that can be reduced to the glamor of economic interest and mimetic desire, the sadistic shudder of power, and the sickly *jouissance* of repressed sex. Out of these assumptions have come the radical forms of environmentalist, feminist and multiculturalist criticism. These ideologies, however, could only begin to flourish once the meanings and values of literature and the other arts had been discredited. The critical movement known as deconstruction was the agent of that discrediting. Having dissected the living body of the cultural tradition, deconstruction left a vacuum where its central content had been; and into that vacuum rushed the enthusiasms of political reduction.

A vital criticism is essential to a vital art; thus in the hopeful rebuilding of our culture that I propose, a new system of critical theory is essential. What must that theory do to be successful? One way of answering this question is in terms of healing: the rejoining of broken wholes, the reuniting of false dichotomies, the bringing

together of cultural energies vitiated by their division. Our theory, then, must rejoin artist with public, beauty with morality, high art with low, art with craft, passion with intelligence, art with science, and past with future.

But before we can begin any new project in critical theory it will be necessary to correct certain central and crucial mistakes in postmodern linguistic philosophy and semiotics--and thus to restore a view of language itself in which meaning is possible. The core mistake, from which grow the simplifications of Derrida and all the sad reductions of contemporary political reading, concerns the problem of reference and representation. In a way the issue is really the peculiar reflexiveness of the prefix "re" in these words. To what does "refer" refer? What can a representation represent except the absence of what is represented? A whole tradition, running from Kant to Mach to Wittgenstein to Derrida, questioned the meaning of meaning and the value of value. Kant envisioned the categories of perception as standing between us and the thing in itself. Mach questioned the reality of scientific "abstractions" such as the atom. (What would he have made of contemporary tunnelling-electron photographs of atoms?). Wittgenstein pointed out, with the brilliance of obviousness, that we must be silent about that of which we cannot speak--the limits of our language being the limits of our world. (But of course in saying this Wittgenstein is, precisely, speaking about that of which we cannot speak, so that it is not unspeakable any more.)

Derrida generalizes the problem of reference to all words, since all words tacitly claim to be referring, and thus all words deconstruct themselves, confess their necessary difference from, and deferral of delivery upon, the meaning that they claim. Wittgenstein had pointed out that the whole (speakable) world was apportioned among our various language-games; Derrida extends this idea, both into a radical scepticism about any natural forerunner of those games, and into a critique of any text for its slippage between those games, its inability to maintain its purity as belonging to one or another. Derrida is all very ingenious, but it becomes clear, when his own smokescreen of language is blown away, that this emperor has no clothes. For all he is saying, after all, is that a word is not the same thing as what it refers to. The "new clothes" show up as nonexistent the moment we reflect that perhaps words never claimed to be the same thing as what they referred to, but that they might very well be related in very solid ways with their referents, for instance as whole to part, as pattern to element, as harmonic to

tone or wave, as enactment to intention (as Wittgenstein hinted) or as container to contained. Nor need we be intimidated by the multifariousness of meaning-strategies. Wittgenstein's idea of language as a toolbox, containing many different ways of meaning, is instructive here; but we do not need to infer from his idea, as have many critics of meaning, that there is no such thing as meaning. Rather, we might seek out a semantic theory which identifies various ways of meaning within a larger evolutionary picture, as species with common roots within a shared ecosystem of signification: and this would be the beginnings of an ecopoetics. The toolbox, after all, is a toolbox.

Derrida insists on breaking language down to its elements--what he calls "morceaux" or "traces"--and, like a physicist who has discovered the indeterminacy of a subatomic particle, proclaims that those elements cannot be pinned down in a precise way. But the conclusion he draws from this truth is faulty, and reveals a reductiveness he inherits, as have so many cultural critics of our century, from outdated Victorian philosophy of science: that because the parts of a text are indeterminate, the whole must be also; and that because a text *can be* broken down, it *is* only a mass of fugitive and disseminated fragments. The very analogy of the quantum scientist and the indeterminate particle gives the game away: for an ensemble of those particles can generate robust harmonics that have all the solidity, durability, and efficacy of traditional matter. As Wittgenstein said, a distinction that makes no difference is no distinction. If it looks like a duck, and quacks like a duck--if it weighs like matter and bounces like matter--if it reads like a coherent text and means like a coherent text--then it is a duck, a piece of matter, a meaningful text. If it fails to pass some test of its elements, some criterion of direct linkage with ultimate being, that Derrida believes would qualify it to be what he thinks it claims to be, that is Derrida's problem. Derrida should not let his anger at an absolute transcendent divine being for not existing defile the rather promising, if amateurish, achievements of this actual evolving universe in the pursuit of being and meaningfulness.

What would an evolutionary theory of value and meaning look like? Value evolved slowly in the universe, increasing with each access of reflexivity and level of feedback, complex entities conferring value upon each other and upon the less complex by sensitively registering their presence, perceiving, eating, mating with, desiring, or

loving them; and conferring value upon themselves by their increasingly intentional and planned attempts to survive and reproduce. More intense and more universal values evolved with increasing ecological interdependence, whether among whole populations of species or in those fantastically complex and swiftly-evolving inner ecologies, the nervous systems of higher animals. Human beings represent the most elaborated and reflexive stage of this process that we are aware of.

Given this view of the universe, various candidates for a good definition of such terms as meaning, reference, representation, and value emerge without strain.

It is clear that a word occupies the last and most temporally complex milieu in the evolutionary series I have described--the human--and that later and more advanced milieux embrace and include earlier ones, though with all the tragic strains and paradoxes and existential tensions they have accrued in the process. Thus we could well define the relationship of reference or representation, for the kind of word that refers to a non-human object, as constituting one of containment or inclusion--even if the containment is not entirely successful and the inclusion is procrustean in the ways characteristic of a temporal universe. The fact that the operation of reference or meaning is not always successful--Priestley's word "phlogiston" is much less good at including and exemplifying its chemical ancestors than the word "oxygen" that supplanted it--does not mean that the operation itself is intellectually incoherent or so compromised by internal contradiction as to be infinitely deconstructable.

In this analysis we will find again and again that the claims of the poststructuralists, exciting and apocalyptic as they sound at first, are really rather wild and hysterical--perhaps because they originated in the overheated atmosphere of denied shame, opportunistic ambition, and intellectual and sexual display that was characteristic of postwar Paris. It is only if utterly unrealistic claims of perfection are attributed to human language that words will fail the test of referring, fairly reliably, to a real world in which they themselves have an existence no less real. We should not allow ourselves to be confused by the relationship of containment, as humanistic intellectuals often are. Local indeterminacy can coexist in a perfectly rational way with global coherence; and the

fact that an element of something--a discourse, a text, a society, a human body, a world--requires a context should not be cause of astonishment or skepticism about their reality. They themselves help to create their context, and contexts are the more robust and substantial, the more inclusive they are. Nor should this idea lead us to conclude that society alone, being the "largest" context, has the exclusive power to construct reality. For society, as we have seen, only imperfectly contains its individual members; and it is not, in any case, the largest context, since it itself exists, as the environmentalists remind us, within a much larger context of natural history and ecology. Society will only come to include that context to the extent that we come to understand the universe through science--so that larger parts of nature get the vote, so to speak--and to the extent that scientific knowledge really becomes disseminated through the population, including its scientifically-illiterate cultural critics.

We can picture the relationship of containment that is proposed here for certain kinds of signification, in terms of those remarkable fractal images that are now being generated by the iterative self-including algorithms of the new mathematicians. A word is like the radiant snowman of the Mandelbrot Set, the flying scud of the logistical equation, the twisted butterfly of the Lorenz attractor--which, when blown up to show its inner detail, reveals miniature, simpler versions of itself at an infinite variety of scales. A word's meaning is the inner structure of a highly complex feedback system involving a human nervous system and some part of the rest of the physical universe.

Meaning is the relationship of strange attractors to the physical processes in which they inhere. Any nonlinear dynamical system, when triggered by a stimulus, will generate a sequence of unpredictable events, but those events will nevertheless be limited to their attractor, and further iteration will fill out the attractor in more and more detail. The brain itself holds memories in the form of such attractors, the dynamical feedback system in this case being circuits of Hebb cells. Thus we can picture the relationship of a word to its meaning as the relationship of a given trigger to the attractor that is traced out by the feedback process it initiates. When the word "refers" to a perceived object--say, a smell or a sight--that object is one which can trigger a subset of the full attractor, as a Julia Set is a subset of the Mandelbrot Set. Thus a single word can trigger a "meaning-attractor," sections of

whose fine detail can also be triggered by various sensory stimuli. This description rather nicely matches with our Proustian experience of connotation and poetic evocation, and with the logical form of generalization. It accords with the results of linguistic experiments concerning the relative strength by which a given example--say, a duck, an ostrich, or a sparrow--is recognized by a speaker as belonging to the meaning of a word ("bird"). It also explains the difference between ideas and impressions, that exercised the philosophical imaginations of Locke and Hume: the richly-detailed subset evoked by the sight of an object would certainly make the general sketch of the whole set evoked by the word look somewhat pale by comparison.

Since the trigger--whether the word or the sensory stimulus--is itself part of the feedback system, it is encompassed by its description, which is the attractor proper to it when it is allowed to iterate its effects upon a complex neural network. Thus the represented, the representation, and the experiencer of the representation are all part of the same physical system. The usual critique of physical descriptions of representation--for instance, John Searle's Chinese Room analogy for artificial intelligence--is that however a given object is represented inside the physical system, it requires a smaller system inside the system to see it and know it, or, as John Eccles believes, a detachable non-physical soul. The chaotic-attractor theory of meaning holds out the promise of an intelligible physical description of meaning that does not require an inner homunculus or the intervention of a metaphysical *deus ex machina*, with further attendant problems of infinite regress--how does the god in the machine perceive and know the representation?--to make it work. One way of putting this is that the issue of reflexiveness, of self-reference or self-inclusion, has been transferred from the metaphysical level where it can only be interpreted as a barren infinite regress or *reductio ad absurdum*, to the physical realm where it can be studied as we study turbulences of other kinds, with their own emergent properties and self-generated orderliness. The reflexiveness, we feel intuitively, should be there in any account of meaning; the trick is to keep it from messing up our own thinking about it, and place it where it belongs, in the operation of the brain itself!

It remains to suggest how this "attractor theory" of signification might work itself out in the etymological history of a language, and express itself in terms of phonology, morphology, and metaphor. Here the idea of sacrificial

commutation may be of use. Every sacrifice was an expiation of the crime of a previous sacrifice, though with the penalty commuted, refined, and abstracted. Sacrifice itself is necessary in order to render the shame of our condition as evolved and self-reflexive animals over into the epiphany of beauty. It is related to the whole history of the universe as a cumulative and nested set of contradictions solved at each higher level at the cost of new, emergent contradictions. Those existential tensions express themselves at the physical level in the turbulences and bifurcations of nonlinear dynamical systems, and at the psychological level as shame, the fear of death, and beauty. The commutative history of sacrifice recapitulates this recursive and tragic process. I suggest that human signification itself might have developed through the commutation of sacrificial cost.

In other words, the social and cultural dimension of language, like the neurosensory dimension, has the form of a nonlinear dynamical system with strange attractors pulling it toward certain "archetypal" forms. Those forms could be seen in the odd "targetedness" of the great sound-shifts that periodically convulse a language; they can also be observed in the way that metaphorization will take parallel paths in different languages, so that when a colorful idiom from another language is presented to us, we can almost always find an equivalent in our own. Thus the words "spirit" in English and "Atman" in Sanskrit have identical metaphoric histories, as do the words "kind," "nature," and "genus," all of which came together again in English, having led separate lives in Germanic, Latin, Greek, and other tongues for thousands of years since their original common root in Indo-European. Metaphorization and sound-changes are every new human generation's way of committing a sacrificial impiety against the tongue of its ancestors, an impiety that commutatively atones for the crime of the ancestors themselves in similarly appropriating the language for themselves from their own mothers and fathers. And since meaning dies the moment it ceases to cut slightly against all previous usage--another valuable if over-emphasized and not entirely original contribution of Deconstruction--it is *constituted* by this continual low-level feedback between the language and the world it contains.

Such might be the rudiments of a new, evolutionary poetics and a new nonlinear theory of meaning and representation. Obviously I have only scratched the surface here; the point is that we do not need to sit helplessly

in the morass of late poststructuralist despair and misologism, and that there are still worlds for the literary humanities to conquer.

And there are practical implications of this model of meaning. (By now such phrases as "model of meaning," with their invitations to further reflexive iteration, should hold no terrors for us, since we hold a clue to the labyrinth, a clue whose own windings are equal to the windings of that dark place we would discover.) One implication is that many of the characteristics of the relationship of word and meaning are already present in the relationship between a percept and the experience of it. If a sense-perception can generate a sort of "Julia Set" in the firing-circuits of brain neurons, then in a way a sense perception is like a word. That is, we share with other higher animals the elements of a sensory language which preexisted the more encompassing kind of language that uses words. Or we could put it the other way around, and say that language is just a larger kind of sensing, using internal triggers to evoke larger attractor-sets than any percept could. Obviously we have here a further reason for exploring our relationship with our animal friends: it is a way of understanding the fundamentals of our own language, of discovering that ur-language we share with other parts of nature than ourselves. One huge advantage of that ur-language is that it is not riven by the linguistic boundaries that divide the more fully human languages like English and French from each other; and if we learn to speak it better, we may find more common ground with cultural Others as well as with biological Others.

In one sense, of course, we already possess such ur-languages, in the shared imagery of the visual arts and in the "universal language" of music. But the theory of meaning proposed here suggests that there is something analogous to music and visual imagery that underlies language itself, obscured by its more recent evolutionary achievements, to be neglected only at the cost of a vitiation and greying of our expression and understanding. I came to this conclusion by an entirely different route a few years ago, while translating the poetry of Miklos Radnoti with my colleague Zsuzsanna Ozsvath. Suffice it to say here that poetic meter turns out to be a sure road to the ur-language, or to change the metaphor, meter is the lyre or golden bough or magic flute that enables us to enter the underworld of that language and to return with intelligible gifts for the community. Meter, like music

and visual imagery, is an ancient psychic technology by which human nature and human culture are bridged; appropriately, and as we might imagine from our discussion of the fractal harmonics of Hebb-cell circuitry, meter is a rhythmic and harmonic system in itself, a way of inducing the wave functions of the brain. The lyre through which Rilke traces Orpheus in the *Sonnets to Orpheus* is the poetic form of the sonnet itself.

If the words of a poet can induce in one brain the same strange attractor that they proceeded from in the poet's brain, an extraordinary possibility presents itself. This possibility is that when those harmonics are in our heads we are actually sharing the thoughts, and indeed the subjectivity, of the poet, even if he or she is dead. The poet lives again when his or her attractors arise in another brain. Poetry, then, is a kind of artificial intelligence program, that springs into being when booted correctly into any good human meat-computer. Thus poetry is indeed a journey to the land of the dead. This view of reading is profoundly different from that of deconstruction and reader-response theory, as the reader of this can surely see!

We need a new kind of poetics, which we might call eco-poetics. The word is, I believe, the coinage of the scholar and literary biographer Tim Redman, who applies it primarily in the economic sense of "eco"; I believe it is a valuable term and can be expanded to cover some important new ground. Though this approach applies to all the arts, I shall specifically address literature. Essentially I am calling for the abandonment of a good part of the present activities of the literary academy, and the beginning of a new literature, a new poetics, and a new criticism based upon the evolving universe and our own leading part in it.