Prefigurements of Art*

Thomas A. Sebeok

0. Preliminaries.

That language is a biotic property specific to man is a truism even in the sense that no other species encountered so far is, in the technical acceptation of this term, language-endowed. Language is a cognitive structure which, like the behavioral extension of any organ of man's body, may be studied along several more or less agreed upon semiosic/ethological dimensions,[1] including the characters of its initial state (ontogenesis), mature state, and end-state (gradual breakdown, partial reconstitution, and eventual termination).[2] With regard to the phylogenesis of language, there has been much random conjecture and some empirical stumbling, but scarcely even translucent enlightenment so far. Verbal sign configurations have been elaborated throughout history into many complex forms of message oriented constructs, encompassing both spoken and literary genres, which are best called jointly—as I had suggested nearly a quarter of a century ago[3]—the "verbal art." Furthermore, language, being "absolutely distinct from any system of communication in other animals," and thus "also the most diagnostic single trait of man,"[4] has as its corollary, by definition as it were, the tautologic proposition that man has a monopoly on all manifestations of the verbal art. These statements and their implication, while hardly contestable, are surely trivial, owing to the equally unchallengeable fact that the communication system of every *other* species stamps it with a unique hallmark, much as language conspicuously segregates out our humanity.[5] They do, however, suggest one interesting question which I propose to explore, if tentatively, in what follows, namely, whether the optimal design of certain animal communication systems can allow, given certain contextual conditions, for a superimposed aesthetic function. In other words, how reasonable is it to search for prefigurements of aesthetically charged averbal sign configurations in man's animal ancestry? What, for instance, could Julian Huxley have meant when he asserted, in passing,

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during a Darwin Centennial panel discussion, that in the behavior of the Satinbird (*Ptilonorhynchus violaceus*)—a remarkable bowerbird living in the coastal forests of Eastern Australia, and a species certain members of which paint the inside of their bower efficiently, even, to echo Huxley's word, "deliberately"—there is "definitely the beginning of aesthetics"?[6] This seemingly bizarre habit, Marshall surmised, "may be an aesthetic extension of a basic drive,"[7] namely, the birds' courtship feeding phenomenon—or just the sort of displacement activity of sexual behavior that some Freudians have posited in men. Gannon,[8] the discoverer of bower painting in this species, also observed that the male appeared to employ a tool—a wad of bark, like a brush or sponge, held in the tip of the bill—to apply the paint, which is composed of saliva mixed by the bird with charcoal dust, dark berries, or wood-pulp. It was subsequently noted that the paint, washed away by the heavy tropical rains, is replaced daily during the height of the sexual season and fibrous bark, often still saturated with charcoal and saliva, is commonly to be found on the avenue floor between the two painted walls and where fallen leaves are always quickly removed. This bird, when constructing its social signals, exhibits a decided preference for blue, less so for yellowish-green, shunning red altogether, a bias manifested, moreover, in such like-colored ornamental objects as feathers, flowers, leaves, berries, snail shells, cicada integument, and, near human habitations, pieces of blue-colored glass beads, strands of wool and tinsel.[9] Generalizing about the entire family *Ptilorhynchidae,* of which about nineteen species occur, Dobzhansky remarks that "it is impossible to deny that a well-adorned bower may give the bird a pleasure which can only be called aesthetic."[10] Recall in this context Nicolas Poussin's maxim—a 17th century evocation of the mediaeval doctrine of *delectatio* as a sign—that "la fin de l'art est la délectation," apropos of which Panofsky insists that "a work of art always *has* aesthetic significance,"[11] regardless of whether it serves some practical—let me qualify: biological—purpose at bottom. We must likewise concede the possibility that "animals perform some of the behavior patterns we observe because they enjoy the resulting experience," regardless of whether such patterns are adaptive, or virtually so, "but result in a pleasantly satisfying feeling" on the animal's part.[12] Whether or not bowers are built, painted, and decorated for the makers' pleasure, the fact remains that the constructions take place, as a rule, during the breeding season and serve as the sites where territorial displays are performed. The

key issue, what the differential effect of the bowers may be on the females, remains unresolved, because this has not been systematically tested.[13]

Contrary to Barthes' contention, that the semiotician is entitled to treat writing and pictures in the same way because what he retains from them both is "qu'elles sont toutes deux des *signes*,"[14] in all living systems that I know of the characteristics of the signs employed are inseparably joined to the kind of information they carry. Similarly, the concept of "secondary modeling system,"[15] which is assuredly among the more salient features of Soviet semiotics, posits a superstructure that persistently confounds two diverse artistic realizations which, I would argue, demand radically different treatment: on the one side, the products of the verbal art and its derivatives, being inescapably built up from signs that are the operands of a natural language, plus certain traditional or newly invented rules for combining them in possible, impossible, contingent, or imperative ways to advance human cognition and communication; and, on the other side, the artistic products of averbal semiotic systems into which verbal signs may, to be sure, encroach in varying degree. The performances we call the verbal art and those that we call the averbal arts generate, respectively, in the dominant and the minor hemisphere, although the specializations normally have a complementary relationship. As Eccles has recently pointed out, "the minor hemisphere is specialized in relationship to pictures and patterns, and it is musical."[16] This separation of hemispheric functions, by the evidence to date, is genetically coded. The minor hemisphere is best envisaged as "a very superior animal brain,"[17] a conception which points precisely in the direction in which future researches are most likely to prove fruitful. The two repertoires of signs may, and often doubtless do, "enter into subtle semantic relationships," as Veltruský emphasizes,[18] the resulting meaning being compounded by a process called codified contiguity. This is achieved by the immense and incessant traffic in the corpus callosum linking the two cerebral hemispheres of the intact human brain, for "probably everything that happens in the minor hemisphere leads to a kind of reverberation in the major hemisphere."[19] There is, however, no ground that I know of for belief that would compel the conclusion that the interpretant of *every* artistic sign must have a verbal component; and should a semiotic system of the second kind be identified in the infrahuman biosphere, it would certainly be altogether delusive to postulate a verbal

infrastructure for the sort of hemispheric specialization intimated is, after all, "unique to man."[20]

The authentic singularity of man consists of this, that he alone disposes over a *pair* of communicative codes: "along with our wholly new and wholly distinct system of true language,"[21] the verbal code, we retain an older system that, for want of a better name,[22] is frequently, contrastively, and hence negatively designated as a human manifestation of a cross-specific averbal code. The latter comprehends a trio of subcodes recently differentiated into separate categories by Uexküll:[23] first, endosemiotic averbal sign systems, or the metabolic code,[24] involving humoral and nervous factors that convey information within the bodies of all animals, including man;[25] second, somatosemiotic averbal sign systems, that function to compact the unity of every organism,[26] a notion kindred to Leibniz's concept of apperception (as expressed in his 1714 paper, *Principes de la nature et de la grâce, fondés en raison*), which is our conscious reflection of the inner state of the monad; and third, outspreading averbal sign systems, such as are used for communication between organisms and between any organism and its external environment. In man, the output of this entire array of subcodes, but particularly of the third kind, is exquisitely harmonized in performing with his outpouring of verbal messages, although the diverse repertories each serve separate ends substantially at variance one from the other—a point worth reemphasizing with Bateson,[27] who rather clearly saw how wrong it is to assume that, in hominid evolution, verbal semiosis has, in any sense, replaced "the cruder systems of the other animals,"[28] that is, averbal semiosis. Had this been the case, our averbal skills and the organs that execute them would inevitably have undergone conspicuous decay. Obviously, they have not; on the contrary, while the verbal art flourished, we have perfected our averbal arts as well—they too "have been elaborated into complex forms of art, music, ballet . . . and the like, and, even in everyday life, the intricacies of human kinesic communication, facial expression and vocal intonation far exceed anything that any other animal is known to produce."[29]

The ideal of semiosic analysis is to combine causal with functional explanation—to show how sign form interrelates dynamically with sign function, both in synchrony and in diachrony. But an evolutionary sequence is hard to come by in an area so complex and multiply amphibiological as art. Instances may be temporally ordered but are not necessarily in

linked sequence. Guthrie offers some interesting ideas, in a semiotic frame, "about how some aspects of our aesthetic sense evolved,"[30] but the part he was concerned with was that which underlies our appreciation of human physical beauty, the valuation of which he traced to two major elements, copulatory lures and status badges. One perhaps insuperable difficulty all investigators have to face is to identify ineffable "signs of artistic enjoyment in other species,"[31] all of them being creatures that are speechless.

The only general survey I can find in the entire literature of the life sciences of basic aesthetic principles possibly shared by man with at least the higher animals was drafted in the late 1960s by another ethologist, Rensch, in an essay that was published only much later in the U.S. (1974) and Great Britain (1976).[32] This authoritative but still, unfortunately, all too inconclusive review, based in large part on the author's well-known experiments aimed to demonstrate the reality of protoaesthetic phenomena, the results of which were found to be in good conformity with those of psychologists[33] who studied the elements of aesthetic preferences in human subjects, is devoted in the main to scribblings and paintings by monkeys and apes, with but a laconic page on "auditive aesthetic sensations."[34] In 1958, Rensch had investigated the efficacy of aesthetic factors in vertebrates, testing preferences for different patterns in a jackdaw, a carrion crow, and six fishes. He showed that, while the fishes always preferred irregular patterns, both species of birds preferred the more regular, more symmetrical, and more rhythmical patterns, doing so in statistically significant numbers. In a color choice test, these birds exhibited a preference for gray and black, being the colors of their own plumage. However, "they preferred patterns with two or four different colours to simpler patterns of one colour or two colours respectively."[35] A student of his, Tigges,[36] later found that jackdaws preferred pure colors (red, blue, yellow, green) to equally bright mixed ones (orange, brown, violet, lilac).

Although painting experiments were conducted by N. N. Ladygin Kohts with a chimpanzee named Joni, in Moscow, as far back as 1913, and Shepherd[37] reported that a chimpanzee drew lines with a pencil, and many an anecdotal story found its way into the literature since then, there are only three serious studies of primate aesthetics: the series of papers by Rensch,[38] a posthumous publication by Schiller,[39] and the engaging book by Morris,[40] especially showing, on the basis of a detailed analysis of one young chimpanzee, Congo, that the splashes of paint or the pencil marks

made by apes are not at all random. The immature Congo, given an incomplete pattern, often made marks which tended to complete it. Alpha, the first-born chimpanzee of the Yerkes Colony, if given a piece of paper, with a cross placed on three of the corners, would put a cross in the fourth corner: "she would also in her crude way try to complete designs and pictures which had been given to her deliberately unfinished or unbalanced."[41] One is thus forced to assume the presence, in advance, of a representation in the animal's nervous system that corresponds to the picture displayed.

The most recent survey of ape creativity may be found in the psychologist Andrew Whiten's excellent account.[42] Rensch, who had worked with a capuchin monkey and a green monkey as well as chimpanzees, observing their drawing or painting with pencil, colored chalk, or brush, professes to have been astonished "to find also aesthetic factors having a positive effect with apes, monkeys and [even] crows comparable with the effect in man."[43] He believes that our feelings of aesthetic pleasure, as we look at different black and white patterns are, in the main, attributable to three basic conditions: symmetry, rhythmic repetition of similar component parts, and consistency of curvatures. His results demonstrate that, with these animals, as with man, "the greater facility to apprehend a design, the details of which are rhythmically repeated or otherwise more easily apprehended, the 'complexibility' is connected with positive feelings and arouses aesthetic pleasure."[44] Rensch tells of incidents where "competent art experts, on being shown monkeys' paintings without being told who had painted them, sometimes enthusiastically praised the dynamism, rhythm and sense of balance."[45] In so doing they have not made fools of themselves, but simply confirmed what the experimental biologists had already also established.

Rensch further supposes that the tendency of apes, including orangutans and capuchin monkeys, to put scarves, ribbons, chains, and the like, around their neck, and to romp about with them on, is to be interpreted as enjoyment of dressing up; hence, in his view, aesthetic factors would be involved in this behavior as well. "It is even more likely," he adds, "that birds find aesthetic pleasure in repeating tunes they hear from other birds or from humans, and in 'composing' new melodies from phrases either learned or already known."[46]

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Following these brief prefatory observations, I would like to reexamine in some detail the question of the putative aesthetic propensity of animals, with specific (although uneven) attention to four semiotic spheres: (1) kinesthetic signs, (2) musical signs, (3) pictorial signs, and (4) architectural signs. Sketchy as such a review must be, no such comprehensive literature survey has been attempted before, probably for several reasons. One of these may be due to the fact that cultural anthropologists who have sought to inquire into the biological roots of art have typically set out to do so with a preconception common to many members of the profession. Alland, for one, opens his chapter on "The Evolution of Art" with this uncompromising sentence: "The creation and appreciation of art in its many forms are uniquely human activities,"[47] adding, a few pages later: "True [*sic*] artistic behavior is seen in no species other than *Homo sapiens*. Not even a hint of it occurs in the natural behavior of other species."[48] His brief exploration of its origins, sensitive as it is, suggests that this lies in play as a biological property, leading him to a debatable definition of art as "play involving rules."[49] This same notion was earlier advanced by Ellen Eisenberg,[50] subsuming art in a more inclusive class of behavior patterns, one which includes all forms of exploration; and earlier still, by Dobzhansky, who felt that at least some forms of art "are related to play."[51] (The union of the play-impulse with aesthetic feelings and sentiments, as linked with superfluous activities and corresponding pleasures, was first propagated by Spencer eighty years ago;[52] he argued that the aesthetic sphere in general may be expected to occupy an increasing part in human life owing to greater economization of energy resulting from superiority of organization bringing a growing proportion of the aesthetic activities and gratifications.) Dobzhansky, however, perceived even in artistic activity an adaptive value, for he saw in it a wellspring of social cohesion, thus raising once again a utilitarian interpretation of the role of art. This viewpoint is most fruitfully developed by Jenkins, a thoroughgoing evolutionist for whom art has its "ultimate source in the human effort to adapt to the environment," and who insists, more generally, that any inquiry into the origins of art must move, as he emphatically puts it, *"toward an analysis of the adaptive situation."*[53] Klopfer, who means by aesthetic preferences simply "a liking for objects or activities because they produce or induce particular neural inputs or emotional states, independently of overt reinforcers," answers his own question, whether we can attribute aesthetic impulses to animals other than

man, in the affirmative. The inquiry entails the belief that there must be a biological basis to aesthetics, and thus shifts to a search into the basis thereof: "what are the historical or ultimate reasons for the development of an aesthetic sense; by what mechanisms is the development of the species-characteristic preferences assumed?"[54] Klopfer, too, comes up against the predicament posed by the traditional view that aesthetic preferences are those for which no immediate functional advantage can be perceived; consequently, he strikes out in a different direction, seeking for guidance from sensory physiology, while also redefining play as a kind of exploratory activity by which the organism "tests" different proprioceptive patterns for the goodness of fit.[55]

When ethnologists search for the sources of art, they more often than not mean the verbal art; play thus comes to mean wordplay, which Alland, for one, connects with poetry,[56] and which must then be excluded *per definitionem* from the rest of the animal kingdom. Archaeologists tend especially to dwell on representative art; as Marshack puts it, "art and symbol are products that visualize and objectify aspects of culture. . . ."[57] Although, on balance, the neuroanatomist Young is undoubtedly right when he says, in the course of his synthesis tracing the sources of human activity from their biochemical basis to the highest levels of consciousness, that "there is no body of facts that yet enables us to understand the origins of aesthetic creation . . . ," [58] the issue remains a tantalizing one, for, as another distinguished biologist put it, "in some situations it becomes really difficult not to impute to animals some sort of aesthetics."[59] The dialectic seems to have begun between Darwin, whose theory of sexual selection is based on the assumption that female birds, for example, are able to appreciate the beauty of male plumage,[60] and his contemporary, Wallace, who disputed this view precisely in semiotic terms. Wallace argued that what is involved here is an instinctive interpretation of certain strings of signs emitted by the male. However this may be, it would be unreasonable to expect a perfunctory and iterative scrutiny of the literature of animal behavior to shed much illumination; a deeper search, on the other hand, might at least highlight some fundamental issues—such as the often misunderstood dichotomy of analogy *vs.* homology, and the even less understood distinction between phyletic homologies and homologies of tradition.

1. Kinesthetic signs.

The kinesthetic art—as the multisensory dance when viewed in a semi-

otic frame is sometimes reductively termed after its most distinctive feature, because in dance (contrasted, particularly, with mime) "movement is often an end in itself"[61]—is seldom alluded to in the context of animal behavior. Sachs adduced several striking cases of bird displays he and others in his field, including recently Royce,[62] explicitly dubbed "dancing." One of his examples is cited after Maclaren,[63] who witnessed this dance of the stilt birds, or cranes, in Cape York in Northeastern Australia:

> The birds . . . were long-legged creatures, tall almost as storks, and white and gray of feather; and the dance took place in the center of a broad, dry swamp. . . . There were some hundreds of them, and their dance was in the manner of a quadrille, but in the matter of rhythm and grace excelling any quadrille that ever was. In groups of a score or more they advanced and retreated, lifting high their long legs and standing on their toes, now and then bowing gracefully to one another, now and then one pair encircling with prancing daintiness a group whose heads moved upwards and downwards and sideways in time to the stepping of the pair. At times they formed into one great prancing mass, with their long necks thrust upward; and the wide swaying of their backs was like unto the swaying of the sea. Then, suddenly, as in response to an imperative command, they would sway apart, some of them to rise in low, encircling flight, and some to stand as in little gossiping groups; and presently they would form in pairs or sets of pairs, and the prancing and bowing, and advancing and retreating would begin all over again.[64]

His second example, which comes from British Guiana, cited after Appun, is, as Royce underlines, "even more interesting since it describes what is essentially a performer-spectator situation":[65]

> [A] group of some twenty mountain chickens of a brilliant orange-yellow color, gathered together in a kind of dance characteristic of these beautiful birds. In the center one of the cocks executed the dance-like movements, as he hopped about the open place with wings extended and tail outspread. On the branches of the bushes round about, the others sat and expressed their admiration of the dancer with the strangest sounds. As soon as one cock was exhausted, he

joined the spectators, uttering a peculiar cry, and another took his place.[66]

These parallels immediately raise several problems, the most obvious being whether the animal's behavior is "merely" analogous to man's, whether, that is, shifting to a more familiar parlance, the label "dance" is "just" a colorful and suggestive metaphor—as it must surely be in Frisch's designation of the kinetic component of the communication system of the honeybee as a "dance"[67]—or whether something deeper is implied, perhaps indeed a remote phyletic homology.[68] Even if only an analogy is meant, this is far from valueless, since its study would throw light upon "the laws of function that rule the evolution of a behavior pattern."[69] It is, in fact, highly productive to compare biological constructs with cultural ones if only to ascertain whether seemingly similar signifiers trigger comparable interpretants, in the sense that the wing of an insect (developed from an epidermal fold), the wing of a bird (developed from a vertebrate extremity), and a wing of an airplane (manufactured, say, of metal), are all shaped in response to the universal laws of aerodynamics. Armstrong, who devoted an entire chapter to drawing parallels between the dances of birds and men, feels that he is justified in employing the identical label for both sets of motor signs because of "a natural recognition of the remarkable similarities which actually exist between the dances of birds and men and the identity of the emotional sources from which both take their origin. The resemblances between avian and human dancing," he claims, "are the outcome of emotional drives which underlie the behaviour of all the higher animals; and the natural corollary is that we can use the terpsichorean activities of men to interpret those of birds, and vice versa. Let us not be scared," he concludes, "by the bogey of anthropomorphism into the arms of the spectre of Cartesian mechanism. It is not anthropomorphism to believe that man and the higher animals have much in common so far as instinct and emotion are concerned, but an acknowledgment of truth scientifically demonstrated."[70]

Sachs' questions, by distinguishing—to recast in modern ethological terminology what he says—phyletic homologies, or those that are transmitted via the genome, from homologies of tradition, that is, those that are passed on via memory, whether animals in fact do dance as man does. The traditional distinction between innate *vs.* acquired characteristics is not at all as clear-cut as Sachs implies, however, and becomes increasingly in-

appropriate when one considers the alloprimates. One reason for this is that, for research dealing with homologies, "it is only necessary that information emanating from one common source is passed on. It is not necessary for reproductive relationships to be involved."[71] What we know about dancing in apes is, while doubtless fascinating, unfortunately far from abundant, and even here a further discrimination demands to be promptly introduced, namely, as between studies of animals in captivity, some of which Sachs knew of, and observations of groups in the wild, which are of much more recent vintage. Both sets of data concern chimpanzees—the latter all but exclusively from the popular writings of Lawick-Goodall.[72]

Lawick-Goodall repeatedly refers to a display, which she reports having seen but three times in ten years, as a "rain dance." These group performances lasting almost half an hour, involved adult males—with females and youngsters in watchful attendance—although often individual males were also observed to "react to the start of heavy rain by performing a rain dance."[73] It is not at all clear from Lawick-Goodall's description of these spectacles what the chimpanzees' behavior pattern could possibly signify. In the human context, what is commonly called a rain dance is performed in many societies as a fertility rite in order to produce rain; it belongs to a class Royce calls metaphorical dances.[74] By contrast, feral chimpanzees, to all appearances, "dislike the rain," reminding the observer of "primitive men . . . defying the elements."[75] Their carnival display is in reaction to a sudden downpour. What we have here is a striking resemblance in form—sufficiently so, it seems, to account for the labeling—but a dearth of information about referential sign function, and therefore a gnawing question mark about the meaning of the convergence between man and chimpanzee in this arena of expressive movement.

Reports of chimpanzees dancing in the laboratory—including what Sachs claimed to be the "most valuable document"[76]—come from the psychologist Köhler, who was for six years in charge of a research establishment in Tenerife.[77] Köhler frequently observed couples moving in dance-like fashion. He depicted a particular configuration about which he remarked that "Die ähnlichkeit mit einem Tanz war besonders gross,"[78] a characterization Sachs wholly concurred with. Nor was this all. Stylized group dances took place, such as the following, which Sachs insisted "was a genuine round dance":

In mock fighting two of them drag each other about on the ground

> until they come near a post. Their frolicking and romping quiets down as they begin to circle about, using the post as a pivot. One after another the rest of the animals appear, join the circle, and finally the whole group, one behind another, is marching in orderly fashion around the post. Now their movements change quickly. They are no longer walking but trotting. Stamping with one foot and putting the other down lightly, they beat out what approaches a distinct rhythm, with each of them tending to keep step with the rest. When two posts or boxes stand close to each other, they like to use these as a center, and in this case the ring dance around both takes the form of an ellipse. In these dances the chimpanzee likes to bedeck his body with all sorts of things, especially strings, vines, and rags that dangle and swing in the air as he moves about.[79]

Sachs identifies here the prefigurements of a series of basic human dance motifs: "as forms, the circle and ellipse around the post, the forward and backward pace; as movements, hopping, rhythmical stamping, whirling, and even ornamentation for the dance."[80] Köhler further tells us that the sympathetic observer would gladly join in this dance, and that when he initiated the movement around the post "in der besonderen Schrittart, welche für die Tiere dazugehörte," he was immediately followed by a couple of chimpanzees; but when he quit, because of fatigue, his dancing companions would squat and sulk.[81] What Sachs is concerned with here ought to be taken very seriously, but remains as yet unresolved, for, as he summarizes: "If the dance, inherited from brutish ancestors, lives in all mankind as a necessary motor-rhythmic expression of excess energy and of the joy of living, then it is only of slight importance for anthropologists and social historians. If it is established, however, that an inherited predisposition develops in many ways in the different groups of man and if its force and direction is related to other phenomena of civilization, the history of the dance will then be of great importance for the study of mankind."[82]

If one defines dance, in the stark fashion of Boas, as "the rhythmic movements of any part of the body, swinging of the arms, movement of the trunk or head, or movements of the legs and feet,"[83] then clearly the chimpanzees' behavior can legitimately be bracketed with ours. It is plausible, moreover, to regard both underlying structures as homologous, implying that they owe their similarity to a common origin, much as laughter and

smiling fit into the phyletic scale.[84] The postulation of a homologous relationship does not, however, necessarily imply a distinction between characteristics that are innate *vs.* those that may be acquired, for homologies may be passed on either via the genome or via memory, that is, by cultural or quasi-cultural mechanisms, in the manner, say, of song traditions in the parasitic weaver finches (*Viduinae*), which were discovered to even transgress species boundaries: these birds learn not only the songs but also the calls of their host species, and close mimicry of the vocalizations of the step-father results in parallel development which may, in turn, lead to eventual species genesis. Whether dance behavior is innate or acquired is not known, but it is important to be mindful that information may be communicated to a succeeding generation in several different ways, and therefore, since form depends on the function, convergence can hardly be excluded. In studies of expressive movements, the investigation is particularly complicated by the fact that the specific adaptations are not simply responsive to the environment, but involve subtle selective pressures which cannot yet be formulated in terms of physiological or biochemical correlates—for instance, a concept such as "aesthetic pleasure." Nonetheless, I find myself concurring with Griffin, when he exclaims that "this does not seem to [him] to be a sufficient reason for avoiding the concepts themselves, as though they were a dangerous plague."[85] This view, moreover, accords, I think, with the line taken by such specialists in the dance as Hanna, who, while she feels "that the configuration of human behaviour that is called dance is significantly different from the behaviour of other animals, including that which has also been labelled dance," at the same time affirms "that human dance has its roots in phylogenetic and ontogenetic evolution, firstly in predisposing psychobiological processes and secondly in social experience."[86]

2. *Musical signs.*

"Music," Merriam tells his readers, "is a uniquely human phenomenon . . ."[87]—but his generalization begs the very question that needs exploring. I would therefore prefer to start journeying backward in time from the Janus-like portal that is the sole rational means of access from nature to culture that Lévi-Strauss sagaciously threw open when befittingly noting that "la musique opère au moyen de deux grilles. L'une est physiologique, donc naturelle; son existence tient au fait que la musique exploite les

rythmes organiques, et qu'elle rend ainsi pertinentes des discontinuités qui resteraient autrement à l'état latent, et comme noyées dans la durée. L'autre grille est culturelle; elle consiste dans une échelle de sons musicaux, dont le nombre et les écarts varient selon les cultures."[88]

Boas made two fundamental observations concerning music: first, that the only kind of music that occurs universally is song, "and the source of music must therefore be sought here;" and, second, that two elements, and only two, are common to all song: rhythm and fixed intervals.[89] It is in the class of birds that the rootstock lies to which these remarks must inevitably lead the unprejudiced investigator, fortified by the opinion of so experienced an ornithologist as Thorpe, who, in repudiation of a typically naive remark of Suzanne Langer's,[90] proclaims his own stand: ". . . increased familiarity, from long study, certainly for me, increases my conviction that our judgment that bird songs, in some instances and in some degree, represent music is not mistaken."[91]

Within the last decade, several competent and thoughtful studies have appeared appraising a field that in the course of its recent development has even won a name of its own: ornithomusicology.[92] One such survey, on the aesthetic content of bird song, was compiled by Hall-Craggs, a British ornithologist.[93] Another, a book-length global reinterpretation of bird song, was undertaken by Hartshorne, a prominent philosopher (perhaps best known to this readership as the senior editor of the *Collected Papers* of C. S. Peirce).[94] As for the controversial but hardly verifiable central thesis of ornithomusicology—an idea first articulated, I believe, by Montaigne—it is argued that birds evolved elaborate musical utterances long before the appearance of man, who may be supposed to have derived his primitive music under the instigation or, at any rate, influence of their song: men certainly heard it and some may have imitated it. (It should be mentioned here that man often mimics different aspects of animal behavior,[95] and particularly that the imitation of bird dances is quite widespread. One example from Europe is the incorporation of a figure, the *Nachsteigen,* from the behavior of the mountain cock, into the Bavarian *Schuhplatter.*)[96] The process of adoption would have been facilitated by the undeniable fact that man and bird share certain requisite physiological foundations: both of us sense the world most consequentially by optical means, and both of us address it most saliently by acoustic means.[97] Indeed, in a number of crucial respects, and particularly as to the predisposition of some song birds,

manifesting critical periods in their lives for song-learning, to master certain sounds rather than others in a manner reminiscent of the kind of constraints on first language acquisition detectable in human children, and in several other important respects, "these birds are closer to man than any nonhuman primate. . . ."[98]

Were the ornithomusicologist's contentions demonstrable, then one could postulate a true homology of tradition, if not a phyletic one: human song would thus be as homologous to bird song as, say, a genetically unrelated second language acquired by a foreign speaker is homologous to the first language learned by a native speaker of that same language. Failing that, we must fall back on the principle of convergent evolution, justified by adequate evidence for formal correspondence. But Szöke's line of argumentation is by no means abrogated or contradicted by the prodigiously erudite Armstrong's chapter on "Bird Song as Art and Play," where this English life-long student of bird behavior repeatedly remarks that "As evidence increases it becomes more difficult to deny that birds possess some aesthetic sensitivity," and that, "whatever else our aesthetic taste may be, it is an extension and refinement of animal abilities." He quotes an apt observation by Paracelsus, the early 16th century physician and alchemist, who admonished: "Man need not be surprised that animals have animal instincts that are so much like his own. . . . Man may learn from the animals, for they are his parents."[99]

The most elusive problem in demonstrating "that birds have aesthetic taste is the difficulty of proving that any characteristic of bird song is nonutilitarian."[100] Hartshorne's book is in part addressed to this predicament, which he formulates thus: "To say 'aesthetic' is to say 'not merely or too directly utilitarian.' But we must be careful to balance this consideration against the seemingly contradictory one that unless an aesthetic activity has some connection with utility it will be unlikely to survive evolutionary change."[101] Hartshorne speculates that there may be an optimum here between irrelevance to survival needs of the species—notably, as an expression of its territorial requirements (the birds with the "best" songs are usually the ones with the most marked territorial behavior)—and too close or immediate a connection with such needs, as represented by the individual singer in a given context. He postulates "a safety factor," a sort of emergency valve for the outlet of surplus energy, a luxury activity that can always be nullified in exigent circumstances.

Rhythm is the basis of form in bird song, as in all music, much as symmetry is in space or equilibrium in matter. Hall-Craggs discusses its prevalence in some detail, as well as of the transposition of fixed intervals that Boas deemed the second all-important element of music, comparable with melody.[102] Armstrong remarked earlier that "it can hardly be fortuitous that some birds do sing and transpose in accordance with our musical scale."[103] An important series of experiments bearing on this point was carried out by Reinert with jackdaws (*Corvus monedula*).[104] After being conditioned to distinguish certain rhythmic acoustic signals, the jackdaws were able to identify them even when played by different instruments, that is, with a different timbre, or when the tempo, pitch, or interval are transposed. They could also distinguish between two-four time and three-four time. The birds could perceive acoustical patterns differing in intensity and duration of tone, and recognized a great many variations. In sum, they did not depend on absolute clues only but, as we ourselves do in the perception of phonemes, on relative ones. Ultimately, I suppose, this is a mathematical matter, and eventually Nelson, in fact, undertook a sophisticated quantitative comparative study of this kind, showing similarities of structuring in several taxa, including behavioral organization in bird and man, with respect to acoustic signals.[105]

Many birds, moreover, possess the ability to follow a train of changing pitches, as a scale, and to distinguish it from another train proceeding simultaneously but at a different speed or in a different direction. In other words, these birds appear to have solved what Cherry had designated in man as the "cocktail party problem,"[106] the essence of which I take to consist of the capacity to select one particular acoustic string, viz., a tune, out from its accompaniment or to distinguish it from another string proceeding at the same time (polyphony). A single individual veery (*Hylocichla fuscescens*) is, for example, able to produce complex polyphonic patternings; nor need there be, in this species, an interval between primary patterns, although it may be present in one voice but not in the other. "At the end of most songs, the two voices come together to cooperate in a characteristic extended trill of *overlapping arpeggios* (song *A*); sometimes this 'cadence' appears to be left to the lower voice alone (song *B*)."[107] Thorpe, on the basis of his distinguished fieldwork, supplemented by laboratory studies, has clearly confirmed the existence of "something like musical appreciation, albeit on an elementary scale, existing in a good many birds,"[108] derived, in part,

from discoveries of antiphonal singing, especially in the compulsively duetting African shrike (*Laniarius aethiopicus*).[109] The notes of the duet constitute polyphonic singing, such that the pitch, timing, and phrasing can, to a large extent, be controlled very exactly, but can also be varied by the singers. Either sex can start and the other finish, either bird can sing the whole pattern alone if the partner is absent, and, when the partner returns, the two birds can either duplicate in perfect time or resume antiphonal singing.

The organized singing patterns of birds have long attracted our attention. In some, the singing is organized to conform with strict sequencing rules; the structure is hierarchical, the levels comparable with the build-up of the human mode of vocal display. Ethologists tend to interpret bird song in terms of the adaptive advantages it confers on the performers and their conspecific audience, while keeping an open mind on the ramifying consequences of the display, which may well surpass a single function and come to encompass the aesthetic dimension. To summarize: "That birds 'sing' is a notion applied popularly to vocal performances that people find aesthetically pleasing, but singing lacks a fully accepted and rigorous descriptive meaning in ethology."[110]

The ornithomusicological hypothesis becomes muddled when one considers that other animals than birds have variously been alleged to "sing": "Cicadas [i.e., locusts] are noisy, daytime musicians, the male alone singing. The sound is produced by snapping a special structure, the tymbal, with a muscle."[111] As with birds, singing is emulative, and this, as Darwin had noted, sometimes gives rise to antiphonic duets or trios.[112] This application of "song" is, however, likely to be metaphorical just like "dance" is in application to the honeybee. Then there is the California singing fish (*Porichthys notatus*), whose song, which varies in tone pitch and quality from specimen to specimen, produced under conditions of colonial activity, was carefully described by Greene.[113] The striking vocalizations of frogs and toads have also been termed "songs,"[114] often in reference to the existence of duetting throughout some nineteen genera, or more complex chorusing behavior, the biological function of which has hitherto eluded all investigators. The bellow of the alligator, assumed to convey an assertion of dominance and a challenge to other males within earshot, is likewise often called "song" in the reptile literature. I personally doubt if phenomena of this sort can be considered as prefigurements in any interest-

ing sense. However, there are at least two groups of mammals in which singing has been reported, and these may be worthier of our regard.

First, there is the case of the humpback whale (*Megaptera novaengliae*), a species whose phonograph recordings have received considerable publicity in the media and on at least American college campuses during this decade; (George Crumb's exotic composition, "Vox Balaenae For Three Masked Players," was directly inspired by the voice of the whale). Mysticete sounds have for some decades been recognized to be varied and complex, but the humpback is the baleen whose rich sonic repertoire has been most thoroughly studied so far.[115] The animals certainly "emit a series of surprisingly beautiful sounds,"[116] including a long train, called a "song," that recurs in cycles lasting up to 30 minutes and perhaps longer. This song is often produced in continuous soliloquy, very loudly, by a single whale for a full eight minutes; there is no evidence of duetting. But its purpose is not really understood; "we can only guess what function this remarkable series of vocalizations serves."[117] This being so, no one can yet say whether the performance has, for the whale—in contrast to the human listener—any sort of aesthetic significance, and thus whether the designation "song" is biologically justified.

The climactic question whether song-like behavior has been observed in the order of Primates can be answered affirmatively, but, among the monkeys, it seems, only for some platyrrhine (New World) species, notably, *Callicebus moloch* (titi monkey). In the case of this monkey, Moynihan applies the term song "in a very broad and general sense, to include all series of notes uttered in more or less rapid and regular succession and distinctly set off, by relatively long pauses, from both preceding and succeeding notes."[118] Moynihan characterizes such passages as only moderately rapid throughout all or most of their length, and these he calls "ordinary" songs. He describes four or more other types and calls these "compound" songs. Among the ordinary songs, he identifies nineteen, but says that this list is certainly not exhaustive. He terms two of the most common compound sequences "full" songs; in these, the normal sequence of pitch is from higher to lower, irrespective of the actual notes involved.

In general, the vocalizations of catarrhine (Old World) monkeys, and especially those of tailless apes, deserve much closer study. Marler and Tenaza have recently stressed that "a comprehensive acoustical description" of the chimpanzee—which has been studied far more than any other ape—

"has yet to be published."[119] With respect to singing behavior, the gibbon may be the most interesting animal of all: as long ago as the 1890s, Blanford, a well-known authority on South Asian mammals, wrote about the hoolock (a species of gibbon found in Assam and Upper Burma), that its powerful voice, at a distance, "much resembles the human voice; [its song] is a peculiar wailing note, audible afar, and . . . one of the most familiar forest sounds. The calls commence at daybreak, . . . several of the flock joining in the cry, like hounds giving tongue . . . . [They] remain silent throughout the middle of the day, but recommence calling towards evening, though to a less extent than in the earlier part of the day."[120] This is an example of the diurnal rhythm that so frequently characterizes song displays. The same term, "song," is also used for the hoolock and several other varieties of gibbon by Marler and Tenaza, who distinguish three kinds of choruses based upon the sex of the singers: those consisting entirely of males singing; those consisting entirely of females singing; and those consisting of duets sung by mated pairs of gibbons.[121] They describe individuals engaged in dyadic countersinging with adjacent neighbors in several species. Predawn chorusing occurs very frequently, with choruses beginning as early as five hours before sunrise. This separates them temporally from dawn bird choruses, and it is assumed that the timing is an evolutionary consequence of interspecific competition for the auditory environment. "Captivity seems to have no effect upon the song structure or the nature of duetting in gibbons," according to these authors.[122] In conclusion, Marler and Tenaza supply a long list of unanswered questions about pongid signaling behavior, insisting that, "Above all, new approaches should be sought to characterize the *functions* of different vocalizations, so that more subtle interspecies comparisons of the proportions of a signal repertoire devoted to different kinds of adaptive tasks may be possible."[123] Considering, therefore, the uncertain state of knowledge about the biological uses of what is nevertheless persistently called "song" in the alloprimates, it seems premature to probe for its aesthetic function, if any.

In concluding this section, and before turning to the representational arts, I should mention that there are birds, among some sixty species of the family *Pipridae,* that *both* sing *and* dance, each species according to its own ritual. Even the earliest explorers of South and Central America noticed them because of their unique dances and the music connected with these dances, as in this entrancing description by Nutting (in 1884): "Upon a

bare branch which overhung the trail at a distance of about four feet from the ground, two male 'Bailadors' were engaged in a 'song and dance' act that simply astounded me. The two birds were about a foot and a half apart, and were alternately jumping about two feet into the air and alighting exactly upon the spot whence they jumped. The time was as regular as clock-work, one bird jumping up the instant the other alighted, each bird accompanying himself to the tune of 'to-lé-do—to-lé-do—to-lé-do,' sounding the syllable 'to' as he crouched to spring, 'lé' while in the air, and 'do' as he alighted."[124] In Costa Rica, where this enchanting bird is known as *el toledo,* people tell the same story in almost exactly the same words while alternately raising each index finger to illustrate the quaintness of the performance. The bird is technically known as *Chiroxiphia linearis* (one of the four so-called Chorus species), or the Long-tailed Manakin, whose antics were recently described, with some variations, anew by Slud.[125] All observers agree that the males do dance and that the *tolédo* call is a constant accompanying feature, although their views differ as to some other details.

3. Pictorial signs.

You have already been introduced above to bowerbirds, a group about whose "artistic" productions no less a scientist than Karl von Frisch has said that it has "much similarity with human behavior in comparable situations: those who consider life on earth to be the result of a long evolutionary process will always search for the beginnings of thought processes and aesthetic feelings in animals, and I believe that significant traces can be found in the bowerbirds."[126] He goes on to quote a wondrous observation by the naturalist Heinz Sielmann about the decorating behavior of a New Guinea species, the Yellow breasted bowerbird (*Chlamydera lauterbachi*): "Every time the bird returns from one of his collecting forays, he studies the over-all color effect. He seems to wonder how he could improve on it and at once sets out to do so. He picks up a flower in his beak, places it into the mosaic, and retreats to an optimum viewing distance. He behaves exactly like a painter critically reviewing his own canvas. He paints with flowers; that is the only way I can put it. A yellow orchid does not seem to him to be in the right place. He moves it slightly to the left and puts it between some blue flowers. With his head on one side he then contemplates the general effect once more, and seems satisfied."[127] Even though Marshall, who, after more than two decades of study, became the

foremost authority on bowerbirds, had indicated, or tried to, a utilitarian basis for all such seemingly artistic manifestations, he summed up his findings thus: ". . . I see no reason, provisionally, to deny that bower-birds possess an aesthetic sense although, it must be emphasized, we have as yet no concrete proof that such is the case. Some bowerbirds certainly select for their displays objects that are beautiful to *us*. Further, they discard flowers when they fade, fruit when it decays, and feathers when they become bedraggled and discoloured. . . . The fact that some bower-birds select objects that appeal to man's sense of beauty is no proof that such articles have a similar effect on the bird. If all bower-birds made collections of bleached bones, less would be written of aestheticism. Yet nobody would suggest that its pile of dry bones and dead snail-shells is less beautiful to [the Great Gray bowerbird] than is the 'beautiful' array of blue and red berries to [the Yellow-breasted variety]. It would, of course, be unthinkable to suggest that bowerbirds—or any birds for that matter—do not get pleasure from the vocal, architectural, and other activities they perform but whether such pleasure has much in common with that of Man, engaged in comparable pursuits, has yet to be proved."[128] At any rate, a scientist of the stature of Haldane was convinced that "a few animals, such as bowerbirds, show *sundaradharma,* behaviour satisfying aesthetic needs. This is most marked in the bowerbirds . . ."[129] Nor does it seem surprising, in the light of conclusions such as this, that Odoardo Beccari, the first naturalist to discover the display of a bowerbird, should have believed that he had stumbled upon a playhouse built by native children!

Over and over, we keep encountering the same pivotal aesthetic paradox: this emerges from a profound confusion about purpose; it drives us to compulsively ferret out any semblance of utility, usually defined as adaptive value.[130] We find it difficult to conceive of art as a coherent part of animal life and can scarcely imagine it as an adornment of their leisure. All researches in this field are stamped by a tension between a deeply felt conviction on the part of many distinguished and sensitive biologists that artistic activity indeed exists in the animal world and the inability to face its presumed lack of importance, even uselessness. More generally, Jenkins has argued that the position assigned to the aesthetic life in Western culture, from Plato onwards, is imbued by an uneasy fluctuation between these two attitudes, "that art is at once useless and fraught with significance, purposeless and yet important."[131] The two poles Jenkins speaks of are perhaps

reconciled in a casual comment of Vygotsky's: "Apparently the possibility of releasing into art powerful passions which cannot find expression in normal everyday life is the biological basis of art."[132] Viewed thus, art becomes a kind of cybernetic device for keeping the organisms' *milieu intérieur,* or, to use Uexküll's corresponding concept, *Innenwelt,*[133] in balance with its surroundings (*milieu extérieur,* or *Umwelt*).

Art, in this homeostatic sense, is surely recognizable in many other biological systems than man. Birds that construct elaborate nests, such as the weavers, build improved nests in their second season, after having practiced during the previous one, now opting for habitations which are "better" in the sense of tidier, neater, more elegant, but not at all demonstrably more useful. One may well ask with the late Waddington, "is it then or is it not an aesthetic 'better'?" Spiders will repair damage made to their webs, but "it is debatable whether this repair is governed solely by utilitarian consideration." The webs of certain drunken or drugged spiders appear both, one assumes, to them, and certainly to us, very unappealing. And chimpanzees and gorillas, when offered the materials used by human artists, "which are obviously exceedingly unnatural and exotic in relation to a normal primate life, produce paintings and drawings in which some aesthetic qualities may perhaps be discernible."[134] This is the topic of a recent overview article by Whiten, himself a practicing painter.[135] Before, however, turning to ape aesthetics, I should at least mention Dücker's interesting work on color preferences of forty-two specimens of birds of different families, in eleven species, especially spotted weaver finches.[136] Animals have an innate positive and/or negative feeling-tone for particular colors or patterns; commonly this is related to species-characteristic signs that serve as releasers triggering their responses to each other.

Schiller's study of more than 200 of Alpha's drawings was a landmark among researches of visual composition in apes.[137] Her drawings, Schiller found, in no case yielded representations. He compared them, in this respect, to scribblings of the human infant from twelve to eighteen months. Nor did he find any evidence of imitative drawing.

Morris discusses the results obtained with Alpha, and compares them with those of his mascot Congo, the second ape artist to be studied in depth.[138] Congo's responses were found to be comparable, when given like tests, with those of Alpha; similar behavior has also been observed in other great apes, and in a capuchin monkey who drew lines on the floor

of his cage when he was presented with color chalks.[139] Several gorillas, from Rotterdam and Basel to Palo Alto, have been known to draw and paint very successfully, as have occasional orangutans. In the mid-1950s, an ape known as Baltimore Betsy became famous from her fingerpaintings. Her work, and those of two other apes, were shown, without identification, to child psychiatrists. "One of the psychiatrists interpreted them as coming from an aggressive seven- or eight-year-old boy who had paranoid tendencies. Baltimore Betsy's drawings were said to be from a fiercely belligerent ten-year-old schizoid girl. A second picture by the same animal was also said to be by a ten-year-old girl who was paranoid and showed a strong father identification."[140] Eventually, twelve paintings by Betsy as well as twenty-four Congos were exhibited—and practically all sold—in London. Julian Huxley, who had opened the exhibition, later made the following comments: "The results show conclusively that chimpanzees do have artistic potentialities which can be brought to light by providing suitable opportunities. One of the great mysteries of human evolution is the sudden outburst of art of a very high quality in the upper Paleolithic period. This becomes more comprehensible if our apelike ancestors had these primitive aesthetic potentialities, to which was later added man's unique capacity for symbol-making."[141]

Morris recapitulates in his justly famous book half a century's picture-making with twenty-three chimpanzees, two gorillas, three orangutans and four capuchin monkeys. Alpha and Congo, who produced some 600 pictures in all, were studied most intensively. The principle that Morris stresses and elaborates is the fact that painting involves actions which are self-rewarding activities, that is, they "are performed for their own sake rather than to attain some basic biological goal. They are 'activities for activities' sake,' so to speak."[142] In human art, this sort of motivation has appeared in many guises. Jenkins' roll-call includes such celebrated aesthetic doctrines as "detachment, catharsis or purgation, isolation, objectification, emotion remembered in tranquility, psychic distance, self-surrender, passivity, pure perception, will-less knowing, reposefulness, equilibrium, synthesis, impersonalness, contemplativeness, empathy, pleasure objectified, disinterested pleasure, receptivity," and many others echoing the same meaning.[143] For Morris, the category of self-rewarding activities is essentially biological, of course: "Most of them are basically physical, meteoric outbursts and are fundamentally similar to human gymnastics and sports, except that they

lack any ulterior motives such as the obtaining of health, money, or social standing. They may inadvertently keep the animal mentally and physically healthy and thus indirectly assist in its struggle for survival, but the actual driving force behind these self-rewarding activities appears to be simply the unleashing of surplus nervous energy."[144] This immediately suggests a central question: why, if they have such a strong picture-making potential, have apes neither developed nor utilized it in the wild? This question corresponds closely to a second one, far more widely debated these days: why if, as alleged, apes have the cognitive prerequisites for the acquisition of language competency haven't they elaborated it in nature? No satisfactory answer to the latter question has been put forward thus far; even the rankest activist hasn't proposed that they have done so, outside of science fiction of the likes of Jules Verne and on the planet of the apes. Morris' answer to the former rests on his claim that, as soon as man "had a real language which described objects as well as moods, the gateway was open to the pictorial representation of these objects,"[145] or, in other words, that the emergence of this averbal art required the antecedence of verbal signs. This suggestion may appear likely to some, although I personally doubt it and, in any case, it is entirely speculative.[146] More to the point, it sheds no light at all on the previous conundrum. The holistic interpretation of pictures is a function of the right hemisphere, an operation normally exercised in conjunction with the left hemisphere; but the minor hemisphere, which seems specialized for dealing with things all at once, has an extremely limited verbal capacity, even though its performance is said by Eccles to be "superior to that of the brains of the highest anthropoids,"[147] while the dominant hemisphere, which tends to deal with things in sequence, is "almost illiterate in respect to pictorial and pattern sense."[148]

Morris adduces five further biological principles of picture making beside the basic one, that the accomplishment is in and of itself rewarding. His second principle is that of compositional control, the power of which is illustrated by Alpha's and Congo's adherence to the simple rules of filling a space and keeping within it, balancing, and cadenced repetition. This was previously evidenced from Rensch's investigations with a capuchin and a guenon monkey, and found, as well, in jackdaws and crows. As Morris notes, the vital words here are: "steadiness—symmetry—repetition—rhythm."[149] His third principle, "calligraphic differentiation," is a developmental one, referring to a slow progress of pictorial growth, which, how-

ever, is less strikingly exhibited by apes than by children. It is closely related to the fourth principle, thematic variation, or, as we might say in semiotics, the concept of invariance with allowable reformulations.

Whiten rightly regards the last two principles—which the proponent himself had put forward merely as a working hypothesis—of dubious status: "optimum heterogeneity," Morris suggests, governs the composition and point of completion of each picture, meaning by this the stage at which the picture is considered to be finished. Congo, it seems, had a very distinct concept of when a drawing or painting of his came to an end. By contrast, Alpha continued to cover the whole sheet with scribble if the paper was not removed. "Universal imagery" is what gives ape pictures as a whole a recognizable character, Morris finally maintains, but the only image which seems to recur with any regularity (also in capuchin art) is the "fan."

Whiten moves beyond the problems of artistic creation[150] that had preoccupied Morris to those of aesthetic appreciation, relying in the main on several papers by Humphrey.[151] Humphrey's initial series of tests was designed to determine if monkeys had favorite colors and preferences for certain brightnesses. The four monkeys tested for color gave the same result: the order of preference in each case was blue, green, yellow, orange, and red. Brightness preference, which was tested by pairing the standard white slide with white slides of differing brightnesses, turned out to be monotonically related to brightness over the range used.

Next, Humphrey tested preferences for pictures, using thirty colored photographs classified as "men" (e.g., a portrait of the keeper), "monkeys" (two infants playing), "other animals" (cow), "foods" (banana), "flower" (daisy), "abstract painting" (a Mondrian). This order of preference turned out to be: other animals/monkeys/men/flowers/paintings/food.

One may well ask, with Whiten, "whether such preferences have anything at all to do with aesthetics."[152] Humphrey posits two different patterns which reflect a dichotomy as to the ways both we and monkeys may exploit our senses: we may, he affirms, look at a stimulus "purely for pleasure" or "purely for interest." The pleasure dimension, corresponding to a pure aesthetic, can be either positive or negative, but is little affected by novelty, whereas the curiosity dimension is positive and changes only toward indifference as the novelty of the stimulus wanes. In Humphrey's view, the two types of responses operate quite independently, although they often coalesce as to timing, in which case their combined effects will yield

a summative expression of preference. Humphrey resumes his findings in five simple principles, to wit:

1. Two independent kinds of relationship obtain between the monkey and the stimulus, called 'interest' and 'pleasure/unpleasure.'
2. When there is a choice between two stimuli, the monkey ranks them according to their relative interestingness and relative pleasantness.
3. If one stimulus is 'appreciably more interesting' than the other, the probability that the monkey will prefer it is 1.
4. If one stimulus is 'appreciably more pleasant' than the other, the probability that he will prefer it is 1 unless the other stimulus is appreciably more interesting.
5. If neither stimulus is either appreciably more interesting or pleasant, the probability that he will prefer each is 1/2.

Unfortunately, these principles were derived from monkeys, not apes, but Humphrey was able to predict from his quantitative model with a high degree of accuracy preferences for a stimulus which combined the two distinctive features of interest and pleasure. Visual feedback, we may safely surmise, is an important part of painting for apes, but we can't be sure—and the question still abides why their desire to create visual art remains latent, to surface, if at all, only in captivity, whether spontaneously or under instigation.

Another puzzle which continues to perplex has been well posed by Whiten, who wonders, "why has nature equipped the chimp and the human with such ability? The interest or curiosity dimension of art can be seen as an offshoot, functionless in terms of survival value . . . But if a pure aesthetic sense is a functional offshoot of some other functional attribute, what is this?"[153] Humphrey has wrestled with this difficult question himself, and I find this animal behaviorist's suggestions particularly intriguing because he believes, as I do, "that a structuralist approach is the key to the science of aesthetics,"[154] and because he has so fruitfully employed semiotic concepts. Like Lévi-Strauss's, whom he cites, his starting point is a conceptualization of an artistic product as a system of signs, but from this obvious notion he goes on to ask how such works acquire their artistic charge. The answer he proposes is that, "considered as a biological phenomenon, aesthetic preferences stem from a predisposition among animals

and men to seek out experiences through which they may *learn to classify* the objects in the world about them. Beautiful 'structures' in nature or in art are those which facilitate the task of classification by presenting evidence of the 'taxonomic' relations between things in a way which is informative and easy to grasp."[155] This argument, of course, presupposes that the capacity for effective classification is important for survival, perhaps on a par with eating and sex. If so, techniques of classification were bound to evolve so as to be a source of pleasure to the animal and thus to shape the non-random differential reproduction of its genes (natural selection). After all, as Humphrey remarks, both animals and men can be relied on to do best what they most enjoy doing. This point of view, coupled with the idea that no work of art is arbitrary, suggests where an animal's feeling of beauty may come from. In the terminology of René Thom, "the work of art acts like the germ of a virtual catastrophe in the mind of the beholder." In other words, although art is always unpredictable, "it appears to us to have been directed by some organizing center of large codimension, far from the normal structures of ordinary thought, but still in resonance with the main emotional or genetic structures underlying our conscious thought."[156]

Humphrey carries his taxonomic metaphor much farther, enriching it with the notion of rhyming, or, as I would prefer to denominate the phenomenon more generally, parallelism. He brings experimental evidence to bear from a rich array of studies of exploratory behavior, and from his own investigations of "stimulus novelty" in monkeys. Parallelism involves the psychological notion of "stimulus discrepancy," or, what in the early 1950's was called "discrepancy theory," ugly coinages for a fundamental concept with wide applications in the animal world and among human babies.

The propensity to classify seems to have acquired, through evolution, diminishing survival value, but then so did sex: humans can enjoy either, but most *tokens,* though pleasurable per se, are not biologically relevant. Only the *type* of activity has a clearcut biological function.

Finally, let it be noted that Humphrey's pleasure principle seems equivalent to Morris's principle of composition. Pleasure, more likely than curiosity, tends to motivate compositional control, but the reverse holds for calligraphic differentiation and thematic variation. To some extent, all of these principles are likely to involve both types of preferences; these components, acting together, may manifest themselves in a principle of

optimum heterogeneity. The prefigurements of visual art in our species can thus be understood a little better against its simian backgrounds. This should surprise no one who is even superficially acquainted with D'Arcy Thompson's classic book, *On Growth and Form,*[157] where this great zoologist, so far ahead of his time, dealt with the basis for beauty in numberless exquisite structures produced by the plant and animal worlds, and showed that it is possible to construct an abstract, purely geometrical theory of morphogenesis, independent of the substrate of forms and the nature of the forces that create them.[158]

4. Architectural signs.

"A building is not only an object but also a sign," Bogatyrev noted in 1936,[159] and Jakobson later elaborated on this dictum by stressing that "[a]ny edifice is simultaneously some sort of refuge and a certain kind of message."[160] The utility—i.e., technological interest—of different architectural configurations is thus generally taken for granted. What remains in question is their correlation with the corresponding universe of signifieds, in particular as regards its aesthetic dimension, and the direction of the artistic movement: is it from external form, considered as a signifier, toward internal organization, which becomes the signified, or is it the converse? The architectural work of art, everyone seems to agree, is devoted to the realization of several ends. It stands at the confluence of multiple interests. Its character is syncretic *par excellence.*

In looking at the endlessly manifold abodes constructed by animals—that serve perhaps to trap prey, to protect or comfort the architect or its kind, especially the young, or to attract the attention of a potential mate—we must look for the artistic value that may be involved, although subordinated to the principal interest of the "survival machine," as Dawkins calls the temporary receptacles housing the colony of genes inhabiting every plant and animal.[161] If there is such a subsidiary purpose, falling passively under the sway of "mere" biological advantage, or supplementing it, an effort must be made to ferret out this aesthetic component. Such a quest is far from trivial, for, in the end, it is tantamount to asking: what is art?

The sources for the materials utilized by animals to erect their dwellings are twofold: either the substances are produced from within their own body, or they are assembled from the environment surrounding them. In the latter case, members of some species may exhibit subtle preferences,

which may justly be termed aesthetic, in their very selection of particular habitats. Indeed, Klopfer even supposes that "the most convincing evidence for the existence of esthetic preferences come from the literature on habitat selection . . ."[162] This discerning ethologist has consistently allowed for constraints due to psychological factors, the most intriguing cases of which are posed by those situations in which the preferences cannot be related to physical abilities, "as when a particular color of flower or shape of leaf or complex of factors is preferred to any other."[163] It is difficult enough to isolate the relevant feature of a complex *Gestalt;* to provide an explanation for the underlying sensory or neural basis for preferences that are termed aesthetic remains generally a difficult research problem for the future.

In the process of building, animals employ essentially the same techniques that we do: digging, masonry, plaiting, weaving, and so on. For Vitruvius —the failed Augustinian architect and engineer later turned influential writer—the universal *homo faber* was the architect, to whom the Romans assigned the art of building as well as the craft of fabricating machinery (i.e., secondary tools).[164] Vitruvius, in spelling out what architecture is, maintained that "two considerations must be constantly kept in view" in the execution of his art and craft, "namely, the intention, and the matter used to express that intention. . . ."[165] Whatever one's opinion may be about the intrusion of intention, volitional control, or, more broadly, of teleological considerations, into the domain of semiotics,[166] there can scarcely be any doubt that man fully shares the second attribute mentioned by Vitruvius with the speechless creatures.

In respect to the concept of *animal laborans,* the animal "which labors and 'mixes with'," or "which with its body . . . nourishes life," but which "still remains the servant of nature and the earth,"[167] it is, in truth, hard to perceive essential differences among the species. Such discriminations as may exist must be sought in Arendt's redefined and refined view of the classic *homo faber,* an anthropocentrically utilitarian figure she nonetheless so insistently, although eloquently, opposed to *animal laborans—homo faber,* "who makes and literally 'works upon'," whose production is tantamount to what she calls reification, the creation, that is, of a uniquely human world in the face of nature. Only *homo faber,* she claims, "conducts himself as lord and master of the whole earth."[168] For her, *homo faber,* "in his highest capacity," assumes, of course, the functions "of the artist, of poets and historiographers, of monument-builders or writers, because without

them the only product of their activity, the story they enact and tell, would not survive at all."[169] This bleak and in the end still narrowly parochial view implies that none of the works of nature, which manifestly come into being without man's intervention, let alone his midwifery, can have aesthetic or even economic value. As Karl Marx has put the same idea in *Das Kapital:* "Der Wasserfall, wie die Erde überhaupt, wie alle Naturkraft hat keinen Wert, weil er keine in ihm vergegenständlichte Arbeit darstellt."[170] This attitude to nature and to natural productions degrades objects into means, where animals are always presumed to be building something not for its own sake but for the sake of instrumentality, or expediency toward the realization of some putative biological end. The absurdity of this Sophistic devaluation of nature was despised by many Greeks, as Arendt noted,[171] and its inherent anthropocentrism perhaps most persuasively resolved in Plato's celebrated argument against Protagoras, whose subjective idealism fails to accord, as I have tried to show elsewhere,[172] with the most elementary lessons of the modern life science.

The field of "natural architecture" is exceptionally fortunate in that there exists a splendid recent book devoted to that subject in its entirety ranging from the invertebrates, particularly the arthropods, to the birds and on to the highest mammals, inclusive of apes. This compendium, which requires no specialized knowledge for its enjoyment, was written by Karl von Frisch,[173] in collaboration with his son, Otto. It bore the original title, *Tiere als Baumeister*—which translates into "Animals as Master Builders" —both more powerful and more suggestive, as well as less overburdened or presumptuous, than the English rendering on the title page.[174]

The architectural activity of animals is best regarded as a manifestation of tool-using behavior—a sophisticated way of manipulating objects and exploring their uses to adaptive advantage. According to Frisch, the use of tools that are not parts of their bodies is rare among animals: "They mostly use the organs of their bodies, chiefly their mouth parts and their legs."[175] Rare though the use of extrinsic artifacts may be over-all, statistically speaking, newly discovered instances continue to be published. A case in point is a learned behavioral sequence recently detected in Northern blue jays (*Cyanocitta cristata*), which involves tool-making, to wit, by the tearing and alteration of pages from a newspaper, and employing these as tools to rake in food pellets which otherwise lay out of reach.[176]

Even the larva of the green lacewing (*Chrysopa slossonae*) uses a tool

in the climax of a complicated sequence that has been inelegantly dubbed "trash-carrying behavior."[177] This insect form disguises itself as, i.e., mimics, its own prey by plucking some of the waxy "wool" from the bodies of the alder aphids amidst colonies of which it lives and feeds, and then applies this material to its own back. The exogenous shield thus constructed protects the larva from assault by the ants that ordinarily "shepherd" the aphids.

Some social insects, notably, several species of *Aphaenogaster*—none of which are mentioned by Frisch, despite the relatively large amount of space he otherwise devotes to the constructions of eusocial insects[178]—use pieces of leaf, mud, and sand grains as tools for carrying soft foods from distant sources to the colony, a maximally efficient way of exploiting available resources.[179]

I recite these random examples of recently uncovered cases of tool-using activity to adumbrate my hunch that such forms of behavior anticipate the more advanced forms of animals' building activities. In ethological jargon, the question becomes: how does tool-using behavior become ritualized?[180] Or, in semiotic parlance: how does a tool, with a primary amplifying function, acquire a superimposed sign-function?[181] The answer to this question, at this stage in the development of both ethology and diachronic semiotics, is precisely the same as to the deceptively innocent one, "What passes in the mind of a bowerbird when he builds and decorates his bower?" Frisch replies, "Naturally, I cannot answer [my own] question. No one can." His denial notwithstanding, Frisch proceeds to declare his conviction that in these birds, no less than in chimpanzees, "not only insight into the consequences of their actions but also evidence of aesthetic feelings can be found."[182]

No purpose would be served by rehearsing here even a sampling from among the host of striking examples of exterior and interior designs masterfully adduced by Frisch. The multitalented bowerbirds figure prominently, as does a large variety of other kinds of birds, including those consummate nestbuilders, the weavers, and especially *Malimbus cassini,* noted for the care and precision of the working male, reminiscent in his technique of a human basket weaver or one with a loom. Among the many mammals whose imposing labors are illustrated, the impressively productive accomplishments of the beaver (*Castor fiber,* or the American kind, *C. canadensis*), however, do deserve to be singled out. The fantastic edifices of this "architectural mute"—the evocative epithet was coined, in 1868, by Lewis H. Morgan[183]—are exemplified by the construction of dams, lodges, bur-

rows, and canals. The opinion that "there is no other animal that can by its labor transform the landscape in the same way as can the beaver and man"[184] is shared by all informed observers. This pre-eminent master builder, particularly busy in the mountains, checks turbulent brooks and, with its dams, protects the fields and pastures below from becoming silted up with sand and gravel. The artificial reservoirs thus created are soon stocked with trout and other fishes, and turned into a refuge for water birds. The very magnitude of some beaver projects is stupefying—the largest dam is that on the Jefferson River, near Three Forks, Montana: one can follow it for some 2,300 feet. Although the beavers' basic engineering skills are innate—"the principles of their art are theirs by inheritance"[185] —their brain is exceptionally well-developed in comparison with that of other rodents, and their correspondingly superior adaptability to changing ecological situations is emphasized by knowledgeable ethologists. Morgan even felt "at liberty to infer an intention on the part of the beaver,"[186] and others believe that beavers profit from example or experience.

By contrast, there is nothing remarkable about the building activities of the Great Apes. Adult chimpanzees, in some regions, are known to fashion fresh nests up in the trees nightly, as do orangutans and gorillas, although heavy males among the latter tend to sleep on the ground. Köhler's experiments with chimpanzees that solve the problem of getting fruit situated beyond the reach of their arms by manufacturing a suitable tool for bridging the distance from themselves to the food—by fitting two bamboo rods together, for instance, or by erecting a tower from packing cases—are widely known, although his interpretation is still debated. While the actions of Köhler's chimpanzees were portrayed as conveying an impression of deliberation and purpose, the animals seem to have but a very modest sense of either statics or balance.[188] Some never managed to solve the problem at all.

The penumbra of an absorbing lifelong research commitment is delineated in two arresting sentences at the end of Frisch's study: "The evolutionary roots of human behavior reach far back into the behavior patterns of animals. Those who are fascinated by these connections need only fasten on one such puzzle, the architecture of animals perhaps. . . ."[189] The prefigurements of architecture, however, are but one detail in the mosaic of the much vaster, much deeper, mystery of the precultural emergence of the averbal arts.

5. Concluding remarks.

At the outset of this essay, I drew a sharp distinction between the verbal art and the averbal arts, proclaiming my conviction that, while it seems unavailing to search for the prefigurements of language-based sign systems, a scrutiny of the roots of the four other semiotic spheres discussed might prove illuminating. Differences in the neurological processing of verbal vs. averbal patterns of input and output are solidly and rationally grounded in separate dominions of the human brain. The evolutionary antecedents are also assuming shape, although they remain blurred at the edges.

The late Bronowski wondered whether "any animal language [has] figures of speech,"[190] by which he appeared to question whether an animal ever uses the same sign-vehicle corresponding to two or more different significates. The answer to the latter must unequivocally be in the affirmative, since the context in which any gesture is delivered decisively shapes its "correct" interpretation. But Bronowski's "figures of speech," as he used the expression in his exploratory article on "Human and Animal Language," is itself merely a figure of speech—a rhetorical device of his own. It has little to do with verbal art. To be sure, it has been widely reported that the creation of signed metaphors as well as metonyms was recorded in different home-raised chimpanzees. In 1976, I recounted that both sorts of tropes were alleged to have occurred: "whereas Washoe created 'water-bird' for duck, a metonymic or indexical expression, being a sign in real reaction with the object noted . . . , Lucy generated 'candy fruit' for watermelon, a metaphoric or iconic term, possessing the qualities signified. . . ."[191] Lately, however, I—and others (e.g., Martin Gardner, personal communication)—have come to feel that such interpretations must be reviewed if not with suspicion at least with caution. Both chimpanzees were getting a steady stream of unconscious feedback from their trainers. Thus only her handler was present in the canoe when Washoe glimpsed her first duck and made a sign for "water" followed by a sign for "bird." There was no awareness of the possibility that Washoe, dragging her hand in the water, didn't sign "water," next noticed the bird, and only then signed "bird." The behavior of the trainer, who (for all we know) repeated the two signs, could easily have taught Washoe a new sign, namely, the "water-bird" sign which she would associate from then on with ducks. The circumstances were, *mutatis mutandis,* similarly indeterminate for Lucy's "candy fruit," "cry fruit" (for onion) and for every other such case

that I am aware of. All of these are subject to other, less portentous, construals, the simplest among which is the pervasive emission of subthreshold involuntary cuing of the destination by the source, or the "Clever Hans" experience.[192] In sum, there is no hard evidence whatsoever for the existence of figures of speech, in the literal sense, among the speechless creatures—a prototypal *contradictio in adjecto!*

A second leitmotif of my article skirted the profound problem of aesthetic significance—particularly in opposition to or juxtaposition with utility—viz., purposiveness of directedness, tantamount, in some contexts, to the Aristotelian art of *chrēmastistikē,* or the amassment of wealth with no limit in respect of its end, but in this context simply to the preservation and improvement of the gene pool, or the long-term environment of the gene. The question whether animals are endowed with "consciousness" has remained wide open,[193] being no doubt poorly posed, but many distinguished life scientists concur that some animals on some occasions behave toward some objects *as if* the organisms were motivated by a recognizably aesthetic incentive. This much is clarion clear, for instance, as regards the bowerbirds.

The essence of the aesthetic impulse surely lies in the structures organisms extract and reconstruct from among salient features of their environment. Albrecht Dürer, among a host of commentators, believed this to be so; according to him, "Denn wahrhaftig steckt die Kunst in der Natur, wer sie heraus kann reissen, der hat sie."[194] Others make a separation between natural or organic beauty and artificial or aesthetic beauty, contrasting the realm of living things with that of "living" forms. But the two are obviously bonded, since all the percipients themselves are a part of nature. The spectacles through which we see the world are partly an apparatus for bringing into focus certain aspects of our existence (*Umwelt*), but they are, at the same time, a means for relating harmoniously varied facets of the universe to each other. To paraphrase a saying of Henri Poincaré, aesthetic sensibility plays the part of a delicate sieve. The challenge, of course, is to explicitly define what those relations—of balance and order that delight—are in the characteristic idiom of each art, as well as in the all-embracing architectonics of the living megacosm. The concept of delight thus undergoes a radical transmutation: it is elevated into a function that biologists can recognize, objectify, cope with in familiar terms. The "artistic animal" is not defined by a heightened sensitivity to movement,

sound, color, shape, but by its innate and/or learned capacity to elicit a stable dynamic structure from the fluid environment, whether inorganic, organic, or a subtle blend of both. The sign systems thus created, which serve an underlying semantic function, take in time an aesthetic turn. How this happens is magisterially brought out in an 1865 Platonic dialogue on the origin of beauty that Gerard Manley Hopkins had composed for his tutor at Oxford.

The dialogue between the Professor of the newly founded chair of Aesthetics (no doubt Walter Pater) and a student takes place in the tranquil setting of a college garden, and the dialectic "battledore" quickly comes to concentrate on "one of the most finely foliaged of trees," the chestnut. The Professor points to the leaves of the tree to illustrate the principle of symmetry, or, more generally, of the structural relations inherent in nature. The Professor asks:

". . . now what is symmetry? Is it not regularity?"

"I should say, the greatest regularity. . . ."

"So it is. But is it not that sort of regularity which is measured by length and breadth and thickness? Music for instance might be regular, but not symmetrical ever; is it not so?"

"Quite so. . . ."

"Let us say regularity then."

The Professor next draws attention to the oak, "an unsymmetrical tree."

"Then beauty, you would say perhaps, is a mixture of regularity and irregularity."

"Complex beauty, yes. But let us inquire a little further. What is regularity? Is it not obedience to law? And what is law? Does it not mean that several things, or all the parts of one thing, are like each other?"

The Professor continues:

". . . regularity is likeness or agreement or consistency, and irregularity is the opposite, that is difference or disagreement or change or variety."

But do these distinctions apply to all things? Beauty is certainly a relation, but *what* is this relation? The sense of beauty in fact is a comparison. The conversation now moves on to the subject of poetry: rhythm, meter, and rhyme.

"Now you remember I wished beauty to be considered as a regularity or likeness tempered by irregularity or difference: the chestnut-fan was one of my instances. In rhythm we have got the regularity, the likeness;

so my aim is, as rhythm is agreed to be beautiful, to find the disagreement, the difference in it. . . . Rhythm therefore is likeness tempered with difference. . . ."

"What is rhyme? . . . Is it not an agreement of sound—?"

"With a slight disagreement, yes. . . . In fact it seems to me rhyme is the epitome of [our] principle. All beauty may by a metaphor be called rhyme. . . ."[195]

If rhyme is taken as the poetic paradigm for beauty, consisting of comparison for likeness's sake (metaphor, simile) as well as for unlikeness's sake (antithesis, contrast), what is the convenient word which gives us the common principle for all such kinds of equations? Hopkins proffers *parallelism,* and moves on to analyze parallelism "both structural and unstructural," parallelism of expression and parallelism of sense, and finally to illustrate his dictum that "The structure of poetry is that of continuous parallelism."[196]

Now it is evident—to recapitulate briefly—that the conspicuous use of reiteration, of a statement of a theme with variations, of the creation of suspense and countervailing tension, of the arousal of expectation and its denial, in short, of parallelism, is also the pervasive pivotal device common to all manifestations of the art of animals discussed in this essay: what is criterial of their kinesthetic art is rhythmic somatic motion; at the heart of their music are "les rythmes organiques" and the transposition of fixed intervals; the cardinal substantives that characterize their picture making are "steadiness—symmetry—repetition—rhythm"; and the mark of their virtuoso architecture is surely geometrical symmetry—broken in multiform ways—that transmutes the ulterior modularity of physical reality into macroscopic projects of utility as well as beauty.

Hopkins' insight about the source of beauty was amplified by Humphrey a little over a century later. He asked: "What is the biological advantage of seeking out rhyming elements in the environment?" The answer he proposed was this: "Considered as a biological phenomenon, aesthetic preferences stem from a predisposition among animals and men to seek out experiences through which they may *learn to classify* the objects in the world about them. Beautiful 'structures' in nature or in art are those which facilitate the task of classification by presenting evidence of the 'taxonomic' relations between things in a way which is informative and easy to grasp."[197] This proposition demands a tripartite justification.

One must explain, to begin with, why the knack for classification should be important for biological survival. If the function of categorization is to sort out sensory experience—to identify, with essential economy, good, bad, and indifferent forms, or, in semiotic phrasing, to sift out the presence of such forms "endowed with signification" that trigger appropriate long-term releasers—then the evolution of efficient classificatory techniques is bound to be of survival value. Humphrey argues that "just as with eating or with sex, an activity as vital as classification was bound to evolve to be a *source of pleasure* to the animal. Both animals and men can, after all, be relied on to do best what they enjoy doing."[198]

Second, it is necessary to show why a maneuver such as Hopkins called parallelism should be optimally advantageous to the classificatory animal. It seems clear that the fundamental role of the central nervous system is precisely to provide the creature with a local map simulating its position in the environment, to enable it to sort out, among other vital intelligence, the images of biologically and/or socially important organisms, viz., to distinguish prey from predator. This is surely best accomplished by an arrangement of such images into a distinctive feature matrix, or in terms of "likeness tempered with difference." Parallelism is the organizing principle employed in many of the most successful taxonomical procedures, including the Linnaean; (more generally, it imbues set-theory). "If it is helpful for the taxonomist to look for 'rhymes' in his materials," Humphrey continues, "so it is helpful for the animal to do so. It is for this reason that we have evolved to respond to the relation of beauty which rhyme epitomises. At one level we take pleasure in the abstract structure of rhyme as a model of well-presented evidence, and at another we delight in particular examples of rhyme as sources of new insight into how things are related and divided."

The third step is to seek evidence, beyond the prevailing propensity of man and animals to classify their surroundings, for the surmise that animals also are attracted in particular to parallelism. To amass a modicum of such testimony was, in fact, the main objective of this study: to adduce instances of parallelism in the animal world that have no demonstrable natural value but which nevertheless give people as well as the animals involved something akin to aesthetic pleasure, even when the process or the product is disunited from its proper biological context.

The universal propensity to classify dictates that animals generate units of signification, or significata, by stipulating redundancies. Several arrange-

ments are possible, such as non-dimensional (taxonomic) classification or dimensional (paradigmatic) classification, in both of which classes are formed by means of intersection.[199] When classes and sub-classes are created, they may be defined by features which are either inherent in nature as the sole feasible solution or, as in man and his tamed creatures, arrays that are arbitrary to a degree (cultural categories, individual idiosyncrasies). Yet even certain human populations may be "forced to meet nature on its own terms and to categorize those aspects of the natural environment which are relevant to it in a biologically realistic way."[200] The conception of class, whether based upon naturally imposed or arbitrarily chosen qualities, sometimes acquires a certain elegance and power elevating it beyond a mere organizational tool, and we can then say that the production carries an aesthetic charge.

Lévi-Strauss and Piaget have both been concerned with primordial questions of human classification. The inquiry of Lévi-Strauss, instigated by a linguistic model, postulates a proclivity in all of us to think in opposites and contrasts, to pry perceptual information from the environment constrained by certain predetermined structures, and to consolidate and combine these percepts in classifying, naming, and mythic systems. Through a series of ordered transformations, these systems relate themes and variations upon them that are effable, for instance, in artistic products which themselves are embodiments of mind.

Animals create a taxonomy appropriate to their species and ecological niche. Thus predators, for instance, distinguish different categories of prey—by size, appearance, odor, and other signifiers—thus forestalling wastefully indiscriminate attacks. *Vice versa,* many potential prey distinguish among different kinds of predators, as we observe from their use of sundry warning signs, variations in their flight-distances and flight-reactions, e.g., depending on whether the enemy is up in the air or down on the ground. It is less well known, however, that animals assign to one another and carry proper names,[201] which individuate each from every other. As Hediger, who devoted a perceptive and semiotically sensitive study to the use of proper names in the animal kingdom, pointed out: "Its proper name is part of its [the animal's] personality. Therefore it distinguishes between its own self and the nonself."[202] Hediger also pleads for research on the appearance of proper names in evolution, for this may "open a new door to the delicate problem of selfconsciousness in animals." Concern with naming, moreover,

focuses attention on parallelism as a special case. Parallelism of this kind evokes a sort of pleasure familiar to all observers of children's behavior. Humphrey comments on this pronounced tendency in children, which is promoted, among other devices, through picture books designed especially for them. The passion for collecting, he feels, is yet another manifestation of the pleasure both mature children and men take in classification.[203] Among the animals, it is no accident that bowerbirds are among the most sedulous of collectors, each species according to its predilection. Thus the display-ground of the Great Gray "may contain an almost inconceivable accumulation of pale or reflective rubbish"—but sometimes also bright specimens of gold or pieces of precious opal—yet every bit of their harvest of treasure "is chosen with great discrimination."[204]

Piaget has demonstrated that young children are limited in performing internally consistent classificatory tasks. Shown an aggregate of diverse objects and asked to place together those that go together, the child will come up with a range of volatile groupings of phenomena that are not yoked by a simultaneous awareness of a whole and its parts, either physically or conceptually. A sense of hierarchy comes later, at a mature stage of operational intelligence; accordingly, sophisticated art usually emerges in human ontogeny as an accessory only to adult cognitive capacity. Comparisons of animal artistic productions with those by children were made as early as 1935, when Nadie Kohts juxtaposed drawings by her chimpanzee, Joni, with those by her son, Roody. She showed that early scribbles by Joni and early scribbles by Roody resembled each other greatly. However, while later drawings by Joni evidenced greater complexity but no imagery, those by Roody exhibited, in addition, mimetic qualities, to wit, the recognizable icon of a face.[205]

When Mukařovský delivered his seminal 1934 lecture, on "L'art comme fait sémiologique," he meant his study to underline and exemplify certain aspects of the dichotomy—which he never questioned—between the natural sciences and the humanities, as well as to bring out the importance of semiotic considerations for aesthetics and for the history of art.[206] Referring, in conclusion, to this programmatic paper, I should like to note the paradoxical aspect of the proposed enterprise: a consistently carried out characterization of every work of art as an autonomous sign composed of an artifact (the signifier), an aesthetic object (its signification), and an abstract,

context-oriented relationship to the thing signified, tends precisely to obliterate the factitious schism it is supposed to uphold.

Notes

1. Thomas A. Sebeok, *The Sign & Its Masters* (Austin: University of Texas Press, 1979), Chapter 2.
2. Sebeok, *The Sign,* Chapter 4.
3. William R. Bascom, "Verbal Art," *Journal of American Folklore,* LXVIII (1955), p. 246, fn. 9; Richard Bauman, *Verbal Art as Performance* (Rowley, Mass.: Newbury House Publishers, 1977), pp. 4, 49, n.2.
4. George Gaylord Simpson, "The Biological Nature of Man," *Science,* CLII (1966), p. 476.
5. Thomas A. Sebeok, "Talking with the Body," *Times Literary Supplement,* January 27, 1978, p. 84.
6. Sol Tax and Charles Callender, eds., *Issues in Evolution* (Chicago: University of Chicago Press, 1960), p. 195.
7. Alexander J. Marshall, *Bower-Birds: Their Displays and Breeding Cycles* (Oxford: Clarendon Press, 1954), p. 65.
8. Gilbert R. Gannon, "Observations on the Satin Bower Bird with Regard to the Material Used by It in Painting Its Bower," *Emu* XXX (1930), p. 39.
9. Karl von Frisch, *Animal Architecture* (New York: Harcourt Brace Jovanovich, 1974), pp. 238-39.
10. Theodosius Dobzhansky, *Mankind Evolving: The Evolution of the Human Species* (New Haven: Yale University Press, 1962), p. 215.
11. Erwin Panofsky, *Meaning in the Visual Arts: Papers In and On Art History* (Garden City: Doubleday, 1955), pp. 10-11.
12. Donald R. Griffin, *The Question of Animal Awareness: Evolutionary Continuity of Mental Experience* (New York: Rockefeller University Press, 1976), p. 78.
13. Even these remarks may need to be modified in the light of such casual but expert observations as S. Dillon Ripley's (in John F. Eisenberg and Wilton S. Dillon, *Man and Beast: Comparative Social Behavior* [Washington: Smithsonian Institution Press, 1971], pp. 8-9), concerning a species of Gardner bowerbird (*Amblyornis*), in New Guinea.
14. Roland Barthes, *Mythologies* (Paris: Seuil, 1957), p. 222.
15. Jury M. Lotman, "Tezisy k probleme 'Iskusstvo v rjadu modeliruiushchikh sistem'," *Trudy po znakovym sistemam,* III (1967), pp. 180-81.
16. Karl R. Popper and John C. Eccles, *The Self and Its Brain* (Berlin: Springer, 1977), pp. 351-52.
17. Thomas A. Sebeok, ed., *How Animals Communicate* (Bloomington: Indiana University Press, 1977), p. 1070.
18. Ladislav Matejka and Irwin R. Titunik, eds., *Semiotics of Art: Prague School Contributions* (Cambridge, Mass.: MIT Press, 1976), p. 254.
19. Popper, in Popper and Eccles, p. 482.
20. Popper and Eccles, p. 353.
21. Simpson, p. 476.
22. Thomas A. Sebeok, *Contributions to the Doctrine of Signs* (Lisse: Peter de Ridder Press, 1976), pp. 155-62; and *Animals,* pp. 1063-67.
23. Thure von Uexküll, "Positionspapier über das Thema 'Semiotik der Angst' " (forthcoming).
24. Sebeok, *The Sign,* Chapter 1.
25. Cf. Hansjochem Autrum, "The Communications Network of the Human Body," in *Man and Animal: Studies in Behaviour,* ed. Heinz Friedrich (London: MacGibbon & Kee, 1972), pp. 77-81.
26. Cf. Autrum, Appendix I.
27. Gregory Bateson, "Redundancy and Coding," in: *Animal Communication: Tech-*

niques of Study and Results of Research, ed. by Thomas A. Sebeok (Bloomington: Indiana University Press, 1968), p. 615.

28. Bateson, p. 614.
29. Bateson, p. 614.
30. R. Dale Guthrie, *Body Hot Spots: The Anatomy of Human Social Organs and Behavior* (New York: D. Van Nostrand Co., 1976), Chapter 9, and p. 73.
31. Guthrie, p. 73.
32. Bernhard Rensch, "Basic Aesthetic Principles in Man and Animals," in *The Nature of Human Behaviour,* ed. by Gunther Altner (London: Allen and Unwin, 1976), pp. 322-45, 445-47.
33. Cf. Rudolf Arnheim, *Art and Visual Experience* (Berkeley: University of California Press, 1954).
34. Rensch, "Basic," p. 345.
35. Rensch, "Die Wirksamkeit ästhetischer Faktoren bei Wirbeltieren," *Zeitschrift für Tierpsychologie,* XV (1958), p. 461.
36. Margarete Tigges, "Muster- und Farbebevorzugung bei Fischen und Vögeln," *Zeitschrift für Tierpsychologie,* XX (1963), pp. 129-42.
37. William T. Sheperd, "Some Observations on the Intelligence of the Chimpanzee," *Journal of Animal Behavior,* V (1915), pp. 391-96.
38. See especially "Malversuche mit Affen," (*Zeitschrift für Tierpsychologie,* XVIII [1961], pp. 347-64) on drawings and paintings as perhaps prestages of copying.
39. Paul Schiller, "Figural Preferences in the Drawings of a Chimpanzee," *Journal of Comparative Physiological Psychology,* XLIV (1951), pp. 101-11.
40. Desmond Morris, *The Biology of Art: A Study of the Picture-Making Behaviour of the Great Apes and Its Relationship to Human Art* (New York: Alfred A. Knopf, 1962).
41. Geoffrey H. Bourne, *The Ape People* (New York: G. P. Putnam's Sons, 1971), p. 216.
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43. Bernhard Rensch, *Homo Sapiens from Man to Demigod* (New York: Columbia University Press, 1972), p. 90.
44. Rensch, *Homo Sapiens,* p. 91.
45. Rensch, "Basic," p. 342.
46. Rensch, *Homo Sapiens,* p. 91.
47. Alexander Alland, Jr., *The Artistic Animal: An Inquiry into the Biological Roots of Art* (Garden City: Anchor Press/Doubleday, 1977), Chapter 2.
48. Alland, p. 24.
49. Alland, p. 30. For a semiotic interpretation of play in vertebrates, cf. Sebeok, *Contributions,* p. 139.
50. Cf. John E. Pfeiffer, *The Emergence of Man* (New York: Harper & Row, 1969), p. 434.
51. Dobzhansky, p. 217.
52. Herbert Spencer, *The Principles of Psychology* (New York: D. Appleton, 1897), II, pp. 627, 647.
53. Iredell Jenkins, *Art and the Human Enterprise* (Cambridge, Mass.: Harvard University Press, 1958), p. 14 and passim.
54. Peter H. Klopfer, "Sensory Physiology and Esthetics," *American Scientist,* LVIII (1970), p. 399.
55. Klopfer, p. 400.
56. Alland, p. 27.
57. Alexander Marshack, *The Roots of Civilization: The Cognitive Beginnings of Man's First Art, Symbol and Notation* (New York: McGraw-Hill, 1972), p. 275.
58. John Z. Young, *An Introduction to the Study of Man* (Oxford: Clarendon, 1971), p. 519.
59. Dobzhansky, p. 215.
60. Cf. George John Romanes, *Darwin, and After Darwin: An Exposition of the Darwinian Theory and a Discussion of Post-Darwinian Questions* (Chicago: Open Court, 1892), pp. 380-85.
61. Anya Peterson Royce, *The Anthropology of Dance* (Bloomington: Indiana University Press, 1977), p. 197.
62. Royce, pp. 3-4.

63. Jack Maclaren, *My Crowded Solitude* (New York: R. M. McBride & Co., 1926).
64. Curt Sachs, *World History of the Dance* (New York: Norton, 1937), p. 10.
65. Royce, p. 4.
66. Karl Appun, *Unter den Tropen* (Jena: H. Costenoble, 1871), pp. 468-69.
67. Karl von Frisch, *The Dancing Bees* (London: Methuen, 1954), and *The Dance Language and Orientation of Bees* (Cambridge, Mass.: Harvard University Press, 1967).
68. I am not, of course, concerned here with spectacles, like circus acts, where animals have purportedly been trained by dint of a trans-species operation to "dance" in exhibitions. Hanna observes: "It is true that a human can dance mechanically or perform a dance pattern conceptualized and created by someone else, in the same way that a nonhuman can be trained to perform a dance by a human. We have all seen 'dancing' chimpanzees, horses, dogs, bears, parrots, or elephants." (Judith L. Hanna, "To Dance is Human: Some Psychobiological Bases of an Expressive Form," in *The Anthropology of the Body,* ed. by John Blacking [London: Academic Press, 1977], p. 212). The latter, however, are only skillfully induced semiotic illusions. The animals' biologically appropriate movements are accompanied by the contrived music, not the other way about.
69. Irenäus Eibl-Eibesfeldt, *Ethology: The Biology of Behavior* (New York: Holt, Rinehart and Winston, 1975), p. 233.
70. Edward A. Armstrong, *A Study of Bird Song* (London: Oxford University Press, 1963), Chapter 15, and p. 195.
71. Eibl-Eibesfeldt, p. 233.
72. For her dramatic descriptions, see, e.g., Jane von Lawick-Goodall, *My Friends the Wild Chimpanzees* (Washington: National Geographic Society, 1967), pp. 75-77; *In the Shadow of Man* (Boston: Houghton-Mifflin, 1971), pp. 52-54. Henry W. Nissen, whose fieldwork was conducted during the dry season, occasionally alludes, nevertheless, to wild chimpanzees performing in parties, in "A Field Study of the Chimpanzee: Observations of Chimpanzee Behavior and Environment in Western French Guinea," *Comparative Psychology Monographs* 8, XXXVI (1932), pp. 1-222.
73. Lawick-Goodall, *Shadow,* p. 54.
74. Royce, p. 207.
75. Lawick-Goodall, *Friends,* pp. 74, 77.
76. Sachs, p. 10.
77. Wolfgang Köhler, "Zur Psychologie des Schimpansen," *Psychologische Forschung* I (1922), pp. 33-35; cf. his *The Mentality of Apes* (London: Routledge and Kegan Paul, 1925), pp. 314-15.
78. Köhler, "Psychologie," p. 33.
79. Sachs, p. 10.
80. Sachs, p. 11.
81. Köhler, "Psychologie," p. 34.
82. Sachs, p. 12.
83. Franz Boas, *Primitive Art* (New York: Dover, 1955 [1927]), p. 344.
84. Cf. Sebeok, *The Sign,* Chapter 1.
85. Griffin, *Animal Awareness,* p. 78. (See footnote 12).
86. Hanna, "To Dance," p. 211. (See footnote 68).
87. Alan P. Merriam, *The Anthropology of Music* (Evanston: Northwestern University Press, 1964), p. 27.
88. Claude Lévi-Strauss, *Le cru et le cuit* (Paris: Plon, 1964), p. 24.
89. Boas, p. 340.
90. Thorpe dismisses Langer's absurd view that the singing of birds, being "unconscious," is not art. For a critical consideration of her writings on music, see further Paul Henle, ed., *Language, Thought & Culture* (Ann Arbor: University of Michigan Press, 1958), pp. 202-20.
91. William H. Thorpe, *Animal Nature and Human Nature* (Garden City: Anchor Press/Doubleday, 1974), p. 307.
92. Peter Szőke, "Ornithomuzikologia," *Magyar Tudomány* IX (1963), pp. 592-607.
93. Joan Hall-Craggs, "The Aesthetic Content of Bird Song," in *Bird Vocalizations: Their Relations to Current Problems in Biology and Psychology,* ed. by Robert A. Hinde (Cambridge: Cambridge University Press, 1969), pp. 367-81.
94. Charles Hartshorne, *Born to Sing: An Interpretation and World Survey of Bird Song* (Bloomington: Indiana University Press, 1973).
95. Linguists will recognize this observation as a generalization of the so-called "bow-

wow theory" of the origin of speech, supposed to have arisen as a consequence of onomatopoeia.

96. See further, Edward A. Armstrong, *Bird Display and Behaviour: An Introduction to the Study of Bird Psychology* (New York: Dover, 1965), pp. 209 ff.

97. This notwithstanding, there are also profound differences, since song birds possess twin sound-producing organs—one in each bronchus—whereas in man, as indeed in all mammals, there is but a single vocal source. Our understanding of the acoustical and physiological processes involved in the singing of birds is as yet very far from satisfactory. For details, see the excellent but neglected work of Crawford H. Greenewalt, *Bird Song: Acoustics and Physiology* (Washington: Smithsonian Institution Press, 1968).

98. Peter Marler and Andrew Gordon, "The Social Environment of Infant Macaques," in *Biology and Behavior: Environmental Influences,* ed. by David C. Glass (New York: Rockefeller University Press, 1968), p. 128. Cf. Nottebohm's remark that "The gap separating human vocal exploits from those of other primates is enormous." (Fernando Nottebohm, "The Origins of Vocal Learning," *The American Naturalist,* CVI [1972] p. 133). The same investigator is principally responsible for the dramatic discovery of lateralization of vocal control in several song birds, notably the canary, in the brain of which localization of vocal control was found with an overlying left hemispheric dominance (Nottebohm, Tegner M. Stokes, and Christina M. Leonard, "Central Control of Song in the Canary, *Serinus Canarius,*" *Journal of Comparative Neurology* CLXV [1976], pp. 457-86).

99. Armstrong, *Bird Song,* p. 235. Cf. also the comment of two anthropologists, cited in Roger W. Wescott, ed., *Language Origins* (Silver Springs: Linstok, 1974), p. 288, "emphasizing bird-song both as an analog to and a model for human song. . ."

100. Armstrong, *Bird Song,* p. 244.

101. Hartshorne, Chapters 2 and 3, and p. 53.

102. Hall-Craggs, pp. 311 ff.

103. Armstrong, *Bird Song,* p. 244.

104. Jürgen Reinert, "Takt- und Rhythmusunterscheidung bei Dohlen," *Zeitschrift für Tierpsychologie,* XXII (1965), pp. 223-71.

105. Keith Nelson, "Does the Holistic Study of Behavior Have a Future?" in *Perspectives in Ethology,* ed. by Paul P. G. Bateson and Peter H. Klopfer (New York: Putnam, 1973).

106. Colin Cherry, *On Human Communication: A Review, a Survey, and a Criticism* (Cambridge, Mass.: MIT Press, 1978), pp. 279-82.

107. Nelson, pp. 288-89.

108. Thorpe, *Animal Nature,* p. 205.

109. William H. Thorpe, *Duetting and Antiphonal Song in Birds: Its Extent and Significance. Behaviour* (Monograph Supplement 18) (Leiden: Brill, 1972).

110. W. John Smith, *The Behavior of Communicating: An Ethological Approach* (Cambridge, Mass.: Harvard University Press, 1977), p. 56.

111. Hubert Frings and Mabel Frings, *Animal Communication* (Norman: University of Oklahoma Press, 1977), p. 79.

112. Charles Darwin, *The Descent of Man* (London: John Murray, 1901 [1874]), p. 434.

113. Charles W. Greene, "Physiological Reactions and Structure of the Vocal Apparatus of the California Singing Fish," *American Journal of Physiology,* LXX (1924), pp. 496-99.

114. Frings and Frings, p. 179.

115. Roger S. Payne and Scott McVay, "Songs of the Humpback Whales," *Science,* CLXXIII (1971), pp. 587-97.

116. Payne and McVay, p. 587.

117. Payne and McVay, p. 597.

118. Martin Moynihan, "Communication in the Titi Monkey, Callicebus," *Journal of Zoology,* CL (1966), p. 119.

119. Marler and Tenaza in Sebeok, *How Animals Communicate,* p. 970.

120. William T. Blanford, *The Fauna of British India: Mammalia* (London: Taylor and Francis, 1888-1891), p. 7.

121. Marler and Tenaza, pp. 1001-09.

122. Marler and Tenaza, p. 1008.

123. Marler and Tenaza, p. 1029.

124. From Paul Slud, "The Song and Dance of the Long-Tailed Manakin, *Chiroxiphia Linearis,*" *The Auk: A Quarterly Journal of Ornithology,* LXXIV (1957), p. 333.

125. Slud, pp. 333-39.

126. von Frisch, *Animal Architecture,* p. 244.

127. von Frisch, *Animal Architecture,* pp. 243-44.
128. Marshall, *Bower-Birds,* pp. 185-86.
129. J. B. S. Haldane, "The Argument from Animals to Men: An Examination of Its Validity for Anthropology," *The Journal of the Royal Anthropological Institute of Great Britain and Ireland,* LXXXVI, 2 (1965), p. 11.
130. So already in Romanes, *Darwin,* p. 410: "All cases where beauty can be pointed to in organic nature are seemingly due . . . to utility."
131. Jenkins, *Art,* p. 130.
132. Lev Semenovich Vygotsky, *The Psychology of Art* (Cambridge, Mass.: MIT Press, 1971), p. 246.
133. Sebeok, *The Sign,* Chapter 10.
134. In Brothwell, *Beyond Aesthetics,* p. 8.
135. In Brothwell, Chapter 2.
136. Gerti Dücker, "Spontane Bevorzügung arteigener Farben bei Vögeln," *Zeitschrift für Tierpsychologie,* XX (1963), pp. 43-65.
137. Schiller, "Figural Preferences," published posthumously, reported by K. S. Lashley.
138. Morris, *Biology of Art.*
139. Bourne, *Ape People,* p. 222; Rensch, "Basic Aesthetic Principles," p. 339.
140. Morris, p. 25; Bourne, p. 224.
141. From Morris, p. 27. The animal paintings at Lascaux, Altamira, and other famous decorated caves of the Upper Paleolithic (c. 35,000 to 10,000 B.C.) do not seem to me directly related to the issues discussed here. The prehistoric art forms of the last Ice Age—which, it is now known, include remarkably life-like engraved "portraits" of men and women, as well as elaborate musical instruments, such as a percussion orchestra of six pieces and the six-stop flutes excavated one at a Ukrainian site and another, dating from the same period, in France—are far too sophisticated to be productively compared with ape art.
142. Morris, pp. 144 ff.
143. Jenkins, *Art,* pp. 126-27.
144. Morris, pp. 144 ff.
145. Morris, p. 146.
146. Eugene S. Ferguson in "The Mind's Eye: Nonverbal Thought in Technology," *Science,* CXCVII (1977), pp. 827-36, has recently documented convincingly that much of the creative thought of the designers of our technology is nonverbal, nor is it easily reducible to words. The importance of his article lies in the fact that the origins of this component of technology lie not in science but in art. David McNeill, "Sentence Structure in Chimpanzee Communication," in *The Growth of Competence,* ed. by Kevin Connolly and Jerome Bruner (New York: Academic Press, 1973), p. 91, has cogently remarked that even if free-ranging chimpanzees had indeed evolved a capacity for language-like communication, "we should not expect it to resemble human language. . . ." This view accords with the opinion of Sherwood L. Washburn, "Human Behavior and the Behavior of Other Animals," *American Psychologist,* XXXIII (1978), p. 410, about apes in general, that "the structure of their natural communications will be like that of monkeys."
147. Popper and Eccles, p. 328.
148. Popper and Eccles, p. 251.
149. Morris, p. 161.
150. Brothwell, *Beyond Aesthetics,* pp. 32-40.
151. Nicholas K. Humphrey, "Colour and Brightness Preferences in Monkeys," *Nature,* CCXXIX (1971), pp. 615-17; and, "Interest and Pleasure: Two Determinants of a Monkey's Visual Preference," *Perception,* I (1972), pp. 395-416.
152. Brothwell, p. 27.
153. Brothwell, p. 39.
154. Nicholas K. Humphrey, "The Illusion of Beauty," *Perception,* II (1973), p. 430.
155. Humphrey, p. 432.
156. René Thom, *Structural Stability and Morphogenesis: An Outline of a General Theory of Models* (Reading: W. A. Benjamin, 1975), p. 316.
157. D'Arcy Wentworth Thompson, *On Growth and Form* (Cambridge: Cambridge University Press, 1945).
158. Thorpe, *Animal Nature,* p. 302; Thom, *Structural Stability,* p. 8.
159. In Matejka and Titunik, *Semiotics of Art,* p. 18.
160. Roman Jakobson, *Selected Writings II: Word and Language* (The Hague: Mouton, 1971), p. 703.

161. Richard Dawkins, *The Selfish Gene* (New York: Oxford University Press, 1978), pp. 21, 25.
162. Klopfer, "Sensory Physiology," p. 400.
163. Peter H. Klopfer, *Habitats and Territories: A Study of the Use of Space by Animals* (New York: Basic Books, 1969), pp. 57-58.
164. Thomas A. Sebeok, *Perspectives in Zoosemiotics* (The Hague: Mouton, 1972), p. 85.
165. Marcus Vitruvius Pollio, *The Architecture of Marcus Vitruvius Pollio, in Ten Books,* trans. by Joseph Gwilt (London: Priestly and Weale, 1826), p. 3.
166. I have previously alluded to these issues, and some of their implications, in Sebeok, *Contributions,* p. 35 (fn. 65), and 127, discriminating sharply between subjective and objective varieties of teleology. I was therefore surprised that several reviewers of my book, notably V. V. Martynov, "Review of Sebeok, *Contributions,*" *Literatury i iazyka,* XXXVII/2 (1978), p. 178, took exception to my strictures, introducing, in the process, several levels of confusion into the argument. Martynov also regrets that I failed to cite the well-known book by Russell L. Ackoff and Fred E. Emery, *On Purposeful Systems* (Chicago: Aldine-Atherton, 1972), who devote their Chs. 10 and 11 to semiotics, but they simply rehearse notions already dealt with much better in various writings of Charles Morris. Matters of artistic intent are obviously pertinent to the subjects dealt with here, but space precludes the possibility of their detailed consideration. Concisely put, in my view, intention had best be regarded as a convention, and the intent of any sign simply its use.
167. Hannah Arendt, *The Human Condition* (Chicago: University of Chicago Press, 1958), pp. 136, 139.
168. Arendt, p. 139.
169. Arendt, p. 173.
170. Karl Marx, *Das Kapital. Marx-Engels Gesamtausgabe,* Part II (Zurich: Ring-Vlg., 1933), III, p. 698.
171. Arendt, p. 157.
172. Sebeok, *The Sign,* Chapter 1.
173. von Frisch, *Animal Architecture.*
174. Perhaps this obvious translation was avoided because it would have echoed the title of another book, *Master Builders of the Animal World,* published at about the same time: David M. Hancocks, *Master Builders of the Animal World* (New York: Harper & Row, 1973). The author of this book is an architect.
175. von Frisch, *Animal Architecture,* p. 22. For a first approach to a semiotic typology of organismal vs. artifactual human and animal sign systems, see Sebeok, *Contributions,* pp. 30, 32. For further references to the use of tools by birds, see Thony B. Jones and Alan C. Kamil, "Tool-Making and Tool-Using in the Northern Blue Jay," *Science,* CLXXX (1973), pp. 1076-78. George M. Guilmet, "The Evolution of Tool-Using and Tool-Making Behaviour," *Man,* XII (1977), pp. 33-47, is concerned with reconstructing the behavioral context which coevolved with tool-using and tool-making in the hominid lineage. He argues that the method of socialization practiced by a tool-making group would affect the degree of formal standardization presented by the tools themselves.
176. Jones and Kamil, "Tool-Making."
177. Thomas Eisner, Karen Hicks, Maria Eisner, and Douglas S. Robson, "'Wolf-in-Sheep's-Clothing' Strategy of a Predatious Insect Larva," *Science,* CXCIX (1978), pp. 790-94.
178. von Frisch, *Animal Architecture,* pp. 72-150.
179. Joan H. Fellers and Gary M. Fellers, "Tool Use in a Social Insect and Its Implications for Competitive Interactions," *Science,* CXCII (1976), pp. 70-72.
180. Sebeok, *The Sign,* Chapter 2.
181. Sebeok, *Contributions,* p. 30.
182. von Frisch, *Animal Architecture,* pp. 244-45.
183. Lewis H. Morgan, *The American Beaver and His Works* (New York: Burt Franklin, 1970 [1868]), p. 101.
184. Lars Wilsson, *My Beaver Colony* (London: Souvenir, 1969), p. 1.
185. von Frisch, *Animal Architecture,* p. 278.
186. Morgan, p. 99.
187. Köhler, *Apes,* especially Chapter V, on "Building."
188. Köhler, pp. 161, 163-64.
189. von Frisch, *Animal Architecture,* p. 286.
190. Jacob Bronowski, *A Sense of the Future: Essays in Natural Philosophy* (Cambridge, Mass.: MIT Press, 1977), p. 112. Cf. Sebeok, *Contributions,* p. 119.

191. Sebeok, *The Sign,* Chapter 6.
192. Sebeok, *The Sign,* Chapters 4 and 5. See now Thomas A. Sebeok and Jean Umiker-Sebeok, *Speaking of Apes* (New York: Plenum Publishing Corporation, 1980), esp. Ch. 1, "Questioning Apes," where this and related issues are discussed in detail.
193. Griffin, *Animal Awareness.*
194. William M. Conway, *Literary Remains of Albrecht Dürer* (New York: Cambridge University Press, 1889), p. 182.
195. Humphry House and Graham Storey, *The Journals and Papers of Gerard Manley Hopkins* (London: Oxford University Press, 1959), pp. 86-114.
196. House and Storey, p. 84. For an elaboration and application of Hopkins' path-breaking studies to grammatical parallelism by a modern master, see Roman Jakobson, "Grammatical Parallelism and its Russian Facet," *Language,* XLII (1966), pp. 399-429.
197. Nicholas K. Humphrey, "The Illusion of Beauty," *Perception,* II (1973), p. 432.
198. Humphrey, p. 433.
199. Robert C. Dunnell, *Systematics in Prehistory* (New York: The Free Press, 1971), pp. 44-45.
200. Ralph Bulmer, "Which Came First, the Chicken or the Egg-Head?" in *Echanges et Communications,* II, ed. Jean Pouillon and Pierre Maranda (The Hague: Mouton, 1970), p. 1082.
201. Sebeok, *Contributions,* pp. 138-40.
202. Heini Hediger, "Proper Names in the Animal Kingdom," *Experientia,* XXXII (1976), p. 1357. On the notion of the "Semiotic Self," see Sebeok, *The Sign,* Appendix I.
203. Humphrey, "Illusion," pp. 435-36.
204. Marshall, *Bower-Birds,* p. 92.
205. Cf. Fig. 3, in Brothwell, *Beyond Aesthetics,* p. 21.
206. Jan Mukařovský, "Art as Semiotic Fact," in Matejka and Titunik, *Semiotics of Art,* p. 8.