Does Beauty Build Adapted Minds? Toward an Evolutionary Theory of Aesthetics, Fiction and the Arts

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Opening Mysteries: The Anomaly of the Arts in the Evolutionary Landscape

Organic evolution has two independent components, which together explain how all of the evolved features of organisms came into being. The first is randomness, which by its inconstant and capricious nature cannot build anything organized. The second is natural selection, which drives the incorporation of adaptively functional features into a species' design over evolutionary time (Dawkins, 1986). Organisms are full of exquisitely organized functional machinery (adaptations), from eyes and muscles to circulatory systems and neural circuits. Natural selection is the only explanation presently known to the scientific community for functional relationships that are more highly ordered than chance can account for (Williams, 1966). Reciprocally, this means that all functional organization discovered to be part of the design of a species must have been built by natural selection. If not, then our complacently nontheistic materialist theories are in trouble (Tooby and Cosmides, 1992).

Therefore, according to the logical framework derived from modern Darwinism, all features of a species' cognitive or neural architecture are either adaptations, byproducts, or genetic noise. Adaptations are present because they were selected to perform a function that ultimately contributed to genetic propagation. For example, the system that identifies snake-ness in the visual array, coupled to fear-releasing circuits, is an adaptation that lowered deaths due to venomous snake bites among our ancestors. Byproducts perform no function of their own, but are present because they are causally coupled to traits that were selected for: avoiding harmless snakes is a byproduct of adaptations for avoiding venomous ones. Noise was injected by the stochastic components of evolution—for example, genetic drift appears

responsible for the capricious fact that a small percentage of humans sneeze as a reflex when exposed to sunlight.

Like modern physics, Darwinian theory is subtle, strange, inhuman, and enormously successful as an explanatory system. It has successfully explained why a great many of the functional design features of species, including humans, have the forms that they do. As evolutionary psychologists have found, evolutionary theory also accounts precisely for a large number of features of the human mind, and their expressions in human behavior. Evolutionary theories of function elegantly predict and account for the existence and detailed structure of cooperation, aggression, sexual desire, love for one's children and family, the dimensions of conflict or tension inside the family, sexual jealousy, the avoidance of incest, the formation of in-groups, and hundreds of other major phenomena that organize human life in all cultures (see, e.g., Barkow, Cosmides and Tooby, 1992).

Nevertheless, unlike the case for nonhumans, there are large realms of human behavior and experience that have resisted any easy or straightforward explanation in Darwinian terms. Indeed, leaving aside history, philosophy, and linguistics (whose findings and objects of study are generally consistent with Darwinism), almost all of the phenomena that are central to the humanities are puzzling anomalies from an evolutionary perspective. Chief among these are the human attraction to fictional experience (in all media and genres) and other products of the imagination. (We will be using the word *fiction* in its broadest sense, to refer to any representation intended to be understood as nonveridical, whether story, drama, film, painting, sculpture, and so on.) If these phenomena did not exist, no evolutionary psychologist, at our present level of understanding, would have felt compelled to look for or predict them. If they were rare or culturally limited phenomena, their existence would not pose a theoretical problem. (No one feels the need to develop an evolutionary explanation for rocketry or Esperanto.) However, aesthetically-driven activities are not marginal phenomena or elite behavior without significance in ordinary life. Humans in all cultures spend a significant amount of time engaged in activities such as listening to or telling fictional stories (Brown, 1991; Hernadi, this volume; Scalise Sugiyama, 1996; in prep.), participating in various forms of imaginative pretense (Leslie, 1987), thinking about imaginary worlds, experiencing the imaginary creations of others, and creating public representations designed to communicate fictional experiences to others. *Involvement in fictional, imagined worlds appears to be a cross-culturally universal, species-typical phenomenon.*

Second, *involvement in the imaginative arts appears to be an intrinsically rewarding activity, without apparent utilitarian payoff.* With rare exceptions (e.g., Hamlet entrapping his uncle, or Maoist revolutionary opera), this activity is not easily explained as instrumental in any ordinary sense. As incomes have risen, people have spent more and more of their time voluntarily inhabiting these fictional worlds. In every industrialized society, every night after work the primary form of recreation is to immerse oneself in the broadcast or projected world of fictionalized lives and events (indeed, the appetite for recreation itself requires evolutionary explanation). Before these technologies existed, novels and stories were hungrily consumed by large proportions of the literate population. In 1841, six thousand New Yorkers lined the docks, desperately anticipating the arrival of the final installment of Dickens' *The Old Curiosity Shop,* deeply concerned about the fate of Little Nell – someone they knew did not exist and so knew could not suffer. Among hunter-gatherers, stories are commonly told around the fire, after the day's work is over (Blurton Jones and Konner, 1976). The demand for high quality fiction may make its production instrumental for many of its creators, but the consumer demand remains driven by the intrinsic reward individuals experience from it. The tension between art for art's sake, and its use for didactic, propagandistic, or other ends is primarily an argument among producers of art. This argument acknowledges that there is some meaning to the idea that art is often pursued as an end in itself—that is, there is something inherently rewarding, rather than instrumental, to being involved in art. Indeed, we have a number of words, such as fun, beautiful, amusing, diverting, entertaining, fascinating, absorbing, recreational, and so on, that refer to the rewarding states of mind that are elicited by involvement in certain noninstrumental activities. These rewarding states of mind seem so natural to us—so obviously the product of the works of art themselves—that their existence seems to require no other explanation. But these experiences would not be possible unless the mind contained elaborate reward systems that produced them in response to some stimuli and not others. Thus, the idea that people listen to stories because they find them interesting is the first step, not the last, in the chain of explanation. Evolutionary researchers want to know why the mind is designed to find stories interesting.

Third, although fiction seems to be processed as surrogate experience, some psychological subsystems reliably react to it as if it were real, while others reliably do not. In particular, *fictional worlds engage emotion systems while disengaging action systems* (just as dreams do). An absorbing series of fictional events will draw out of our mental mechanisms a rich array of

emotional responses—the same responses that would be appropriate to those same events and persons if they were real. We care about the people involved, we identify our welfare with one or more of the characters, we may be afraid, or disgusted, or shattered, as if (in the emotional channel) those events were happening to us. We feel richly but act not at all, indeed losing awareness of our bodies and nonrelevant senses and activities in proportion to how absorbing the fictional input is. A real lion actually lunging at us would evoke terror *and* flight—the emotion program and behavior are linked (Cosmides and Tooby, 2000b). But while a cinematic version of the lion may evoke terror, the flight behavior that terror is ordinarily designed to produce is disengaged: We do not run from the theater. The experience may give us new weightings on the fearfulness of lions or the dark, but these weightings express themselves in real behavior elicited by real situations subsequently, not in behavior directed toward the fictional event. This selectivity in how our mental subsystems respond suggests functional design.

Fourth, it appears as if *humans have evolved specialized cognitive machinery that allows us to enter and participate in imagined worlds* (including pretense, Leslie, 1987; and fiction, Cosmides and Tooby, 2000a). Pretend play is now recognized as so fundamental an expression of the human cognitive architecture that its absence in a toddler is seen asdiagnostic of a neur ological impairment (autism; Frith, 1989). The machinery that permits pretense can be selectively impaired while other faculties are spared, suggesting that it is the product of a specialized subsystem, and not simply a byproduct of general intelligence. There are children with autism who cannot pretend despite having a normal IQ, and correspondingly children who can pretend despite be saddled with very severe cognitive dysfunctions (Baron-Cohen, 1995). Behaviorally, pretend play appears in all normally developing children in all cultures around eighteen months of age, about the time that infants become maturationally equipped to engage in sophisticated social activity that acknowledges the existence of other minds. The cognitive machinery underlying pretend play includes specialized forms of representation (metarepresentations), which decouple the pretense from one's store of world knowledge (Leslie, 1987). These decoupling mechanisms appear to be adaptations, whose function is to protect our knowledge stores from being corrupted by the flood of false information ("fictions") that the ability to engage in imaginative activities allows (Leslie, 1987; Cosmides and Tooby, 2000a).

In short, pretend play is a reliably developing feature of the human species, which appears to be complexly designed to perform certain activities. Moreover, the existence of adaptations designed to prevent the data

corruption problems that would otherwise be caused by fictional information implies that there was some benefit to being able to entertain fictions. But what is the adaptively functional end-product that this machinery evolved to serve? How did this contribute, under ancestral conditions, to gene propagation? This is a major mystery. Even more intriguingly, pretend play parallels adult involvement in fictional worlds in a number of key respects. It is intrinsically rewarding, non-instrumental, and it centrally involves the mental representation of states of affairs known to be false to the individual carrying out the mental activity. Moreover, it appears to involve the same cognitive design features that protect children in pretend play from confusing fiction and reality (Cosmides and Tooby, 2000a). Indeed, from a cognitive or computational point of view, they seem to be fundamentally the same activity, and so discovering the function of pretend play may elucidate the function of participating in imagined worlds for adults.

The anomaly posed to evolutionary psychologists by the arts (and pretend play) can now be stated. Our species-typical neural architecture is equipped with motivational and cognitive programs that appear to be specially designed to input fictional experiences and engage in other artistic activities (Cosmides and Tooby, 2000a). Yet the evolved function or selective benefits that would favor the evolution of such adaptations remains obscure. Natural selection is relentlessly utilitarian according to evolution's bizarre and narrow standards of utility, and does not construct complex neural machinery unless that machinery promoted, among our ancestors, the genetic propagation of the traits involved. So, why are these neurocognitive programs built in to human nature?

From an evolutionary perspective, acceptable answers are limited to three:

(1) The human engagement in fictional experience, pretend play, and other aesthetic activities are the functional products of adaptations that are designed to produce this engagement. Therefore, engagement in fictional experience and other aesthetic activities must have contributed to the survival and reproduction of our hunter-gatherer ancestors, even though we do not presently know how.

(2) The human engagement in fictional experience, pretend play, and other aesthetic activities is an accidental and functionless byproduct—a susceptibility—of adaptations that evolved to serve functions that have nothing to do with the arts *per se*. According to this hypothesis, engagement in the arts is like catching a disease or becoming addicted to drugs. It is not something that humans were designed to do, but something they are vulnerable to. Or as W.H. Auden put it, "Poetry makes nothing happen."

(3) The psychological basis of these activities is the result of genes that spread by chance during evolution. (We consider the cognitive and motivational features related to aesthetic experience and pretense to be too well-organized and reliably developing to be explicable as chance fixation of neutral alleles, and will not consider this hypothesis further.)

If the first hypothesis is true, it is important to identify the function or functions (i.e., the adaptive consequences) of these adaptations, which caused them to be selected for among our ancestors. Discovering the function of an adaptation is worthwhile because it usually opens the door to a large series of additional discoveries about the structure and organization of the phenomena in question. In this paper, we would like to outline some hypotheses about the possible functions and significance of immersing oneself in aesthetic activities, fictional worlds, and pretend play (Cosmides and Tooby, 2000a; Steen and Owens, in prep.).

For many years, we considered the second hypothesis—the byproduct hypothesis—to be the correct one. Until a decade ago we routinely used various artistic behaviors unproblematically as examples of evolutionary byproducts in our lectures. We still consider the byproduct hypothesis to be the default hypothesis, with a great body of logic and evidence in favor of it. Steven Pinker has recently argued this position with great cogency, suggesting that many of the arts are technologies that "pick the locks" that safeguard the brain's pleasure circuits (Pinker, 1997). Pinker sketched out how many well-known features of the visual arts, music, and literature take advantage of design features of the mind that were targets of selection not because they caused enjoyment of the arts, but because they solved other adaptive problems such as interpreting visual arrays, understanding language, or negotiating the social world.

Although this argument is a powerful one, and we remain persuaded that it successfully explains many features of the arts, we nevertheless have gradually come to the conclusion that there is much that it leaves unexplained. We think that the human mind is permeated by an additional layer of adaptations that were selected to involve humans in aesthetic experiences and imagined worlds, even though these activities superficially appear to be nonfunctional and even extravagantly nonutilitarian (Cosmides and Tooby, 2000a, Steen and Owens, in prep.; see also Cosmides and Tooby, 2000b, and Pinker, 1997, pp. 541-543). This seemingly unlikely possibility is the hypothesis we would like to explore in the remainder of this article.

To give one reason why we think the byproduct explanation is inadequate, consider one straightforward expectation about the human mind derived from evolutionary analyses. Successful action depends on access to

accurate information about the world. Accordingly, organisms should have an appetite for obtaining accurate information, and the distinction between true information and false information should be important in determining whether the information is absorbed or disregarded. This "appetite for the true" model spectacularly fails to predict large components of the human appetite for information. When given a choice, most individuals prefer to read novels over textbooks, and prefer films depicting fictional events over documentaries. That is, they remain intensely interested in communications that are explicitly marked as false.

The familiarity of this phenomenon hides its fundamental strangeness. Novels and films are not an accidental side effect of attempts to manufacture accurate informational packages. They are not near misses. And the most basic design feature you would expect to be built into a reward system for inputting information—an appreciation for its truth—seems to be completely switched off in a wide variety of circumstances. Yet, when dealing with communication that is *intended* to be accepted as truthful, people are intensely interested in its accuracy. This rules out the hypothesis that our minds are too poorly designed to care about such a distinction. No one would read the *Wall Street Journal* if its pages of numbers were known to be false, or old computer manuals whose instructions were obsolete. The switching off of an aversion to falsehood under predictable circumstances is an element that has seemingly been added to the human cognitive architecture. It is not a necessary byproduct of some otherwise known or expected feature. If survival depended only on accurate information, then children should pay attention only to factual broadcasts, and parents should only find providing accurate information to their children rewarding. Yet, as parents we notice a mutually understood delight when we initiate some fantastic pretense with our daughter or when she initiates one with us. Indeed, the whole educational environment created for very young children is drenched in fantasy—that is, falsehoods. Logically, this seems like an abuse of children, but parents acting out of (presumably) evolved intuition feel that it is not. Why?

To understand the problem fully, it is important to be clear on what *false* means when we say that fiction is *false information*. In the first place, the usual Gricean strictures are radically changed. Most especially, fiction when communicated is not intended to be understood as true—as literally describing real events in the world accurately. No one is meant to be deceived, or to revise their specific factual beliefs about the real world. Even more fundamentally, in fiction semantic relations of truth, existence, and reference are suspended (for discussion, see Cosmides and Tooby, 2000a). Truth is suspended—only within the fictional world of *The Winter's Tale* does Bohemia

really have a seacoast. Existence is suspended—*Oedipus Rex* is not imperiled by Oedipus never having lived. And reference is suspended—Dr. Strangelove can mention the President without referring to Kennedy or Johnson, and Oedipus can think he is sleeping with Jocasta without believing that he is sleeping with his mother. Although fiction often embeds real facts, places, events, and people, they are not necessarily or even usually marked off from the nonexistent "facts," places, events, and people in any way detectable to an audience that does not already know the difference. Andrei Bolkonsky does not step across any metaphysical boundary at Borodino marking off history from invention. Within a fictional narrative, everything (whether true in reality or not) has the same undiscriminated and largely indiscriminable standing, and all propositions are freely interwoven without the least regard to their extrinsic accuracy. By its entry into fiction, a fact loses its dependence on its truth in the external world and becomes something different. Indeed, we would claim that fictions consist of sets of propositions that (1) are bundled together, (2) refer internally to each other rather than to the world, and (3) can tolerate the uncontrolled proliferation within the bundle of other false propositions and their amalgamation with true propositions precisely because (4) the entire bundle is cognitively walled off so that its constituents cannot easily migrate into and corrupt our other knowledge stores (Cosmides and Tooby, 2000a). The idea that art somehow embodies truth is an ancient and enduring belief, but the factuality of Shakespeare's War of the Roses is not the kind of truth intended. What kind of truth, if any, does art convey, and why, paradoxically, does this kind of truth need to be conveyed in a matrix of false propositions? How could it be true, as Picasso said, that "Art is a lie which makes us see the truth"?

Why did Humans Evolve Aesthetic Reactions? The Overlooked Importance of the Internal World

Organisms, including humans, ought to be motivated to make choices, take actions, or invite experiences and interactions that change things in an adaptive direction. We expect that humans have evolved motivational systems (or systems of aesthetic preference) that are designed to find rewarding the kinds of actions and experiences that would have been adaptive for our ancestors. The conditions that can be changed in an adaptive direction can be divided, for analytic convenience, into three realms: (1) changes made to the external world, (2) changes made to the body, and (3) changes made to the brain / mind.

Actions produced to accomplish fitness-enhancing outcomes in the external world constitute a large and diverse set of behaviors, ranging from having sex, nurturing cooperation, aggressive defense, feeding your infant, winning social approval, or selecting a habitat to live in. The preferences or aesthetics associated with this realm of activity correspond to traditional adaptationist theories of motivation. Aesthetic theories arising from such analyses include theories of sexual attractiveness developed by Symons' (1995) and his followers, and Orians and Heerwagen's (1992) theory of habitat aesthetics.

Actions produced to cause fitness-enhancing changes to the body include eating, stretching, sleeping, noninstrumental physical exercise, temperature regulation, massage, elimination, sneezing, vomiting, and so on. This involves a separate realm of somatosensory aesthetics, which, so far has not been substantially developed, outside of theories of food preference and aversion. We will not dwell on it here.

Actions produced to cause fitness-enhancing changes to the brain / mind are a third category, and obviously include play (Fagen, 1981; Symons, 1978; Steen and Owens, in prep.), learning, and perhaps dreaming (States, this volume). We think that the task of organizing the brain both physically and informationally over the course of the lifespan is the most demanding adaptive problem posed by human development. Building the brain, and readying each of its adaptations to perform its function as well as possible is, we believe, a vastly underrated adaptive problem. We think that there is an entire suite of developmental adaptations that have evolved to solve these adaptive problems, and that the possible existence of many of these adaptations has gone largely unexamined. Thus, in addition to world-targeted and body-targeted aesthetics, there a complex realm of brain-targeted aesthetics as well.

How underrated is this adaptive problem? The performance of computational systems like the brain are, by their nature, exquisitely sensitive to the precise layout of their circuits, and to the information supplied to their data-bases. As those whose personal computers frequently crash can attest, tiny changes in a computational system make the difference between successful computation and computational collapse. In comparison, the functional performance of relatively homogeneous tissues such as muscles, the liver, or the lungs, is far less sensitive to the exact ordering of largely interchangeable cell populations. Building, readying, and maintaining the brain is thus a developmental problem many orders of magnitude more exacting than any other developmental task. Moreover, the brain appears to consist of a large number of distinct sub-computers, computational

specializations, or modules, from language and vision to social intelligence, predator avoidance, and sexuality (Tooby and Cosmides, 1992; Pinker, 1997; Sperber, 1996). Hence, each one requires developing a different organization, and poses a different set of developmental problems. If this view is correct, each psychological adaptation, from the language faculty to the auditory system, should come equipped with its own aesthetic, designed to help involve the individual in experiences, such as babbling (Pinker, 1994), play fighting (Symons, 1978), or play chasing (Steen and Owens, in prep), that will develop, calibrate, or tune the appropriate neurocognitive system.

In the Darwinian world of physical causality, organisms are recognized as being self-replicating chemical robots (Dawkins, 1986). Organisms can grow, survive, and reproduce only because they are largely assemblages of adaptations: complex functional machinery designed to perform all of the steps necessary to live a successfully reproductive life. So, the first adaptive problem an organism faces is the task of assembling itself correctly (Cosmides and Tooby, 1999). All mature adaptations depend upon the prior existence of adaptations designed to build them. The task of developmental adaptations is to (1) successfully construct all of the other adaptations that constitute the species-typical functional design, and (2) bring those adaptations into a state of optimal readiness to deal with the prospective demands they will confront in that individual, in that lifetime, in that local physical, social, biotic, and cultural environment.

Genes underlying adaptations are selected so that, in development, genes and specific aspects of the world interact to cause the reliable development of a well-designed adaptation (Tooby and Cosmides, 1992). This means that information and structure necessary for the proper development of an adaptation may be stored in the world as well as in the genome, and that selection will shape developmental programs to exploit information-rich features of the world. This allows adaptations, such as the language faculty (Pinker, 1994), or rhesus fighting (Symons, 1978), to be far more elaborate than could be managed if all of the necessary information had to be supplied by the genome. What is genetically specified in adaptations is an economical kernel of elements that guides the construction and initialization of the machinery through targeted interactions with specific structures, situations, or stimuli in the world (e.g., wrestling with your brother, throwing rocks at randomly chosen targets, playing with words).

This means that aesthetic motivations may be a necessary guidance system for the development of each adaptation – that is, motivations to detect, seek, and experience certain aspects of the world are evolved design features, present to help adaptations become organized into their mature form.

According to this view, a neurocognitive adaptation may operate in two different modes (Tooby and Cosmides, 2000a; Steen and Owens, in prep.). The first is its *functional mode,* when it is performing its evolved function (e.g., the visual system performing useful scene analysis, the language system generating utterances for communicative purposes). The second is its *organizational mode.* This mode of operation is designed to construct the adaptation, to provide it with the correct weightings, information, and representations, and in general to develop a better organization for carrying out its function (e.g., babbling in order to develop a more effective language system). The organizational mode of each adaptation is expected to have its own separate aesthetic component. Thus, these motivational guidance systems are vital components of developmental adaptations designed to help construct adaptive brain circuitry, and to furnish it with the information, procedures, and representations it needs to behave adaptively when called upon to do so (Cosmides and Tooby, 2000a; 2000b; Steen and Owens, in prep.).

Hence, many seemingly purposeless behaviors may be driven by adaptations operating in their organizational mode. According to this analysis, aesthetically driven behavior only appears non-utilitarian because our ordinary standards of function are focused on the struggle to achieve adaptive changes in the external world, such as caring for children, acquiring a mate, foraging, and so on. When we recognize that for many actions the goal is instead to make adaptive changes in the immense and subtle internal world of the mind and brain, then the puzzle of how natural selection could build complex systems to produce pointless behaviors (potentially) evaporates. The lack of correspondence between aesthetically driven behavior and useful outcomes in the external world is exactly what you would expect if the system driving the behavior is designed to produce adaptive internal changes, when the external price is not too great. (Of course, the most rewarding situation of all is when the same behavior is useful externally and internally, which may explain why first successes are so sweet). Natural selection, a relentless but devious task-master, seduces you into devoting your free time to these improving activities by making them gratifying. That is, these adaptations should schedule the intensity of the attractiveness of brain-developing behavior in light of the competing payoffs of world-targeted and body-targeted behavior. Such activities should be more appealing when one is safe and fed (Frederickson, 1998), without obvious reproductive opportunities, prevented by darkness or other restrictions from pursuing pressing instrumental goals, or impeded by (real)

immaturity from producing useful work. Indeed, the payoff on such investments is greater earlier in the lifecycle, when competing opportunities are lower, the adaptations less well developed, and the individual can expect to benefit over a longer subsequent lifespan from her investment in increased neurocognitive organization. For this reason, we expect that children should live according to behaviorally imperative aesthetic sensibilities in an aesthetics-drenched world, although their standards of the fun and the beautiful will be somewhat different from ours.

Beauty, awe, fascination, horror, and so on are terms that refer to aspects of an evolved psychology of aesthetics. As Symons (1995) puts it, "beauty exists in the adaptations of the beholder." A general evolutionary theory of beauty can be simply stated, but at its most general level is not very informative: 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. (Attention impelled for instrumental reasons appears to be driven by different subsystems. Mark Twain, for example, lamented that his learning to read the Mississippi River as a pilot robbed the river of its beauty [Twain, 1883].) However, the class of beautiful entities is immense and heterogeneous, with no other unifying principle except that our evolved psychological architecture is designed to motivate sustained attention to them through making the experience intrinsically rewarding. For this reason, there can be no general theory of the properties of things found beautiful—only a heterogeneous set of subsidiary theories, such as theories of sexual attractiveness (Symons, 1995), landscape aesthetics (Orians and Heerwagen, 1992), or phonological aesthetics. These subsidiary theories will be highly principled, but the principles will be different from domain to domain. We think that many things will be experienced as beautiful because of adaptations operating in their organizational mode. For example, we think that many invariant natural phenomena— stars, fire, faces, complex skyscapes and landscapes, harmonically resonant acoustic phenomena, pure tones and colors, fractally invariant sounds such as wind, rain, and running water—are experienced as beautiful because their invariant properties allow them to function as test patterns to tune our perceptual machinery. The brain, because it "knows" in advance what these cross-generationally invariant signals should be like, can compare the actual input with its innate model of the expected input, and use the difference as a corrective feedback signal.

All we experience out of this nonconscious process is the peaceful pleasure of relaxed attention, directed at stars on a clear night, or the rush of wind in leaves, or a fire burning down into coals, or the wash of rain on the roof.

Of course, the experience of invited attention varies depending on the configuration of its evolved functions. For example, one's attention may be compelled by the aesthetic of terror, one component of an emotion mode (Cosmides and Tooby, 2000b). Terror has an aesthetic (i.e., organizing and attention-summoning) component because it is vital to monitor surprising, dangerous situations closely both to make correct immediate decisions for escape and to store up information that might guide subsequent encounters. However, no well-adapted organism should be designed to seek to repeat such menacing predicaments. In contrast, beauty signals situations to which attention should be paid as they are unfolding *and* which are also advantageous to seek out and prolong. Horror refers to the attention compelled by potentially damaging situations that initially exhibit so many of the same cues as safe or advantageous situations that it requires exquisitely focused attention to discriminate between them. Seemingly safe situations that actually conceal adversaries or predators are one category that compels our attention—one used incessantly in fiction to sustain interest. Incest, another horrifying case, is a situation in which the perceptual appearance of a member of the opposite sex fits all the species-typical attractiveness cues, and yet that specific person nevertheless would be a disastrous sexual partner.

It is also important to distinguish "beautiful" as something attention-inviting, from "beautiful" as the psychological registration of high value. Whether the value registered is unique to an observer (as a child's beauty may be to her parent) or generally shared (as many aspects of sexual attractiveness may be; Symons, 1995), this sense of beauty refers to the cognitive co-registration of deep valuation with the perceptual representation of the object of the valuation. Moreover, because it is often advantageous to pay attention to people, things, or situations of high value, valued entities are often experienced as perceptually rewarding as well. Despite this overlap, the beautiful as something highly valued remains a distinguishable psychological phenomenon from the beautiful as something attention-inviting.

Given the forgoing, the question becomes, why do we experience a deep sense of beauty—of attention expended in a deeply worthwhile way—when we read Melville or Murasaki, Shakespeare or Sophocles, Exodus or the Eddas? More precisely, why might we be *designed* to experience a deep sense of beauty in response to such encounters?

Decoupling as the Doorway into a Wider Aesthetic Universe

Humans are radically different from other species in the degree to which we use contingently true information – information that allows the regulation of improvised behavior that is successfully tailored to local conditions (Cosmides and Tooby, 2000a). When hominids evolved or elaborated cognitive adaptations that could use information based on relationships that were only "true" temporarily, locally, or contingently rather than stably and across the species range, this opened up a new and vastly enlarged universe of potentially representable information for use. This new universe makes possible the identification of an immensely more varied set of advantageous behaviors than other species employ, giving human life its distinctive complexity, variety and relative success.

This advance, however, was purchased at a high price. The exploitation of this exploding universe of contingent information created a vastly expanded risk of possible misapplications, in which information that may be usefully descriptive in a narrow arena of conditions is false, misleading, or harmful outside the scope of those conditions. This scope problem is exacerbated by the fact that information, to be useful, must be combined and transformed through inferences. Not only do inferences propagate errors present in the source inputs, but the resulting outputs are then often fed as erroneous inputs into other inferences. This multiplies the errors in successive chains and spreading waves. This process has the potential to corrupt any downstream data set interacted with, in a spreading network of compounding error, transforming coherent sets of representations into unreconstructable tangles of error and confusion. In short, the heavily inference-dependent nature of human behavior regulation is gravely threatened by erroneous, unreliable, obsolete, out-of-context, deceptive, or scope-violating representations.

Consequently, because information is being input into the human mind that is only applicable temporarily or locally, the success of this new hominid computational strategy depends on continually monitoring and re-establishing the boundaries within which each set of representations remains useful. In short, one price that humans paid for this new knowledge was surrendering the naïve realism that is the birthright of other species – species untroubled by the need to piece together belief systems and struggle with the question of how much to trust them and when to abandon them. (On this view, both *Alice* and *Hamlet* are works of literature focused on an evolutionarily ancient but quintessentially human problem, the struggle for coherence and sanity amidst radical uncertainty).

As a result, humans live with and within large new libraries of representations that are not simply stored as true information. These are the new worlds of 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, the not-true-here, the what-they-want-me-to-believe-is-true, the will-someday-be-true, the certainly-is-not-true, the what-he-told-me, the seems-true-on-the-basis-of-these claims, and on and on. Managing these new types of information adaptively required the evolution of a large set of specialized cognitive adaptations. For example, it involved the evolution of new information formats, based on what we call scope syntax, that tag and track the boundaries within which a given set of representations can safely be used for inference or action (for a fuller discussion of these issues, see Cosmides and Tooby, 2000a).

Elements of this syntax include operations that *decouple* or cognitively quarantine sets of representations from each other, so that they do not interact with each other promiscuously – that is, without respect to the scope boundaries within which they are applicable (Leslie, 1987). This decoupling allows us to solve problems by supposing and by reasoning counterfactually: evolved inference engines can be vigorously applied to propositions, and possible outcomes evaluated, without the risk that either the counterfactual premise or any conditional downstream inferences will be stored in our encyclopedia of world knowledge as unqualifiedly true. It would be catastrophic if, for example, the human cognitive architecture did not distinguish what actually was true from what others believe to be true, or from what would be true under certain conditions. The human mind, then, preserves storehouses of information whose truth value is suspended, in decoupled form, ready to be tapped to make inferences (such as about what others think) or regulate behavior whenever the organism finds itself inside the scope of the conditions where such information applies. Decoupling and recoupling is like letting out or pushing in the clutch, engaging different realities to drive behavior in different settings. (For a strong dissent on the need for what we call scope syntax, see Ellen Spolsky, this issue[1].)

Viewed against this background, fiction as "false" information no longer seems quite so strange or different from the other types of information humans are designed to actively represent and maintain. Indeed, if other facts are scope-bound to particular situations, contingencies, times, places, plans, conditional futures, or minds, fiction is only a limiting case, in which the real-world scope wherein the bundled set of representations reign as true has shrunk to nothing. You might think that a well-engineered mind should therefore discard or disregard such representations, but this would

only be a good choice if inputting such representations had no positive organizational impact on the brain or mind. We think that fiction consists of representations in a special format, *the narrative*, that are attended to, valued, preserved, and transmitted because the mind detects that such bundles of representations have a powerfully organizing effect on our neurocognitive adaptations, even though the representations are not literally true (for a fuller discussion of the evolutionary function of fiction, and possible cognitive adaptations for fiction, see Cosmides and Tooby, 2000a).

The presence in the human mind of scope syntax and the machinery for decoupling representations allows humans to greatly widen the contexts within which adaptation-organizing experiences can occur. Through scope syntax and other design features, activities that organize an adaptation can be liberated from the constraints of having to encounter and practice the actual task, which may be very limited, dangerous, or may simply not contain the informative feedback or revelatory data necessary by the time the organism needs the adaptation to be functioning effectively. For example, as Steen and Owens (in prep.) point out, chase play may develop flight skills that could not be advantageously developed purely in the context of actual instances of predator escape.

The emancipation of the organizational mode of an adaptation from its functional mode can take place if there is an abstract isomorphism between some of the elements in the organizing experience and elements in the adaptive task (e.g., between throwing rocks at pine cones and throwing rocks at prey animals; or between figuring out the psychology of the characters in *The Possessed* and figuring out the psychology of the members of your family). The world is full of such isomorphisms, but it was the evolution of scope syntax and decoupling that opened the door to fully exploiting them. This is because even the most analogous situations are mixtures of both the usefully parallel and the destructively nonparallel. To extract useful organization by inputting interactions with these situations, the mind needs to be able to decouple, quarantine, or separate off the nonisomorphic parts of the experience, so that these incongruent elements are not input into mental databases or used to calibrate cognitive adaptations. Not all parts of the experience are usefully registered or stored, and the ability to decouple the mind from processing disorganizing inputs while preserving those that have an actual organizing effect is essential to the functioning of such a system. Without this ability, the nonisomorphic features of the experience would cause disorganization at least as easily as the isomorphic parts would cause organization. Because decoupling and scope syntax solve these problems, they allowed the tremendous expansion of aesthetically driven organizational

activities in human evolution. Thus, to use these opportunities, the human cognitive architecture needs adaptations that can:

1. detect activities embodying an exploitable isomorphism;
2. guide actions in order to make this isomorphism experientially salient;
3. extract the organizing information present in the experience; and
4. decouple the aspects of the organizational domain that are irrelevant, nonisomorphic, or disordering from being processed by the adaptation as true or relevant for its development (e.g., one can learn from Cordelia that overt emotional demonstrativeness is not a reliable cue to devotedness—a truth about an abstract relationship—but the reader should discard the specifics as irrelevant, rather than concluding that being named "Cordelia" *is* a reliable cue to devotedness).

It is important to recognize that our developmental adaptations may not be able to detect what experiences are actually organizing in the modern world – only what experiences manifest the cues that would have made them organizing in the environments that we evolved in. Just as we now culturally engineer foods whose flavors signal the presence of nutrients that may have been artificially removed, it is certainly possible that many modern recreations, entertainments, and aesthetic activities do not actually improve or ready our adaptations – although many undoubtedly do. Moreover, the process emphasizes forms of preparation appropriate to the ancestral world, regardless of whether this prepares one for life in the modern world. This explains the overrepresentation in popular media of such things as attacks by predatory nonhumans, chase scenes, physical violence and blood revenge (often rendered counterproductive in the modern world by legal systems, police, and jails), and the overrepresentation in many other forms of recreation of now useless athletic and perceptual skills.

Clothing the Innate Skeleton in Flesh

At least since Aquinas, one prominent and often dominant view has been that the human mind resembles a blank slate, and that almost all mental content is supplied from sensory experience. The alternative view, supported by a growing body of findings in evolutionary psychology, is that the human mind inherits from evolution a large stock of what we may as well call innate ideas, as well as emotion programs, and other psychological programs that inject mental content of their own into the human mind. That is, much of our mental content is not derived from experience, but only elicited by it (Tooby and Cosmides, 1992). This evolved mental inheritance is strange, in that it is contentful but abstract. Hence, the human mind may have available

during development innate concepts such as food, mother, animal, object, person, male, female, exchange, cheating, word, belief, desire, predator, and so on—but the cognitive inheritance does not supply very much information about them, or how they interrelate to each other or to the world. In other words, innate ideas (and motivations) are incomplete ideas, that need to be fleshed out and organized into higher level systems during the process of development (German and Leslie, 2000). We think that various forms of experience are valued because they help flesh out, using developmental adaptations, the structure and richly informative detail missing from our species-typical design. Our evolved inheritance is very rich compared to a blank slate, but very impoverished compared to a fully realized person.

In this process of incarnation, humans, being social and communicative organisms equipped with decoupling, are no longer limited by the slow and unreliable flow of actual experience. Instead, we can immerse ourselves in the comparatively rapid flow of vicarious, orchestrated, imagined, or fictional experience. A hunter-gatherer band might contain scores or even hundreds of lifetimes' worth of experience whose summary can be tapped into if it can be communicated. So, vicarious experience of especially interesting events, communicated from others, should be aesthetically rewarding. Moreover, these do not need to be accurate portrayals of real events to have valuable organizing effects.

For example, the precultural animals ancestral to humans evolved emotion programs that were activated by the detection of certain images or situation cues. The organism only had to know how to respond when it *actually* faced the situation. What should be done when a snake is detected? What is it like when a sibling is attacked? Because humans are descended from animals whose psychological architectures were organized in this way, a great deal of information about value-weightings is locked up as emotional responses, waiting to be triggered by exposure to the correct constellation of situation-cues (Cosmides and Tooby, 2000b). Fictional information input as a form of simulated or imagined experience presents various constellations of situation-cues, unlocking these responses, and making this value information available to systems that produce foresight, planning, and empathy. With fiction unleashing our reactions to potential lives and realities, we feel more richly and adaptively about what we have not actually experienced. This allows us not only to understand others' choices and inner lives better, but to feel our way more foresightfully to adaptively better choices ourselves (Cosmides and Tooby, 2000a, b). How would I feel if I acted in a cowardly fashion, and my community knew it (*Lord Jim*)? How would I feel if my sister died, and I were responsible?

Indeed, we evolved not so long ago from organisms whose sole source of (non-innate) information was the individual's own experience. Therefore, even now our richest systems for information extraction and learning are designed to operate on our own experience. It seems therefore inevitable, now that we can receive information through communication from others, that we should still process it more deeply when we receive it in a form that resembles individual experience, even though there is no extrinsic reason why communicated information needs to be formatted in such a way. That is, we extract more information from inputs structured in such a form. What form is this? People prefer to receive information in the form of stories. Textbooks, which are full of true information, but which typically lack a narrative structure, are almost never read for pleasure. 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 agent's actions causing and caused by events (as we experience ourselves), in pursuit of intelligible purposes. Scalise Sugiyama (in prep.) and Abbott (2000) have made the interesting proposal that the narrative form is itself a cognitive adaptation. Whether or not this is true, we think that stories are told in a way that mimics the format in which experienced events are mentally represented and stored in memory, in order to make them acceptable to the machinery the mind uses to extract meaning from experience. We are designed, for example, to extract new information from episodic memory, even though it lacks full sensory detail, and our preferences for narrative inputs may owe a great deal to our ability to process this schematically condensed simulacrum of experience.

According to this account, the kind of truth conveyed in art is not propositional or referential in the ordinary sense. It consists of the increased mental organization that our minds extract from experiencing art, which is why this form of truth has seemed so elusive, so difficult to articulate or explicitly define. This organization consists mostly of what might, for want of a better word, be called skills: skills of understanding and skills of valuing, skills of feeling and skills of perceiving, skills of knowing and skills of moving. Picasso's paradox—that "Art is a lie which makes us see the truth"—turns out not to be so paradoxical after all. To call art "lies" simply acknowledges that a simulacrum of individual experience has been manufactured largely out of false propositions or orchestrated appearances. Such falsities can convey truth because they are not processed as propositions with truth values, but as an experience whose false particulars are (in effect) thrown away. The truth inheres in what the experience builds in us.

In sum, we think that art is universal because each human was designed by evolution to be an artist, driving her own mental development according to evolved aesthetic principles. From infancy, self-orchestrated experiences are the original artistic medium, and the self is the original and primary audience. Although others cannot experience the great majority of our self-generated aesthetic experiences, from running and jumping to imagined scenarios, there are some avenues of expression that can be experienced by the creator and others. Sounds generated for aesthetic purposes—whether in the form of music, mimicry, or words—are a major example. Once others can experience an individual's aesthetic productions as members of the audience beyond the self, art becomes social, and motives for its production may become mixed. Moreover, the ability to remember (or to record on some kind of medium) how to produce an experience allows the experience to be re-performed, and hence successively elaborated and perfected. Music and stories are two forms of art that require no technology, in which the audience can include more than the creator, and for which memory (and skill-acquisition) are sufficient to record enough of the experience to allow its repeated performance and hence improvement. This allows a history of elaboration to develop for a work of art both for a given performer, and over successive performers (Sperber, 1996). Art forms that meet these requirements become cultural as well as individual, creating the cultural category "art." The invention of additional recording media (paint, clay, film, etc.) has allowed a steady expansion of audience-accessible art forms over human history. We suggest, however, that the socially recognized arts are only a small part of the realm of human aesthetics, even though our ability to record performances permanently has caused the body of such audience-directed efforts to become massive, and its best exemplars overpowering. These works are compelling because their experimentally tested social elaboration has led them through long sequences of improvement. But still, they stand on a base of an evolved psychology that uses aesthetic experience throughout the lifecycle to guide our minds into becoming more fully realized.

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Note

1. Spolsky raises a number of interesting and important issues, too wide-ranging to fully address here. See our reply at the end of her article, this issue.

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