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Against biopoetics: on the use and misuse of the concept of evolution in contemporary literary theory

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AGAINST BIOPOETICS: ON THE USE AND MISUSE OF THE CONCEPT OF EVOLUTION IN CONTEMPORARY LITERARY THEORY

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Abstract

This dissertation is a critical assessment of “biopoetics”: a new literary theory that attempts to import ideas from evolutionary science to the study of literature. Borrowing from the field of evolutionary psychology, the biopoeticists argue that some literary forms and themes are particularly valuable because they result from our innate and evolved cognitive structure; they also attempt to create a normative aesthetic from the idea that evolution is progressive. In its first half, this study examines the claims of evolutionary psychology and their application by the biopoeticists; in the second half, it examines the idea that evolution is progressive, and considers the implications this may have for literary theory. In its conclusion, this work argues that biopoetics, conceived from a dissatisfaction with other contemporary literary theories--and in particular with such theories’ politicization of literature--is more dubious in its assumptions and reasoning, and more programmatically political, than the approaches that it seeks to replace.

Introduction

A new methodology is gaining ground in literary studies--one that challenges the politicization of literature and the denigration of beauty that the dominant interpretive schools have been preaching for years. This methodology aims at finding the truth about literary works through an understanding of science, and developing an aesthetics that recognizes that beauty transcends politics.

Specifically, this new methodology calls for an integration of literary studies with an understanding of evolutionary science--particularly with the implications of that science for human nature (humans *have* a pre-social nature) and for an aesthetics that recognizes human nature. Such a methodology also recognizes that contrary to a fashionable pessimism, life, and the universe as a whole, is inexorably evolving towards higher forms--and encourages an aesthetics that celebrates as well as emulates such evolutionary progress.

This methodology is proposed by the leaders of a growing movement called “biopoetics.” Given its name by Brett Cooke, the co-editor of an anthology of work within this new paradigm, this movement consists of humanities scholars working within what they call the “evolutionary model”--a model that principally calls for making

connections between the developing field of evolutionary psychology (previously known as human sociobiology) and the study of literature, but that also, for some of these scholars, calls for a recognition of the supposedly progressive nature of evolution. In the pages that follow, I hope to provide a thorough explanation and critique of the biopoeticists' paradigm and of the scientific assumptions behind it.

The biopoetics movement is small, but growing. Humanities study in the academy, always troubled by the necessity of proving its relevance, is particularly vulnerable in lean times. In the current atmosphere in the United States of shrinking budgets and departments, more than ever there is a pressure to make work in the humanities appear more systematic and scientific. Biopoetics (a movement whose members are almost exclusively based in the US) proposes that the systematic study of literature can lead to objective knowledge--about texts and about human nature. Surely such a view of the role of literary study would be attractive to parents paying tuition and state legislatures voting on funding.

Moreover, as evolutionary-psychological explanations become more popular in the broader culture (explaining everything from why men rape to why women earn less than men) and as an increasingly economically stratified society

calls for more sophisticated ideologies to legitimate the depredations of global capitalism, the opportunities for growth of a critical theory and aesthetic that assumes that gender differences are innate and preaches that “progress” is the good, the true and the beautiful are tremendous.

The attempt to root aesthetics in human nature is hardly a new one, but the modern movement to explain presumably innate human behavioral tendencies as adaptive responses to conditions in the ancestral environment can be traced to the publication of E.O. Wilson's *Sociobiology* in 1975, which applied new theories from evolutionary biology--particularly the notion of “inclusive fitness”--to the study of animal (including human) behavior. To understand the work of the biopoeticists, we must understand the science upon which it is based.

Human sociobiology (which was roundly criticized for its political implications) has re-emerged in recent years as “evolutionary psychology.” It is this field that the biopoeticists embrace. The claims of evolutionary psychology have been popularized in recent years by books with titles like *The Moral Animal* and *The Mating Mind*. Although such books claim to synthesize and popularize solid empirical research, their approach is generally this: identify some apparently universal human tendency, then speculate as to what adaptive advantage such a trait might have held in the

ancestral environment. The classic example of this is the fact that in virtually every culture, men are more promiscuous than women. The evolutionary-psychological explanation: the strategies for men and women to get the most children into the next generation are radically different. The best way for a man to guarantee many offspring is to impregnate many women, while the best policy for a woman, whose eggs (and possible time devoted to pregnancy) are limited, is to find a mate to stick around and help raise her offspring. Therefore we are all the descendants of promiscuous men and nesting women, and share their tendencies.

The critiques of evolutionary psychology are many, but in the following pages I will focus on two: evolutionary psychology (like the larger field of what Stephen Jay Gould calls "Darwinian fundamentalism") assumes that every inherited trait is adaptive, and it is too quick to identify as innate human tendencies which can be more parsimoniously explained as cultural products.

We must come to terms with such criticisms if we are to evaluate the attempts of the biopoeticists to apply evolutionary psychology to the study of literature. Such attempts range from the speculations that innate tendencies like male promiscuity and incest avoidance can be used to gauge the "universality" of a work of literature's themes to

more grounded research (actually closer to cognitive science than to evolutionary psychology) into the consequences for artistic form of the limitations of human memory and pattern recognition.

The success or failure of most of these attempts depends to a great degree on the persuasiveness of the evolutionary-psychological model, so I will spend a great deal of time addressing specific critiques of evolutionary psychology. Since much of the work of evolutionary psychologists is avowedly speculative and cutting-edge (part of Richard Lewontin’s critique is that evolutionary psychology is so speculative as to not be science at all), I will examine the definition of science, as well as consider arguments as to whether highly speculative "science" with possibly pernicious consequences should be practiced at all.

The criticisms of evolutionary psychology put its status as a science into serious question. It has not, however, been completely discredited, and it could in fact grow into a more mature science. So we must consider this: independent of the cogency of evolutionary-psychological arguments, what are the consequences for criticism and theory of the idea of evolved and innate human behavioral tendencies? The biopoeticists seem to think that quite a lot turns on this idea; I will argue that rather little does, unless one embraces the idea (rejected by mainstream

evolutionary psychology) that "innate" means "good." Biopoetics ultimately represents an attempt, rooted in highly speculative science and elaborated in a desperate and often vague way, to rescue aesthetics from politics. If there is no innate sense of beauty, say the biopoeticists, then beauty (and art) is whatever people say it is. Art becomes ideology, as the biopoeticists' enemies--Marxists, feminists, and the like--claim.

In addition to the idea that evolutionary psychology can provide some insight into the nature of literature and the value of individual works, some of the most prominent biopoeticists attempt to derive an aesthetics from their belief that evolution is progressive.

Despite Darwin's caveats, many persist in reading "fittest" in “survival of the fittest” to mean something like "absolute fitness"--that is, that organisms aren't just "fit" in the sense of adapted to their environment, but show some general increase in complexity or quality. (This despite the fact that algae are the modal organism on the planet.) The notion of evolution as progress, as a ladder with man (so far) at the top has been used to underwrite a number of political programs--among them the smarter versions, such as Herbert Spencer's, of Social Darwinism--and it is seeing a resurgence as an ideological

justification for the libertarianism of the new technological overclass.

The biopoeticists subscribe to this notion of progress, and explain such progress through appeals to controversial findings from the field of complexity studies. From such findings they assert not only that life and the cosmos are evolving into “higher” forms, but that it should be so, and that we should actively encourage or accelerate this evolution. They also attempt to directly construct a theory of beauty from complexity studies.

Frederick Turner, a prominent theorist of the biopoetics movement (and co-editor of the *Biopoetics* anthology), has written a book-length epic poem, *Genesis*, about the terraforming (“making Earth-like”) of Mars. In this work Turner presents an ethos of progress that he has partially presented in nonfiction works: it is man's obligation, as the most complex life form on earth, to encourage the universe's tendency toward higher forms. One important way of doing this is by bringing life to lifeless planets like Mars. And the most effective way of doing *this* is through unbridled capitalism.

As with evolutionary psychology, the ethic of evolution as progress operates, through a dubious scientific claim and an even more dubious application of that claim, to forestall political debate. It will not, however, be my primary goal

in the following pages to evaluate the political implications of the biopoeticist paradigm--although those consequences will probably strike most readers as pernicious.

Why, then, is this still-inchoate movement deserving of such attention? Although membership in this movement is still small, as I indicated earlier, this approach to literature is poised to become very influential, both within the academy and in popular culture. *Lingua Franca* has published a cover story on evolutionary-psychological approaches to the arts, and *Reason* magazine, the foremost US journal of libertarian politics--and favorite reading, after *Wired* magazine, of techno-elites everywhere--seems to have adopted biopoetics as the official aesthetic theory of smart libertarians.

Yet, as we shall see, many of the basic assumptions of this approach are highly questionable, and the reasoning is often shoddy. Because biopoetics is an *emerging* paradigm, we might expect it to be somewhat internally incoherent, or for there to be disagreements about empirical evidence supporting its claims; more than this, though, biopoetics is false to its own stated mandate: characterizing contemporary theory as scientifically illiterate and poorly reasoned, the biopoeticists embrace claims that most scientists (even those whose theories they enlist to support their arguments)

reject, and their reasoning is poor by almost any academic standard--but particularly feeble when compared to the rigor of, for example, the work of Jacques Derrida, the biopoeticists' frequent target of condemnation.

Moreover, decrying the politicization of literature and criticism by contemporary theory, the biopoeticists ultimately argue for an aesthetics and critical theory that is based more crudely on a political vision than the least sophisticated feminist or Marxist criticism.

The rapidly growing field of biopoetics cries out for criticism, then, not only because of its political implications--and its status as a reflection of the dominant ideology of the late-capitalist US--but because it is, to put it simply, bad theorizing. Its claims to have discovered the truth about literature are ludicrous; its criticism and theorizing can be "interesting," but interesting in the way that a literary theory based on Aristotelian physics might be, or the literary theory of Hippolyte Taine is. (In fact, one biopoeticist, Joseph Carroll, highly praises Taine's work as a precursor to biopoetics, particularly his use of "race"--the innate differences between peoples in body and temperament--as an explanatory factor in his discussion of literature. Most evolutionary biologists and psychologists, on the other hand, believe that the category of race is a useless explanatory concept.)

If all that one desires of one’s critical theory is that it be interesting, rather than truth-seeking--and assuming one finds this sort of “scientific” criticism interesting--one might find biopoetics to be a fine critical theory. For me, its questionable fundamental assumptions and logical incoherence make biopoeticist work a failure even as interesting fiction--I cannot suspend my disbelief.

Ultimately, this is why I believe biopoetics is deserving of criticism. I prefer that my critical theory both instruct and delight; biopoetics does neither. That this sort of thing might become popular--that one might have to reckon with this nonsense in writing, in class, or in conversation--is a real possibility, one that I do not view with pleasure.

Therefore the following: an attempt to take biopoetics and its scientific assumptions seriously, an attempt to salvage what is useful from its critical framework, an attempt to challenge biopoetics on its own ground, dealing fairly with its most cogent arguments and most persuasive theorists.

Part I: Evolutionary Psychology and Literary Theory

The Model

Darwin's most important insight was suggested by Thomas Malthus's observation that the human population will always grow at a faster rate than available resources: differential reproduction. Animals will differ in the number of their offspring that will survive into the next generation. Since animals differ, however subtly, in a variety of ways (size, hairiness, color), hereditary traits that enhance an animal's ability to survive to reproductive age and to reproduce will tend to be preserved, while other traits will not. This process, in which some members of a species survive and reproduce, preserving their hereditary traits, while others do not, Darwin called "natural selection" or (in a phrase borrowed from Herbert Spencer) "survival of the fittest."

This famous phrase is somewhat misleading, because although it suggests movement towards some sort of "absolute" fitness--that is, progress--Darwin always meant fitness within an ecological niche. The phrase is actually a tautology; fitness in fact for Darwin *meant* survival into the next generation; the phrase could be translated as "survival of that which survives" or "fitness of the fittest." However, despite the confusion it generates, the term

persists, perhaps because it is so evocative of the constant struggle that Darwin saw in nature.

Natural selection (to employ the more precise phrase), operates thus: if a particular trait is advantageous--let us say hairiness in cold climes--eventually those whose ancestors were particularly hairy will come to completely dominate. If the cold-climate whatevers are reproductively isolated from the original population of whatevers, eventually they will differ genetically so much from the original population so much that they become their own species (that is, they can only reproduce with one another).

Evolutionary psychologists (and before them sociobiologists) apply this Darwinian logic to *behavior.*

The methodology works this way: some trait is observed to be virtually universal, and then an explanation for this behavior being genetically advantageous in the Environment of Evolutionary Adaptation (also known as the “ancestral environment”) is proposed. Simple enough, and not unlike the methodology used by evolutionary biologists (but, we shall see, fatally flawed).

The founding observations of evolutionary psychology were made by geneticist A.J. Bateman, and were elaborated on by biologists George Williams and Robert Trivers. Bateman’s observation, made in 1948 (from studying fruit-flies) was

that while females had the same number of offspring regardless of how many males they mated with, males had more offspring the more females they mated with. Such an arrangement, Bateman observed, would encourage “an undiscriminating eagerness in the males, and a discriminating passivity in the females” (Qtd. in Segerstrale 56).

George Williams, in his 1966 work *Adaptation and Natural Selection: A Critique of Some Current Evolutionary Thought*, restated the subject of differing male and female genetic interests as differing “sacrifices” necessary for reproduction. The male’s “essential role may end with copulation, which involves a negligible expenditure of energy and materials on his part, and only a momentary lapse of attention from matters of direct concern to his safety and well-being” (183). Males benefit (that is, they get their genes into the next generation most successfully) by having “an aggressive and immediate willingness to mate with as many females as may be available” (184).

For females, however, “copulation may mean a commitment to a prolonged burden, in both the mechanical and physiological sense, and its many attendant stresses and dangers” (184). It is therefore in the interests of her genes to reproduce only in particularly good circumstances--

and one of those circumstances is a particularly fit inseminating male. These differing needs and strategies lead to courtship: males attempt to present themselves as highly fit whether they are or not--and females show discrimination (184).

Robin Trivers, with his 1972 paper “Parental Investment and Sexual Selection,” replaced Williams’s language of “sacrifice” with one of “investment.” “Sperm is cheap; eggs are expensive” would soon come to be the mantra of sociobiologists everywhere, the assumption being that virtually all observable differences in behavior between males and females are rooted in reproductive “strategies” resulting from this biological difference.

It was these observations, and their consequences, that E.O. Wilson popularized in his books *Sociobiology* (1975) and *On Human Nature* (1978). These works, although proposing few new ideas, were an extraordinarily thorough synthesis that influenced research in a number of fields, as well as provoking a formidable backlash. Wilson's primary contribution in this work was to apply ideas from evolutionary biology--particularly the notions of "kin selection" and "inclusive fitness" (the notion that the gene, rather than the individual or the group, is the primary unit of selection, and that, therefore, traits

unfavorable to the individual can persist into the next generation if the survival of close relatives is enhanced--in the world of behavior we call such traits "altruistic") to animal behavior. While Wilson's speculations about the evolution of altruistic behavior among ants were well considered and persuasive to many (Wilson was, and still is, a renowned naturalist and entomologist), his final chapter, on human behavior, was not quite so readily accepted.

“Kin selection” and “inclusive fitness” are terms introduced by biologist William Hamilton in the early 1960s, and they are at the center of the new “selfish gene” model embraced by Wilson and Richard Dawkins (in his famous popularization, *The Selfish Gene*). What Hamilton proposed was that the most important unit of selection for natural selection to operate on was the *gene*, rather than the individual organism (as Darwin argued) or on the group or species as a whole (as some people were beginning to argue before the notion of gene selection was introduced, but which was never well explained as a mechanism). Hamilton’s elegant theory, introduced to explain “selfless” or altruistic behavior among some animals, was that if certain behaviors contributed to the well-being and reproductive success of one’s kin (that is, those who share a great deal of one’s genes), then it is sometimes beneficial to the

organism to engage in behaviors that might seem “selfless” but in fact serve to get one’s genes into the next generation.

Biologist J.B.S. Haldane is said to have lampooned this kind of logic by remarking that he would never give his life for his brother, but would give it for “two brothers or eight cousins” (Segerstrale 63), but it does seem to explain some sorts of animal behavior--in particular, the behavior of ants and bees, the selflessness of which was a question that Darwin himself was unable to solve. Hamilton’s theory predicts that the higher the degree of relatedness between organisms, the more selfless behavior will be observed. Ants and bees do all sorts of things that are completely selfless from the organism’s viewpoint.

Despite devastating critiques by scientists such Stephen Jay Gould and Richard Lewontin and philosophers such as Philip Kitcher, as well as general disapproval from the left of the political consequences of sociobiological speculation about innate *human* tendencies, human sociobiological research continued, to emerge in recent years as "evolutionary psychology."

The scientific and political critiques were often intertwined, but (as we shall see in the next section) not always: Wilson was accused of racism despite the fact that he

approvingly cited data and conclusions *from Lewontin* indicating that "race" was not a useful explanatory concept in biology. Wilson was less often accused of sexism, despite the fact that his strongest conclusions touched on innate gender differences in behavior.

In a nice bit of sleight-of-hand, the evolutionary psychologists distinguish themselves from the sociobiologists by claiming that while the sociobiologists identified innate tendencies and said they were therefore *good*, evolutionary psychology allows that traits that might have been adaptive in the ancestral environment may no longer be useful. While some figures in sociobiology might have made the former claim, such was surely not the claim of Wilson and the other principal figures in sociobiology. The evolutionary psychologists have focused on an at most marginal tenet of sociobiology as its major flaw, making their own field, which is identical to human sociobiology in nearly every respect, seem corrected.

This debate aside, what are the implications of the ideas of inclusive fitness and evolved psychological “traits” as applied to human beings, in either sociobiology or evolutionary psychology? As we shall see, many evolutionary-psychological explanations are origin stories explaining well-documented phenomena from cognitive science-

-such as why humans are better at remembering faces than remembering names. The more revolutionary work of evolutionary psychology is in its arguments about the innateness and evolutionary origin of more complicated behaviors. One of the first, and now one of the most central, “findings” of evolutionary psychology was in the area of sex and gender.

As Wright sums up the argument in *The Moral Animal*, if we merely accept that natural selection implies a fitness benefit from relative choosiness in women, that such choosiness is virtually culturally universal, and that cultural theories cannot explain these differences as parsimoniously, we must accept that gender differences (at least in regard to mating behavior) are at least partially innate (46-48).

This theory, probably the most uncontroversial (within the field; it’s certainly politically explosive) and most touted of evolutionary psychology’s “findings,” obviously has profound social implications, some of them quite disturbing. For example, in their 2000 book *A Natural History of Rape: The Bases of Sexual Coercion,* evolutionary psychologists Craig Palmer and Randy Thornhill argue that the phenomenon of rape is a direct consequence of these differential reproductive strategies: men may be predisposed to rape because if they are facing complete

reproductive failure, or simply because of their predisposition to want to have intercourse with as wide a variety of women as possible.

Because of men's predisposition to rape, Palmer and Thornhill argue, they should be educated about this natural rape drive, the better to suppress it. Such an education, they suggest, might be a requirement for a young man's receiving his driver's license (179). The program would include instruction in the evolutionary causes of men's arousal at the mere image of a woman, as well as explanations of why men might be led to demand sex even when women don't want it, and frequently misinterpret gestures or clothing as sexual overtures (179).

Of course, this program would emphasize that despite the fact that men have an evolved tendency to rape, this natural impulse is *no excuse* for rape, and that if they comprehend and resist these impulses, they may be able to avoid committing rape (179).

Women too, should receive an education that addresses, in addition to how apparent youth is the most significant risk factor for rape, how health, symmetry, and hormone markers such as waist size, in addition to clothing and makeup that enhance apparent fertility, all contribute to the risk of rape. Not that women should be urged to look ill

and infertile--they must simply be aware of the risks involved in not looking this way (182).

Such arguments are easily lampooned, but Thornhill and Palmer's "diagnosis" of rape is exemplary of evolutionary-psychological methodology. Although there was a brief media firestorm over the book when it was first published, most of the criticism of the book revolved around its distasteful political *implications*, not around its science.

In fact, some of the foremost proponents of evolutionary psychology lined up to praise the book: Steven Pinker, perhaps the best-known and most-respected of the academic popularizers said in his blurb for the book jacket, "This is a courageous, intelligent, and eye-opening book with a noble goal--to understand and eliminate a loathsome crime. Armed with logic and copious data, *A Natural History of Rape* will force many intellectuals to decide which they value more: established dogma and ideology, or the welfare of real women in the real world." John Tooby and Leda Cosmides, editors of *The Adapted Mind*, one of the founding documents of evolutionary psychology, also defended Thornhill and Palmer's science, in a letter to *The New Republic*.

Thornhill himself was already an eminent authority in evolutionary psychology, the co-author of a well-known study--"Human Facial Attractiveness and Sexual Selection:

The Role of Symmetry and Averageness" (1994)--arguing that we have evolved to find facial symmetry attractive because in the environment of evolutionary adaptedness it was adaptive to do so. He argues that there is a transcultural standard of beauty based on this preference. This idea has been popularized in such books as Nancy Etcoff's *Survival of the Prettiest: The Science of Beauty* (2000).

Critics on *Jenny Jones* and in the pages of *Time* and *Newsweek* (both of which have run cover stories on evolutionary-psychological "proof" of innate psychological differences between men and women), by implicitly accepting the evolutionary psychology paradigm, allowed Thornhill and Palmer to take the scientific high ground, their position essentially being, "We don't like this any more than you do, but these are the facts. Given those facts, here's what we think should be done."

To halfhearted challenges like, "If rape is about reproduction, then why are so many men, children, and women obviously past reproductive age so frequently the victims of rape?" Thornhill and Palmer could respond, from the ever-shifting ground of adaptive explanation, that the mental module was about forced sex, not about discrimination among candidates for rape on the basis of suitability.

The debate over *The Natural History* of rape presented an excellent opportunity for a public discussion of the

methodology of evolutionary psychology, the insights of which have enlivened the discourse of both cocktail party bores and (as we shall see) literary critics. Such a discussion failed to emerge.

This episode is instructive not because it tars the entire enterprise of evolutionary psychology, but because it illustrates how far the evolutionary-psychological model has colonized the popular consciousness--the arguments about the *science* were fought almost exclusively in orthodox evolutionary-psychological terms--and also how quickly evolutionary-psychological explanations, *even if true*, can be used to make very questionable assertions about the role of mental "organs" in a world full of more proximate causes of emotions and behaviors.

The incident is also noteworthy because the assertions made by Thornhill and Palmer were so *un*controversial within the field. If one wished to emphasize the loathsome uses to which evolutionary psychology can be put, one would do better to emphasize the work of Kevin Macdonald, professor of evolutionary psychology at California State University at Long Beach and witness for the defense at the trial in Britain of Holocaust Revisionist David Irving. Macdonald's thesis about the Jews, set forth in a trio of works--*A People That Shall Dwell Alone: Judaism as a Group Evolutionary Strategy*; *Separation and Discontents: Toward an*

Evolutionary Theory of Anti-Semitism; and *The Culture of Critique: An Evolutionary Analysis of Jewish Involvement in Twentieth-Century Intellectual and Political Movements*--is that Judaism is basically a group evolutionary strategy to maximize intelligence. Macdonald, while not a holocaust denier himself, sees anti-Semitism, and even Nazism, as the inevitable response to this eugenics program (Shulevitz 1). Far from a fringe figure, Macdonald was, at the time of the trial, a prominent member of the Human Behavior and Evolution Society (the professional society to which most of the most prominent evolutionary psychologists in the United States belong), serving as archivist, secretary, editor of the newsletter, and member of the executive board (Shulevitz 2).

Despite the increasing appearance of such easy targets, it will not be primarily my project in the following pages to evaluate directly the political or social consequences of the arguments of evolutionary psychology. For reasons that I hope will become clear in the following section, I believe that challenging “scientific” findings because of their political consequences is not only “wrong” in the sense of “mistaken by contemporary canons of science,” but is ultimately a *rhetorically* weak strategy.

It will, rather, be my project in the following pages to evaluate the *epistemological* status of the evolutionary-

psychological enterprise, and to consider, regardless of the disagreements among scientists about the goals and accomplishments of that enterprise, the consequences of this fledgling science for the field of literary criticism and theory.

The Critique

Although evolutionary-psychological speculation may sound plausible, critics of sociobiology and evolutionary psychology maintain that this is the essence of their critique: evolutionary psychological explanations are *plausible*, but not particularly scientific. The critiques of evolutionary psychology are many, but perhaps the most elegant and complete critique was made by philosopher Philip Kitcher, in his 1985 book *Vaulting Ambition: Sociobiology and the Quest for Human Nature.*

Kitcher begins his critique with two fundamental distinctions: between “broad” and “narrow” sociobiology and between narrow sociobiology and “pop” sociobiology. Broad sociobiology, in Kitcher’s view, is the study of the biological basis of social behavior--encompassing such issues as the mechanisms, development, genetics, and function of social behavior--a program to which few reasonable people would object (114-115).

Narrow sociobiology, on the other hand, focuses exclusively on evolutionary questions: how did the behavior evolve, and why does it persist? How, in particular, do traits such as altruism, which would seem to *reduce* individual fitness, evolve? (115)

It is the insistence of evolutionary theory on assuming adaptive explanations for every aspect of an organism--and the importation of this methodology to sociobiology, in which all *behaviors* are assumed to be adaptive (which leads to the creation of pseudo-problems such as the “problem” of altruism)--to which evolutionary biologists like Stephen Jay Gould most object. Kitcher, however, has a more specific target: “pop” sociobiology.

Pop sociobiology, as Kitcher defines it, is the application of ideas about the evolution of animal behavior to the construction of theories--often quite sweeping--about human behavior and politics; such theories are most frequently addressed to a popular audience rather than to the scientific community.

But pop sociobiology, in Kitcher’s view, is practiced not only by journalistic popularizers, but also by scientists like E.O. Wilson, who may make real and compelling discoveries yet also advance grandiose and poorly grounded claims.

Although many writers have made cogent critiques of sociobiology (most notably Stephen Jay Gould and Richard Lewontin), Kitcher describes, perhaps more clearly than anyone, the logical structure of sociobiological argument.

Pop sociobiology, argues Kitcher, relies on a chain of invalid inference that he calls "Wilson's ladder." Wilson’s

ladder has four "rungs": first, it assumes that all members of a certain group would maximize their fitness in their typical environments by exhibiting a specific behavior; second, when we find a certain behavior in virtually all members of a certain group, we can conclude that this behavior became prevalent and remains so through natural selection (specifically by increasing fitness); third, since selection acts upon genetic differences, we can conclude that there are genetic differences between the current group and their ancestors who failed to reproduce; fourth, it will be difficult to modify the behavior by altering the social environment, because the behavior is either impossible to eliminate or impossible to eliminate without giving up other important goals (127).

Most of the critiques of sociobiology can be understood as attacks on one or more of these rungs--so the ladder provides a fine framework for organizing these critiques.

For Stephen Jay Gould, the leap from the first rung to the second is the crucial flaw of sociobiology--it is an unabashed endorsement of what is known as the "adaptationist" program, which Gould argues has a logical flaw at its center: the confusion of historical origin and current utility.

Much of Gould's career has been an attack on the adaptationist program--which he has recently dubbed

"Darwinian fundamentalism" (“Fundamentalism”). One of Gould's most famous discussions of the topic, and one in which he and his co-author Richard Lewontin introduced a rather arcane term into common usage, is contained in an address that he delivered to the Royal Society in 1978. "The Spandrels of San Marco and the Panglossian Paradigm: A Critique of the Adaptationist Programme." The arguments made here are central to a serious critique of sociobiology and evolutionary psychology. The adaptationist program is still the dogma of many evolutionary thinkers, and it is superficially quite convincing; it would therefore be appropriate to discuss in some detail the still somewhat controversial critique of this program.

In the “spandrels” paper, Gould and Lewontin object to the adaptationist program because of its faith that natural selection always optimizes. The adaptationist program works by breaking down the organism into unitary “traits” and imagining an adaptive story for each one. Even traits thought to be non-optimal are assumed to be the result of trade-offs with other optimized traits. Gould and Lewontin believe that the evolution of organisms can be more scientifically explained by considering organisms as integrated wholes, and by considering constraints placed on natural selection by lineages, developmental pathways, and general architecture. They fault the adaptationist program

for failing to consider the distinction between origin and current utility; for refusing to consider alternatives to adaptive stories; for accepting adaptive stories on the basis of mere plausibility; for failure to consider other causes of evolutionary change, such as random fixation of alleles, production of non-adaptive structures by developmental correlation with selected features; for not separating adaptation and selection; for not considering the possibility of multiple adaptive peaks; and for not considering current utility as an epiphenomenon of non-adaptive structures.

It is sociobiology's failure to consider alternatives to adaptive explanations to which Gould and Lewontin object; to give a simple example: suppose Wilson is right, and there are significant and nearly universal differences between male and female human behavior (of course there is great reason to suppose the measurable differences are far less than he supposes). Let us additionally suppose that such differences are proven to be completely hereditary. Gould could still object that the existence of such traits does not automatically imply adaptation: they could be a relic of our hominid ancestors, who were much more sexually dimorphic (as measurable by size) than we.

Gould and Lewontin in fact propose several alternatives to immediate adaptation for the explanation of form, function, and behavior.

There is, for example, the possibility of change occurring absent any adaptation or selection at all. This can occur due to genetic drift or population bottlenecks. Genetic drift occurs like this: say we have five green and five red lizards. Five of them are killed by accidents--a tree falling, a flood, whatever. If all of the green ones happen to be killed, the only ones left would be red, meaning a change in the gene pool. Evolution has occurred, despite the fact that there is no advantage in having red skin and there was no selection. All of the deaths are random. If this occurred in the rain forest, it would have occurred even if there were natural selection for green skin because of its utility for hiding from predators.

A population bottleneck (a special case of genetic drift) occurs when there is a reduction in the size of the population--and therefore in the gene pool of the population--and then a return to the original population size.

Particular *parts* of organism may also evolve despite an absence of adaptation or selection because they are correlated with selection of some other trait. For example, considering our red and green lizards again, let us suppose

that the gene which gives our lizards green skin also gives them immunity from a certain virus. If the virus is introduced into their environment, the red lizards might all die, while the green ones are unaffected. There would only be green lizards left, but not *because* they are green. They would remain because being green is associated with another trait that does confer selective advantage.

Another way in which a trait might evolve is that it might vary in a direct way with another trait (this is called allometry). Let us say body size and metabolism are related allometrically. In our lizards' environment, there is a selective advantage to being large. The lizards become larger over several generations; their metabolic rate increases, too, although there was no selection for an increased metabolic rate.

Sometimes, there can be a decoupling of adaptation and selection. Lewontin gives an example of one form of this--selection without adaptation--in another essay: a mutation that doubles the fecundity of individuals will sweep through a population. If there is no increase in available resources, members of the population will lay more eggs (for example), but the excess births will die off because of resource limitations. The individuals are no better adapted than before--in fact, if a predator prays on immature members of the population, population size may actually

decrease. Yet selection will always favor those individuals with higher birth rates (7).

Adaptation can also occur in the absence of selection. Imagine for a moment that our lizards' skin color is determined not by genetics, but by diet. If we put our differently colored lizards (from different environments) in a rain forest, there will be heavier predation on the red lizards. But the diet here turns all the lizards green. As the red lizards eat the new diet, they turn green. We are left with an entirely green population. The green lizards are adapted to the green environment, but not because of selective forces.

Finally, sometimes adaptation and selection occur, but the adaptation is a secondary use of available parts. Gould and Lewontin explain this idea in their discussion the *Tyrannosaurus'*s forelegs. Although the Tyrannosaur no doubt used them for something, it would be foolish to seek an immediate adaptive explanation for them, argue Gould and Lewontin, when they are the reduced product of functional limbs in the Tyrannosaur's ancestors. The size of the Tyrannosaur's limbs is likely to be the result of a fixed allometric relationship between increases in head and limb size. As there are well-known rules for relationships between parts of animals at different sizes (both within and among species), Gould and Lewontin claim that such

explanations are much more testable than adaptive explanations.

As these proposed alternatives to optimization through selection and adaptation suggest, Gould's argument with the Darwinian Fundamentalists can be summed up rather easily: they are not historical enough. In concentrating on adaptedness, they ignore historical contingency and the constraints that such contingency puts on the supply of variation on which natural selection can work.

This emphasis on historical contingency can be seen in what is probably Gould's most famous and most profound contribution to paleontology and evolutionary biology: the theory of "punctuated equilibrium." Introduced in a paper written with Niles Eldredge in 1977, this theory was proposed to explain a puzzle in paleontology: the dearth of intermediate forms in the fossil record. What the record seems to show, instead of the gradual transformation of species that the dominant interpretation of the theory of natural selection would suggest, most species appearing suddenly and changing little in form during their existence.

What Gould and Eldredge argued was that this dearth was not an artifact of the incomplete fossil record, but that it reflected reality: species *do* emerge in a geological instant, remain basically stable throughout their lifetimes, and then disappear. But how can there be such long-term

stability in the face of selective pressure? And if such stability is the norm, how does speciation occur at all?

Species remain static for long periods of time for two primary reasons. First, absent very intense selective pressure, even the most adaptive trait will be swamped by genetic drift.

Second, even when there are phenotypic changes in lineages from one generation to the next, such changes typically do not accumulate. They "wobble" around a phenotypic mean. Jonathan Weiner describes this process in his book *The Beak of the Finch*:

> In wet years, there is selection for slender beaks that enable finches to eat small soft seeds. In dry years, there is selection for more robust beaks. These are suited for cracking the larger harder seeds available in droughts. Wet years are interleaved with dry ones, so there is no long-term directional selection. The mean size and shape of the finch beak wobbles to and fro. If this fluctuating environment persists over the long term, finch species will be in stasis, as Gould and Eldredge define it. There will be no long-term shift in finch phenotypes. (76)

So how does speciation ever occur? There are many theories, but occasional Gould co-author Elizabeth Vrba has argued that rare catastrophes (in human terms; in geological time they are relatively frequent) can cause a "turn-over pulse," in which those species that do not become extinct are fragmented. In these fully isolated populations, changes can accumulate, rather than being dissipated in a large

population. And each population, which could survive its sister populations by mere chance, is already genetically sampled, leading to phenotypic changes that have nothing to do with fitness (Sterelny 102).

This touches on an issue that Gould frequently raises in his emphasis on historical contingency: mass extinctions. The sudden death of the dinosaurs (again, sudden in this context could mean tens of thousands of years) is perhaps the best-known example of this. In a geological instant the dinosaurs, which had ruled the earth for tens of millions of years, suddenly went extinct. It is now generally (although not universally) believed by the scientific community that this event was caused by a massive asteroid strike. It is universally accepted that such a strike did occur at roughly the time of the dinosaur extinction; what the Alvarez hypothesis proposes was that this asteroid impact triggered the Cretaceous extinction, probably by kicking up debris that caused a "nuclear winter" effect, during which most cold-blooded animals could not survive.

This event is important because without it, the only mammals in existence would be the sort of tiny creatures that spent their lives hiding and fleeing from the much more successful dinosaurs. The entire biological history of the world would be different. As Gould has often noted, if we

were to "play back the tape of history," there would be no reason to expect that creatures anything like us would exist.

By asserting the importance of contingency, Gould is not denying causality; in fact, quite the opposite--he is defending it. If we were really to rewind history and start again, everything would occur exactly as it has. What he means is simply that things would have been different had it not been for all the contingent events (like asteroid impacts) that have occurred. One could not have predicted the emergence of larger mammals, and eventually man, because of the greater fitness of mammals; mammals "won" because an entire ecosystem was desolated--because of "chance." Mammalian success was not preordained.

And the Cretaceous extinction is hardly a singular event. There have been several sudden mass extinctions in the history of life on earth; at the end of the Permian, over 90% of the animal life on earth became extinct. Some of these extinctions were possibly because of asteroid impacts (many paleontologists now believe that virtually every one of the great extinctions was caused by such a cosmic event); they were almost certainly because of massive geological or climatic change.

One might ask at this point whether we could not consider the ability to survive such catastrophes a kind of fitness. We could, but as Gould has pointed out in many discussions of the "unit of selection debate" (Dawkins and others, on one side, argue that genes and "gene complexes" are the primary--perhaps sole--unit of selection, while Gould and company, on the other, argue that selection operates primarily on individuals [phenotypes] rather than on genes, with some selection also operating on the species, and perhaps even group [although this is more controversial] levels) and in the "evolvability" of different species, "species selection" operates on different traits from those on which individual-level selection works. Species may be particularly viable (or evolvable). Species with a great deal of genetic variability may be more resilient in the face of catastrophic change than others; so may those with broad geographic ranges. But these are characteristics of the species as a whole, and may have little or nothing to do with the adaptedness of an individual organism to a given environment.

While these are powerful arguments that evolution does not operate (at least not exclusively) by the accumulation of tiny changes over time, Gould's most persuasive arguments about the role of chance in the evolution of form are seen

in his discussions of the "Cambrian Explosion" and the "Burgess Shale."

It is now generally agreed that most of the major animal groups emerged in a relatively short time during the Cambrian Age, about 530 million years ago. In the Cambrian, "we find segmented worms, velvet worms, starfish and their allies, mollusks (snails, squid, and their relatives), sponges, bivalves and other shelled animals appearing all at once, with their basic organization, organ systems, and sensory mechanism already operational" (Sterelny 90).

Since then there has been development within phyla, but no major deviation from the forms that emerged in a geological moment. This in itself is a strong argument for the sudden emergence of species generally, but the Cambrian holds a more important lesson for us.

The Burgess Shale Fauna, found in a quarry in British Columbia, were an important discovery because these fossils, dating from the Cambrian, preserved not just records of hard structures such as shell and bone, but soft structures as well. And these records revealed the existence of animal forms we never knew existed.

Gould points out, in his book *Wonderful Life: The Burgess Shale and the Nature of History*, that with a single exception, all of the living phyla (the major subdivisions

of animal life) are found in the Cambrian. But the Burgess Shale reveals the existence of animal forms as disparate from each other and from existing phyla as existing phyla are from one another; basically, there were many more phyla in existence in the Cambrian than there are now.

Why is this important? Gould argues that despite the consensus view, and despite the fact that there are many more *species* in existence than there were in the Cambrian, the idea that there has been a steady increase in diversity (basic forms adapting to specific habitats) is mistaken--or at least misleading. There has in fact been a *reduction* in the disparity of forms that animal life takes.

This is important, because if a great number of possible forms *did* emerge and then disappear catastrophically (the Burgess Shale Fauna, familiar and unfamiliar, disappeared very quickly), and if the *existing* forms seem inherently conservative (that is, showing very little change over time), then many--perhaps even most--of an animal's traits would be better explained as the product of a specific lineage than as an adaptation to a local environment.

Gould provides a simple example of this in his chapter "Male Nipples and Clitoral Ripples" in *Bully For Brontosaurus*. One of the questions that he is most

frequently asked, often by puzzled librarians trying to find out for a patron, is "why do women have two breasts rather than one?" After all, most women only have one baby at a time--is not the extra breast unnecessary, and a metabolic waste? After considering mathematical models that have been proposed to try to make adaptive sense out of this puzzle by weighing the drag of an unnecessary breast against the possibility of malnourishing the rare twin, Gould points out the obvious: women have breasts because of bilateral symmetry, a pattern that was set far back in our lineage.

The real emphasis in this essay is not on phyletic constraints, but on a couple of examples of developmental constraints, another important challenge to unbridled adaptation. "Male nipples" prove to be another puzzle to those who believe in pervasive utility for all parts of all creatures. Adaptationist explanations of male nipples invoke past utility; the most persuasive of these is the not-very-convincing theory that men in primitive societies used to nurse babies. In fact, to simplify a fairly detailed discussion of embryonic development, men have nipples because women do, "and the embryonic pathway to their development builds precursors in all mammalian fetuses, enlarging the breasts later in females but leaving them small (and without evident function) in males" (127). The same logic explains

the existence of the clitoris, the position of which makes orgasm from intercourse difficult for virtually half of all women. This argument is somewhat more controversial, because male nipples seem transparently without function while the clitoris *may* have been co-opted for adaptive functions such as "cementing pair bonds" (a typical sociobiological explanation). (This co-optation of a previous existing structure for another purpose is "exaptation" in Gould's terminology; his most famous example is the panda's thumb, which is not a thumb at all, but an extension of a bone in the wrist that has come to function as a thumb).

Incidentally, this theory would seem to present evidence, were any needed, contradicting the assertion made by Daniel Dennett and others that Gould's science takes a back seat to his progressive politics: his non-adaptive explanation of the clitoris has angered some feminist biologists, traditionally his allies. (Although it should be noted that he believes that the non-adaptive explanation *is* the more progressive one; he provides a fairly convincing argument that the presumption of the utility of the clitoris [and the female orgasm] has caused women immense suffering.)

As Gould and Eldredge point out in the "Spandrels" essay, phyletic constraints explain not only why our bodies are not optimally designed for upright posture (for example,

women have much more difficulty than most other animals in giving birth because our hips became narrower when we deviated from our quadrapedal ground plan), but also why "no mollusks fly in air and no insects are as large as elephants" (194).

There has recently been even more evidence to support non-adaptive explanations in the evolution of form and function--from demonstrations of neutral, nonadaptive changes in the evolution of nucleotides (Gould, “More Things” 106) to studies of the conservation of basic pathways of development, which support the view of evolution as being as much about constraints as it is about selection leading to perfect adaptation: "The major developmental pathway for eyes is conserved and mediated by the same gene in squids, flies, and vertebrates", while "the same genes regulate the formation of top and bottom surfaces in insects" but with the order inverted because our backs are anatomically equivalent to insects' bellies (“More Things” 106).

As Gould sums up the limitations of the adaptationist program in an article in the *New York Review of Books*:

> Yes, eyes are for seeing and feet are for moving. And, yes again, I know of no scientific mechanism other than natural selection with the proven power to build structures of such eminently workable design. . . . But does all the rest of evolution--

> all the phenomena of organic diversity, embryological architecture and genetic structure, for example--flow by simple extrapolation from selection's power to create the good design of organisms? Does the force that makes a functional eye also explain why the world houses more than 500,000 species of beetles and fewer than fifty species of priapulid worms? Or why most nucleotides in multicellular creatures do not code for any enzyme or protein involved in the construction of an organism? Or why ruling dinosaurs died and subordinate mammals survived to flourish and, along one oddly contingent pathway, to evolve a creature capable of building cities and understanding natural selection? (36)

It appears clear that there is much more to evolution than adaptation; but how is this relevant to the debate over evolutionary psychology? The problem is that evolutionary psychology is adaptationist to its core. As we saw in the last section, the field is full of what Gould and Lewontin have dubbed "just-so" stories: speculative stories about how a particular trait developed to serve a particular purpose. If this is a problem in evolutionary biology, where more plausible and economical explanations are often rejected in favor of adaptive stories, it is a disaster for evolutionary psychology.

First of all, isolating traits is a problem. Gould and Lewontin discuss in their "Spandrels" essay the problems generated when we consider, for example, the chin as an isolatable "trait" rather than as the interaction between two growth fields; in evolutionary psychology we are faced not only with the problem of distinguishing selected traits

from such artifacts, but with the problem of identifying whether they exist at all. The chin, whatever its origin, undeniably *exists*; whether a "mate ejection module" exists at all is rather questionable.

Moreover, evolutionary psychology's primary methodological advantage over sociobiology--the concession that some traits might not be adaptive now, but were in the ancestral environment[1]--makes its claims even more speculative and less testable than explanations that appeal to known environments. No one really knows how humans and proto-humans lived hundreds of thousands of years ago; to appeal to descriptions of how a particular cognitive disposition *might* have been advantageous *if* the ancestral environment had been so is not methodologically sound.

This is especially true if the cognitive dispositions that evolutionary psychology purports to explain are only presumed to exist because of (in addition to folk knowledge) these models themselves. As we have seen, the typical method of the evolutionary psychologist is to identify some trait assumed to be universal (the propensity to rape, for example), and then to explain why it might have been advantageous in the ancestral environment (a strategy for

[1]Although, as we have seen, this progress has been oversold. Most of the best-known architects of sociobiology--including E.O. Wilson--acknowledged this.

men facing complete reproductive failure to get their genes into the next generation).

In fact, the independent empirical research supporting even the notion of broad innate cognitive tendencies is rather thin. As Anne Fausto-Sterling argues in her exhaustively researched *Myths of Gender: Biological Theories About Women and Men (1992)*, even such fond assumptions as "women have poorer math skills, and better verbal skills, than men" are (leaving aside the question of whether such differences are the result of very early environmental differences) not confirmed by every well-formed study; those studies that *do* confirm such cultural expectations (and, admittedly, some do--and none of the studies shows the tendency running the other way) because of confirmation bias tend to be those that are published in scientific journals and reported on in the mass media.

Indeed, another of the central assumptions of evolutionary psychology--that the mind is made up of separately evolved, if interactive, modules--is far from uncontroversial. Even if one agrees generally with the computational model of the human mind--the working assumption of most theorists of the mind--one need not accept that it is *necessarily* modular, and even if modular, those modules are not necessarily innate and evolved.

Modular organization is not necessarily an inherited result of natural selection; much of the most exciting work in robots today involves mechanisms that learn in a bottom-up sort of way, starting from a few extremely simple rules of behavior (Moravec, *Mind*; Moravec, *Robots*). And the evidence from human development is hardly unequivocal: Annette Karmiloff-Smith, in her essay "Why Babies' Brains Are Not Swiss Army Knives," provides a thorough discussion of how the empirical research on children supports an environmental explanation of the development of skills and abilities at least as well as it does an innatist explanation.

Modularity in fact cuts across political lines: the idea that intelligence is a unitary thing rather than a reification of a disparate set of skills (an assumption that is the target of Gould's critique of IQ testing in *The Mismeasure of Man*) is the central assumption of Charles Murray and Richard Hernstein in their much-maligned work *The Bell Curve: Intelligence and Class Structure in American Life*, in which they therefore must argue strongly against modularity.

Jerry Fodor, one of the architects of the modular theory of mind (*Modularity*), has been very critical of the idea of innate and evolved modules, and has directly challenged Pinker's model. More famously, Noam Chomsky, for reasons that

are not at all clear, has always denied that the innate and hereditary language structures that he claims to have identified are evolved.

Gould (particularly convincingly and completely in his academic work *Ontogeny and Phylogeny*, but also throughout his popular work), in addition to many other scientists and popularizers, such as Carl Sagan, has argued that what in fact distinguishes the human brain is its lack of the specialization that typifies most species. This is because the human brain, as well as the human body, is marked in its *neoteny* (meaning "preservation of juvenile characteristics"). It is a popularly known fact that humankind shares over 98 percent of its genes with the chimpanzees. Gould argues that (as in many cases in which a small amount of genetic disparity leads to large phenotypic differences) many of those genes in which we differ affect rates of development.

It is not simply a cute, chance anthropomorphism that baby chimps look very human. We *are* baby chimps, as much in body as in mind: just as our bodies are essentially frozen in a juvenile state, so are our brains, which makes them particularly labile (and our youth a particularly vulnerable time). Gould in fact argues that given the large size and capacity for learning of the human brain, specialization would in fact be *disadvantageous.* Wouldn't a being with a

brain particularly prone to absorbing *cultural* knowledge, which can accumulate and change very rapidly compared to the stately rate of evolutionary change, be much better adapted to any given environment than one with innate modules?

Although Gould chooses to keep his critique on firmer scientific ground, understandably wary of relying on notions of human exceptionalism, other critics of evolutionary psychology are not so cautious about seeing human culture as the primary challenge to evolutionary-psychological explanations. Such explanations might be fine for ants, they say, but not for humans.

Such a claim is not as idealist as it might first appear. They are not arguing for some sort of mind/body dualism or for the autonomy of culture from the natural world; they are simply arguing that the evolutionary psychologists are too quick to jump to evolutionary explanations when simpler cultural explanations are available.

Even as implacable a critic as Gould accepts the usefulness of sociobiological logic in some situations: when beings, such as ants, have no apparent way to pass on knowledge through culture, there must be some kind of evolutionary explanation (although not necessarily an adaptive one).

Ultimately, whether one believes that sociobiology and evolutionary psychology are "scientific" or not depends on one's definition of science and one's notion of what science's relation to society is and should be. Wilson, Dawkins, and other supporters of evolutionary psychology believe that an area of inquiry can be called a science even if it is largely speculative and untestable.

The principal opponents of evolutionary psychology--Gould and Lewontin in particular--have a somewhat more restrictive view of legitimate science. As Ullica Segerstrale sums up Lewontin's position in *Defenders of the Truth: The Battle for Science in the Sociobiology Debate and Beyond*, Lewontin believes that scientific arguments should be *correct*, not just *plausible*; that correctness is most likely to be obtained through experimentation; that speculation about past evolution can only ever be plausible, and so is not scientifically useful; that large generalizations about evolution are almost certain to be wrong because of the complexities involved; and that we should focus on predictions employing the experimental method and ask restricted questions (105-106).

It is unclear which came first--Gould and Lewontin's demanding requirements for legitimate science or their distaste for sociobiology--but it is clear that on its own terms, their critique is devastating. By standards distilled

from other, established sciences, evolutionary psychology (at least in its present form) is "unscientific."

Gould, in fact, has been quite consistent in holding ideological allies to the same high standards to which he holds his foes: he has been outspoken, for example, in his critiques of "feminist science" (which he has said does not exist) and of Jeremy Rifkin's lack of integrity or knowledge of evolutionary theory in his environmentalist and anti-technology screeds (*Urchin*).

Less compelling than scientific critiques such as Gould's and Lewontin's, however, are those critiques that begin from a certain moral or political perspective and therefore hold evolutionary psychology to a *higher* standard than other sciences. Kitcher himself does this (although his argument does not stand or fall on this assumption).

According to him, 'pop' sociobiologists have thrown away their caution when they write about human behavior. He suggests that *standards need to be raised* when it comes to statements about humans. When there are implications for humans, some usual practices of science, such as bold generalization, should be curtailed and the standards of evidence need to be higher than in other, less sensitive areas of science (388).

Indeed, some critics are so incensed by the *implications* of sociobiology that they cannot be bothered

with challenging the science; the implications invalidate the science. Philosopher Mary Midgley, for example, in a 1979 review of *The Selfish Gene*, was apparently so blinded by her distaste for the implications of the theory that she totally misread a fairly clear argument:

> [Dawkins'] central point is that the emotional nature of man is exclusively self-interested, and he argues this by claiming that all emotional nature is so. Since the emotional nature of animals clearly is not exclusively self-interested, nor based on any long term calculation at all, he resorts to arguing from speculations about the emotional nature of genes. . . .Genes cannot be selfish or unselfish, any more than atoms can be jealous, elephants abstract, or biscuits teleological. (451)

From such statements, one might gather that Midgley had not even read the jacket copy, much less the book. Dawkins never claims that genes, let alone organisms, are "selfish." He is using the metaphor of "selfishness" to make a point about gene selectionism as opposed to individual or group selection. His discussions of emotion in fact emphasize the existence of altruism as a strong emotional motivation.

In later years Midgley was to admit that "she did not really wish to go after *Dawkins* as much as she wanted to quench any attempt by *Moral Philosophers* to use selfish genery as a backup for their purposes" (Segerstrale 77)--to "criticize Dawkins to such an extent that no moral

philosopher would ever want to use him as scientific backing for philosophical theorizing" (Segerstrale 77).

These strategies of working from the political implications to criticize the science are for the most part ineffective--and not simply because they present a challenge to any tedious commitment to truth or objectivity. They are rhetorically ineffective because those who do not already agree with Kitcher or Midgley are unlikely to see political implications that they disagree with as a reason to reject science otherwise seen as valid. Kitcher's argument is really that science with anti-egalitarian implications should be treated more cautiously than other science; true-believing evolutionary psychologists would argue that certain egalitarian policies already in place--laws to remedy gender imbalances in hiring, for example--already have human costs.

And here is where the political implications of evolutionary psychology become clear. None but the crudest popularizers would draw a direct connection between the conclusions of evolutionary psychology and the world of politics. The conclusions are not as facile and offensive as, say, "Men are prone to rape; therefore rape laws should be more lenient," or "Homosexuality is anti-adaptive, and should therefore be illegal," or "Man does not have wings;

therefore he should not fly." The ideologues of evolutionary psychology understand the naturalistic fallacy too.

The arguments are subtler and more logical--and therefore more dangerous. Wilson, a professed liberal, lays out the argument thus:

> In hunter-gatherer societies, men hunt and women stay at home. This strong bias persists in most agricultural and industrial societies and, on that ground alone, appears to have a genetic origin. . . . My own guess is that the genetic bias is intense enough to cause a substantial division of labor even in the most free and most egalitarian of future societies. . . . Even with identical education and equal access to all professions, men are likely to continue to play a disproportionate role in political life, business, and science. (“Human” 40)

This is, in Kitcher's schema, the last rung of the ladder--"Because there are these genetic differences and because the behavior is adaptive, we can show that it will be difficult to modify the behavior by altering the environment" (Kitcher 127), and if we ignore the quick conflation of "genetic" and "difficult to modify,[2] this argument does have a certain logic. If a certain behavior is innate and extremely intractable (for example, a feminine predilection for care-giving and a male one for abstract math), then attempts to modify this behavior (by, say, equalizing the male and female proportions of day-care

[2]As Gould points out, "Many defects of vision are 100 percent heritable and easily corrected by a pair of glasses" (*Urchin* 35).

workers and of mathematicians) could have real, even devastating, social costs.

Here is the real social consequence of evolutionary psychology--not that it offends our *a priori* egalitarian ideals, but that social and political implications are read off from an immature and speculative science. One might reasonably argue, *contra* Gould and Lewontin, that evolutionary psychology is a legitimate science, albeit a highly speculative and untestable one; in this view, the only harm that it can do is waste research time. But to derive political programs, as some evolutionary psychologists (and, more often, their popularizers) do is quite *unreasonable*.

To argue that some political program should be instituted or dismantled because evolutionary psychology predicts that we should have certain innate tendencies, in the absence of any evidence that such tendencies either exist or are intractable, is to encourage the worst sort of social experimentation (something the generally conservative evolutionary psychologists are usually opposed to). What any reasonable person should object to, rather than the specifics of these proposals (for example, the anti-feminist conclusions derived by some popular interpreters of evolutionary psychology), is that *any* political program

should be derived from such shaky science: better that we muddle along, attempting to solve our social problems in an empirical, experimental way, than to weigh the social costs and benefits in advance based on dubious speculation.

Philosophers of science may speculate on whether evolutionary psychology is, or may ever be, a science. To the layman, it seems to deserve at least that much consideration. But even if it is a science, it is still in its infancy. It may turn out to be a dead end; its "predictions" may fail to be realized by, say, cognitive scientists (one of many reasonable objections to evolutionary psychology is that it warps the research program of the otherwise fairly objective field of cognitive science by encouraging an overabundance of research down certain avenues that would receive no special consideration were it not for folk psychology and its support by evolutionary "just so" stories). It may, on the other hand, bear some fruit. In the meantime, it would be best for us to avoid compounding speculation with speculation.

Evolutionary Psychology and Literary Theme

Assuming that there is something to evolutionary psychology, what does all of this have to do with literary theory or aesthetics? The most comprehensive application of evolutionary psychology to literary theory is Joseph Carroll's *Evolution and Literary Theory*. In this ambitious work, Carroll attempts to counter what he views as the excesses of post-structuralism and related approaches (he groups feminism and Marxism with post-structuralism) and establish a new foundation for literary criticism and theory.

The first third of Carroll's work consists of an indictment of most of contemporary literary criticism, which he sees as dominated by the post-structuralist model. There is nothing particularly original in this indictment, which is vocally shared by most theorists with evolutionary approaches and better stated by several critics outside of the evolutionary approach: Terry Eagleton, Alex Callinicos, and Christopher Norris to name a few.

We will pass over these arguments briefly, as they are not at the core of Carroll's proposal, shared as they are by many who would strongly disagree with his assumptions about human nature. What is interesting about these arguments is that Carroll would choose to include them at all. Setting up

a straw-man poststructuralism and demonstrating that it has little useful to say about literature is hardly original with Carroll. What Carroll adds to the argument is a second proposition: if we acknowledge that there is a world outside of language (which he claims the poststructuralists deny), then we must accept that science has something useful to say about literature and its production (reasonable enough), and we must therefore accept that there is an essential human nature (completely unwarranted). Carroll quickly moves from quite reasonable arguments that the insights of science might have a useful role in the humanities (an argument that anti-foundationalist Richard Rorty would heartily approve) to arguments asserting the truth of a rather controversial science. To reject evolutionary psychology, in Carroll's view, is to reject science itself, although as we have seen, many respected scientists are quite suspicious of the claims of evolutionary psychology--and many of the principal architects of this new approach would not approve some of Carroll's more extreme claims. To believe in the world, argues Carroll, one must believe in an innate human nature--to believe otherwise would be "unscientific"--despite the fact that hard-nosed positivists like B.F. Skinner are as thoroughgoing in their critiques of an innate human nature as the most wild-eyed poststructuralist philosopher.

So the critique of poststructuralism does not automatically lead one to an endorsement of evolutionary psychology; but if the more extreme claims of popular evolutionary psychology are true (and, despite its critics, the EP model has yet to be definitively demolished), do they provide us with any useful insight into literature?

Carroll, clearly, believes they do. First, Carroll claims that the "relationship between the organism and its environment . . . . should take a position of hierarchical priority over every other concept" (3). What it means for this relationship to "take a position" of priority over other concepts in literary criticism is never made exactly clear, but what Carroll seems to be asserting is that because this relationship has *causal* primacy (see Carroll's third point, below), it should be the context within which most discussion of literature should take place.

Second, and most central to our discussion, Carroll asserts that "innate psychological structures--perceptual, rational, and affective--have evolved through an adaptive process of natural selection and that these structures regulate the mental and emotional life of all living organisms, including human beings" (3). Carroll points out that "this concept sets itself in irreconcilable opposition to the idea that human beings are blank slates, that the

structure of motivations and cognition is infinitely malleable, and that language or culture provides all qualitative content and structure for human experience" (3). Carroll will elaborate on what he means by "regulate" in this context; just how far evolved traits determine the structure and content of the mind (very far, Carroll will maintain) will be an important question in regard to his larger project. None of the arguments of Carroll's enemies hinge on the notion of a *tabula rasa*; some, like Freud (at least the non-structuralist, biologistic Freud) even name some of the specific structures and contents of the mind. Carroll's argument is not that there are *some* innate characteristics rather than none, but that there are *many* rather than a relative few.

Third, and not very controversial if one accepts Carroll's second claim, "all 'proximate causes' or intermediate human motives are regulated by the principles of inclusive fitness as 'ultimate cause" (3). This concept, claims Carroll, "does not imply that all organisms at all times, and especially not all human organisms, are directly seeking to maximize their reproductive success" (3). It does imply, however, that "all innate psychological structures have, in ancestral environments, evolved under the regulative power of reproductive success and that these

innate structures remain fully active at the present time" (3). An important corollary to this concept, for the purposes of literary criticism, is that "reproductive success, in its twin aspects of sexual union and the production of successful offspring, is central to human concerns and literary works" (3).

Reproductive success, asserts Carroll in a formulation that will be central to his argument, as well as quite problematic, "provides an organizing principle that can be adjusted or modified or repressed (at great cost) but cannot simply be ignored" (3).

Here Carroll is asserting that innate psychological structures have a causal primacy in the production of literature, in much the same way that many Marxists assert the primacy of the mode of production--the primacy of "determination in the last instance." But while Marxists can explain the reductionism implied here by either maintaining that their focus on the mode of production is actually an issue of *emphasis* ("We're explaining how the mode of production relates to literature, others may explore other causal factors") or diligently explaining that the mode of production, while in a complicated way ultimately determinative, is merely part of a structure of semi-autonomous mechanisms (or that the whole thing is properly

deemed the mode of production), Carroll (and this will prove to be one of the great failings of his model) fails to either mitigate his claims ("I'm just investigating one mode of explanation, in a curiously neglected area") or provide a convincing model of how these innate psychological structures interact with other causal factors. When he says primacy, he means *primacy*, with a single-mindedness that would abash the most economistic of Marxists.

Fourth, Carroll claims that "representation, including literary representation, is a form of 'cognitive mapping" (3). Which is to say that "representation is an extension of the organism's adaptive orientation to an environment that is, in the first place, spatial and physical" (3). This notion is central to Carroll's characterization of literature, as he develops the argument that the primary purpose of literature "is to represent the subjective quality of experience" (4).

Carroll's central assumption in making these claims is that "literary works reflect and articulate the vital motives and interests of human beings as living organisms" (4). Carroll argues, based on this assumption, that "innate biological characteristics provide the basis for all individual identity and all social organization, that authors exercise originary power in the construction of

literary figurations, and that literature represents objects that exist independently of language" (4).

These claims are relatively abstract, and formulated in such a way that a weak reading of them results for the most part in truisms (of course literature is produced by organisms with motives; who else is going to write it?), while a strong reading results in radical--and radically unlikely--claims (art is solely the product of organisms, whose psychologies are solely the products of genetics). How can these claims be used practically in the interpretation of literature? Carroll early on provides us with a reading, applying these principals, of a canonical work of literature.

Wuthering Heights provides us with a well-known example, argues Carroll, of the problem of incest in literature--a problem that has been approached by many literary critics employing Freudian assumptions that have been “falsified” by evolutionary research. According to Carroll, this research “reveals” that the Freudian notion that incest is an innate drive that is repressed by social convention is mistaken. Research “suggests” (it is not clear why Carroll switches to such tentative language) that a distaste for incest is genetically programmed (145).

Knowledge of this innate tendency has important consequences for literary criticism; such knowledge can help us avoid erroneous interpretations of such texts as *Oedipus Rex*, in which incest is clearly a theme, and help us avoid “erroneously importing mother/son incest into texts, such as *Hamlet*, in which incest is not a central issue” (145).

We see problems developing in the model already. Even if there is an innate incest-avoidance instinct, *Hamlet* is a work of fiction; that a desire for incest is rare (or contrary to nature, whatever that means) in no way means that Shakespeare did not intend for incest to be a theme in his play. (Carroll believes that authorial intention is particularly determinative of meaning.) And what of twentieth-century authors who are aware of Freud's model and believe that there *is* a general desire for incest? Would it be illegitimate to see such a desire as important in these texts?

The problem becomes even clearer in Carroll's discussion of *Wuthering Heights*. Even if there is a "genetically programmed" distaste for sexual relations between boys and girls who are raised together, a desire for it is not unheard of--and even if such desire were impossible, Bronte could still have written about it. As Alan Richardson puts it in his essay "Rethinking Romantic

Incest: Human Universals, Literary Representation, and the Biology of Mind," "If Emily Bronte is at liberty to people the Yorkshire Moors with ghosts, why not incestuous foster-siblings as well?" (560) To argue against an interpretation of the novel that sees in the central relationship "Byronic sexual displays" because evolutionary psychology tells us that such sexual desires are unlikely is not unlike arguing that *Paradise Lost* couldn't possibly be about God and Satan because such entities probably don't exist. And again, this critique assumes Carroll's own position that authorial intention is determinative of meaning; we haven't even examined whether his arguments on this front are persuasive.

This example does provide a model of how criticism might be informed by evolutionary psychology, if it fails to explain why evolutionary psychology should be central. The science of evolutionary psychology can tell us what is likely or possible for people to feel, and therefore perhaps give some insight into what the *author* intended, in the same way that the science of physics might hint at the correct reading (in terms of intent) of a battle scene: the physically impossible reading is probably not the correct one.

But despite the shortcomings of this example, Carroll has a grander notion of the place of evolutionary psychology in literary criticism. It rests in his idea of the relative

importance of evolutionary psychology as an explanatory method.

Any criticism is informed, Carroll maintains, by certain assumptions about the relative importance of different causal forces. Critical judgments about literature are shaped by assumptions about whether “all texts inadvertently reveal repressed subconscious conflicts, allegorize the socioeconomic conditions of production, [or] enact the triumphal self-affirmation of Being-in-the-World”(40), or such texts “display the indeterminacy of meaning in an endless semiotic dissemination, helplessly reproduce an autonomous cultural episteme, or reflect the interaction of an organism with its environment” (40).

Carroll makes the reasonable point that if a critical method is based on flatly *wrong* assumptions about causality, it will probably be wrong (Carroll assumes that criticism must be true, rather than simply interesting) in much of its interpretation. It is unclear, however, why evolutionary psychology, or even the idea of literature as the product of biological organism, should take precedence as an explanatory model.

Perhaps his definition of literature might give us some clue as to the significance of evolutionary theory for literary criticism. Carroll defines literary works as “representations that either take the quality of personal

experience as their special subject or register the writer's own sense of the experiential quality of his or her subject" (109), that are intended to evoke aesthetic and emotional as well as intellectual responses in the reader (109), and that are composed of *words* rather than some other sort of symbol (109).

Despite some problems with distinguishing "the writer's sense" of something from an "objective" account (what Carroll seems to mean by this is something like "objectivity effect" or "objectivity intent"--that is, the author or text seems to *intend* to provide an objective picture of the world, even if by our lights that picture is distorted by ideology or outdated scientific models), this definition of "the literary" does demarcate a fairly clear field of study. What, then, is the purpose of criticism?

Criticism "is concerned to gain objective knowledge about literature--'to see the object as it really is'--and also to communicate the personal and cultural value of literature" (112).

Here Carroll explicitly endorses Matthew Arnold's ideas about the role of literature and criticism, specifically the notion that the purpose of literature and criticism is "to establish a relation between the new conceptions [of science], and our instinct for beauty, our instinct for conduct" (Qtd. 113).

Literature provides a subjective view of life, delivered in words with certain attention to formal qualities. Criticism provides objective knowledge of the text, principally by explaining the author as organism in environment, and comparing the insights of literature with the scientific knowledge of evolutionary psychology. But why? What does it mean to "establish a relation between the new conceptions and our instinct for beauty, our instinct for conduct"?

The subjective view that literature provides is "a highly developed body of intuitive qualitative judgment about human experience" (114). This knowledge can serve as "an important point of empirical reference" in evaluating new scientific notions about human psychology and culture" (114). (Of course, as we saw in the *Wuthering Heights* example, if a text's "intuitive qualitative judgment about human experience" clashes with evolutionary-psychological received truth, either the text or its interpreter is wrong.)

The idea that the primary function of literature might be to provide a counterpoint to the scientific worldview, to articulate in non-propositional form an intuitive, emotional sense of the world, is hardly a new one, as we see in Carroll's wholehearted endorsement of Arnold. There is nothing distinctly Darwinian about this. But given his

definition of literature and his description of the role of criticism, what does the Darwinian model add to this discussion?

We have seen that knowledge of evolutionary psychology might add something to the reconstruction of authorial intention--giving evolutionary psychology a useful, if not obviously important, role in criticism as defined by Carroll. Carroll, however, sees its role as more central.

To understand why, we must examine his ideas about the conflict between authorial norms and cultural norms. Carroll argues that if authorial and cultural norms are the same, the protagonist is likely to ultimately adjust completely to his or her society--as Tom Jones and Emma Woodhouse do. If authorial and cultural norms differ, the story is likely to end in "isolated alienation": Gulliver shuns human beings to live with the horses, Stephen Dedalus leaves Ireland.

This is an interesting schema for the discussion of the two *logical* possibilities of narrative. Where Carroll gets into trouble, however, is precisely where evolutionary psychology impinges on this schema. Into the discussion of the relationship between authorial norms and cultural norms he brings the notion of biological "norms."

Individuals differ in their dispositions, and these dispositions are largely "elemental" or innate. Such an assertion is hardly controversial if one accepts the

evolutionary psychological model. Sometimes authorial norms and cultural norms differ--this is also uncontroversial. But Carroll makes a crucial error when he introduces the idea that some aspects of personality are not only innate and virtually universal (both fine if one accepts mainstream evolutionary psychology) but somehow *normative* because their origins were adaptive.

The fundamental fallacy behind this assertion becomes clear in Carroll's discussion of homosexuality. Homosexuality, claims Carroll, violates not only *cultural* norms but biological norms as well:

> If, as in the case of homosexual writers, both male and female, the writer's own sexual orientation diverges from the species-typical characteristics necessary to the propagation of the race, the tension between these two norms, the individual and the species-typical, will almost certainly play a large role in the organization of figurative elements for that author. This tension is complicated by the relation between personal organization and cultural norms, but my contention . . . is that species-typical norms and cultural norms are distinct categories; neither category is reducible to the other. (163)

It is certainly possible that there are certain innate and nearly universal traits. What is not clear is why it should make a difference if the author's norms differ from dominant cultural norms or from dominant innate norms.

Biological norms, asserts Carroll, are not only dominant, but also *functional*--otherwise they would not exist (Carroll is here both assuming universal adaptedness

and that current utility and adapted origin are the same). Homosexuality, however, "presents an instance in which the psychological organization of an individual operates in a manner different from that of people whose behavior is functional for the members of that species as a whole" (167).

Here Carroll is explicitly rejecting the idea proposed by E.O. Wilson that homosexuality evolved through kin selection. That is, the presence of a homosexual would be so advantageous to that person's kin that the trait would be passed on despite the fact that that person might be less likely to have children.

Carroll is not alone in rejecting this notion. Most theorists of evolutionary psychology find this explanation unsatisfying; the numbers just do not add up. But while homosexuality is for evolutionary psychologists merely a somewhat uncomfortable reminder that not all important and central psychological characteristics were adaptive or evolved, Carroll comes to a conclusion that few of these theorists would endorse: homosexuality is not only not adaptive, but it is a dysfunction.[3]

[3] Carroll approvingly cites one sociobiologist, George Kocan, who does not hesitate to label homosexuality a pathology: "The most parsimonious approach is to view homosexuality as it has traditionally been viewed in the behavioral sciences, as pathology. The persistence of diabetes or prostate cancer in the human population does not make them adaptive and in need of any sociobiological analyses. They are simply diseases" (Qtd. 169).

This position is not merely offensive and politically dangerous, but it is also fallacious. Even if we accept that homosexuality is somehow “dysfunctional” because its origin is not adaptive, it is not at all clear why this fact should have any normative force. As we saw in our discussion of E.O. Wilson, one of the most basic differences between evolutionary psychology and sociobiology claimed by evolutionary psychologists is that evolutionary psychologists are clear about the distinction between adaptive origin and present utility--this despite the fact that most prominent sociobiologists, E.O. Wilson among them, had already made this distinction.

Evolutionary psychologists again and again maintain that the innate tendencies that they have “discovered” to exist and to have adaptive origins--aggression, nepotism, rape--may in fact be nonfunctional today, either for the individual or for the species. Yet it is central to Carroll’s argument that the “species typical” be considered normative, as we see in his discussion of “deviations in parental behavior.”

Carroll argues that without a sense of the species typical, without a recognition that “functional” behavior has some kind of normative status, we cannot truly understand the pathological character of some of the

relations described by authors. For example, if we imagine that the arrangement in which parents are responsible for the raising of their own children is purely a cultural construct, then “we trivialize the anguish in the pathology exemplified by Mr. Dorrit, as well as the psychological heroism of those who cope with this pathology” (169).

Carroll is hardly unique in using notions of human nature to criticize human institutions; such notions are not even the exclusive property of the political right: Herbert Marcuse applied a very basic set of propositions about human nature to argue that people in modern capitalist society were not as happy as they thought they were, or as they could be.

And yet Carroll carries this argument farther. He is arguing that if one’s disposition goes against the species-typical--even if that disposition is just as “elemental” or “innate” as the dominant one--then it is the individual, not the culture, who is wrong.

This may appear to be a minor point, but in fact it touches on the central justification for Carroll’s project. Unless, as Carroll argues, “species-typical norms and cultural norms are distinct categories” (163), and unless this distinction somehow *matters*, then the Darwinian critical approach loses its revolutionary vigor. If the

central conflict in much of literature is between individual character and cultural norms, what is added to the discussion by the knowledge that, say, the cultural norm of heterosexuality is both statistically dominant and of adaptive origin?

In a recent essay, "Human Universals and Literary Meaning: A Sociobiological Critique of *Pride and Prejudice, Villette*, *O Pioneers!, Anna of the Five Towns*, and *Tess of the d'Urbervilles,"* Carroll again asks the question that *Evolution and Literary Criticism* raises but does not really answer: "What relevance do human universals have for the interpretation of specific literary texts?"

The answer, apparently, is not much. Carroll admits that "sociobiological critics have only begun to consider the question of evaluation" (13) and that such evaluation has so far "focused on the presence of universal themes or sociobiologically typical behaviors,"[4]--and he admits that such a model for evaluation is lacking.

But he gropes toward a method of evaluation by suggesting that we can explain the appeal of great works by examination of their handling of these universal themes and sociobiologically typical behaviors. *Pride and Prejudice* and

[4] Frederick Turner, whose work we will examine later, has argued that one measure of literary worth is the number of such themes dealt with in a given work.

Tess of the D'Urbervilles, we learn, are popular novels not only because of their "extraordinary stylistic felicity in the invocation of their subjects" (21) and the "rich and magnanimous generosity of fellow human feeling" (20) with which they treat their characters, but also because "they appeal to common and basic motivational structures" (21).

Anna of the Five Towns and *O Pioneers!*, on the other hand, are less popular works because they have "eccentric motivational structures" (22) and therefore "present interesting puzzles for critical analysis" but "also leave a sense of dissatisfaction" (22).

That a work's popularity might be related in some interesting way to the universality of its themes or "motivational structures" is not such a ridiculous idea, as far as it goes. The differences in popularity between some works may indeed be partially due to the familiarity of the themes dealt with.

And yet, again, it is unclear how consideration of a work's popularity necessarily entails any kind of position on the innateness or adaptedness of the motivation being considered. If a work's popularity can be explained by the typicality of the themes and motivations it considers, what difference does it make if those themes and motivations are *innate* or *enculturated*, so long as they are typical? And

even if this analysis of popularity is legitimate, should popularity be the measure of greatness?

Ultimately, Carroll's project of arguing for the centrality of Darwinian thinking to literary criticism and interpretation fails on its own terms. Although, as we saw earlier, a knowledge of evolutionary psychology might play some modest role in divining authorial intent (that is, making some intents more or less probable), it is unlikely to provide much more illumination than this.

Carroll's main contribution is the suggestion that the concord/conflict between the author's or protagonist's psychological structure and cultural norms might provide some insight into a work's meaning. But the original part of his suggestion, that there is a useful distinction between cultural norms and the "species-typical," remains ungrounded.

Likewise, any attempt to explain a work's value, as opposed to its popularity, by appealing to its treatment of evolutionarily salient themes is also unconvincing without some argument as to why popularity and greatness should be equated. It is also unclear why, even in the explanation of popularity, the *adaptedness* of the themes, as opposed to their typicality, is important.

Carroll’s work represents the most complete and convincing argument so far for the importance of Darwinian thinking in the understanding of literary content. But perhaps the Darwinian model can provide more of a guide in the discussion of literary form.

Evolutionary Psychology and Literary Form

While most evolutionary psychologists see the entire realm of the aesthetic as a byproduct of other human behavioral tendencies--“cheesecake for the mind,” in Steven Pinker’s memorable phrase--many with an evolutionary approach to the arts believe that art serves a more basic evolutionary purpose: it is a primary behavior, selected for because of the reproductive advantage that it confers. Although Joseph Carroll has suggested, in reviews of Wilson’s *Consilience* and Pinker’s *How the Mind Works*, that the creation and consumption of art and literature might in themselves be adaptive, heritable behaviors, his work does not really pursue this approach.

Anthropologist Ellen Dissanayake, in a series of books and articles on the subject, has proposed that the arts are the product of something she calls “making special,” a term that “refers to the fact that humans, unlike other animals, intentionally shape, embellish, and otherwise fashion aspects of their world to make these more than ordinary” (*Aestheticus* 30).

Making special doesn’t occur only in the arts, broadly defined--visual art, music, dance, painting, literature--but also in forms of ritual and play, behaviors that have long been interpreted as conferring adaptive advantage on

animals: “Play allows young animals in a protected or ‘not for real’ arena to develop practical and social skills that can be used later” (*Aestheticus* 32), while “ritualized behaviors formalize, stylize, and emphasize ordinary attributes that thereby acquire a secondary communicative function and smooth the conduct of social life” (*Aestheticus* 33).

Making special has a particular significance for humans because of several effects: it “provides something to do in uncertain or troubling circumstances and gives the psychological illusion . . . of coping” (*Aestheticus* 36), causes us to treat certain objects and activities that might be essential to survival with special care (*Aestheticus* 36), and provides ceremonies and other “multimedia group events” that pass down information from generation to generation in memorable form, as well as uniting people.

What most of us think of as “art” is what Dissanayake calls “aesthetic making special.” Making special is “aesthetic” when things are made special by means of what Dissanayake calls “protoaesthetic” elements:

> features that inherently give perceptual, emotional, and cognitive pleasure and satisfaction in their own right. The reason that they are inherently pleasing and satisfying is probably because they indicate that something is wholesome and good--e.g., visual signs of heath, youth, and vitality such as smoothness, glossiness, warm or true colors, cleanness, fineness, lack of blemish; vigor, precision, and comeliness of movement;

> sounds that are resonant, vivid and powerful. In any modality, repetition, pattern, continuity, clarity, dexterity, elaboration or variation on a theme, contrast, balance, and proportion are appealing, presumably because they engage and satisfy cognitive faculties, indicating comprehension and mastery, hence security. (37)[5]

Beauty found in nature evokes what may most simply be described as an aesthetic response. Art is created by a process of "making special,"––a process seen in the ritual behavior of many animals, including humans--but in this case applying those "beautiful" or "aesthetic" elements.

Such a theory has much to recommend it to the humanist fearing that he or she is devoted to something superfluous to the lives of virtually everyone. Art, because the desire to produce and consume it was selected for, is, in Dissanayake's words, "like eating, sleeping, sex, socializing, and parenting . . . a fundamental and essential part of human nature." (150) Art, we are reassured, is important.

But what does this approach add to the evaluation and explanation of literature? Does it provide any norms of judgment, any useful tools of analysis? Can it provide us

[5] I will discuss later in this chapter this notion--that there are things in nature that we have evolved to experience as beautiful--in regard to the work of Frederick Turner, but an interesting discussion of an experiment in landscape choice (people prefer to look at pictures of savannahs) can be found in Appleton. Also provocative are studies that suggest that there are nearly universal preferences for certain shapes and forms (Cosmides and Tooby). Of course, none of these studies proves that the documented preferences are either innate or evolved through natural selection.

with a better definition of the literary? Other than suggesting that producing and consuming literature is pleasurable, “aesthetic making special” as a concept does not really do much work. The idea of the intrinsically beautiful, as we shall see in the work of Frederick Turner, might provide a norm of judgment, but this is not the distinctive part of Dissanayake’s theory.

The idea that there is in innate artistic “sense”--an evolved desire to create and consume art with certain formal characteristics--might play some role in explaining, as with Carroll’s work, the popularity and effectiveness of some works. Ultimately though, Dissanayake’s message in arguing that art is an evolved behavior is simply that art is “important.” In her recent work *Art and Intimacy* she argues for more artistic education in the schools (10), and since *What is Art For?* has argued for more integration of art into modern society.

Although Dissanayake is careful enough not to suggest that art is necessary or important because it is functional now in the same ways in which it was functional (and therefore selected for) before, she does suggest that satisfying the artistic sense might be an important human need:

> What is wrong with calling these tendencies biologically endowed needs? Part of human nature? All over the world, individuals in social groups,

> particularly those closer to the environment in which we were evolved, display them and satisfy them to greater and lesser degrees. In historic times, after the rise of civilizations, we can see that in many societies these needs are not filled so completely or comprehensively, resulting in what might be called deformations of a fairly stable, universal human nature (an ideal construct, perhaps, and never completely realized, but an entity like a "species" or "model" with identifiable, specifiable, fairly uniform characteristics). (*What* 198)

Geoffrey Miller believes that he has found the adaptive purpose of art: it is a form of sexual display. Miller, an evolutionary psychologist, began his project as an attempt to explain not the arts but humans' impressive brains. Those brains are difficult to explain, argues Miller, for three primary reasons.

First, "really large brains and complex minds arose very late in evolution and in very few species. . . . Far from showing any general trend towards big brained hyper-intelligence, evolution seems to abhor our sort of intelligence, and avoids it whenever possible" (17). This being the case, "why would evolution endow our species with such large brains that cost so much energy to run, given that the vast majority of successful animal species survive perfectly well with tiny brains?" (17)

Second, there is a very long period time between the first evidence of the expansion of the human brain and any evidence of survival benefits. Although "brain size tripled

in our ancestors between two and a half million years ago and a hundred thousand years ago" (18), there is little evidence of its utility until much later:

> Arguably, one could not ask for a worse correlation between growth in a biological organ and evidence of its supposed survival benefits. Our ancestors of a hundred thousand years ago were already anatomically modern humans with bodies and brains just like ours. Yet they did not invent agriculture for another ninety thousand years, or urban civilization for another ninety-five thousand years. How could evolution favor the expansion of a costly organ like the brain, without any major survival benefits becoming apparent until on after the organ stopped expanding? (18)

Finally, Miller points out that there have not been any plausible adaptive explanations for the things that humans are particularly good at. If our skills of "humor, story-telling, gossip, art, music, self-consciousness, ornate language, imaginative ideologies, religion, and morality" (30) are greater than we would expect a general computer as powerful as the human brain to have, if these imply innate propensities, not one has proposed a convincing--to mainstream evolutionary psychologists--explanation of how these skills could have developed as adaptations.

To explain these uniquely human qualities, Miller makes a distinction that Darwin made--between "natural selection" and "sexual selection." This distinction refers to the fact that some traits may be selected for because of the

“survival advantage” they confer, while others are selected for because of mate choice, regardless of, and sometimes in direct opposition to, survival imperatives. The most famous example of a trait selected for through sexual selection is the peacock’s tail: a metabolically expensive trait that nonetheless attracts females. The origin of the female peacock’s preference for large, colorful tails is obscure; in fact, the most popular explanation for this preference is that by being so wasteful, the tail advertises the male peacock’s fitness--it has resources to waste.

The important fact about sexual selection is not necessarily the origin of such seemingly “unfit adaptations”--the trait selected for could as easily be one that is valuable for individual survival as one that advertises metabolic waste—-but the runaway quality of such selection. Once a trait begins to be desired, those males who have it are at a reproductive advantage--and then so are those females who choose to mate with these males. Even if the trait is disadvantageous to individual survival, if the trait means more reproduction, it pays (from the Darwinian standard of fitness, rather than from the popular notion of “absolute fitness”) to have the trait or to desire it in a mate.

Miller points out that evolutionary biologists no longer make the distinction between natural selection and

sexual selection--when they say “natural selection” they mean “selection for survival or reproductive advantage”--but he makes the distinction for the same reason that Darwin did: to emphasize that selection does not always work towards increased survivability. Miller, an avowed evolutionary psychologist, points out that “Many evolutionary psychologists, who should know better, even ask what possible ‘survival value’ could explain some trait under discussion” (8).

Miller actually ends up bolstering Gould’s project of arguing that evolutionary psychological programs that look for an adaptive explanation for every trait are too speculative to be scientific. While Gould does not emphasize the runaway, positive-feedback nature of sexual selection in most of his work, the operation of sexual selection can be added easily to his list of alternatives to “fitness” explanations of evolutionary change.

Miller’s discussion of the difficulty of explaining the human brain and its unique abilities through appeals to fitness conceived narrowly as “survivability”--and his explanation of these traits by the notion of sexual selection--actually parallels a famous early dispute in Darwinian thought. Alfred Lord Wallace, a contemporary of Darwin’s and an early champion of the notion of natural selection, famously parted ways with Darwin over the

evolution of man. Man’s unique cognitive abilities, argued Wallace, could not have evolved through natural selection; therefore, man and his unique brain are the result of the direct action of god.

Wallace is popularly supposed to have reached these conclusions because of a failure of will, or a latent idealism or mysticism--he just could not reconcile himself to the fact that the human mind was the result of a blind natural process. Stephen Jay Gould, however, points out that his disagreement with Darwin actually resulted from Wallace’s “hyper-selectionist” stance. For the reasons that Miller mentions, Wallace could not explain the human brain through appeals to “fitness.” Darwin, employing the more pluralistic stance advocated by Gould, argued that a lack of adaptive benefit was in no way a demonstration that a trait was not evolved; adaptation is not the sole source of evolutionary change, and many mechanisms, among them sexual selection, could be employed to explain a trait that seems to have initially conferred no survival benefit (*Thumb* 48-50).

Because we cannot explain the human brain--and in particular apparently innate skills like language--through fitness stories, argues Miller, we must look to sexual selection. In a provocative thesis, Miller uses the “conspicuous metabolic waste” sexual selection origin story:

the arts, beginning with ornamentation and song, were taxing wastes of cognitive resources, demonstrating a mate's fitness. Once "artiness" became, almost arbitrarily, a desired trait, the runaway process of sexual selection quickly--by the standards of natural selection--led to an unnecessarily large (by survival standards) and "artistic" brain.

It is a fascinating thesis, attractive not only because of its argument that the arts were the primary motor for the development of human intelligence (rather than a useless side-effect), but also because of its comforting suggestion that intelligence and artistic talent might be sexually desirable (as contrasted to most evolutionary-psychological discussions of human sexual attractiveness, which basically argue that symmetry and size in men, and symmetry and youth in women, are the only real trans-cultural standards).

As with Dissanayake's theory, Miller's thesis, even if true, does not necessarily provide us with any tools for the interpretation of or evaluation of art or literature. It might, again like Dissanayake's theory, suggest that there is an innate desire for artistic or cognitive stimulation, but the fact that the ability to create and appreciate art might be an evolved one in no way makes it innately valuable. At most it might console the poor poet that his

decision not to go to law school may not necessarily result in complete reproductive failure.

Robert Storey's *Mimesis and the Human Animal: On the Biogenetic Foundations of Literary Representation* asks the same question that Dissanayake's and Miller's works do: what is art for? For Storey, the notion that art is a byproduct of other tendencies--or even that the urge to produce and consume art is evolved and innate--is not enough. Storey argues that art (and therefore literature) has always had an adaptive function, and still has the same function.

Some of what Storey theorizes is fairly plausible--if not particularly well proven. For example, in his chapter entitled "Comedy and the Relaxed Open-Mouth Display," Storey argues that, contrary to, say, Freudian hydraulic metaphors that posit that laughter constitutes a venting of psychic energy, cognitive science suggests that "the element common to all laughter-inducing situations . . . is the presence of a masterable discrepancy or incongruity" (163). The comic results from the assimilation of incongruities into our conceptual schema, and, says Storey, "The adaptive advantage of assimilating incongruities into diverse behavioral and cognitive systems--and, in doing so, extending intellectual reach, accounts, undoubtedly . . . for the funniness of a joke" (163).

Comedy (not in the formal, classical sense, but in the sense of “the art of the funny”) exists to satisfy the adapted pleasure we experience upon mastering cognitive discrepancies. More than simply pushing evolved buttons to derive pleasure (exactly what Pinker means by “cheesecake”), however, comedy serves a valuable function: “laughter . . . can strengthen both the stress- and disease-fighting immune system; it can alleviate pain and reduce psychological tension; it can increase creativity and flexibility of thought” (149).

Tragedy, however, serves a different function: it educates the spectator--through empathetic identification with the tragic hero; through “ambivalence over the emotional allegiances of the hero,” which results for the audience in “a preparedness for instruction about their [the allegiances’] social and psychological consequences” (149); and through “vicarious endurance of the tragic catastrophe, which, through being indexed in memory by the ‘painful’ emotions” teaches the audience how to avoid the “inevitable” (149).

Tragedy teaches us, not by giving us *ideas* about social action, but by showing us instructive scenarios.

This is a plausible explanation of the social functionality of tragedy, but it is difficult to see what is particularly Darwinian about any of this; even the claim

that the pleasure of laughter derives from solving a "masterable discrepancy" is a claim from cognitive science that could be confirmed or disconfirmed without the manufacture of adaptive explanations. And is there really anything novel about the notion that tragedy (and narrative in general) educates us in a useful way? Such a claim would only be particularly Darwinian if Storey were making the claim that tragedy (or narrative) was a "trait" that had evolved because it served an adaptive purpose.

And again, assuming all of this is true, what tools of explanation and evaluation does such a model provide? Like Carroll (and unlike Dissanayake and Miller), Storey does attempt to apply his model to a few individual works. For example, he provides a not uninteresting discussion of Antigone's decision to bury her brother in defiance of Creon.

It seems that she has been prepared by natural selection to value her brother (in the environment of evolutionary adaptedness it was a better genetic investment to care for a brother, who shares half of your genes, than even to care for a child, who is likely to die, or a mate, who might leave):

> In standing with her brother, Antigone is thinking with a primitive's heart, but the circumstances hardly favor such thinking. Not only is she up against powerful civic sentiment, but she confronts a king who fears that his dominance is

> threatened, and threatened by his “natural” inferior, a woman. (120)

This interpretation is plausible--even conventional (as critic Tony Jackson says of Storey’s reading, “Who would deny that Antigone’s dilemma involves a conflict between immediate family obligations and obligations to civil authority?” [*Questioning* 129])--but it is difficult to see how its grounding in evolutionary psychology makes it particularly radical. This interpretation makes perfect sense without the hypothesis of certain *innate* dispositions. Again, as with Carroll’s discussions of Shakespeare and Bronte, knowledge of evolutionary psychology might provide some insight into authorial intention by indicating that some behaviors are more probable than others (assuming that the author is attempting to be “realistic” and to some extent shares our ideas about human motivational structures), but that is all.

Poet and critic Frederick Turner--whose ideas about progress, complexity, and literature we shall discuss at length in later sections--has made perhaps the most detailed Darwinian/cognitive analysis of literary form in his discussions of poetic meter and the significance of the typical length of a line of poetry.

The poetic line in almost every culture and epoch takes about three seconds to read aloud--and three seconds, points

out Turner, is the length of our “mental present”--the length of time during which we remember completely everything that we experience, before those experiences are passed on to long-term memory and edited. Because the poetic line coincides with this mental present, “poetic meter is the most efficient and memorable way of communicating verbal information” (*Inner* 47); just as we can remember, say, ten seven-digit telephone numbers much more easily than we could remember seven strings of ten digit numbers, poetry that comes packaged in three-second lines is easily remembered.

But even more important than the mnemonic advantages that the three-second line confers is the “driving” effect that such a three-second line has. Natural brain rhythms, like the alpha rhythm, which runs at ten cycles every second, can be “driven” by an external rhythmic stimulus, causing “large changes in brain state and brain chemistry” (*Inner 48)*; driving the alpha rhythm can result in seizures, but driving the three-second cycle has even more interesting effects.

Turner claims that research into trances induced by chanting indicates that chanting either the same three-second phrase (or different three second phrases with identical rhythmic structures) causes changes in the chemistry of the brain that alter how the brain absorbs information and how it processes that information:

> A state resembling the relaxed awareness that is the goal of meditative disciplines is attained, but at the same time a powerful channel is opened up between the linguistic left temporal lobe of the brain, normally somewhat isolated, and the emotive and evocative limbic system. New experiences of insight and empathy with nature and with other human beings become possible. (*Inner* 48)

And while the length of the line has this driving effect, meter has its own distinctive cognitive effects. Metered poetry, long recognized as conveying information in its variation (if we are reading many lines of iambic pentameter and a line breaks from that pattern, we notice it), conveys information in a specific way: “The information is processed and understood not with the linguistic left brain but with the musical and spatial right brain” (*Inner* 49). Therefore, “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” (*Inner* 49). Ultimately, argues Turner, poetry “is a biocultural feedback loop that makes us able to use much more of our brain than we normally can” (*Inner* 55).

This is a quite plausible extrapolation from fairly uncontroversial findings in cognitive science; along with the work of Mark Turner on narrative it is one of the most convincing applications of such findings to the study of literature. More than convincing, though, it is *attractive*. To the poet or critic of poetry haunted by questions of

“relevance,” this theory provides justification in its argument that poetry is a pretty amazing tool to achieve “higher consciousness.”

So Turner’s discussion of poetic form is a fine example of the application of cognitive science to literary study--and if it provides few means for making qualitative distinctions *between* poems, this hardly makes it unique among such applications--but its connection to the Darwinian paradigm is more complicated. One could on one level see this work as complementary to the mainstream cognitive science position on art, as exemplified by the work of Steven Pinker; like Pinker’s “cheesecake for the mind,” the form of poetry exploits certain innate cognitive and emotional tendencies to give pleasure (and, in this case, to inform).

Turner’s position, however, is more radical. A fuller discussion of Turner’s work must wait, but let it suffice here to say that Turner wishes to do more than claim that the production and consumption of poetry is a useful behavior parasitic on more basic (and presumably evolved and adaptive) cognitive tendencies. Not content with explanations such as Dissanayake’s and Miller’s, which view relatively high-level behaviors such as artistic production as traits both adaptive and selected for-–and certainly aware that even most evolutionary psychologists find

adaptive explanations for art unconvincing--Turner argues that poetry is the result of a more general evolved and adaptive tendency: the recognition of beauty. Beauty, Turner claims in an argument developed in *Natural Classicism* (where he first developed his theory of poetic form) and most fully developed in his more recent work *The Culture of Hope,* rather than being a culturally variable concept, is

> an objective property of the fundamental generative process of the universe--thus possessing a real, not just subjective, existence. Like our eyes, our aesthetic sense is designed to perceive objects that are actually out there: systems which show promise for emergent forms of order. (“Evolutionary” 103)

Such a sense “would have adaptive significance” (“Evolutionary” 103). Turner’s arguments in defense of these claims are too complex to evaluate here, dependent as they are on the science of complexity (the subject of our next section), but it is important to note that Turner--unlike Darwinian humanists who either see the arts as either without primary adaptive significance or, like Miller and Dissanayake, provide somewhat plausible explanations of adaptive purpose but admit that the connection of such purpose to present function is tenuous--sees the perception of beauty and the production of artistic beauty as innately *good*, transcending politics or narrow functionality.

Leda Cosmides and John Tooby, whose *The Adapted Mind* was one of the founding documents of evolutionary psychology, have recently softened their stance on the question of the adaptedness of the arts. In *The Adapted Mind* they took the position, like Steven Pinker and most established evolutionary psychologists, that aesthetic behavior was a by-product of other adaptations. But in a recent essay, "Does Beauty Build Adapted Minds? Toward an Evolutionary Theory of Aesthetics, Fiction, and the Arts," Cosmides and Tooby discuss the possible adaptive significance of something that they call "off-line thinking."

Off-line thinking is a concept that they develop in order to explain a few basic facts about fictive narrative: first, "involvement in fictional, imagined worlds appears to be a cross-culturally universal, species-typical phenomenon" (7); second, "involvement in the imaginative arts appears to be an intrinsically rewarding activity, without apparent utilitarian payoff" (7); third, "fictional worlds engage emotion systems while disengaging action systems" (8); and finally, "it appears as if humans have evolved specialized cognitive machinery that allows us to enter and participate in imagined worlds" (8).

The challenge for the believer in pervasive selection is clear: we seem to have specialized innate abilities

regarding the arts, yet there is no convincing explanation for how these skills could have emerged adaptively.

Geoffrey Miller's explanation for artistic "instincts" that seem to lack survival value is sexual selection. Sexual selection can lead to the development of all kinds of traits that might seem, at best, a metabolic drag; in humans, those traits are artistic behavior and big brains. Cosmides and Tooby, however, believe that there are only three acceptable explanations for our artistic propensities: pretend play, fictional experience, and other aesthetic experiences are direct adaptations; these things are the result of other adaptations--"cheesecake," or, as Cosmides and Tooby put it, "something that humans were designed to do, but something they are vulnerable to" (9); or these activities are the result of genes that spread by chance during evolution.

They reject the final hypothesis as extremely unlikely--the behaviors under question are too complex and well organized to have developed by chance. The second hypothesis, which they formerly embraced, and which they maintain explains many features of the arts, they now find not completely adequate. These behaviors may have adaptive value in themselves, and been selected for. Why do they think this? Because for some reason–-and despite the fact that organisms have a need for, and therefore presumably a desire for, reliable information about the world--"when

given a choice, most individual prefer to read novels over textbooks, and prefer films depicting fictional events over documentaries" (11). For this apparently anti-adaptive tendency to persist, it must in fact have adaptive value. (Note the familiar hyper-selectionist logic: if a trait is apparently non- or anti-adaptive, we just haven't looked closely enough for an adaptive explanation.)

In order to explain this preference for fiction, Cosmides and Tooby first present a basic evolutionary-psychological theory of beauty:

> A human should find something beautiful because it exhibits cues which, in the environment in which humans evolved, signaled that it would have been advantageous to pay sustained sensory attention to it, in the absence of instrumental reasons for doing so. This includes everything from members of the opposite sex and game animals to the exhibition by others of intricate skills. (14)

This functional definition of beauty as "a fascination with the apparently useless," they point out, means that there can never be a general theory of the properties of the things found to be beautiful,[6] but it can direct us in the investigation of the utility of finding the particular thing beautiful. For example, Cosmides and Tooby argue that certain phenomena, like landscapes, stars, and fire, "are

[6] This "anti-essentialist" definition is in fact reminiscent of Terry Eagleton's discussion in *Literary Theory: an Introduction* of the term "literature" as being similar to the term "weed": weeds are any plants we don't want in our yards; literature is a kind of writing that we

experienced as beautiful because their invariant properties allow them to function as test patterns to tune our perceptual machinery" (14).

So why, given this definition, do we experience beauty upon reading works of literature (or fiction in general)? Because they are in the form of *narrative*. Narrative is a special instance of what Cosmides and Tooby call "decoupling"--the human ability and tendency to entertain many different and sometimes contradictory models of the world. The ability to deal not only with the true but with "the might-be-true, the true-over-there, the once-was-true, the what-others-believe-is-true, the true-only-if-I-did-that" and so on is a particular strength of the human organism.

Cosmides and Tooby argue essentially that fictive narrative, as suggested by several of the *Biopoetics* contributors, is a form of useful scenario-spinning: it allows us to sharpen our wits and prepare for the unfamiliar. That it is *narrative* is important because, they argue, we process "more deeply" information that comes to us in the form of individual experience:

> We prefer accounts to have one or more persons from whose perspective we can vicariously experience the unfolding receipt of information, expressed in terms of temporally sequenced events (as experience actually comes to us), with an

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particularly value in a certain way (5).

> agent’s actions causing and caused by events (as we experience ourselves) in pursuit of intelligible purposes. (18)

Because hypothetical scenarios come to us in narrative form, they must be “untrue” in their details, but they are still instructive in their modeling of all sorts of possibilities in the world and their development in the experiencer of certain skills: “skills of understanding and skills of valuing, skills of feeling and skills of perceiving, skills of knowing and skills of moving” (19).

Unsurprisingly, Cosmides and Tooby’s account of the adaptive nature of literature (very broadly defined as fictive narrative) is more detailed and convincing than those of the critics collected in the *Biopoetics* anthology. But even if we find the argument that a taste for narrative is innate, that innate means adaptive, and that narrative was *in itself* selected for and not the by-product of other adaptations convincing, what does this tell us about literature? In a general sense, it asserts the cognitive value of fictive discourse--a value that would seem to persist despite the radical changes in the human environment since the environment of evolutionary adaptedness.

But do we really need evolutionary psychology to tell us this? That a taste for narrative is an adaptive trait--if true--is no doubt an important fact. That it is innate,

regardless of its origin, is even more important. The latter fact is a useful tool for aesthetics and rhetoric, explaining the appeal of certain kinds of discourse, and providing predictions as to universal appeal and intelligibility of certain kinds of works in different cultural contexts.

But of what importance is it to the critic that this taste for narrative is adaptive? It is the findings from cognitive science--which are, incidentally, falsifiable in a way that the speculations of most evolutionary psychology are not--that are of some modest usefulness to the critic. The evolutionary origin of a taste for narrative is as useful for a theory of reading as the evolutionary origin of the eye--that we *have* eyes is certainly significant in the development of literature, but *how* we got them is not.

And this problem is representative of the situation of practically all criticism in the evolutionary mode: even if the claims drawn from evolutionary psychology are true (and as we have seen, critics of an evolutionary bent are not nearly so cautious in their speculation as are most evolutionary psychologists), this fact does not seem to have much significance for the evaluation of and explanation of literature--unless one is willing to make the jump from adaptive origin to present *value*.

The work of Joseph Carroll, as we have seen, is exemplary in this way. He borrows from evolutionary psychology certain claims about human emotional organization and behavioral tendencies. But his arguments about the interpretation of literature (arguing that *Wuthering Heights* doesn't deal with incestuous feelings but with infantile acting-out) are based in only a modest, and modestly useful way, on evolutionary psychology. As we noted earlier, applying the "findings" of evolutionary psychology in the thematic study of literature can only affect, as with other empirical facts about the world, our sense of what the author probably intended. It is unclear, however, how this is particularly radical or more insightful than, say, ideological criticism.

Robert Storey's work, too, although he presents it as revolutionary riposte to the poststructuralist orthodoxy, provides a rather traditional notion of criticism, with only an almost superfluous grounding in evolutionary psychology to distinguish it. He makes the perfectly reasonable arguments that literature allows us to "have the pleasure of the emotions that accompany loss or injury while remaining certain that [we] will suffer the real effects of neither" (115), and that narrative "helps ensure the cohesiveness of a culture by bringing the potentially disruptive in line with social norms" (114), but these arguments, aside from

being as old as Plato and Aristotle, do not depend for their cogency at all on the insights of evolutionary psychology.

The degree to which literature works upon an innate and relatively immutable psychological structure is certainly an important question, the answer to which might assist us in making probabilistic claims about the reception of literature. But again, even though Storey makes some rather halfhearted arguments about the historical fitness-enhancing qualities of literature, such an adaptive origin story adds nothing to a discussion of the creation of, effect of, or social functionality of literature.

What Carroll and Storey--and most of the critics discussed here--seem to find revolutionary about their methodology is the assertion that literature is a biological phenomenon. But such a claim is either a truism[7], or an insane claim of monocausality: literature is the result of--and *only* the result of--an evolved and immutable psychological structure.

Nancy Easterlin, a critic generally quite sympathetic to the project of applying evolutionary psychology to the study of literature and frustrated with the general scientific illiteracy of scholars in the humanities, asks,

[7] As critic Tony Jackson points out, “barring supernatural explanations, thought cannot ultimately be anything but biological” (*Questioning* 327).

“Do cognitive predispositions predict or determine literary quality?” Her answer: so far, no--and maybe never.

Easterlin points out that as a result of the hypothesis of innate cognitive predispositions there are two basic positions taken in regard to the evaluation of art: “that artworks whose form and method are based most demonstrably on biological patterns are superior to those that are not” (“Cognitive” 244) and “that art exists to break up patterns of behavioral response (presumably biologically based), and therefore is most valuable when it deviates from cognitive or behavioral norms” (“Cognitive” 244).[8]

The latter position is obviously similar to the position of Bertolt Brecht or that of the Russian formalists--art as that which changes our view of the world by “estranging” it, by violating the conventions by which it is usually represented--adding only the hypothesis that the cognitive schema that are being challenged are the result of innate cognitive architecture rather than the result of ideology or the autonomous development of aesthetic form. The arguments for this position would be as strong as those for any other theory of art as estrangement.

[8] Contemporary biopoeticists are generally disinclined, as we have seen, to make arguments for art that goes against the grain, as it were, of human cognitive tendencies. Easterlin, however, brings up the example of Morse Peckam, who in works such as *Man’s Rage for Chaos* (1960) argued that “the human drive to order results in the suppression of much important information, and that it is the role of art to break up behavioral orientations and create new patterns of response” (244).

The former position is explicitly embraced by Frederick Turner and implicitly adopted by Joseph Carroll. A full consideration of Turner's position must wait for a discussion of his entire theory of "natural classicism," but Carroll's position, as it stands, needs elaboration. Although, as we have seen, Carroll is primarily interested in theme rather than form, he does suggest, without much argument to support this position, that those works that employ more "universal" themes are more likely to be great works of art. As Easterlin points out, this position, as well as the position that aesthetic forms that "flatter" our innate cognitive tendencies are superior to those that do not, does not follow logically; the most that can be said of such works is that they might be easier to assimilate or comprehend than works in other forms or dealing with other themes.

Tony Jackson has argued that the biopoeticists' claims about the revolutionary nature of a criticism informed by evolutionary psychology are the result of a mistaken idea about the epistemological claims of poststructuralism, which they see as the dominant paradigm ("Questioning"). Jackson argues that critics like Storey and Carroll conflate relativism with nihilism. Easterlin, despite her misgivings about evolutionary-psychological criticism, thinks that the biopoeticists' criticisms of the epistemological foundations

of poststructuralist criticism are fairly cogent (“Voyages” 60).

This is hardly the place to discuss the meaning of poststructuralism--whether there is even *one* poststructuralism, what its claims are (if it can be said to consistently make claims), and whether those claims make any sense (and what the import of asking whether it makes sense is). What should be stressed--and Tony Jackson does stress this--is that regardless of its epistemological claims, the poststructuralists would not necessarily disagree with the assumptions of the biopoeticists. For example, of Joseph Carroll’s *Evolution and Literary Criticism* Jackson says this:

> Carroll evidently feels he is saying new things here. He feels that he is proving the biological basis for the traditional (that is, pre-poststructuralist) notions of literature and thereby disproving the claims of poststructuralist interpretations. But poststructuralism would agree with most of these ideas; the disagreement would involve what actually happens with literature in specific cultural contexts. Unless biologically based analyses are going to explain literary affect in toto, then the realm of history, desire and politics will inevitably come into play. (“Questioning” 326)

While Jackson may be a bit too sanguine about the adequacy of poststructuralist criticism--poststructuralist explanations are as often idealist theories about the autonomy of, and all-determining nature of, discourse as they are theories of the complex material determination of

the world--he is certainly correct in pointing out that despite their epistemological claims, poststructuralists would not necessarily disagree with many of Carroll's assumption: anti-foundationalists as uncompromising as Richard Rorty and Stanley Fish would see nothing wrong with the claims of evolutionary psychology, provided that those claims were well proven as proof is defined by the dominant scientific paradigm. That such theorists would point out that science is a set of mutually reinforcing propositions that can never be *ultimately* grounded does not mean that they do not see the "accuracy" and utility of contemporary science (provided, of course, that we understand that utility only makes sense in terms of an already-present model, and so on).

Biopoeticists believe that they are making a radical claim in maintaining that humans are physical, biological beings; but their ideological bogeymen, the poststructuralists (along with feminists, Marxists, and others who wish to "politicize" the aesthetic) would not disagree--or, rather, they would only disagree by pointing out that humans are not *only* biological beings, or by pointing out that this claim, while cogent and reasonable to most people today, is in a strict sense epistemologically ungroundable.

The biopoeticists also believe, of course, that humans are not just biological beings, but biological beings with an innate, evolved, and adaptive (at least in origin) psychological architecture. There is in fact throughout the work of the biopoeticists a certain “he who is not with us is against us” logic that quickly moves from the truism that human beings exist as biological beings to the idea that any remotely plausible evolutionary-psychological theory is true; either one must believe with the poststructuralists that there is nothing outside of language, or everything is socially constructed, or whatever else it is that these radicals believe, or one must believe that humans not only do exist outside of language (or whatever) but that they also have a certain set of innate cognitive tendencies.

Assuming that the evolutionary-psychological claims that the biopoeticists make are true--even the ones that are controversial among evolutionary psychologists, such as the idea that art in general, or certain aesthetic forms, is an adaptive trait--what significance do these ideas have for the explanation of and evaluation of literature? As we have seen in the work of Dissanayake, the hypothesis that the artistic impulse is evolved and innate can reinforce the idea that art performs both individually and socially important functions: that it served specific functions in the environment of evolutionary adaptedness can at least

suggest that it serves similar functions today. Of course, most evolution-minded critics are well aware that adaptive origin and present function are not necessarily the same; but when Dissanayake argues that because the artistic impulse is innate and evolved a diminishment of the "artistic" in modern life might be of psychological consequence, she is making a reasonable point (assuming, of course, that the premise is correct).

And yet, does such a theory really add much to literary theory that cognitive science does not? One might argue that the speculations of evolutionary psychology are valuable in the search for innate cognitive structures[9]--they might suggest the specific modular basis of difficult-to-explain universal and apparently innate psychological tendencies and abilities, for example--but it is still the cognitive science that is of direct import, not the speculative stories of the origins of cognitive structures.

Speculative adaptive stories invented by literary critics would seem to have two primary justifications: suggesting (like evolutionary psychology itself) research programs for cognitive science, or implicitly suggesting that the adaptive purpose of art *must* be its purpose now--or

[9] Although, as I noted in the earlier discussion of sociobiology and evolutionary psychology, many critics believe that evolutionary psychology actually distorts the research program of cognitive science by placing undue emphasis on validating the assumptions of folk

if it isn’t, it should be. On this model Dissanayake, for example, is doing a little of both: on the one hand she seems to be *doing* evolutionary psychology--suggesting, like Cosmides and Tooby, an adaptive explanation for a trait that she sees as both universal and innate; and if the adaptive story itself is not falsifiable, that the cognitive structure is innate *is*, at least in theory. One could say that she and critics with similar programs are simply expanding evolutionary psychology into the explanation of art as a trait, and that their project is as valid as the project of evolutionary psychology in general.

On the other hand, stories of evolutionary origin proposed by literary critics are often attempts to do what evolutionary psychologists are usually careful enough not to do: imply that adaptive origin and present function are the same. Many of the critics whose work we have considered move with quite unreasonable haste from origin stories that they know to be controversial even by standards of evolutionary psychology to an argument about the necessity of art for psychological and social health *today*. Adaptive origin might *suggest* present utility (and many biologists would caution against going that far), but to suggest present utility before even proposing a program to verify that the “trait” exists is certainly premature.

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psychology.

So in their own evolutionary psychological explanations of art and literature the biopoeticists reproduce and amplify the epistemological shortcomings of the discipline of evolutionary psychology; they are prone to the same problems of evidence and fallacious reasoning (explicit and implicit). When they extend the field of evolutionary psychology by inventing their own origin stories, they are on very shaky ground. These stories have the *rhetorical* effect of adding a sheen of plausibility to arguments about innate structures that otherwise have weak justifications in cognitive science, but they are logically weaker than those proposed by most mainstream evolutionary psychologists.

But what of the more modest project of importing the claims of evolutionary psychology to literary criticism. How useful has this project been, or can it be? Is it really revolutionary? Tony Jackson has, I believe, been accurate in maintaining that much of the belief among members of this movement that they are doing something of consequence is the result of their pugnacious misreading of the meaning of (or at least the literary-critical *implications* of) poststructuralism; they believe that asserting, for example, that authors are biological beings who are (at least in a sense) the originators of their works is a radical challenge to the poststructuralist establishment--despite the fact that there is hardly an interpretive model that does not at

least implicitly accept the importance of an intention *effect*.[10]

If an appropriation of evolutionary psychology isn't a radical challenge to dominant interpretive paradigms, in what way can such an appropriation aid in the interpretation and explanation of literature? Models such as Dissanayake's, although they are methodologically suspect, can at least suggest a theory of the psychological and social *importance* of art (provided that one always keeps in mind the distinction between origin and present function).

Models such as Storey's and Dissanayake's, which suggest that certain works are not only valued but *valuable* because they embrace certain "innate" forms or themes overreach; they are in fact examples of the naturalistic fallacy: an attempt to derive an *ought* conclusion from *is* claims alone. Frederick Turner, we shall see, tries to provide an argument that explains *why* such forms are "good"; without such an argument, however, literary value judgments rooted in theories of innate cognitive tendencies make no sense.

[10] As Jonathan Culler points out in *On Deconstruction,* although intention, for a number of reasons, can never be ultimately determinative of meaning, an attribution of intention is an essential part of the context of any interpretive act (121-126). Stanley Fish has also argued that of the many things we might do with texts, *interpreting* them is something we would not say we were doing unless we assumed an author with an intent.

Ultimately, the models presented by critics influenced by evolutionary psychology are far from revolutionary. When they are not making somewhat basic logical mistakes--or coming up with evolutionary just-so stories that most evolutionary psychologists would find unconvincing--they produce interpretations that seem to be connected in only the most tenuous way with the findings of evolutionary psychology.

Although there is no reason to think that evolutionary psychology will ever revolutionize literary interpretation, or to think that it should ever become central to such interpretation, evolutionary psychology might make a more modest contribution. As we saw that Carroll's work suggested (before it was carried away by more grandiose claims), evolutionary psychology might aid in interpretation simply by virtue of being knowledge about how the world works.

If true, axioms such as "humans tend to have an innate distaste for sexual intercourse with close kin" or "men tend to desire more, and more varied, sexual partners" can certainly add to literary understanding. Just as an understanding of, say, gravity or the Second Law of Thermodynamics can assist us in understanding what a text *probably* means (*ceteris paribus*, the interpretation in which the boulder is rolling uphill is probably not the correct one), a knowledge of innate cognitive structures can assist

in the same sort of understanding.

If evolutionary psychology ever becomes a mature science, if its claims are ever well proven (or even merely accepted as well proven), it will become an essential part of the critic’s conceptual toolkit, like other well-known scientific precepts. It is unlikely, however, to change the way we think about literature.

Part II: Evolutionary Progress and Literary Theory

Biological Progress

Charles Darwin cautions to “never say higher or lower” in regard to evolution (Gould, *Full House* 137); his theory of natural selection as the mechanism of evolution (which he consistently defined as “descent with modifications”) provides neither a possible mechanism for “progress” nor any criteria for judging progress. Nevertheless, in the broader culture (although not, for the most part, in the scientific community), “evolution” is equated with “progress”--progress that led inexorably “up” from microorganisms to the jewel of creation: us.

The idea that evolution led inevitably to us--or even to “intelligent” life like us--is believed by hardly any evolutionary biologists, and the idea of evolution as “progress” is generally deplored within the field. Nevertheless, there is a sizeable minority of evolutionary biologists who believe that there is there is a general trend toward increasing *complexity* among organisms.

We saw in our first section that the term “survival of the fittest”--borrowed from Herbert Spencer, who certainly *did* believe in progress--is in fact a tautology: since “fitness” in orthodox Darwinian theory is a measure of how

many descendants of an organism survive into the next generation, the phrase actually translates to “survival of that which survives.”

Remember how natural selection works, according to Darwin: members of a species differ in some respects--some have traits that are advantageous to reproduction, others have disadvantageous traits. *Ceteris Paribus*, those organisms with the advantageous traits will come to dominate. If a group is reproductively isolated, enough of these traits can accumulate for speciation to occur--the group is no longer able to mate with the original species.

It is important to note here that “fitness”--in the sense of being adapted to one’s environment, of having traits advantageous to reproduction--refers to whether a particular organism has traits that are advantageous in a particular ecological niche. There is no such thing as “absolute” fitness--being well adapted to *all* ecological niches; in fact, such a notion is not even coherent.

Thus the universal disdain for the idea of progress within orthodox Darwinism: there is no notion of a general trend toward greater fitness; and as fitness depends greatly on the particular environment in which an organism is embedded *and* a given degree of reproductive success can be achieved by radically different strategies, there are no

traits--of size, complexity, and so on--that can be considered *universally* advantageous.

Local adaptation (adaptation within a niche) may as easily result in anatomical simplification as in greater complexity: *Sacculina*, a descendant of the barnacle, is a “formless bag of reproductive tissue” much simpler than its ancestors (Gould, *Full House* 139); such simplification frequently occurs among parasites.

And yet the idea of *some* kind of direction to evolution persists, not only in the popular culture, but even among some members of the scientific community. Even as esteemed a naturalist as E.O. Wilson has sometimes seemed to endorse the idea of a trend toward increasing complexity and size of organisms.

The persistence of this notion of evolution as progress could be attributed to ideology, to a persistent anthropocentrism. We wish to see evolution as leading “up” to us because we wish to see ourselves as the greatest of all creations (so far)--the pinnacle of a new Great Chain of Being--and as therefore having the right to use the rest of nature as we wish. As we shall see, this belief in evolution as progress also serves--and has long served--to justify certain social relations: apparently irrational, exploitative, inefficient, or unjust social relations can be justified by pointing to this idea of progress.

But functionalist ideological explanations alone will not suffice to explain the belief in evolution as progress--our imaginary relations to the real conditions of existence are not created by dominant groups out of whole cloth: there is history, and there are conventions of discourse. One need not be a metaphysical realist to assume that, generally speaking, ideology cannot simply be made up in order to serve a social function.

So where *does* this idea of Darwinian evolution as progress come from? Darwin is partially to blame for appropriating the term “evolution” at all: before Darwin redefined the term to mean “descent with modifications,” the term encompassed the idea that such descent was also an “ascent” to higher forms. “Higher” tended to be an ill-defined term (defining higher and lower is still a problem for advocates of evolutionary progressivism), but it was simply assumed that man was the “highest” form of life yet achieved on earth.

But the simple history of the term does not explain the persistence--not merely among a majority of those of the public who believe in evolution at all (49% in the US) or who believe in evolution without the intervention of god (10%)(Chang), but by a not-insignificant number of biologists who work within the utterly dominant Darwinian paradigm--of the idea of progress. Darwin *won*; why aren’t

the implications of the theory of natural selection more widely accepted?

Stephen Jay Gould believes he can explain this curious state of affairs. The idea that evolution is not progressive is one that Gould spent his entire career illustrating and explaining; but in *Full House: The Spread of Excellence from Plato to Darwin,* Gould (whose popularizations usually take the form of essays in the journal *Nature* that are ultimately collected in book form) devotes an entire book to the subject. In an earlier book, *The Mismeasure of Man,* Gould examined the history of attempts to quantify human intelligence, revealing the ways in which, from craniometry to IQ testing, well-meaning and distinguished researchers find in their data, through experimental and conceptual "mistakes," evidence to justify the dominant ideas of their culture--usually about gender or race.

Full House applies the same methods of ideological/scientific critique employed in the celebrated earlier work--neither maligning the scientists who are blinkered by ideology for "lying" nor ignoring the fact that when they err, they always err in the direction of the dominant ideology. In *Full House*, which Gould considers a companion volume to *Wonderful Life*--his study of the Burgess Shale fauna, which presents some of the most persuasive empirical confirmation of the Darwinian "prediction" of

nonprogressivism--Gould points to a few basic causes of a belief in evolutionary progress. Most of these causes take the form of misunderstandings of basic concepts in statistics--misunderstandings that are understandable, if unfortunate, in the general public but highly questionable among scientists.

E.O. Wilson, for example, who should know better, believes that evolution is progressive. He lets slip, however, that the reasons for this belief are not scientific. In a passage from *The Diversity of Life*, Wilson makes one of his strongest claims for evolutionary progress:

> Many reversals have occurred along the way, but the overall average across the history of life has moved from the simple and few to the more complex and numerous. During the past billion years, animals as a whole evolved upward in body size, feeding and defensive techniques, brain and behavioral complexity, social organization, and precision of environmental control. *Progress, then, is a property of the evolution of life as a whole by almost any conceivable intuitive standard*, including the acquisition of goals and intentions in the behavior of animals. It makes little sense to judge it irrelevant. Attentive to the adjuration of C.S. Pierce, *let us not pretend to deny in our philosophy what we know in our hearts to be true*. (187) (emphasis mine)

Intuition, like common sense, is the homeland of ideology; Wilson is aware that there is no evidence for--or, within the theory he has devoted his life to expanding and defending, a mechanism for--progress. There isn’t even a criterion for progress: he is reduced to vaguely gesturing

toward increased size and “complexity” (itself, as we shall see, a troublesome and disputed term) and asserting that in our hearts we know progress when we see it.

We will soon examine the idea of complexity and its countless definitions; but before we look at such technical arguments, let us look again at Wilson’s assertions. Perhaps there are no clear criteria for progress, but Wilson is right: life began with a few small and simple organisms; now the world is teeming with life, and there are large and “complex” organisms. To the observer not blinded by the absence in orthodox Darwinian theory of a means for progress, doesn’t this at least *look* like progress?

It is this idea--that the existence of big and complex organisms constitutes a *prima facie* case for progress--that is the foremost obstacle to understanding the non-progressive nature of evolution; Gould argues that believing that the existence of large creatures constitutes proof of progress in evolution results from a basic misunderstanding of the idea of statistical trends.

It is indisputable, of course, that while once there were only a few micro-organisms, there are now many creatures, many of which are quite big and “complex” in many senses of the word. If this were all that is meant by “progress,” then one would have to concede that indeed there *is* progress.

This is not, however, what is meant by evolutionary progressivists; they maintain that there is a general *trend* or *tendency* to evolution: that there is some sort of inexorable surge “upward.” Gould’s explanation of the increase in the number of large organisms is much more elegant and persuasive: an increase in the statistical “sample” (the total amount of life on the planet) leads to a greater absolute, although not relative, number of large organisms.

If we were to look at a group of ten human beings, we probably would not find anyone over six feet five inches tall. If we were to look at ten *million* people, we would find plenty of people that tall--and some much taller; the tail end of the distribution now includes a lot more people.

If we took the first sample on Tuesday and the second on Friday, we would not maintain that people had grown in the intervening time because of the existence in the latter sample of very tall individuals; but this is exactly the kind of claim that progressivists are making, according to Gould. The existence of large and complex organisms is taken as evidence of a trend, although there has been no *average* increase in size.

In fact, now--as billions of years ago--the dominant life forms on the planet are single-celled organisms: bacteria. Bacteria are not only what Gould calls the “modal”

life form on the planet (there are more of them than of any other) as well as the median (if we were to list every living thing on the planet in order according to size, the middle one would be a bacterium), but they also outweigh all other biomass on the planet combined.

Given that the modal life form on the planet has not changed in billions of years, where is even the appearance of an increase in complexity and size? In the increase in the *average* size of organisms. Unlike in our height example, there has been over time a real (if surprisingly minute) increase in the average size of organisms.

Why has there been an increase in the average size of organisms? Because unlike in our example, the *other* end of the distribution has been cut off. The number of organisms has increased, and therefore chance throws up a few large animals on the right-hand tail of the distribution; this affects the *average* because although the distribution remains what is called a “random walk,” it is a random walk *away* from a wall of minimum complexity.

What we call “life” has a lower bound, and those organisms that reproduce started from an absolute minimum in complexity. Moreover, small-bodied species *near* the minimum size tend to be the only survivors of mass extinctions--so that each extinction starts with only small species. After

each extinction event, there has been an increase in total number of species, increasing total diversity.

Given these facts,

> We note an increase in size of the largest species only because founding species start at the left wall, and the range of size can therefore expand in only one direction. Size of the most common species (the modal decade) never changes, and descendants show no bias for arising at larger sizes than ancestors. But, during each act, the range of size expands in the only open direction by increase in the total number of species, a few of which (and only a few) become larger (while none can penetrate the left wall and get smaller. . . . [I]n cases with boundary conditions . . . extreme achievements in body size will move away from initial values near walls. Size increase, in other words, is really *random evolution away from small size, not directed evolution toward large size.* (Gould, *Full House* 162)

The distribution of life on earth as to size actually looks like one would expect a random distribution against a left-hand boundary to look: like only the right-hand side of a Bell curve, with an overwhelming preponderance of microbes on the left, and a very small number of large mammals on the right.

When this left-hand wall is not a factor, there is no evidence of a general trend towards larger size, and a small but growing amount of data supporting the idea that there is no general trend towards larger size. One study by researchers at Florida State University comparing 342 Cenozoic species with their known descendants found no such

general trend: a descendant was just as likely to be smaller as to be larger (Arnold 206).

It remains a logical possibility that even though much of the appearance of increasing size and complexity is the result of an increase in total variation, we might find empirical evidence of a general increase in size of lineages not beginning near the wall of minimum complexity.

It would then be legitimate to speak of a general trend towards more complexity. Such evidence, however, has not been discovered, and absent a plausible mechanism for increased size and complexity, there is little reason to suppose that it will.

If there is any sort of general trend, it is much more likely, argues Gould, to be in the other direction:

> One common mode of Darwinian success (local adaptation) does entail an apparent preference for substantial decreases in complexity--namely, the lifestyle of parasites. We are not speaking here of an organic rarity, but a mode of life evolved by probably hundreds of thousands of species. Not all parasites gain adaptive benefit through simplification, but one large group of species certainly does--those that live deep within the bodies of their hosts, permanently attached and receiving all their nutrition by commandeering the blood supply, or some of the food already digested by the host. Such species require neither organs of locomotion nor digestion, and natural selection favors their loss. One or a few novel organs might evolve for special needs--hooks for attaching to the host, or suction devices to drain off food, for example--but these elaborations are more than offset by a far greater number of lost organs. (Gould, Full House 200)

(Interestingly, these parasitic species, consistent with the cobbled-together nature of all life, often preserve in their *development* the history of their "more complex" ancestors--yet another reminder of the importance of history and contingency in the evolution of life.)

So: no known mechanism for increasing complexity, no evidence of increasing complexity, an explanation for the appearance of increasing complexity. Given these facts, how can the scientist or educated layperson persist in thinking that evolution leads to increasing complexity and size?

As we saw with E.O. Wilson, even the most learned of evolutionists can be led astray--the appearance of complexity confirming what his heart knows is true. And the absence of real evidence *for* increasing complexity is not the same as evidence against (although such evidence is accumulating). If they can propose a plausible mechanism, the orthodox Darwinists might for now retain their belief in progress without appearing completely irrational.

The appearance of a general increase in size has led some biologists working within the Darwinian model to propose a general adaptive benefit of increased size. As biologist Anthony Hallam puts it:

> Since phyletic size increase is such a widespread trend in the animal kingdom, there must be manifestly one or more selective advantages of

> larger size. . . . Among those proposed are an improved ability to capture prey or ward off predators; greater reproductive success; increased regulation of the internal environment; and increased heat regulation per unit volume. (Hallam 264)

But this adaptive benefit is only proposed *because* of the debatable assumption that size increase is "a widespread trend"--there is no direct evidence of general adaptive benefits of larger size, and certainly no evidence that, overall, those benefits outweigh the reproductive and survival *costs* associated with larger size (as we shall see, the biopoeticists carry this logic one step further: "obvious" trends in larger size indicate an adaptive benefit to larger size; the assumption of presumed adaptive benefits somehow strengthens the original assumption of a general trend).

Similarly, a few biologists believe that there has been a general increase in intelligence, or in neurological complexity, in nature. The case for this is perhaps even weaker than for a general increase in size: the curve from least intelligent to most intelligent life is much steeper, meaning that even the *appearance* of a trend is much less apparent in this regard.

Nevertheless there is that appearance, and the apparent trend is generally explained as a concomitant to the general increase in size. But the case for increased intelligence

sometimes depends on the example of humankind: evolution led to us, the smartest animals ever, so there must be an evolutionary impetus toward greater intelligence.

This assumption is highly questionable on the statistical grounds that we have already examined--one outlier does not a trend make. Moreover, as we saw in our discussion of Miller, very few evolutionary biologists--or even the more extreme evolutionary psychologists--have been able to propose an immediate evolutionary advantage to human intelligence, or to many of the specific abilities of the human brain.

The overwhelming majority of evolutionary biologists agree with Gould that human intelligence is a historical "accident." Not only humans but even "human-like" animals were hardly an inevitability. We are the descendants of tiny mammals who came into their own when the dinosaurs died in the Cretaceous extinction; but if the dinosaurs had not died out (for example) there is no reason to suppose that--like the planets on *Star Trek* populated by human-like intelligences--the earth would now be run by a race of intelligent dinosaurs.

Despite the general skepticism in the scientific community in regard to the idea of a trend toward increasing intelligence--and the overwhelming rejection of the idea of the inevitability of human-like or –level intelligence--the

leading biopoeticists persist in claiming that evolution is progressive, and that aesthetic, ethical, and political values can be inferred from evolutionary progress.

They see the appearance of increasing complexity and feel that it calls for explanation; they see human intelligence and feel that it must be the culmination of something--and perhaps the jumping off point for something even higher.

The biopoeticists could base their case on the idea of a general increase in intelligence. They would, however, have to produce a better explanation for this increase than that it is linked with increased size if they want to come to their desired conclusions; and if they wish to stay within the pan-selectionist model (and, as we shall see, if they want to support their normative conclusions), that explanation must involve a specific and direct benefit to intelligence.

They choose, however, to also base their argument on the example of human intelligence. As we saw in our discussion of evolutionary psychology, biopoeticists are willing to make speculations that even the most ardent evolutionary psychologists are not; in proposing adaptive explanations for human intelligence they are just as reckless.

Ultimately, though, they realize that adaptive explanations are not enough: human intelligence defies such explanations. But they are unwilling to accept that human intelligence is in a sense a historical accident and a by-product of other adaptations.

Alfred Lord Wallace was unable to find an adaptive explanation for the superfluous majesty of the human mind; rather than change his model of natural selection to accommodate such a thing, he ultimately rejected a scientific explanation altogether. The only explanation that remained was supernatural, magical: God.

Like Wallace, the biopoeticists are so stymied by their pan-selectionism that they cannot remain within the Darwinian model. But unlike Wallace, they do not turn to God. To explain the human mind, and ultimately the mystery of progress, they turn to another sort of magic: self-organization.

To understand why the biopoeticists believe that all matter, not just life, tends toward “higher” levels of organization, we must take a brief detour through another science: complexity theory. It is a science, we will find, that so appeals to them that they will incorporate it into their models for more than its explanation of progress.

Complexity

To understand what is known as “complexity theory,” “dynamical systems theory,” “self-organization theory,” in addition to a number of other names, we must begin by understanding the form of this theory that first entered public consciousness in the nineteen-eighties: chaos theory.

After the publication of James Gleick’s best-selling popularization of the field, *Chaos: Making a New Science*, one could hardly avoid references to and analogies to the field. In the popular consciousness, chaos was best symbolized by one of the field’s most suggestive images: the “butterfly effect.” An illustration of “sensitive dependence on initial conditions,” the butterfly effect summoned the image of the flapping of a butterfly’s wings changing weather patterns on the other side of the globe.

That such a phenomenon could occur was considered surprising because most systems studied by classical mechanics were presumed to change in linear proportion to changes in their inputs: a billiard ball (on a frictionless table) sent at the same vector and same force as another ball, but from a fraction of an inch away, would end up some readily calculable distance from its fellow. The relationship between these two elements would take the form of a linear (i.e. non-exponential) function: y=2x perhaps,

or y=1/2x. Such functions are called “linear” because when graphed, they describe a straight line.

But despite the many great successes of the classical model, this model was based on an idealization of real systems. In nature there are few--if any--systems like our frictionless billiard table. Rarely do we find systems with only two elements and no external influences. Even the calculations of the orbits of the planets of our solar system are based on idealizations: they are only useful and “accurate” because of the scale of the system being studied.

Systems involving more than two elements, or affected by factors like friction, must be modeled by *nonlinear* (exponential) functions: X^2=y, for example. The important difference between linear and nonlinear functions is that, generally speaking, linear functions have a general or “closed form” solution (Kellert, *Wake* 3; Coveney, *Frontiers* 35), which means that there is a relatively simple solution allowing us to discover the final state of the system (Kellert, *Wake* 3; Coveney, *Frontiers* 36).

Nonlinear systems (that is, systems that are modeled by nonlinear functions) have no such simple solutions. The only way to find the end state of a nonlinear system is to calculate every state leading up to that end state: the model must actually be “played out,” and no system can be

accurately predicted by a model simpler than the system itself.

Why is any of this important or surprising? After all, few of us really believe that the world is as orderly and predictable as the idealizations of classical mechanics would suggest. Folk wisdom such as “For want of a nail . . .” and science fiction stories in which a minor change in the past (a time-traveler stepping on a butterfly in the Jurassic, say) results in a completely altered future (an idea parodied on a Halloween episode of the popular television show *The Simpsons)* reflect our general sense that the future is inherently unpredictable.

Yet chaos theory was hailed as revolutionary in part because of a misunderstanding of these epistemological claims as being an ontological claim: specifically, a refutation of determinism. Researchers in the field could hardly have predicted this; in fact, the field was more precisely defined as “deterministic chaos” (a definition encompassing the idea that “chaotic” behavior was often the result of simple underlying rules). Nevertheless, in the popular mind--and, as we shall see, in the minds some who hoped to apply chaos theory to the humanities--chaos theory implied not only that the future was *unpredictable* but that it was in fact *undetermined*.

Since the notion of determinism plays a role in some of the normative conclusions made by the biopoeticists, it might be of some use to quickly review what exactly is meant by the concept. Perhaps the most famous formulation was made by Pierre Simon, Marquis de Laplace:

> An intelligence which, at a given instant, would know all the forces by which nature is animated, and the respective situation of all the elements of which it is composed, if furthermore it were vast enough to submit all these data to analysis, would in the same formula encompass the motions of the largest bodies of the universe, and those of the most minute atom: nothing for it would be uncertain, and the future as well as the past would be present to its eyes. The human mind, in the perfection that it has been able to give to astronomy, provides a feeble semblance of this intelligence. (Qtd. Ruelle 29)

Laplace never thought that his “demon,” as it is frequently called, was a practical possibility. He was simply pointing out that in a universe of matter in motion, controlled by physical laws, every future state of the universe follows of necessity from the preceding state.

One way of looking at this a little less grandly is simply to say *each* state of the universe is the necessary result of the previous state; if we could somehow “replay” any given moment, the next moment would be exactly the same. Yet another way of looking at this would be through a more human example. You are driving your car and approach a traffic light just as it turns red. You hit the brakes just

in time to avoid barreling through the red light. A determinist would say that if we could repeat this event--if the antecedent states were the same--there is no way you could have done otherwise. How could you have?

Although determinism is the working model of most scientists, this seemingly common-sense notion has generated interminable debate on its consequences for “free will.” Many philosophers, even up to the present day, find the supposed implications of determinism for notions of human freedom and responsibility to be distasteful, indeed unacceptable.

The debates about whether “could have done otherwise” in the sense of the above example is an accurate empirical description of the world, whether such a notion even makes logical sense, and what role this particular definition of freedom plays in our ideas of “strong” or “ultimate” responsibility can take fairly technical forms; we will therefore only consider these debates as they touch directly upon claims made by the biopoeticists.

We will also consider later the possibility that quantum events might be “undetermined,” or that the physics of dynamical systems might result in undetermined behavior. The important thing to note here is that chaos--at least in the form of sensitive dependence--presents no challenge to

this model; it in fact depends on the notion of determinism.

If this misreading of the implications of chaos research constitutes the most significant effect of chaos theory on popular culture, is this really all there is to the spread of the idea that chaos is really a new or revolutionary kind of science? Not at all.

One profound observation made by the pioneers of chaos theory, also illustrated by the idea of the “butterfly effect,” is that apparent chaos or complexity can emerge from underlying simplicity (some forms of complexity theory, as we shall see, spy another phenomenon: surface order [simplicity?] arising from underlying disorder).

The import of this observation is that although as a practical matter me may never be able to accurately predict the weather or the development of an ecosystem beyond the near future, we might be able to understand *how* such things develop, and to model what might be considered the underlying dynamical “rules” of such a system.

But what relevance do such concepts as “sensitive dependence” and “underlying simplicity” have for the humanities in general, and for literary theory in particular? Perhaps the best-known early approach to appropriating chaos theory for literary studies was in N. Katherine Hayles’s work *Chaos Bound*.

In this work Hayles (a literature professor with a Master's degree in chemistry) attempts both to make chaos theory accessible to the humanities scholar and to argue that there are deep affinities between chaos theory and contemporary cultural theories and movements. As she puts it in her introduction,

> . . . there are also suggestive similarities across disciplinary lines. Suppose an island breaks through the surface of the water, then another and another, until the sea is dotted with islands. Each has its own ecology, terrain, and morphology. One can recognize these distinctions and at the same time wonder whether they are all part of an emerging mountain range, connected both through substrata they share and through the larger forces that brought them into being . . .. In this book, I argue that certain areas within the culture form what might be called an archipelago of chaos. (3)

As this analogy suggests, much of Hayles's analysis will be of the "it is no accident that . . ." variety. It will be the burden of Hayles's argument to prove not only that chaos theory and contemporary cultural theory arose because of a particular cultural milieu (terms like "zeitgeist" or "expressive causality" come to mind, although she never uses them) but also that there is indeed some deep philosophical affinity between chaos and postmodernism and poststructuralism. The latter attempt meets with only moderate success.

More successful, however, is her exposition of fundamental concepts of chaos theory. Her first chapter,

"Self-Reflexive Metaphors in Maxwell's Demon and Shannon's Choice: Finding the Passages," makes clear the connection between entropy and information and the fundamental disagreement in the field about the relationship between order and information. The Shannon-Weaver heuristic--popular, we are told, with electrical engineers--explains that "the more uncertain a message [is], the more information it [can] convey" (57). The Brillouin heuristic, which grew out of an analysis of Maxwell's demon (which Hayles explains very clearly) "makes sense only if information and entropy are opposites" (58).

Hayles reconciles the two viewpoints, noting that neither position associates absolute order or randomness with information:

> Like the optimist and pessimist regarding a glass of water, Shannon and Brillouin locate themselves at the halfway point of the information-probability arc and look in opposite directions. . . . Shannon, looking forward, sees a downward-sloping curve and argues that the more certain the message is, the less information it conveys. Brillouin, looking backward, also sees a downward curve and argues that the more surprising a message is, the less information it conveys. Both recognize that maximum information comes when there is a mixture of certainty and surprise. But where Brillouin emphasizes certainty, Shannon stresses surprise. (59)

Hayles sees the difference between the viewpoints this way: "*Shannon considers the uncertainty in the message at*

its source, whereas Brillouin considers it at the destination" (58). This is a valuable observation, but perhaps the most important point of this chapter was its making clear that "maximum information is conveyed when there is a mixture of order and surprise, when the message is partly anticipated and partly surprising" (53). This chapter also succeeds in making somewhat concrete the concept of “the edge of chaos,” a concept from complexity theory that the biopoeticists find quite useful.

Hayles's chapter on Prigogine and Stengers's *Order out of Chaos* (Prigogine’s work, we will find, is much more popular with humanities scholars than with Prigogine’s fellow scientists) is somewhat less successful--although this is probably more due to the difficulty of the concepts being addressed than to any lack on Hayles's part. The arguments about self-organization are fairly clear, but the metaphysical speculations about the unidirectionality of time are not. Here follows part of Hayles's summary of Prigogine and Stengers's "refutation" of the notion that "the necessity for time to move forward is . . . inherently subjective, an artifact of the observer's presence":

> They assert that once the [pool] balls are dispersed [from an original triangular rack], the information the triangular form represents has been dissipated. For the pool balls to reassemble, they would have to "communicate" with each other

> about position, momentum, trajectory, and so on, so that all the different motions would be coordinated in just the right way. Even for a few pool balls, the volume of information involved is very large. If the entire universe were to run backward, it would be essentially infinite. Thus Prigogine and Stengers conclude that time can go only forward because an infinite information barrier divides past from present. (97)

Whether it is the idea itself or Hayles's explanation that is unclear I am not sure; I am sure that this does not make any sense. Hayles had just made the conventional argument that

> although nothing inherent in physical reality causes time to move in one direction, it goes forward and not backward because the probability for events to happen in a myriad of different ways is infinitely greater than for them to happen in one way. And why must things happen in just this way? Because our knowledge defines the triangular pattern, and only the triangular pattern, as "past." (97)

That is to say that the triangular pattern is no less likely than any one of the multitude of configurations possible; the balls don't need to communicate to form the triangular configuration--it’s just that we see that one unlikely pattern as the "past" while any one of the equally unlikely other configurations can be the "future."

That this notion is not made clearer is a problem, but the notion of self-organization does not depend on it; and anyway, as Hayles points out, the Prigogine branch is only half of what we call chaos theory. In addition to the self-organization branch, there is also the Lorenz-Feigenbaum-

Mandelbrot-Shaw strange-attractor branch--the branch emphasized by James Gleick in his influential book (Prigogine’s work is now more frequently associated with complexity theory than with chaos theory proper). Hayles's chapter on this branch, which concludes with a discussion of Gleick's book, is very useful (read: clear and concise).

Fairly interesting chapters on *The Education of Henry Adams, The Golden Notebook*, and the works of Stanislaw Lem are interspersed with the technical chapters--the *Education*, we are told, "transforms its voids and ruptures into gaps from which radiates an energy that radically reorganizes whatever comes in contact with it" (77), while Lessing's book "has many of the characteristics associated with the new paradigms--a problematic relation between local sites and global theories, an interest in recursive symmetries as a principle of organization, an awareness of how small fluctuations can effect large-scale changes" (241); the connection between Lem and chaos theory, although "he seems not to know" about it (115), is less forced because of Lem's explicit interest in cybernetics and information theory--but the book really heats up when Hayles starts trying to draw connections between chaos and poststructuralism.

In a chapter called "Chaos and Poststructuralism" Hayles does a fine job of summarizing some major points of

thinkers such as Derrida, Barthes, and Michel Serres. She also gets down to what she's been leading up to all along--drawing affinities between contemporary cultural theory and the chaos paradigm.

For example, Hayles draws a very convincing parallel between Derrida's notion of iteration and Feigenbaum's. Hayles's gloss of Derrida's notion:

> Any word, he argues, acquires a slightly different meaning each time it appears in a new context. Moreover, the boundary between text and context is not fixed. Infinite contexts invade and permeate the text, regardless of chronology or authorial intention. Hamlet, for example, influences our reading of *Rosencrantz and Guildenstern Are Dead*; but *Rosencrantz and Guildenstern Are Dead* also influences our reading of *Hamlet*. The permeation of any text by an indefinite and potentially infinite number of other texts implies that meaning is always already indeterminate. Because all texts are necessarily constructed through iteration (that is, through the incremental repetition of words in slightly displaced contexts), indeterminacy inheres in writing’s very essence. (181)

On Feigenbaum:

> Recall that Feigenbaum attributed the universal element in chaotic systems to the fact that they were generated from iterative functions. He showed that for certain functions, individual differences in the equations are overwhelmed as iteration proceeds, so that even though the systems become chaotic, they do so in predictable or *regulated* ways. Derrida claims that his iterative methodology is similarly regulated, in the sense that its production of undecidables is not a capricious exercise but a rigorous exposition of the text's inherent indeterminacies. (183)

Even more successful is Hayles's comparison of Barthes's *S/Z* with the Shannon-Weaver heuristic. Shannon, remember, views maximum information as the result of the right balance of surprise and certainty. But while Shannon is concerned with separating "noise" from desired meaning, in the Weaver interpretation "the 'desired meaning' goes from being what the sender intended to whatever comes out at the end after semantic noise has been included" (193).

This, we find, is similar to the viewpoint espoused by the Barthes of *S/Z*, a work that seems to valorize the proliferation of interpretations for their own sake. Barthes argues that literature is in fact the "art of noise" (188), and in turning a 13,000-word story into a 75,000-word analysis, "he claims that the reader will find this extra information more delectable than the original message" (188).

In her final chapter, "Chaos and Culture," Hayles extends her argument to cultural postmodernism, which she defines as "the realization that what has always been thought of as the essential, unvarying components of human experience are not natural facts of life but social constructions. We can think of this as a denaturing process" (265). Hayles argues that "with language, context, and time

all denatured" by theory, "the next wave . . . is the denaturing of the human" (266).

It would not be useful here to review Hayles's clear and uncontroversial discussion of, say, the denaturing of language via Saussure. What is most important about this final chapter is her discussion of the denaturing of the human. Here she quite reasonably invokes Donna Haraway's "Manifesto for Cyborgs." Although there is little truly original in this essay (and Haraway freely admits how much of her argument is stolen from science fiction writers from Olaf Stapledon through John Varley), it does make available to the academy arguments about how technology literalizes what we poststructuralists intuitively recognize--the constructed nature of the autonomous subject. As Hayles puts it,

> Haraway argues that information technology has made it possible for us to think of entities (including human beings) as conglomerations that can be taken apart, combined with new elements, and put together again in ways that violate traditional boundaries. (283)

The problem with this interesting final chapter, though, is that Hayles fails to make apparent the affinities between chaos theory and cultural postmodernism. While she made productive comparisons between, say, Derrida and Feigenbaum, Hayles never quite succeeds in arguing that the denaturing of the human has much of anything to do with the

new chaos paradigm, or even that the denaturing of the human is a uniquely postmodern phenomenon.

One doesn't have to be a poststructuralist to agree with Donna Haraway's critique of the autonomous subject (one can imagine as hard-nosed a positivist as B.F. Skinner agreeing with her entirely); but even if one embraces (for the sake of Hayles's periodization) the notion that Foucault and his contemporaries invented the idea that "man" is an ephemeral construct, Hayles still fails to really explain what this denaturing has to do with the complex of scientific approaches she has defined as "chaos theory."

But this "failure" may in fact rest on Hayles's (defensible) refusal to ever really define what she means by chaos. She hints at what she means ("order in disorder") but never really gives a useful definition--if by “useful” we mean something like "can be explained to someone in fifty words or less."

Early on, Hayles explains her use of the terms "chaos theory" and "science of chaos" despite their signaling that "one is a dilettante rather than an expert":

> Part of my project is to explore what happens when a word such as "chaos," invested with a rich tradition of mythic and literary significance,is appropriated by the sciences and given a more specialized meaning. The older resonances do not disappear. They linger on, creating an aura of mystery and excitement that even the more

> conservative investigators into dynamical systems methods find hard to resist. . . . The name *is* important, for in its multiple meanings it serves as a crossroads at which diverse paths within the culture meet. (9)

That this is more than just a defense of a failure to adequately define an important term (or to choose a more specific one) becomes clear when we consider again Hayles's chapter on entropy. Here we find that the very slipperiness of the term in different contexts proves immensely productive of new ideas. In her fast-and-loose use of the term "chaos" Hayles is trying to create the same sort of productive situation.

Although her work accomplishes this, by most measures it is a failure. Carl Matheson and Evan Kirchhoff, in a generally critical essay on the use of chaos theory in literary studies, argue that Hayles's work, like that of many others applying chaos theory to the study of literature, fails to make a compelling case that creating an analogy between chaos theory and literature or literary theory contributes anything to our understanding of any of these subjects ("Chaos").

Matheson and Kirchhoff do not object primarily to the many mistakes or misstatements that Hayles makes, both in regard to literary theory and to chaos theory, although these could be considered a major problem: right-wing watchdogs of the use of science in the humanities Paul Gross

and Norman Levitt provide a withering indictment of Hayles based primarily on an enumeration (hardly exhaustive) of such mistakes in their book *Higher Superstition: The Academic Left and its Quarrels with Science* (98-106).

Matheson and Kirchhoff concede rather generously that confusion over a few fundamental terms does not necessarily make a discussion like Hayles's inherently unproductive. They argue, however, that her analogy *is* nevertheless unproductive.

Matheson and Kirchhoff propose that there are several ways in which an analogy can be useful, some more powerful than others: an analogy might allow us learn about a given subject in ways that might not otherwise be possible; an analogy might be the best way for someone who is familiar with one subject but unfamiliar with another to learn about the unfamiliar subject; someone who is somewhat acquainted with a given subject might learn more about that subject by learning about the analogous one; or there is a structural similarity between two subjects, "and this is inherently interesting" (41).

Matheson and Kirchhoff argue convincingly that Hayles's work fails to accomplish either of the first two goals: the conclusions drawn from applying chaos theory to literary studies could be drawn without this analogy, and because her

“intended audience is not composed of scientists in need of elementary instruction in literature” (42).

Hayles has also not shown that those somewhat acquainted with the study of literature can learn more about it by learning about chaos theory, primarily because

> If the terms contained in the scientific illustration must be laboriously explained before they become at all comprehensible, the analogy itself is often effectively deflated, and can be discarded altogether in favor of the ordinary-language explanation which necessarily accompanies it. (42)

Matheson and Kirchhoff argue that Hayles’s argument does not even meet their minimum criterion for a useful analogy: as Hayles is unable to demonstrate significant structural similarities between chaos and literature or chaos and literary theory, such an analogy is not even interesting.

Here Kirchhoff and Matheson are being too harsh. They may be correct about there being no significant structural similarities between the two terms of Hayles’s analogy (although this is debatable), but this does not mean that such an analogy is not *interesting*. It is the very *slippage* of the term “chaos” that is conceptually productive, not the almost accidental similarities between chaos and literature.

Hayles’s work does not succeed if we view the goal of literary theory and criticism as discovering the “truth.”

Its scientific misstatements and logical gaps make for an unconvincing argument. But if we judge her by the standard that she attributes to Barthes--the proliferation of interpretations is in itself good, and the “noise” of criticism surrounding a text can be more interesting than the text itself--it is certainly an “interesting” one.

This is where Hayles’s application of chaos theory is superior to that of the biopoeticists: hers succeeds on its own terms; theirs does not. One could appreciate their work as a contribution to the proliferation of discourse about literature, as interesting writing about writing; Hayles’s work operates in just this way.

But the entire justification for the biopoeticists’ project is that contemporary literary theory is not “scientific” enough, that it does not obey scientific rules regarding logic and evidence. If their arguments are just as lacking in empirical evidence--and are much weaker logically--than those of their rivals, their project can hardly be considered a success.

Hayles’s work provides one model for the importation of chaos theory into literary studies: observe some similarities with literature, note that these similarities (“real” or not) are interesting. But how *do* the biopoeticists do it?

Self-Organization

The biopoeticists are not primarily interested in "chaos theory" as we have defined it (this term, never popular among researchers in the field, is now practically dead anyway). They are more concerned with the field that could be said to embrace chaos theory. The object of study of this field is variously known as "complexity," "dynamical systems," "self-organization," "emergence"--among many other names. That these concepts are not exactly synonymous is a reflection of the ill-defined nature of the field.

According to a list compiled by the Massachusetts Institute of Technology, at least thirty-one different definitions of complexity have been proposed by researchers (Horgan 197). One of the most frequently referred to definitions is one proposed by Gregory Chaitan, a researcher at the Santa Fe Institute: the complexity of something can be measured by the amount of processing power it takes to completely model it (Coveney and Highfield, *Frontiers* 37). The problem here is that such a definition would accord a rotting carcass at least as much complexity as a living animal, and would describe, in the words of John Horgan, "a text created by a team of typing monkeys as more complex--because it is more random and therefore less compressible--than *Finnegans Wake*" (Horgan 197).

Researchers have often considered rejecting the term "complexity" altogether as being so ill-defined as to be meaningless (Horgan 197), and many of the scientists at the Santa Fe Institute simply employ "interesting" as a loose synonym (Horgan 197). But as Horgan points out, "what government agency would supply funds for research on a 'unified theory of interesting things'?" (Horgan 198)

According to Chris Langdon, another researcher at the Santa Fe Institute, chaos is related to complexity in that both deal with nonlinear dynamics (Lewin 12). But while chaos deals with apparently random, "chaotic" phenomena that are the result of the interaction of many parts, "complexity" deals with the emergence of a different kind of interesting behavior from such interaction:

> From the interaction of the individual components *down here* emerges some sort of global property *up here*, something you couldn't have predicted from what you know of the component parts. (Qtd. in Lewin 12)

That "couldn't have predicted," we will find, makes this statement controversial, but the statement does give us a rough definition: if chaos can be described as "disorder out of order," complexity could be described as "order from disorder."

On one reading, the one stressed by the biopoeticists, this is a radical statement: it implies a violation of the Second Law of Thermodynamics ("entropy increases"). Indeed,

one researcher, Stuart Kauffman, believes that we may need a fourth law to accommodate self-organizing phenomena (*Investigations*).

On another, less controversial reading, self-organization or emergence simply refers to the phenomenon of globally interesting behavior resulting from many parts interacting locally. Two popular works--*Out of Control: The New Biology of Machines, Social Systems, and the Economic World*, by Kevin Kelly, and *Emergence: The Connected Lives of Ants, Brains, Cities, and Software*, by Stephen Johnson--provide fascinating studies of these phenomena.

For example, the human mind. The current model of the human mind embraced by most cognitive scientists, as we saw earlier, is the modular one. What this means is that the human mind (and consciousness) is not simply a unitary, global phenomenon. There is no “self” that runs everything. What we think of as “mind” is an epiphenomenon of the interaction of countless cognitive “modules,” each of which is not transparent to the others but, rather, interacts in a relatively limited way.

An ant pile, too, seems to have a consciousness, and to plan things: the location of a new pile, where to put the dead, where to put the garbage, where to find food. But this “smart” global behavior results from “dumb” ants following

simple rules and communicating with each other in a limited way.

Human cities grow in a way that can also seem directed, but is really just the result of individuals making decisions. This explains the appeal of such “bottom-up” simulation games as *SimCity*--a game in which the player controls such things as property taxes and general infrastructure while an algorithm simulates the kinds of decisions people living in such a city would make about where to live, what businesses to start, and so on. The resulting “city” grows in ways that appear to simulate the dynamics of a real city.

This notion of self-organization is not altogether new. In fact, the classic example of this sort of self-organization is what Adam Smith called the “Invisible Hand” of the market. By purely local interaction, the “market” results in efficient use of resources: if demand for a product increases, supply will respond; if it decreases, some suppliers will choose to sell a different product.

It is important to keep in mind the distinction between this idea of self-organization, which is well documented and implies no mechanism outside the known laws of thermodynamics, and the ideas embraced by the biopoeticists, which are supported by few undisputed studies and propose no mechanism other than a new law of nature. It is this version

of self-organization on which their belief in the progressive nature of evolution relies--and it on this version that we will continue to focus as we consider the biopoeticists’ aesthetic arguments based on this belief.

Frederick Turner: Beauty and Evolution

Frederick Turner, a professor of English Literature at the University of Texas at Dallas and a celebrated poet, believes that we have forgotten about beauty.

As we saw in our chapter on evolutionary psychology and literary criticism, Turner has provided an explanation of the operation of metered poetry in light of findings from cognitive science: he believes that metered poetry comes to us in "stereo" mode--integrating left- and right-brain function and thereby allowing us to make fuller use of our brains: in particular, to reach new heights of empathy with humans and nature.[11]

Although he suggests an immediate adaptive function as the origin for this mechanism, he is rather halfhearted about justifying this suggestion; he seems aware that a specific adaptive explanation for such a late-appearing (in the history of the species) trait is unlikely to be very persuasive.

[11] This thesis, which relies on somewhat overhyped and oversimplified notions of the left-brain/right-brain split, raises a couple of interesting questions: why would integrating the two halves of the brain increase cognition? Presumably, (given the sort of Darwinian logic that Turner endorses), the human brain is split for a reason, and cognitive science does suggest that the specific nature of human cognition results from the parallel operation of the two halves, which are (relatively) limited in their communication with each other. Moreover, research suggests that women's brains are somewhat less divided in their function (each half is less specialized: verbal processing, for example, more often occurs in both hemispheres, while in men it tends to be

He does not need such a specific adaptive story, however, because his explanation of the function of poetry is that it is part of a general human capacity for recognizing and creating beauty. We have already seen, in several forms, the argument that the human capacity for creating and appreciating art has an adaptive origin: "making special" for Ellen Dissanayake, or sexual selection for Geoffrey Miller, for example.

Turner's argument, however, hinges on his definition of beauty. Beauty, contrary to the beliefs of both the political left and right, is neither merely ideological nor merely pretty. It is not subjective; it is in fact "real" (*Culture* 10).

"All human societies," Turner informs us, "possess the concept of beauty" ("Evolutionary" 106). What is beautiful, of course, we all agree on: peacock feathers, tropical fish, and, of course, the blue satin bowerbird, which as part of its courtship ritual builds a complicated and apparently useless bower, which is decorated with colored objects and painted with berry juice ("Evolutionary" 106).

Having provided examples of (but yet no definition of) "the beautiful," Turner asserts that we have an innate tendency to respond to beauty. His argument proceeds

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localized in the right-brain); does this mean that women's brains work better than men's?

curiously: first, he asserts, our capacity to create and experience beauty is a characteristic of an evolved animal, and that beauty is thus in some way a biological adaptation.

Beauty is “a physiological reality” because the experience of beauty can be linked to the activity of certain brain chemicals, such as endorphins and enkephalins. Turner points out that drugs such as heroin and cocaine are addictive because they chemically resemble the “chemistries of joy” with which the brain rewards itself (“Evolutionary” 107).

We experience pleasure, which is ultimately chemical, when we perceive beauty--a pleasure so great that “artists will starve in garrets” and “for whose mimicked substitutes rats and addicts will happily neglect food and sex” (“Evolutionary” 107).

What then is the adaptive function that this sense of beauty serves, asks Turner, this sense that is so strong that it can lead us to forgo nourishment or the opportunity to reproduce?

Before we proceed to Turner’s answer, we should note that there are problems with this argument already. First of all, it conflates the chemistry of “joy” with the specific experience of beauty. While there is plenty of evidence that viewing “pretty” things stimulates the release of certain chemicals in the brain, *lots* of things stimulate the release

of these chemicals, and the suggestion that heroin addicts and rats with electrodes in the pleasure centers of their brains are experiencing “mimicked substitutes” for beauty is unwarranted and misleading.

Moreover, Turner provides little argument to support his assertion that the experience of beauty is an adapted trait at all. As we have seen, Steven Pinker, along with most cognitive scientists and evolutionary psychologists, believes that the pleasure that we experience when we encounter beauty is a form of “cheesecake for the mind.” (Just as we have a taste for sweets not because they are good for us but because we have an adaptive desire for certain tastes or foods that were scarce in the environment of evolutionary adaptedness but all too plentiful in the industrialized world, we enjoy the “pretty” because it flatters certain innate tendencies of the human mind.) The controversial assertion that it is a primary trait and not a by-product or mediated trait therefore requires some argument. And even if we assume that it *is* an identifiable trait, this is leaving aside the questions raised by Stephen Jay Gould and others about the assumption that every trait has an adaptive explanation.

Let us assume for the moment, however, that Turner is correct in his assertion that the experience of beauty is an innate and adaptive trait (the claim is at least not

demonstrably false; as we've seen, adaptive stories are unfalsifiable, which is why many consider them fundamentally unscientific); what adaptive function *does* beauty serve?

Turner's origin story begins somewhat like Geoffrey Miller's: with sexual selection. He asks us to imagine a mating ritual that affects an individual's likelihood of reproducing. Those who have the cognitive ability to perform the ritual have a better chance of attracting a mate and leaving progeny. Cultural changes in the ritual will give an even greater reproductive advantage to those individuals who can easily master those changes ("Evolutionary" 108).

This notion of sexual selection as the spur towards the development of the human brain, expanded upon in other essays,[12] is thus far very similar to Miller's: demanding mating rituals gave a reproductive advantage to those who had the best cognitive skills (at least in regard to these rituals) and eventually led to the modern human brain.

But whereas Miller emphasizes the somewhat arbitrary, out-of-control nature of sexual selection (since sexual selection has little to do with survival, any particular trait could become hypertrophied through what is basically a historical accident), Turner wants to emphasize that evolution led to a particular human propensity to create and

[12] "Beauty: The Foundation of Cognition" and "An Evolutionary/Chaotic Theory of Beauty and Meaning."

recognize beauty, a propensity that he argues has survival value in itself.

He reaches this conclusion by a rather circuitous route, introducing first the notion of the evolutionary origin of standards of human beauty.

In this hypothetical situation, according to Turner, the idea of beauty is obviously important. The ritual led not only to a general improvement in cognition, but to “a capacity for recognizing and creating beauty,” a competence that was selected for because of the ritual (*Culture* 108). As the ability to recognize beauty was selected for, “to be, and to be able to recognize, a beautiful human being, and to desire to mix one’s genes with him or her” might have also driven human evolution (*Culture* 108). In this scenario, “personal physical beauty takes on new importance”; ultimately, argues Turner, “we look the way we do as a species, largely because that was the way our ancestors thought intelligent, strong, loving, and imaginative-ritual-ready animals ought to look. We are the monument to our progenitors’ taste” (*Culture* 108).

This idea of the evolutionary development of transcultural standards of beauty is a common one in evolutionary psychology, but it is unclear how it relates to the hypothetical with which Turner has presented us. Traditional evolutionary-psychological explanations of the

development of standards of human beauty revolve around relatively straightforward arguments: youth (in women) and symmetry of features, for example, are attractive in a potential mate because they are indicators that healthy progeny might result from a union with this person. How Turner gets from an evolved ability to perform a mating ritual to an evolved propensity to perceive beauty--and to desire to embody it and mate with it--is completely obscure. However, this leap does allow him to introduce the idea of beauty into the argument:

> If the theory of the biocultural evolution of the sense of beauty through traditional ritual is correct, we might expect to see a specific set of capabilities, natural-classical genres or systems by which we generate, recognize, and appreciate beauty, based on new or revised neural structures in the hominid brain, that would be culturally universal and fundamental to the human arts. What should we call these special human abilities? They would be much more powerful and more sharply focused than the general processing of the basic mammalian brain. Perhaps we could call them hereditary knowledges, or lores, or skills, or powers. . . . Or perhaps we should call them genres, because they have distinct forms and even rules. . . Let us settle for the word “charms,” in the combination “neurocharms.” (*Culture* 208)

Note the introduction of the idea of beauty into the discussion of the development of skills due to the mating ritual: the argument as originally formulated required no specific content for the ritual, but now the skills are somehow about beauty.

There is no logical problem, within the framework of sexual selection, in simply arguing that what we find beautiful now is what our ancestors found beautiful, and that what our ancestors thought beautiful was somewhat arbitrary (Miller makes this argument in part), but this is not the argument that Turner is making. He ultimately argues that beauty is *not* arbitrary in this way.

Leaving aside for a moment this questionable origin story, let us consider his fascinating proposal about special human skills related to beauty.[13] The idea of "natural classicism" is one that he first developed in his 1991 book of that title, which first introduced his theories about poetic meter.

> People see (hear, touch, taste, smell) the beautiful, and recognize it by a natural intuition and a natural pleasure. This "natural intuition" is for us human beings activated, sensitized, and deepened by culture, is a natural capacity of the nervous system [that] now incorporates a 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 have called "natural classicism." (*Culture* 106)

[13] It may seem peculiar at this point to still be withholding a definition of beauty, but it is important in examining the logic of Turner's argument that he provides both an inductive definition of beauty (beauty is what is found in those things that the right people find beautiful) and a content-neutral origin story for the sense of beauty before he provides his ultimate definition.

The neurocharms (a term first introduced and most thoroughly developed in *Beauty: The Value of Values*), one of which is poetic meter, are at the heart of his theory of natural classicism. “Natural classical” art is that art which makes use of these innate abilities, which include (and the heterogeneous grouping of things and actions is Turner’s) syntactical organization; trope, symbol, metaphor, and various forms of reference; collecting, selecting, classification and hierarchical taxonomy; dramatic mimesis (basically reflection and modeling); debate, dialectic, and eristics; the scientific imagination; narrative, story, and myth; musical meter, tempo, and rhythm; musical tone, melody, and harmony; musical performance; pattern recognition; color sense; eye-hand mimetic capacity; dance, gymnastic, and the martial arts; mapping; poetic meter; cuisine; and the art of massage (*Culture* 109-110).

These are divided, in Turner’s schema, between left-brain and right-brain “charms,” with dance, mapping, and (as we have seen) poetic meter mediating between the two hemispheres (*Culture* 109-110).

There is much evidence from cognitive science that many of these are innate and specialized human capacities. They are obviously capacities of the human mind; the question is whether these capacities are simply the abilities of a very complex general computing machine, or specialized modules

that allow humans to perform particularly well in these domains. There is a general agreement among cognitive scientists that the human mind is modular in this way; there is less agreement as to whether these modules are inherited or acquired, and the question of the *evolution* of such modules takes us out of the realm of cognitive science into the speculative realm of evolutionary psychology.

Turner argues, not completely unpersuasively, that these abilities are innate because we are so awfully good at them, asking us to imagine that we had developed other skills instead:

> If our species had evolved in a highly mechanized biocultural milieu, it could easily have developed an innate skill for instant, easy and unconscious calculation of mathematical problems. Just by an act of intention as simple as raising one's arm, one could bring to one's mind the value of pi or the square root of two to any desired decimal place, or rattle off the first three hundred prime numbers. We regularly, as in the grammar of the language we speak, or in the evaluation of speeds or vectors in a busy intersection, perform calculations at least as complex and requiring at least as much neural processing. We very nearly did develop this capacity: some idiot savants seem to have the power of instant calculation, though it looks as if other brain capacities may have had to be sacrificed in order for them to do so. Or imagine that we could as naturally recognize or create an eight-second poetic line as we do the normal and universal three-second one. Or that we could as instinctually catch the "tune" of a piece of serial music when we have not heard it before, as we can pick up a melody based upon the universal human music scale. Or that there is the same kind of unambiguous natural mimetic and representational referent for musical keys and phrases, preexisting musical conventions, that we

> find in visual outline pictures, so that programmatic or narrative music would be as easily interpreted across cultures as pictorial representations are. Or that the meaning of such works as Spenser's *The Fairy Queene* or Joyce's *Finnegans Wake*, aspects of which appeal to hypothetical but not actual human linguistic abilities, should be as transpicuous to the general understanding as those of Homer, Shakespeare, and Tolstoy, which are at least as complex but which are tuned to real human brain capacities. ("Beauty" 367-368)

Of course, it is not easy to compare the "difficulty" of different tasks; computers are good at certain things not only because of their architecture but because of how they are programmed; it is quite possible that an artificial intelligence developed in a "bottom-up" manner, through *learning*, would be as inept at doing on-the-fly calculations as most humans (Moravec, *Mind*). That certain things that humans do, such as seeing and balancing and understanding speech, are incredibly difficult for computers to do is suggestive, but hardly definitive proof of modularity.[14]

Assuming that these neurocharms exist--and that they are innate and adaptive in origin--what difference does this make for literary theory and criticism? We need not rehearse here the logical problems involved in taking these statements about human nature and turning them into

[14] This question of comparing the difficulty of different tasks is responsible for a few of the holdouts from the modular model of the human mind. For a lucid (though biased towards modularity) discussion of this debate, see Pinker (1997).

evaluative standards. As with the other theorists we have considered, knowledge about the innate structure and content of the human mind might help in developing a theory of literary effect, and also might assist in reconstructing authorial intention, but such knowledge automatically entails no particular value claims.

If Turner were claiming that these “neurocharms” were a response only to the fundamentally contingent dance of sexual selection--as Miller essentially does--then his theory would face these limitations. But Turner claims that this sexual-selection story about the development of the sense of beauty (and he has here jumped from claims about cognitive structures that his own story describes as having contingent origins to claims that these structures are collectively related to beauty) is only part of the story:

> 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 the 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. (*Culture* 114)

There are two serious flaws in this argument: first, both the theory of the gene as the unit of selection (the theory that Turner believes is true) and the theory of sexual selection both imply that there might be traits that are beneficial to the organism but detrimental to the species. Second, Turner himself has argued elsewhere that it might be possible--even beneficial--for a species to evolve to hold certain beliefs, even if those beliefs are false.

But let us assume, however, that Turner is correct in stating that there is a sense of beauty--a sense of something *out there* in the world; what, ultimately *is* beauty, or the experience of beauty? The experience of beauty, proposes Turner, is “a recognition of the deepest tendency or theme of the universe as a whole” (*Culture* 114). Our experience of beauty “enables us to go with, rather than against,” this deepest tendency, “to be able to model what will happen and adapt to or change it” (*Culture* 115). What is this tendency? The universe’s “self-organizing process” (*Beauty* 59).

Before examining exactly what Turner means by this, we should perhaps examine how Turner comes to the conclusion that our sense of beauty is a recognition of self-organization. Turner derives this idea from a discussion of one of the neurocharms--visual pattern: it seems that people prefer to look at visual images that are neither too simple

nor too complex. When subjects are shown images of horizontal, vertical, or radial lines, they prefer to look at images that have neither too few nor too many lines: they prefer those that are just right (*Culture* 111).

From this seemingly mundane fact about the function of the eye, Turner comes to a general conclusion: “Patterns are beautiful that exist at the margin between order and disorder, that exhibit a hierarchical organization which is troubled and opened up by contradictory elements” (*Culture* 112). And there is “only one kind of phenomenon [that] can satisfy all these criteria, and that is the form of a growing organism or evolving system” (*Culture* 113).

That we find evolving systems beautiful he deduces from the function of the eye. But what is it about evolving systems that is so special?

Without any argument as to why it should be seen as the “central tendency” of the universe, Turner provides a list of “descriptions or characteristics of that theme”: “unity in multiplicity,” “complexity within simplicity,” “generativeness and creativity,” “rhythmicity,” “hierarchical organization,” and “self-similarity” (“Transcending” 7).

Turner argues that these descriptions belong “to feedback processes and the structures that are generated by them” (*Culture* 116). One example of a feedback process,

Turner claims, is evolution. Evolution, however, “is only one of a class of processes that are characterized by various researchers in various ways: nonlinear, chaotic, dissipative, self-organizing”--equating “feedback processes” with that over-used and ill defined term, “complexity” (*Culture* 117).

It might be helpful at this point to summarize Turner’s argument so far, which has remained fairly consistent throughout his work since 1979 but which is most integrated in *The Culture of Hope*: beauty is an objective characteristic of the universe. Humans, as biological beings, develop certain traits through evolution. Sexual selection could hypothetically provide the spur for the development of bigger brains and specific skills--“neurocharms”--related to the mating ritual. These skills are also related (incidentally?) to beauty.

Humans find interesting things that are neither too complex nor too simple; therefore the beautiful exists “at the margin between order and disorder.” This is because our sense of the beautiful is a recognition of the deepest theme or tendency of the universe: feedback, a term that encompasses systems that are chaotic, self-organizing, dissipative, or nonlinear. That beauty is real and objective we know because humans would not have a sense of beauty if such a sense were not functional for the entire species--and

it couldn’t be functional if it weren’t true (this despite his mating ritual fable of the origin of the aesthetic sense, and despite his own discussion of how false beliefs *can* be adaptive).

As we have seen, this argument is fallacious, or at least incomplete, at every step. But let us turn from his unconvincing story of how the sense of beauty developed--his explanation of why we find beautiful the things we do--to his discussion of why feedback, chaos, nonlinearity, or self-organization *should* be what we find beautiful.

Perhaps his normative claim is rooted in his assertion that feedback is the fundamental theme or tendency of the universe. Turner provides little argument as to why this should be the case--and as it stands, the assertion makes little sense: one might concede that almost every thing and process in the universe is characterized by feedback, but everything in the universe is characterized by many things. To say that the central tendency of the universe is feedback is akin to saying that the central tendency of humans is to breathe, because everybody does it.

But perhaps Turner simply means that the universe shows a *statistical* tendency toward increasing complexity, self-organization, and so on. We will examine in more detail in the next section why such a claim is almost certainly false. Let us suppose, however, that he is correct: complex systems

are emerging everywhere, more and more all the time (the other possible interpretation of his claim--that the universe *as a whole* is becoming more complex rather than less--is one even Ilya Prigogine would not endorse; even he admits that the universe [assuming that it is a closed system] will eventually wind down); so what?

It should not be necessary here to reiterate the distinction between adaptive origin and present function, or between “adaptive” and “good.” We may charitably assume that Turner is not making the simple and fallacious argument that our taste for beauty has an adaptive origin and is therefore good.

What he seems to be arguing is that our sense of beauty is not only adaptive in origin but also adaptive *now*. What can this mean? Adaptive for what? To make sense of this claim, we should perhaps examine his discussion of hypothetical “false but functional” beliefs. Although Turner believes that nature *is* teleological (and we will examine in a moment Turner’s connection of the sense of beauty to a belief in natural teleology), this part of his argument does not seem to hinge on the truth of this proposition:

> Concede even that beauty, value, meaning, freedom, planning for the future, teleology, soul, etc, were indeed complete nonsense; nevertheless for a species to operate as if they were real--by nurturing its young, self-sacrifice, ritual celebration and the like--such a species would be at a competitive advantage with others. But that

> concession is now a purely metaphysical one, with no practical or scientific relevance. Those “abstractions” will have become laws of nature. Good hard empirical science would tell us that of course the universe is full of value and purpose. If values are for animals as functional as teeth, that does not make the values any the less values than it makes teeth any the less teeth. Only if we let the likes of Kant dictate our definition of value--as essentially unlike teeth--is there a problem: but it may be that Kant’s values never existed anyway, and the word value would be more useful applied to something that does exist. If values necessarily evolve in the struggle for survival, belief in the meaninglessness and valuelessness and directionlessness of the universe is an act of purely religious faith, maintained in the face of the cold hard facts of meaning, design, love, progress and beauty. The austere and faithful dialectical materialist, in his sackcloth and ashes, could then say with the mystic “Credo quia absurdus est”--I believe because it is absurd. (“Transcending” 231)

This argument is a central one in his aesthetic theory--demonstrating as it does the link between Turner’s factual and normative claims--and therefore calls for some untangling.

Although it is a question still debated by epistemologists and philosophers of science, the assumption that there is no such thing as a value-free fact is one we may grant Turner (despite his vociferous objections elsewhere to the “politicization” of science). This assumption, however, does not free Turner from the responsibility for explaining, in a work presumably intended to persuade others to embrace his aesthetic values, the

connection between values and observations almost universally accepted to be *factual* assertions. He does not disarm us by admitting up front that he is collapsing the fact/value distinction, nor does he free himself from the responsibility for logical argument by appealing to the authority of "serious philosophy" that he believes collapses this distinction.[15]

But, again, Turner is not only arguing that his view of the universe as teleological is *true* but that such a belief is *useful*. This is a questionable assumption; one could easily image a species with no sense of cosmic destiny whose members still cared for their young, engaged in ritual, were sometimes self-sacrificing--in fact displayed at least as many qualities contributing to the continuity of the species as a species that did believe in cosmic purpose.

Although Turner's notion that the "central trend" of the universe is self-organization is factually false, and his derivation of an ethics from this trend (even if it were true) fallacious, his aesthetic might still stand simply on what seems to be Turner's central value, as illustrated by

[15] Although it is almost certainly true that all normative philosophies (except those whose authors admit that their founding assumptions are ultimately ungroundable) do collapse the fact/value distinction, arguably almost all of these do so not by providing a compelling argument about the nature of this distinction but by making unwitting (or rhetorically justified) leaps in logic. That great philosophers have violated Hume's law is no refutation of it.

his discussion of the functionality of belief: the survival and “evolution” of the human species.

If we jettison Turner’s speculation about the anti-entropic nature of the universe and his derivation of an ethics from this nature, we are left with a politics and aesthetics of (evolutionary) progress--one that we will see is not without its virtues. But before we purge his aesthetics of its metaphysics, let us take him at his word: the universe is evolving, and as the most complex, intelligent, and self-aware (as far as we know) species in the universe, it is our responsibility to assist the universe in its surge to increasing complexity. What does this mean for literature and aesthetics?

In *The Culture of Hope*, Turner presents five basic ideas for an “ecopoetics” (an early name for what Turner and Brett Cooke will later dub biopoetics), a poetics that is informed by ideas about natural classicism, self-organization, progress, and the idea that “beauty is a real property of things” (221).

Such a poetics will concern itself with

> healing: the rejoining of broken wholes, the reuniting of false dichotomies, the bringing together of cultural energies vitiated by their division. Our theory 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. (222)

It is unclear how these imperatives follow from the rest of Turner's argument; he does suggest, however, that the split between the cultural left and the cultural right is that the left values disorder while the right values order. The solution, he says is in the middle--the "radical center."

So we need a poetics of healing. What will this entail? First, it must understand "ratio, space and quantity" (222) and "reconnect with mathematics, geometry, logic, number theory, and geometry" (222). This will allow us to notice interesting things such as that Dante's description of the cosmos in the *Paradiso* is similar to recent mathematical theories of the universe that describe it as "a double super-sphere, that is a sphere with two centers, each of which is the periphery of the other" (222).

Second, the new poetics must understand the physical world, a world that "is full of subtle phase-changes, turbulences, emergent orders, and self-reflective processes" (222). Such processes can "act as amazing models and analogues for artistic creation" (222).

Third, the new poetics must embrace the living world. We must assimilate the findings of sociobiology and natural classicism, and also understand the way that DNA "edits, expresses, and repairs itself" because "literature, music, and art . . . do exactly the same things" (223).

Fourth, the new poetics must understand the human world--that is, understand that the history of tradition and ritual and artistic form is not the history of societally imposed ideologies, but the history of the different expressions of innate predispositions (223).

Fifth, the new poetics calls for art that is popular, but that does not “truckle to the infantile and uncultivated appetites of the masses” (224). How should it do this? Look to Shakespeare (224).

Sixth, the new poetics should avoid imposing modern moral values on the past (224). This could result in “important” historical literature.

Finally, the new poetics should assimilate our knowledge about the spiritual universe. The world can be seen as “both the fetal body of a divine being, and as a sort of theater in which its story will play itself out” (225), and “the very nature of the good, the beautiful and the true is still being worked out, created, and unfolded” (225).

These suggestions are mostly fairly reasonable--even if they do not necessarily follow logically from Turner’s broader argument. Literature and theory should understand science and history--and if science and history were as Turner sees them, then it would be reasonable for literature and theory to see them this way.

But they *do not* follow from the broader argument; moreover, they are so vague or commonsensical as to provide very little guidance: understand science and history, obey natural classical conventions, be popular *and* good--like Shakespeare. What does this have to do with evolution or self-organization?

Turner actually provides very little in the way of guidance as to how his ideas that the universe is self-organizing and evolving, and that humans should share the universe's "goals," should affect literary or critical practice--particularly in terms of form.

In terms of theme, however, we can extrapolate that it means that great literature should celebrate the evolution of mankind and the universe, and that works that are thematically anti-evolution are questionable. This extrapolation seems accurate in that Turner, a fairly acclaimed poet, does celebrate evolution in his work, and nowhere more so than in his book-length epic poem *Genesis*--a work about the struggle to terraform (make Earth-like, presumably for human habitation) the planet Mars.

This work, which follows natural classical guidelines in its hewing to a traditional narrative and in its use of iambic pentameter, addresses a theme that Turner has dealt with elsewhere--most prominently in an essay originally written for *Harper's* magazine about the spiritual reasons

for terraforming Mars, but also in the *Culture of Hope* and in several other essays.

We have already seen Turner's leap from a belief in the evolution of the universe to a belief that evolutionary progress is "good." It is our responsibility to contribute to the complexification of the universe, and terraforming Mars is a grand project to do this--the making of a lifeless rock into a world full of life.

In *Genesis* the hero, Chance Van Riebeck, battles assorted enemies--particularly members of the Ecotheist movement, which "divides human beings off from the rest of nature and regards all human interference with nature as an evil" (*Genesis* 15). Chance and his followers succeed against the assorted enemies of life and evolution, and the planet is eventually terraformed.

The poem is an often moving dramatization of many of the political and aesthetic positions espoused in Turner's critical work--self-organizing systems are beautiful, the universe is evolving, we have a responsibility to help it evolve--but aside from these themes, it is difficult to see how the poem is particularly influenced by an aesthetic of complexity or evolutionary progress.

Turner's vision is a grand one, but the grand theory in which he embeds his ideas of natural classicism results in an impoverished poetics. What Turner ends up recommending is

nothing more than that art thematically celebrate complexity and evolution. We will examine later the worth of such a project; for now, let us now simply note the irony of a critical theory conceived as a corrective to the politicization of contemporary theory calling for the utter subservience of art to a particular political agenda.

Alexander Argyros: Self-Organization, Complexity, and Literary Theory

Alexander Argyros also attempts to derive normative political and aesthetic conclusions from chaos theory. In *A Blessed Rage for Order: Deconstruction, Evolution, and Chaos*, Argyros argues that biological and cosmological evolution are progressive, that chaotic systems are "the beautiful," and that the goal of art is to imitate the chaos of the universe *and* help it reach higher levels of complexity.

Argyros bases his argument on some by-now-familiar assumptions. First, Argyros proposes, without any argument as to how this could take place, that "literature is an emergent evolutionary development of Homo Sapiens" (Argyros 196). We have already examined in some detail the claims by assorted theorists that art in general or literature in particular is an adaptive behavior--and the rejection of such theories by most mainstream evolutionary psychologists; let it suffice to say here that Argyros does not present even the sorts of feeble arguments that Turner does for how literature could develop adaptively.

Although he fails to present a plausible evolutionary story for the origin of literature, he does, like several theorists working in the evolutionary paradigm, propose a socially important *purpose* for literature. According to

Argyros, “literature is most fruitfully understood as an activity through which human beings create models of the possible effects of concrete choices” (197).

Of course, why art would be “most fruitfully understood” as serving this purpose is unclear if he has not made an argument for this purpose being literature’s adaptive origin--and even if he *had* made such an argument, he provides no reasons why we should primarily consider literature as serving this purpose instead of the many *other* purposes literature obviously serves.

Although Argyros makes no explicit argument, the tacit logic here is clear: since literature’s adaptive purpose was this kind of modeling/prediction, literature should be judged by how well it achieves this purpose.

Criticism, meanwhile, reduces the various scenarios generated by literature to “the higher cortical level of concepts, hypotheses and theories” (207). While literature “engages the entire brain, from the reptilian stem to the huge human neocortex,” criticism works only in the neocortex, translating the experience of literature into ideas that can be discussed and evaluated.

Criticism completes the work of literature by providing “hypothesis synthesis” (205), and by making judgments about the values of specific readings (206). Presumably, the more “valuable” reading is the one in which the text is seen as

generating the most useful scenario--“most useful” meaning “most accurately modeling the world.”

This is obviously a blatant example of the naturalistic fallacy, but as a stand-alone proposition, the idea that literature provides counterfactual models of the world--and that works can be judged by the usefulness or accuracy of the models they provide--is not the most ridiculous claim one could make.

In any case, Argyros proceeds with this definition, embracing along the way Frederick Turner’s notion of “natural classical” cultural universals. Argyros agrees with Turner that humans have certain propensities for creating/appreciating certain themes, forms, and genres.

Argyros believes that great art must employ “natural classicism” to anchor the otherwise wild and unfruitful experimentation of art, because “human future projection cannot be purely free . . . but must, if it is to be as free as possible, use the entirety of the past as its springboard” (224).

Art must be “as free as possible” in order to provide a model of “the trends and patterns that nature has manifested in the evolution and self-organization of matter and energy” (224).

This is the crux of Argyros’s argument. Argyros argues that the best works of literature will be those that are

“chaotic” and “self-organizing” in form (or which deal with themes of chaos and self-organization) because the universe itself is chaotic and self-organizing! Such works will be better because they will be more accurate models and because (as we will see), to Argyros, “beautiful” *means* chaotic, self-organizing, complex.

To evaluate these claims, we must examine the underlying assumption behind them: that the universe--along with life--is evolving toward greater complexity. What can this mean? We have already seen how there is no clear evidence of an increase in complexity in nature, or any mechanism for such progress in the Darwinian model.

And the idea that the universe as a whole is moving toward greater complexity (less entropy) is an extremely marginal one: all of the mainstream cosmological theories describe a universe that began in a *low-entropy* state and which is moving toward maximum disorder. Islands of order may exist in this winding-down universe, but they take place against a background of increasing disorder.

But there has yet been no evidence to definitively claim that evolution is *not* progressive; given a mechanism, it just might be. And although the universe as a whole may be increasing in entropy, those islands of order do exist--and persist. How do we explain this?

Unlike Frederick Turner, who tends to simply *claim* that matter becomes more organized, Argyros relies for his argument on the speculations of Ilya Prigogine, who argues that in certain systems “far from equilibrium,” order can spontaneously emerge.

Why is this important? Because it is an apparent violation of the Second Law of Thermodynamics, which states that in a closed system, entropy always increases (or remains the same in a reversible system). Entropy is a rather difficult concept, but it can be roughly defined as “manifest disorder.” Another way of thinking about entropy is simply to see increasing entropy as the tendency for systems to reach more and more likely configurations.

The classic example of this involves air molecules in an air-tight chamber. Left to themselves, these molecules will spread out throughout the chamber. Such a distribution is the *most likely* distribution of these molecules.

If the air were compressed by a piston, so that it only occupied the bottom third of the chamber, this would be an unlikely arrangement of these molecules; if the pressure were removed, the molecules would spontaneously return to their most likely configuration. The reverse would never happen: the molecules would never spontaneously get together in a third of chamber (actually, this is theoretically

possible, but the likelihood is vanishingly small). Eggs do not unscramble themselves, glasses do not unbreak.

The Second Law is perhaps the best established--and most justified, both theoretically and empirically--of the physical laws. As Arthur Eddington put it:

> The Law that entropy increases--the Second Law of Thermodynamics--holds, I think, the supreme position among the laws of Nature. If someone points out to you that your pet theory of the universe is in disagreement with Maxwell's equations--then so much the worse for Maxwell's equations. If it is found to be contradicted by observation--well these experimentalists do bungle things sometimes. But if your theory is found to be against the Second Law of Thermodynamics, I can give you no hope: there is nothing for it but to collapse in deepest humiliation. (Qtd. in Penrose 154-155)

Nevertheless, there are a few scientists who, disliking the philosophical consequences of the Second Law, are devoted to disproving it--or as Stuart Kauffman puts it in his book *Investigations*, finding a Fourth Law regarding the self-organization of certain systems (primarily living systems).

Kauffman is following in the tradition of Ilya Prigogine, a Nobel Prize-winning scientist[16] who developed a

[16] James Horgan, without naming names, indicates that many of Prigogine's fellow scientists working in thermodynamics or complexity studies think that he has "won the Nobel Prize for less cause than any other recipient" (*End* 217). Horgan also notes that even those scientists who admire Prigogine for the work in irreversible thermodynamics that won him the Nobel Prize think that the philosophical conclusions that Prigogine draws from his research in far-from-equilibrium systems are unwarranted.

theory of dissipative structures, “according to which patterns are supposed to form when the uniform, uninteresting ‘thermodynamic branch’ of the system becomes unstable” (Shalizi).

Very few of Prigogine’s fellow scientists believe that Prigogine has shown anything like a tendency for open dissipative systems to order themselves--although pop sociologists such as Alvin Toffler have been much taken with the idea. Many of the systems that Prigogine has studied do in fact appear to become more ordered; the standard explanation for this is that such systems are *importing* order from the larger systems in which they are embedded.

Physicist Roger Penrose provides a lucid explanation in his popular work *The Emperor’s New Mind* of the standard model of importation of order at work: he explains how the Earth’s biosphere, and the individual life-forms it comprises, are entropic systems that would fall victim to entropy if they did not constantly import low-entropy.

Contrary to popular conceptions, we do not really obtain *energy* from food and oxygen; except when we are growing, or putting on weight, the energy in our bodies remains approximately the same throughout our lives. We take in energy, but that energy leaves our bodies again, in the form of heat. What we import is *low entropy*:

> We take in energy in a *low-entropy* form (heat, carbon dioxide, excreta). We do not need to gain energy from our environment, since energy is *conserved*. But we are continually fighting against the Second Law of thermodynamics. Entropy is *not* conserved; it is increasing all the time. To keep ourselves alive, we need to keep lowering the entropy that is within ourselves. We do this by feeding on the low-entropy combination of food and atmospheric oxygen, combining them within our bodies, and discarding the energy, that we would otherwise have gained, in a high-entropy form. In this way, we can keep the entropy in our bodies from rising, and we can maintain (and even increase) our internal organization. (319)

Meanwhile, the Earth as a whole is receiving low-entropy visible light photons and re-radiating high-entropy infra-red ones. Visible light photons, having a higher frequency than infra-red photons, *individually* have higher energy; the infra-red photons, having less energy, are more numerous, meaning that this energy has more degrees of freedom than the incoming energy; it is therefore spread out over a greater phase space, and the entropy is much greater.[17] (320)

There is little technical work challenging Prigogine's conclusions in his popular, non-technical work about spontaneous order--most scientists do not believe that the

[17] Put simply, "phase space" is a conceptual space in which each element or variable in the system has its own dimension (each element or dimension is referred to as a "degree of freedom"; that a system has more degrees of freedom is frequently misunderstood to mean that the system is somehow more free). Therefore, if we think of graphical representation of a system in phase space, each state of the system can be represented by a single point. The trajectory of that point represents the evolution of the system over time.

Second Law needs defending, and accept the adequacy of the standard model--but there are a few very lucid explanations of the confusion that Prigogine's and Kauffman's work can lead to among non-scientists.

Particularly enlightening is an article by Dorion Sagan, a paleontologist, and Jessica Whiteside, a magician, for SWIFT, the journal of the James Randi foundation. Randi, who is closely allied with the *Skeptical Enquirer*, is a magician and perhaps the world's most famous debunker of "paranormal" or "supernatural" phenomena: his promise of one million dollars to the first person to demonstrate any sort of psychic phenomenon--ESP, telekinesis, precognition--under laboratory conditions has remained unclaimed for decades. As a professional skeptic, he also supports research debunking all sorts of unlikely things, from alien abductions to perpetual motion machines.

Sagan and Whiteside point out that if Kauffman's claims are taken seriously--if he is really arguing that order can spontaneously emerge in a system considered as a whole--he is simply mistaken; if this were true, it would be a refutation of the Second Law of Thermodynamics. Kauffman has noted an interesting phenomenon, however, that calls for explanation:

> What Kauffman really means (it seems; he has a talent for grandiose obfuscation) is that order (i.e. nonrandom arrangements of matter) can arise

> without natural selection. This is a decent idea (one attractive to Stephen Jay Gould, long opposed to the narrow adaptationist view of evolution which would invent a natural selection survival story for every attribute of every organism--e.g., socially objectionable ones like rape), but completely mistaken if we accept it at face value. Order (or better, organization, which suggests a process more than a state) in physics is never "for free" but always the result of previous order or organization, always paid for in the coin of energy. (4)

Although Gould has spoken favorably of some of Kauffman's theories, he has, unsurprisingly, "specifically repudiated" the suggestion that, as Kauffman believes, life inexorably becomes more complex because of mathematical laws (Horgan 136). Unlike Gould, who emphasizes contingency in evolution, Kauffman is driven by a dissatisfaction with the "cold and mechanical" notion that life is constructed out of random variation and selection (Horgan 136).

This unlikely agreement, however, does point out a fundamental contradiction in biopoeticist thought: if biological complexity can be built by mechanisms other than natural selection, as the biopoeticist interpretation of complexity theory implies, this undermines the assumption behind their radical evolutionary psychology--that the existence of every part of an organism can be explained by an adaptive story.

Physicist Jean Bricmont discusses a confusion similar to that surrounding Kauffman's work (the failure to consider

the larger system in which a “self-organizing” system is embedded) in the work of Ilya Prigogine. Prigogine argues that in open systems far from equilibrium, order can increase, and there is movement *away* from equilibrium. Bricmont points out that

> This is correct, provided that part of the environment *is more ordered than the system*, where “order” is taken in a technical sense: the system plus its environment (considered as approximately isolated) is in a state of low entropy, or is in a small subset of its *total* phase space and moves towards a larger subset of that space. But it is misleading to suggest that order is created out of nothing, by rejecting “entropy” in an unspecified environment. It is not enough to be an “open system”; the environment must be in a state of low entropy. While it is correct to say that the Second Law “applies only to isolated systems”; it should not be forgotten that most systems can, at least approximately, be considered as subsystems of isolated ones, and that, therefore, the Second Law does imply some constraints even for open systems. (“Chaos in Science” 32)

Bricmont patiently considers many examples of “self-organization,” explaining how such organization is always the result of order in the environment. For example, the Benard instability,[18] in which structure seems to emerge from the introduction of heat to a system (heat is usually a source of disorder):

[18] “A fluid is maintained between two horizontal plates, the lower one being hotter than the higher one. If the temperature difference is large enough, rolls will appear” (Bricmont 33).

> But what is needed, of course, is a temperature *difference* between two plates. So, if one heats up from below, one must have some cooling from above. The cooling acts like a refrigerator, so it requires some "ordered" source of energy. The more one heats, the more efficient must be the cooling. (Bricmont 33)

So what difference does it make if certain systems are creating order rather than importing it? First of all, the idea of "order for free" is necessary if one wishes to argue that there is some sort of trend toward increasing complexity in the universe--otherwise, the universe as an isolated system must be seen as "winding down." Argyros would have to embrace something like Kauffman's Fourth Law to maintain this; and this assumption is necessary for Argyros to maintain that there is evolutionary progress from which we can draw normative conclusions.

Second, Argyros believes that this notion of anti-entropy--with its implication that order is achieved autonomously--provides some kind of refutation of Laplacian determinism. This notion is frequently seen in popularizations of chaos theory and of complexity theory (Laplace is given quite a drubbing in Gleick's *Chaos* and in Coveney and Highfield's *Arrow of Time* and *Frontiers of Complexity*) despite the fact that chaotic systems are assumed to work the way that they do *because* of determinism.

This is not to say that determinism in the Laplacian sense is *true*; it is possible that "undetermined" events occur on the quantum level--and that these events could have an effect on the macro level. Complexity theory, however, is simply irrelevant to this argument. As physicist Jean Bricmont puts it, "If we did not know about quantum mechanics, the recent discoveries about chaos would not force us to change a single word of what Laplace wrote" (*Science)*.

But why should Argyros so badly *want* chaos to provide a refutation of determinism? Because he believes that free will and determinism are incompatible--that for there to be freedom and responsibility in a meaningful sense, some things, like our choices, must be "undetermined."[19]

The philosophical debates over free will and determinism are ancient, and have become extremely complicated, so let us focus here on the idea of free will that Argyros embraces. He appears to believe that we are determined *up to a point*, but that "chaos" creates a break in the causal sequence.

[19] Ilya Prigogine's philosophical speculations about the nature of far-from-equilibrium systems seem motivated by a similar distaste for the consequences of determinism. In an interview with John Horgan, Prigogine maintains that "You cannot on one side believe that you are part of an automaton and on the other hand believe in humanism" (Qtd. in Horgan 218).

To put this in terms of our earlier example: if you slam on your brakes at the red light, you *could have done otherwise* even if all the antecedent conditions were the same. If it were somehow possible to play this moment back, we might do something different--because our brain function is chaotic, and therefore undetermined.

This is very similar to philosophical arguments that were made in the wake of findings in quantum mechanics that seemed to imply that some events were undetermined. It was argued, for example, that although we are determined in our behavior up to a point, quantum indeterminacy could explain our free will. Again, we approach the red light. Antecedent conditions would seem to determine our decision. But no--quantum events might cause some neurons to fire “randomly.” If we were able to replay the event, quantum effects could bring about a different decision.

According to this argument, our freedom lies in the acausal, random events that interrupt an otherwise causal and deterministic sequence of events.

The flaw in such an argument--proposed by, among others, philosopher G.E.M. Anscombe in her essay “Causality and Determination”--is its assumption that “undetermined” equals “freely willed.” As physicist David Deutch puts it,

> Replacing deterministic laws of motion by indeterministic (random) ones would do nothing to solve the problem of free will. . . .Freedom has

> nothing to do with randomness. We value our free will as the ability to express, in our actions, who we as individuals are. Who would value being random? What we think of as our *free* actions are not those that are random or undetermined but those that are largely *determined* by who we are, and what we think, and what is at issue. (*Fabric 338)*

Erwin Schrodinger--one of the founding architects of quantum mechanics and devisor of the “Schrodinger’s Cat” paradox--also saw no logical connection between quantum indeterminacy and free will (Ruelle 31-32).

There are many conceptions of free will, some compatible with determinism and some not, but what is clear is that *randomness* or *lack of determinism* has nothing to do with free will. Even David Hume, who famously proposed that we could never prove causality but merely note the “constant conjunction” of some events, argued that our notions of freedom and responsibility in fact *assume* determinism (Ayer 126*)*.

To make this a little clearer: when you approach the red light, your decision is determined by, among other things, the antecedent state of your brain. You are responsible for that decision not despite the fact that it was determined, but *because of it*. That decision was the inevitable conclusion of a causal sequence.

If you were forced to alter your decision because of the flip of a coin, say (and we can think of random firings

in the brain as “flips of a coin”), you would hardly think of that decision as being “more free,” or of yourself as being “more responsible” because of this imposed randomness. Rather, you would think of yourself as *less* free.

It may be difficult to understand why the paradoxical notion of “ultimate” freedom and responsibility--the idea that our decisions are neither determined nor undetermined, but arise freely and autonomously--should be of such concern to anyone other than God (and perhaps Kant); and indeed, to most scientists, the question of determinism (at least on the macro level) is a settled one, with no particular consequences for our everyday notions of freedom and responsibility.

Nevertheless, Argyros wishes for chaos theory to square the circle of ultimate freedom and responsibility. Unlike Frederick Turner, who is savvy enough to admit that complex systems are only “free” in the sense that their future states cannot be calculated by any systems simpler than themselves, Argyros simply assumes that the practical impossibility of predicting the behavior of complex systems is itself a refutation of Laplacian determinism, despite the fact that Laplace himself acknowledged this impossibility.

Argyros insists on conflating “chaotic” with “non-deterministic”; throughout *A Blessed Rage for Order* he confuses the epistemological claim that certain systems are

unpredictable with the ontological claim that such systems are *undetermined*. According to Argyros, chaotic systems, like good art, steer a course between stultifying order and determinism and complete disorder. [20]

The notion that certain kinds of complex systems are "more free" than others in an ultimate sense (Argyros insists on reading "having more degrees of freedom" as "being more free" rather than "having more elements") is important for Argyros's aesthetics and politics: liberal capitalism is the most free political system, and experimentation rooted in natural classicism leads to the most free art, because these forms are "chaotic" and therefore "free."

Argyros is refreshingly direct about his political commitments:

> Whether of the teleological or the demystifying type, academic Marxists tend to agree that capitalist/technological institutions are oppressive constraints on the freedom of human beings. I will conclude this chapter by suggesting the opposite, that it is precisely a form of multinational, free-market capitalism whose energy is channeled productively by a certain amount of socialist top-down control that is most likely to foster freedom, justice, community, and individual happiness in a world that is metastable between matter dominance and spirit dominance. (329)

[20] Stephen Kellert points out that Argyros makes a basic mistake when he claims that chaotic systems are neither deterministic or random, "when they are both" (*Science* 232).

(This last part about “matter dominance” and “spirit dominance” is a typical bit of ecopoeticist bad faith: Argyros, like Turner, has a habit not only of viewing the injustices of today in the light of an unimaginable post-matter eschaton but also of imagining that matter and scarcity have already lost their pre-eminence in human life.)

But what, exactly, has all this to do with aesthetics or literary theory? Argyros has made some highly questionable--even wrong--assumptions about human nature, progress, and complexity: he has embraced a radical version of evolutionary psychology, proposed that biological and cosmological progress are self-evident, and proposed complexity theory as the motor of that progress. He has also proposed that chaotic systems are the most free (without giving a coherent definition of freedom).

On one level, Argyros is simply arguing that because the purpose of literature is to generate plausible scenarios (and we know this is what literature should be because it evolved to serve this purpose), and because the world is unpredictable, the speculations of literature should be made using natural classical rhetorical terms--both to make those speculations more comprehensible to humans and to ground the speculation, in order to better model the unpredictable-but-not-completely-disordered world.

If we ignore the fallacy of equating evolutionary origin with present function, accept the plausibility of an unlikely evolutionary psychological model, and accept that art is most effective when it “goes with the grain” of human behavioral propensities, this argument is not completely incoherent.

As a broad general claim, stripped of the unnecessary and obfuscatory chaos metaphor, the idea that literature should constitute an arena in which we can play out scenarios of our future, and that such scenarios are more useful--more accurate--when they are neither too conservative and ordered or too radical and disordered makes some sense. This aesthetic is revealed as somewhat lukewarm when stripped of the suggestive language of chaos theory, but the purposes and methods that it suggests for literature are not unreasonable.

But Argyros is more ambitious than this. His full aesthetic theory seeks to integrate his ideas about these purposes and methods with his belief in progress.

One way in which Argyros attempts to construct an aesthetic from this belief is by defining beauty in terms of the motors of progress, arguing that “evolution, feedback, chaos, and ritual . . . combine to form a system which *is* the beautiful” (286).

Why should we think of such systems as beautiful? Because they are self-organizing, and therefore creative: when a far-from-equilibrium system makes a “global leap” in organization, “such events are truly creative--they bring into existence something that did not previously exist” (286).

So: beauty is defined as the result of “creative” processes--“creative” being defined as “producing something that did not previously exist.” On its face, this seems a useless formulation: since everything in the universe at any given moment did not previously exist, doesn’t this definition simply identify *everything* as beautiful?

His definition becomes clearer when he explains his notion of how complex systems operate, proposing that the beautiful is “the unpredictable and discontinuous emergence of higher levels of systemic complexity” (287).

The “unpredictable” we can grant him (no real-world system is utterly predictable), but it is that “discontinuous” that is essential to this argument--and this word is totally wrong in this context. To reiterate a point we discussed earlier: complex or chaotic systems operate the way they do *because they are deterministic*, not because they are not.

Here the misreading of Laplace becomes important. Not content to simply say that there are points at which the

behaviors of certain systems are in a sense harder to predict (when considered on a specific scale), Argyros wants to claim that there is an actual break in the causal sequence.

Like the philosophers who sought freedom in quantum indeterminacy, Argyros wants to equate “nondeterministic” with “free.” Argyros goes further, though, equating “free” with “creative.”

We have already seen the problems involved in trying to salvage a meaningful sense of absolute freedom from indeterminacy; but perhaps he means to simply define “creative” *as* nondeterministic, without any complicating talk of “freedom.” This would only make sense, of course, if there were some reason to think that the systems he describes as beautiful are nondeterministic (or even somehow less deterministic than other systems). There isn’t.

Proceeding with this incoherent definition of beauty, Argyros goes on to make a completely nonsensical claim:

> When we read a work of literature that we are tempted to describe as beautiful, I suspect that, at the very least, the work is a self-similar system, displaying similar patterns at different levels of description, and that it functions as a nonlinear, dynamical system able to occasion global leaps of organization in the reader’s mind. (287)

Even if we grant him the metaphor of literature as bringing about “global leaps of organization” (reminiscent

of a silly speculation by Turner about works of literature being strange attractors), this assertion makes no sense. If Argyros is claiming that works of literature are *literally* self-similar, as fractals are--displaying *the same* pattern on several scales--it is simply wrong. If he means fractal-*like*--displaying patterns that seem somewhat similar on several levels--it is difficult to imagine what would not fit this description.[21]

These tenets--there are "natural classical" forms that must be used if art is to be understood most widely; art must be "chaotic" both because creativity inheres in chaotic processes and because the world, about which art hypothesizes, is chaotic--are ultimately subordinate to Argyros's primary idea, however: that there is progress.

What does Argyros mean by this? Much like Frederick Turner, Argyros believes that there is a trend throughout the universe toward greater complexity. He bases this belief on the "obvious" increases in complexity in the Earth's biosphere (we have already examined the flaws in such reasoning) and on the speculations of Paul Davies, the author of such popular science books as *God and the New*

[21] This argument is quite similar to one cited by Eugene Eoyang as one of the more egregious misuses of chaos theory in literary studies: "'Humpty-Dumpty' displays fractal self-similarity because it rhymes"(Qtd. in Kellert, "Science" 218)

Physics, that the cosmos is becoming more ordered rather than less. Argyros puts it this way:

> If by history we mean something like the history of Homo sapiens, the evolutionary history of biological organisms, or the history of the entire cosmos, then certain long-standing trends are inescapable. One of these is the self-organization of the universe into increasingly complex entities. (214)

If Davies--along with Argyros--means that the universe is increasing in average or total complexity, this is an extremely controversial claim, one that is in direct contradiction to the Second Law. The universe, considered as a closed system, cannot spontaneously become *more* ordered.

On the other hand, if he simply means that there will continue to be pockets--even, in a sense, “eruptions”--of order in a universe that is as a whole winding down, it is difficult to see how this could constitute a trend (or, in Frederick Turner’s words, “the central tendency of the universe.”)

Let us grant Argyros these two extremely controversial claims: that life is increasing in complexity and that order sometimes arises spontaneously in the universe, not from order being imported into a system but through a *real* increase in order, raising the total order of the universe.

What does this imply for aesthetics and for literature? To understand Argyros's aesthetics, we must first understand his politics.

First, as we have seen, Argyros believes that chaos provides a direct justification for certain kinds of social systems:

> Ultimately, I believe that chaos offers a bracing vision of political normativity. If the universe is, indeed, a society of chaotic, self similar layers, then it appears that everything in nature, from prebiotic dissipative systems, to the ecosystem of a river, to the organization of a primitive nervous system, to the dynamical flow of a human brain, to the shape of a kinship group, a city, a nation, or a world works best when it resembles a chaotic attractor. (331)

Now, there are a number of problems with this argument, not least of which is that, as Stephen Kellert points out, "this antecedent condition is in fact false: the universe is not made up entirely of 'chaotic, self-similar layers'" ("Science" 225).

Moreover, as Kellert also points out, even if the universe were the way Argyros thinks it is, this would not necessarily mean that chaotic systems "work well" unless we assume that the universe selects for systems that by definition work well ("Science" 225). (Actually, if the universe were made up entirely of "chaotic, self-similar layers," to draw normative conclusions from this would be

nonsensical--like saying “objects work best when they are made of matter.”)

Argyros *might* mean, proposes Kellert, something like “in the long run, only robust systems will persist,” but he points out that this “assumes that new systems are not continually generated” (“Science” 225). We will examine in a moment a fairly successful attempt to generate a normative political model from complexity theory that emphasizes the robustness of complex systems, but Argyros neither provides any proof that chaotic systems are more robust than other systems nor explains why such robustness would be valuable.

More important than the argument from chaos, however, is the argument from progress. That the universe is evolving toward greater complexity implies, for Argyros, that “our chief responsibility to the universe” is “to be an instrument of its introspection and evolution” (115). For Argyros, evolution is the primary value, and the primary goal should be to assist this (inevitable?) process.

Literature, in this view, “can be thought of as an adaptation of Homo Sapiens to facilitate the handing of the main baton of evolution from the biological or genetic realm to the cultural realm” (206). This is of course rather silly, if we are expected to read this as a claim that literature arose *in order to* speed up evolution.

Literature can, nevertheless, contribute to cultural change, even "evolution." Argyros argues that it *should* fill this role not only because we should do what the universe wants, but also because our evolutionary future is just lovely:

> Our world is evolving toward a global society. . . . This world would witness the gradual merging of knowledge and reality with a concomitant sharpening of the distinctions among the kinds of knowledge available to human beings, the increasing individuation, sexualization, and information-processing capacity of its inhabitants through a radically lengthened life-span due to nanotechnology and some form of computer-neural interface, the emergence of an immensely complex global state in which the old nation-state allegiances are felt to be underpinned less by metaphysical necessity than by aesthetic choice (this is like the difference between killing someone biologically and doing it on stage), the increasing reverence for art that is at once classical and experimental, the rehabilitation of our old bio/noo/sociotemporal roles, such as sex roles and kinship roles, in a flexible and ultimately aesthetic manner, and the discovery of new forms of devotion to the sacred. An information-centered world could be, to resurrect an old Puritan idea, the setting for a new Eden. (328)

Like Turner, Argyros seems to realize that his chaos-and-complexity-based arguments for free-market capitalism are feeble, and feels the need to justify his political preferences by reference to a future telos--a technological utopia. Presumably socialism would slow our ascent into the noosphere.

As with Frederick Turner's politics, when stripped of the metaphysics of inevitable progress, of inexorable complexification, Argyros's notion is difficult to challenge on its own terms. That the inefficiency, injustice, and ecological destructiveness of capitalism are justified because of the wealth that the system ultimately provides, far from being a marginal notion, is a central assumption of mainstream neoclassical economics.

Although one could challenge this assumption in various ways, an aesthetics subservient to a politics of "chaotic" capitalism and "evolutionary" technological progress would not be the most ridiculous or inhumane aesthetics ever proposed.

But what, finally, does such an aesthetics amount to? Argyros explicitly states that he is not arguing "that painters should devote themselves to painting seahorse tails and writers to writing great evolutionary epics" (342). In fact, as natural classicism implies, there are only a few great aesthetic themes, which are "legitimate cultural attractors, drawing artists to their basins across cultures and through time" (342).[22]

[22] This metaphor not only is befuddling, but also provides an example of a scientific mistake (one of many) that Argyros makes throughout the book--confusing "attractor" and "basin of attraction." The basin of attraction is constituted by all the points that are drawn to an attractor. To speak of something being drawn *to* a basin of attraction makes no sense.

If this chaotic/progressive aesthetic does not call for literature to address certain themes, as Frederick Turner's does, what concrete proposals does Argyros make?

Very few. Argyros does suggest that "chaotic" art (as we have seen, *very* loosely defined as art that has both structure and "randomness") will produce more novelty than other art, and "a society that is able to manufacture more innovation will be more likely to survive in the long run" (330).

So literature that is, well, imaginative but anchored by natural classicism is the best sort of literature because it will create "controlled novelty" (what writing does not?), and such "chaotic" art, in addition to being beautiful because it is the result of a creative process (again, what isn't?), is necessary for a chaotic, evolutionary, self-organizing society--and chaotic, evolving societies are not only the quickest route to techno-utopia, but also our "responsibility" as members of an evolving universe.

Even if we grant Argyros all of his dubious stipulations and conclusions, his aesthetics is practically useless--his notion of chaos so broadly defined as to include almost anything, his one example of "chaotic" form in literature (the use of natural classicism) seeming to

reveal nothing more than an idiosyncratic preference for a certain ratio of “order” to “randomness.”

But we need not grant Argyros all of his assumptions, and perhaps the most dubious of these are two that he shares with Frederick Turner--that complexity theory posits evolutionary progress as a central “trend” or “theme” in the universe and especially in the development of life, and that we can draw some normative conclusions about this.

And yet, even if Argyros and Turner cannot logically connect the findings of complexity theory to their valorization of complex or self-organizing systems, there is certainly nothing intrinsically wrong with their defining “beautiful” as “complex” and finding things that either are or seem to be self-organizing--embryos, whirlpools, whatever--beautiful. Such an aesthetic is no more loosely defined than past theories that aestheticized “life.”

Nor is there anything particularly monstrous about their politics of human progress to an ultimate Omega Point, an ultimate ascent of spirit into the noosphere; even if they are mistaken about the route to such transcendence--liberal capitalism--they would not be the first to subordinate aesthetics to a teleological politics. If they desire art that values “evolution” over “justice,” as Turner’s poem *Genesis* does, one cannot challenge this

commitment by questioning their science or their reasoning--one must challenge that politics directly.

The problem here is not that the aesthetics of Argyros and Turner is based in an *a priori* reprehensible politics--the problem is that these theorists claim that their aesthetics are apolitical. Turner constantly bemoans the fact that feminists and Marxists have politicized art; Argyros believes that the nature of the universe is incompatible with poststructuralism (Argyros is a little confusing, or confused, here; he argues that no particular political or ethical beliefs flow from poststructuralism, but also argues that the politics of poststructuralism is wrong).

But they do not escape politics by redefining beauty; the literature that their theory values (at least as far as Turner explains it; Argyros's aesthetic is, as Raymond Williams said of Christopher Caudwell, not even specific enough to be wrong) is as crudely subservient to politics as Socialist Realism. If these authors would simply admit their political commitments--that they *like* capitalism and dislike the whining of losers, that they think a grand technological future justifies almost any apparent injustice or waste now--their aesthetic would be far more convincing.

Genesis, along with Turner's other poetry, expresses this evolutionary ideology far more effectively than does

the non-fictional work of Turner and Argyros because it does not rely exclusively on reasoned argument. Reduced to propositional form the idea that “we should contribute to the evolution of the universe because the universe evolves” is ridiculous; in an epic poem, it is an inspiring religious tenet. The pro-capitalist ideas put forth in Ayn Rand’s novels are even more bizarre when put into propositional form, yet generations of otherwise bright adolescents enjoy her novels and think that they believe in her politics and ethics (until confronted with the consequences of and self-contradictory nature of these beliefs).

There are many possible justifications for the unbridled capitalism advocated by classical liberalism--the rights-based justifications of Robert Nozick, the utilitarian justifications of Friedrich Hayek and Ludwig Von Mises--but while utilitarian justifications are subject to debate (does unbridled capitalism really lead to greater happiness than socialism?) and rights-based theories lead to theoretical edifices as incommensurable as the basic rights they assume (Nozick’s libertarianism vs. John Rawls’s welfare liberalism), the notion of progress as a universal imperative is used by the biopoeticists, as it was by Herbert Spencer (who believed the evolutionary imperative trumped all other concerns): to short-circuit political debate.

That is to say, one can at least attempt a utilitarian calculation weighing the wealth and technological prowess generated by capitalism against the suffering of its victims (is a more equal, but less wealthy overall, society a maximally happy one? Is it even true that great income inequality is necessary for a productive society?), but if one assumes *a priori* that progress is a universal imperative, and what is most desirable is what leads to such progress, the most rapacious and brutal forms of capitalism are justified if they can be shown to hasten mankind's ascent into the noosphere--or, as Neal Stephenson calls it, "the great global furball."

Alternatives to this mythical valorization of complexity can be seen other recent works of science fiction dealing with the terraforming of Mars. If Turner's goal in the valorization of complexity is to take the politics out of politics (as he also wants to take it out of aesthetics), Kim Stanley Robinson, a celebrated science fiction writer with a PhD in literature (Fredric Jameson was his dissertation director), in his own three-volume Mars epic, leaves it in, in all its human complexity. The central question for Robinson, in the words of one of his characters, is "Why do we value life more than rock?" But even this riposte to Turner is not really Robinson's ultimate message. Robinson doesn't really take a position on

whether bringing life to Mars or preserving it in its pristine glory is preferable. These are absolute ethical principles with which one really cannot argue. What is important to Robinson is how the question of whether to terraform Mars is ultimately political--the result of real struggle over who gets to dispose of resources.

Bruce Sterling, too, provides a fascinating take on the terraforming issue in his “Shaper/Mechanist” stories (stories that take place in a milieu of humans radically altered by technology)--those posthumans involved in the terraforming of Mars do so because of precepts distilled from Ilya Prigogine's complexity: they are helping Mars move up the "Prigoginic levels." Although this commitment to the terraforming of Mars is the most moving ethical/political commitment in these works (and virtually identical to Turner's position), the most thoughtful characters in these stories think that this ideology is utter nonsense--as does Sterling, who admits in his preface to a recent edition of *Schismatrix* that Prigogine himself thinks shaper/mechanist ideology a complete misreading of his work.

Robinson's Mars novels reveal the dual errors in Turner's position: first, in thinking that there is a tendency in nature toward higher forms, and second, in believing that if this tendency is the case, man should therefore emulate it or encourage it.

But this logical leap is not really an “error” in the context of Turner’s project, as revealed in his nonfiction as well as his fiction; he is engaged in myth-making--a different project from those of Robinson and Sterling, who, although their focus is more on the *conflict* of political visions, are guided by their own political ideologies (among them a liberal receptiveness to debate).

So these biopoeticists subscribe to marginal science, and their reasoning from facts to values is wrong--or at least rather transparently fallacious. They are probably mistaken about liberal capitalism being more “chaotic” than other systems, and it is unclear that liberal capitalist societies will “evolve” faster than others.

Their arguments in favor of their values are either deceptive or sloppy; and yet, given that all values are ultimately ungroundable, let us accept the validity of an aesthetics based on the evolution of humanity and the cosmos--and a belief that capitalism is the way for humankind, or at least its social systems, to evolve most rapidly. If they want pro-evolutionary myths and wish to judge the quality of a work of literature based on their perception of how that work contributes to/inhibits evolution, how do we judge that project?

Even if we accept the premise that evolutionary progress is the ultimate value, the aesthetics that Argyros

and Turner construct from this premise is sadly wanting. The *only* real guideline they provide is to ask whether the work is pro-evolution or not.

Contrast this with the sophistication of and lively debate in Marxist criticism, which also in a sense subordinates the aesthetic to an ultimate political goal. From Trotsky's discussion of whether Shakespeare should be read to Fredric Jameson's attempts (following Ernst Bloch) to find utopian hope in the most right-wing cultural products, from Lukacs's endorsement of realism to Brecht's championing of modernism, Marxist literary criticism has realized the difficulty of judging a work by its political intent or predicted political effect.

Perhaps it is unreasonable to judge these theories by such standards. Marxist literary theory has existed for over a century, biopoetics for less than twenty years (if we can describe E.O. Wilson's sociobiological speculations about art in *On Human Nature* as biopoetics, as Brett Cooke and Frederick Turner have). Attempts to derive an aesthetic from evolutionary progress, however, date back at least as far as Herbert Spencer, and the biopoeticists have not progressed beyond Spencer's ideas that art serves to keep our facilities in shape (much like the "off-line" thinking described by Cosmides and Tooby), and that progress in art--

like progress in all things--lies in “heterogeneity”: the progressive differentiation of forms (“Progress”).

At this time, even the paths of development that have been sketched out by the “pro-evolution” biopoeticists--more precise definitions of “pro-evolution” themes and “complex” literary forms--appear unpromising.

Conclusion

The biopoetics project--an attempt to depoliticize literary theory and criticism, to make criticism more “objective” and “scientific” through an explicit connection with evolutionary theory (specifically, through an application of evolutionary psychology and of the idea of evolution as progressive)--must ultimately be considered a failure, even on its own terms.

Where it conceives most contemporary literary theory as impoverished for not considering all of the causes (especially material causes) of the production of literature, the biopoeticists present an essentially monocausal explanation of literary production: literature is the product of authors, whose identities are completely determined by biology.

Such an explanation of literary production pales in comparison to, for example, the application of the Althusserian concept of overdetermination in the work of Pierre Macherey and others (a concept that can ultimately encompass any new ideas from the sciences). Moreover, while the biopoeticists condemn most literary theorists for ignorance of or indifference to science, the science that they place at the center of their theory, evolutionary

psychology, is, to say the least, immature--and they extend the hypotheses of this science far beyond the wildest claims of its practitioners.

While they accuse contemporary theory of “politicizing” literature, they make “apolitical” claims such as Joseph Carroll’s that we must understand homosexuality as a dysfunction if we are to understand works involving homosexual characters. In fact, there seems to be no method in the biopoeticists’ novel evolutionary-psychological hypotheses; all that these hypotheses seem to share is their happy support for the biopoeticists’ cultural claims.

If their arguments for the greater explanatory power of their model are weak, the biopoeticists’ normative claims derived from evolutionary psychology are even more feeble: those works that employ themes involving “innate” concerns (reproduction, child care, male aggressiveness and female coyness) are greater than those that do not; those that flatter our adaptive and innate cognitive structures (our desire for a sense of pattern, or our three-second memory “pulse”) are greater than those that do not.

Even if their evolutionary-psychological claims are all true, the biopoeticists still fail to provide an explanation of why such works should be considered better than others. That works going, as it were, with the grain of human

cognition rather than against it are the greater ones requires arguments that they do not provide. The *most* that can be asserted from the mere existence of the cognitive propensities that the biopoeticists identify is that works that play to these propensities might be more widely comprehensible than those that do not--and even this assertion questionably assumes that cultural influence on the human mind is slight.

When they recognize the inadequacy of mere assertion of innate tendencies--as Frederick Turner and Alexander Argyros do--and attempt to root their preference for traditional forms in a larger argument, the biopoeticists get into even more trouble. As all the biopoeticists do with evolutionary psychology, Turner and Argyros root their argument in a highly questionable scientific claim: evolutionary progress. They then pronounce such progress good, and construct very tenuous arguments that certain literary forms and themes are the product of, and contribute to, that progress.

Elements of biopoetics may one day prove useful as part of a broadly conceived materialist poetics. Evolutionary psychology will always be a speculative science; one cannot test its assertions of adaptive origin. As cognitive science progresses, however, we will better understand the skills and weaknesses of the human mind; it may even prove to be

the case that certain themes have a particular appeal to humans because of the construction of their brains. Such findings, combined with an understanding that humans are embedded in cultures, could perhaps contribute in a modest way to the discussion of how literature is created and received.

These areas are properly the domain of cognitive science alone, however. Although some fine work has been done by literary theorists applying the still-modest findings of this science (Mark Turner, for example), this work is convincing due to the very extent that it does *not* rely on evolutionary just-so stories.

The theory of evolution, and especially the theory of its primary motor, natural selection, deserves consideration by literary theorists, who should applaud attempts to expand their critical toolkit. A critical theory that would come to grips with evolution, however, would do well to ignore the foundation constructed by the biopoeticists, and seek to build itself on firmer ground.

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