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MUTUALLY INTERPRETATIVE RELATION
BETWEEN HUMAN AND AVIAN
NATURAL HISTORY

By Professor WM. E. RITTER
UNIVERSITY OF CALIFORNIA

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MUTUALLY INTERPRETATIVE RELATION BETWEEN HUMAN AND AVIAN NATURAL HISTORY¹

By Professor WM. E. RITTER
UNIVERSITY OF CALIFORNIA

Why do I use the antiquated term natural history instead of the thoroughly modern term biology? Because I want to emphasize the truth that natural history is antiquated if being alive is antiquated, and not otherwise.

Were the word biology to be used in the original meaning of its Greek ancestor it would mean almost exactly what natural history meant as used by two of the greatest students of animate nature that have ever lived. I refer, as probably most naturalists would surmise, to Aristotle and Charles Darwin.

The meaning in common of the two terms was "way of life." With the Greeks *bios* meant the way of life, especially of men, but also of animals generally. It included birds rather specially it would appear from the famous play, "The Birds," by the great comic poet, Aristophanes. And with Aristotle natural history meant way of life of animals generally but included man rather specially, as shown by the great place man has in his "Natural History of Animals."

Now way of life is first and foremost way of acting—way of doing things. It is behaving. It is conduct. And particularly significant is the fact that this implies individual organisms, each composed of many parts so related with one another that the individual is able to act

¹ Modified from a paper read at the annual meeting of the Cooper Ornithological Club held in Berkeley on April 16, 1937. It is a sort of epitome of portions of two books by me: "The California Woodpecker and I" a study in comparative zoology (now in press); and "Nature in the Light of Science, Art, Philosophy, and Religion" (nearly ready for the press).

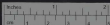
by means of its parts in such fashion as to meet its own necessities, inclinations and desires. The separateness of every individual from every other is manifest in the fact that each one must act by means of its own parts. No individual can act by the *direct* means of the parts of any other individual. No one breathes or talks by means of the lungs and mouth of somebody else.

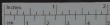
Originally and fundamentally, then, both natural history and biology meant and really always must mean the mode by which individuals act so as to continue their existence as living bodies and to continue the existence of the race or species.

Foundational therefore to all knowledge of the living world (and for that matter of all the world) are individual bodies so organized as to be alive. And, strikingly enough, among these bodies are the very ones that do the knowing! So it falls out that among the ways of life of certain of these bodies is learning and knowing the very subjects we name natural history and biology. Let us come down to the business in hand, that of men and birds.

We are all vertebrates; no room for intelligent question about that. This is only another way of saying that we are all built on the same ground plan. For this occasion it is enough to notice only two items in this plan: our two pairs of limbs and our heads.

Although the grossly obvious limbs of men and birds are extremely unlike in many anatomical points they are unmistakably alike in many other points. Hardly any thoughtful person can fail to be impressed by this two-fold truth.





So likewise as to heads. No one can avoid taking some notice of the fact that a bird has two eyes, two ears and a mouth in its head no less truly than has a man, despite the great difference in general shape and get-up of the two heads.

But what is specially to the purpose in this disquisition is comparison of the way men and birds use the parts under consideration—how the members are utilized by their possessors in their ways of life. In their typical mode of locomotion birds so far outstrip us humans in our typical mode that we never pretend to be in their class. Their way of life, in which their fore limbs play such an essential part, gives them an enormous advantage over us as judged by the same criterion. What plodders we humans are when we go a-foot, as compared with birds when they go a-wing!

But exceedingly important as is travel for both birds and humans this is far from the whole story. Both must do many other things in order to keep on living and living as they like to live. So we turn to the other anatomical member under consideration, the head, and reflect a bit on the use birds and men make of this member in their respective ways of life.

Perfectly obvious, is it not, that both use it to several common ends? For instance, the fact that in both the mouth is in the head makes it inevitable that the head should be extensively utilized by both for eating, to say nothing of other activities involved in the nutritional business. Then there is the utilization of the mouth by both in the production of sound—of vocalization. The importance of this to both, but especially to humans, far surpasses, from one point of view, its importance in eating and breathing. Reflect, also, on the extent to which both manipulate their eyes in seeing by means of the head-neck combination. Herein birds are specially expert in several respects.

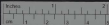
Now comes a matter that, although it has received much attention from some

directions, has never, so far as I know, received enough or of the right kind from any direction. I refer to the principle of correlation among the parts of an individual animal. While the principle applies to almost if not quite all the myriad parts (including the cells) it is specially obvious and important as between the head and the fore limbs of the higher vertebrates—the very parts that force themselves upon our attention in this study. Surely no one needs reminding of the way a bird uses its head and wings cooperatively—except, perhaps, as a reminder of how much more extensive and nice the cooperation is than in cursory notice one takes account of.

As for the way a human uses his head and fore limbs cooperatively—well, let anyone keep a record of all his movements for a busy day and see what fraction of them falls into the class of head and arm-hands cooperation. No one could fail to be impressed by such a study—if he never was before—with the extent to which not only his way of life but his life itself are dependent on this combination of these anatomical parts, and on his activities by means of them.

Indeed so obvious are the ways of life of us humans dependent upon the cooperation and coordination of these members, especially if any skilled hand work is involved, that we take it as a matter of course and pay little or no attention to this portion—the strictly psychobiological principles involved.

But there are other vital principles involved that are far from obvious to common experience, and so enter very little or not at all into conscious knowing and thinking by the vast majority of persons. I refer to the great question of how we mortals and birds come to be the possessors of parts so remarkably related to and cooperative with one another. The question divides into two distinct portions. One portion is that of how the relation comes to pass in the development of the individual—human, bird, lizard,



frog, fish or any other member of the vertebrate phylum. The intricate sciences of embryology and genetics struggle with this portion of the question and have gained much information concerning it. What is more, they have secured a good deal of real understanding in connection with it.

The other part of the question is that of how the individuals not merely as such, but as members of races, come to have parts thus correlated and cooperative. Paleontology is the chief science which gathers specially relevant facts for the struggle with this question.

An enormous accumulation of facts of both anatomy and physiology enables students to conclude that the coordinateness and cooperativeness of the parts of an animal must be in its nature at the various stages of its individual development and of its racial development, as well as in its nature as shown in those activities that make the individual alive or living.

Observations on the anatomy and physiology of animals now living and observations on the anatomy of animals long since dead, both individually and racially, and reasoning on all the sense data in accordance with Aristotle's principle of complete reality (*entelecheia*)² seem to compel us to conclude that just as we must, and in practice actually do, accept the living individual animal (especially our consciously knowing individual selves) as a whole at any particular moment, so we must accept the individual as a whole (a complete reality) throughout all the moments of its life. A particular bird is as truly a living reality at the moment of hatching, say, as at any other time during its life, including the moment just before the depredator's fatal wound or the hunter's fatal shot. So likewise as to a particular human. Its real aliveness is not limitable to any single moment for the sufficient reason that it is involved in the

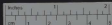
² W. D. Ross, "Aristotle's *Selections*," Glenside, 1927.

aliveness of a great host of parts having different rates of vital action. For example, the rate of "flow" of a nerve current is very different from that of the blood current, yet both are essential to the vital existence of a bird or a man. That the sciences of living nature are being driven to such a conception under the designation of organicism, is, I think, beyond doubt.

Although racial development (evolution of the most usual meaning to-day) is somewhat more difficult to interpret from this standpoint, it must, I am quite sure, be so interpreted. Thinking about evolution always presupposes a racial line, or line of descent. Nor is there anything known to science for such a line to be composed of except individual organisms, capable of maintaining themselves in the living state and of propagating their kind. Mr. Darwin's constantly invoked idea of "descent with modification" and the French evolutionists' idea of transformation are meaningless generalities as applied to living nature as a whole, except as they envisage uncountable millions of individuals composing the ancestral line of each and every individual now living. And not only that: every one of these ancestral individuals must be envisaged as composed of many parts essential to their individual existence and through which modification and transformations new kinds of individuals have been produced.

Every individual in the ancestral line of any kind of modern birds (of my woodpeckers, for example) in its long course back to its presumed reptilian ancestors must be imagined as possessing two pairs of limbs and a head modifiable in the direction of those actually possessed by the birds of to-day.

So far this imaginary picture contains little beyond what the orthodox evolutionary picture contains, but now comes a point that the orthodox picture does not contain in any truly kinetic sense: every one of those ancestors must have



depended for its aliveness upon using its limbs and head cooperatively no less than does its descendants of to-day. One of the major implications of this brings the principle of correlation of parts into the racial life to correspond with its application in the individual life. For another thing, it implies that as to parts in which the correlation is most vital for the existence of the individual the existence of each part so related is dependent on the existence of its correlate. It implies that the bird's head as such would not exist except for the existence of the bird's limbs as such. Since in the case of birds the mode of locomotion is the most definitive quality in their way of life, we are bound by the logic of the general problem to consider with special care the body parts most concerned, not only as to the structure and function of the parts in birds of to-day, but as to the modifications and transformations that have taken place in the ancestral line to produce these parts. Despite the enormous mass of observational evidence now available from anatomy, physiology and biochemistry, that it is in the very nature of a living body to consist of mutually dependent, interacting parts, when the question of how the body comes to be thus composed, very many moderns (seemingly most analytic students, particularly if their specialty happens to be genetics) are in much the intellectual state on this matter as was old Empedocles. For him, recall, the parts of a living body come together "not all at once, but coming together at their pleasure, one from this quarter, one from that."² While it is true that, so far as I know, no modern biologist regards, as did the ancient Greek, love as the "center of the whirl," the question of what brings the parts together is less important than the supposition that originally they were independent—some in one quarter, some from another. An organizer or a psychoid, for

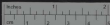
² Charles M. Bakewell, "Source Book in Ancient Philosophy," p. 43, 1907.

example, may appear to some more scientific than "love" as an agent for doing the trick. But really if one's curiosity goads him to inquire about the intrinsic nature and the origin of the agent, I fail to see much if any advantage of these modern over the ancient explanations.

While it has sufficed for our discussion thus far to speak of the head and the limbs as the correlated parts, we must now be more specific, more analytic. No one will hesitate as to what some of the most important specifications must be. The muscular and neural parts of the structure involved must certainly be noticed. So far as concerns the head the brain is a crucial sub-part. Even "brain" is too general if one is eager to understand the ways of life of birds or any other vertebrate animals; the cerebral part of the brain must come into special reckoning. I am here assuming that along with my reader's familiarity with the wonderful activities of birds in breeding, nest building, incubating, caring for the young; also with their abilities in meeting their necessities for food and other things, there is connected some knowledge of the dependence of these activities on the anatomical and biopsychical nature of individual birds; and that in this nature the brain is of foremost importance.

The knowledge we now possess of the dependence of avian ways of life on the use birds make of their body parts acting cooperatively and our knowledge of the racial history of birds and their parts lead us to expect that many of the parts would be a sort of anatomical record of that history. Considering the great dominance of locomotion in their activities, we ought to expect that the record suggested would be especially distinct in the brain and the fore limbs, these being the parts most directly involved in locomotion.

Recurring to the other member, humans, of our comparative duet, we are justified by all the best established knowl-



edge of living things in presuming that the general principles relied upon in interpreting birds will hold for interpreting humans. These principles are: The unity of ground plan of birds and humans, making them namable as vertebrates; the dependence of each individual existence and way of life on its ability to use its parts in cooperative action so as to assure its own existence and enable it to produce other individuals like itself; the existence of racial or ancestral lines composed of myriads of individuals, the existence of each of which must have depended on its parts in like fashion with the dependence of its living descendants; and finally the modifiability by natural causes of individuals to produce new kinds of individuals.

Let us put now a typical bird (one of my woodpeckers, for example) and a typical human (my humble self, for example) alongside each other to make the comparison unqualifiedly concrete. The woodpecker's wings and my arms and hands may receive first attention, since "way of life" of each of us is foremost in interest. Nothing either of us can do with our heads can be so momentarily striking as the bird's winged dart into the air after flying insects or in play; and the arm-swinging of my morning gymnastics. But no spectator of our performances could be oblivious of the fact that our brains are concerned in what he may see us doing, despite the exceeding inconspicuousness of brain action. How unfortunate that the activities that go on in the brain and nerves of an acorn-harvesting-and-storing California woodpecker, and an acorn-harvesting-and-storing California Indian woman, can not be thrown on the screen side-by-side with the activities of wings and arms-hands of the performers! We must depend on the neurologists and physiologists for the brain-nerve portion of this comparison. By dint of great labors they have made much knowledge available for our enterprise. Note the results as

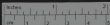
applied to these two performers: While the woodpecker can beat the Indian all hollow at gathering acorns from the trees, the Indian can beat the woodpecker still more at storing them and utilizing them for food.

The reason for this is perfectly obvious so far as the fore limbs are concerned: The birds can reach the acorns with the greatest ease even on the tops of the tallest oaks, or from oaks in the most inaccessible places—for ground travel. But they must make a separate trip, forth-and-back, for every nut, their fore limbs being entirely excluded from direct participation in the business. No collecting basket or bag here—only the mouth for picking and carrying, even this being of only one nut capacity!

And as to storing—well, that these woodpeckers do a remarkable job is widely recognized, but it is remarkable only as a bird job—not as a human job. For even the Indians often construct a storage place for the nuts that, simple as it is, requires more varied and complex activity and is, on the whole, much more efficacious than the sort of storage place made by the woodpeckers. Furthermore, the Indians subject the acorns to various quite elaborate processes in preparing them for eating, of which the woodpeckers do nothing whatever and about which they know nothing.

In connection with the fore-limbs aspect of the comparison, it is obvious that an extensive set of activities involved in the Indian way of life with respect to the nutritive function is performed by means of these limbs, modified into arms-hands, that is, organs for grasping and holding. This set of activities is wholly absent from the woodpecker's way of life, due to the fact that these members have been modified into wings, organs for grasping and exceedingly efficient way of travel.

Considering the difference in the avian and human brains that should correspond (according to the principle of correlation of parts) with the different uses the two



kinds of creatures make of their fore limbs, let us first notice what the comparative anatomy of the two brains shows. It is a commonplace of the anatomy and embryology of vertebrates that the brain presents a ground plan quite as clearly recognizable as is the ground plan of the backbone, the eyes or of the blood-circulating system.

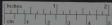
Embryology makes clear the beginning of the brain by modification of the front end of what becomes the spinal cord into three enlargements known as primary vesicles. By extensive growth and modification of these vesicles all the variously sized and shaped brains of the many classes and orders of vertebrates come into existence. Although the modifications in each of these vesicles are extensive they are much greater in the first, counting from before backward, than in the other two. While the parts of the adult brain derived from the second and third vesicles are present in all vertebrates, from fishes to humans, certain parts derived from the first vesicle are almost wholly lacking in fishes as less evolved members of the branch; while other parts derived from this vesicle are present in great size and elaboration in the more evolved members.

On the basis of these anatomical and developmental facts investigators have adopted the terms "old brain" and "new brain." These terms are expressive and quite justified, provided one never forgets that they refer to two parts of one and the same brain and not to two distinct brains.

What this nomenclature means is that while all vertebrates from the evolutionally oldest (fishes) to the evolutionally youngest (humans) possess the oldest portion of the brain, only the evolutionally youngest possess the new brain in its largest, most highly elaborated form. The cerebrum, which constitutes by far the chief mass of the human brain, hardly exists in fishes. If even its beginning is present here it is so small and indistinct as to be hardly recognizable.

Now for the bearing of all this on the comparison of the human and the avian brains: While in both the cerebrum is unmistakably present, in the human brain the cerebrum, with the cerebral cortex, is enormously larger in proportion to the entire brain than it is in the avian brain. I know of no serious effort to determine the quantitative relation between old brain and new in either men or birds. Mere inspectional estimates made by several persons on the basis of published figures agree on about twenty (old) to eighty (new) for the human, and ninety (old) to ten (new) for the avian. From all that is now known about the neuro-muscular system (anatomical) and the sensory-motor system (functional) it would seem beyond question that the striking differences between human and avian brains are correlated with the most striking differences between the two groups in their ways of life. No doubt many other body parts are involved in the correlation, but these parts must be preeminent in the involvement. Accordingly, we may say the great dominance of new brain over old brain in humans may be viewed as a sort of anatomical record of the great dominance of the activities humans perform by means of their fore limbs in operating on the external world; and of the highly complex activities they perform by means of their mouths and other vocal organs for communicating with the animate world, especially the human portion of it. Contrariwise, the great dominance of old brain over new brain in birds may be viewed as such a record of the great dominance of the activities birds perform by their fore limbs in moving from place to place and of the relatively simple activities they perform by means of their mouths and vocal organs for purposes of communication.

It will be remembered that our comparative illustration called attention to the great advantage (on the whole) the Indians have over the woodpeckers in utilizing acorns for food; and that in the



main this advantage is in the fact that the Indian's hands are utilizable for the purpose, while the bird's wings are not at all so utilizable—*directly*. No reference was then made to the fact that the structural-functional conditions on the basis of which hands are utilizable in the acorn business makes them utilizable in hundreds of other businesses. It is doubtful if any single item in the entire way of life of animals has been a more potent determiner of a group's status in the whole animal world than the utilizability of the human fore limbs, especially the hands, for hundreds, even thousands of different purposes. Recur again to the Indian woman in the acorn business, as the first in a comparative series. While she is manipulating (note the relation of the word to *essava*, the hand) the acorns, another woman of some other tribe may be weaving baskets, while still another is weaving rugs, another decorating a papoose carrier with beads, and so on. Simultaneously an Indian man somewhere may be chipping a piece of flint for an arrowhead; another somewhere else may be pulling his bow string to speed his arrow at his prospective victim; another may be fashioning a bit of copper or silver into a finger ring, while yet another may be making a flute from a long bone of some large bird.

No one can follow such a lead, taking Charles Darwin's attitude toward natural history and the origin of man, and fail to enter finally the whole world of industrial and fine arts.

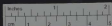
Then there is the other aspect of the same great scene—the aspect that exists in virtue of the utilization of the human mouth and vocal organs in producing language. That speaking as men do speak is no less certainly dependent on neuro-muscular activity than is weaving, writing and piano playing, no informed modern doubts. So it comes to pass that the way of life of the human species taken in its complete reality shows us still another unbroken series typified by the

Indian mother's simple speaking to her infant, through the measurably complex tribal chant, on to the oratory of a Demosthenes or a Pitt; or to the opera singing of a Schumann-Heink.

The scene is not yet complete even in outline, for it does not contain a hint of the remarkable interlocking of the arms-hands series and the vocal organs series. Starting with the Indians again, notice scene specially gifted individual manipulating a crudely fashioned paint brush to mark some rock with characters that stand for or symbolize objects and acts long and well known and talked about by him and his kindred. The lead thus presented brings us finally to such productions as Plato's "Republic," Mommensen's "Roman History" or Shakespeare's "Hamlet." Here is presented also a way of life, a mode of activity, that illustrates a functional correlation of parts in the case of head-and-hands that is peculiarly significant. The reference is to mathematics. We read: "Mathematics is a game played according to certain simple rules with meaningless marks on paper." This definition is, according to Bell, by David Hilbert, said to be regarded as the foremost living mathematician.

While such a conception may seem to some persons a "drastic deflation of mathematical truth" (Bell), to a naturalist it appears to bring the activities involved into line with the conception of natural history as one of man's most highly specialized and important ways of life. Would any cultivator of "pure mathematics" contend that the reasoning involved might be carried even theoretically by the mind without marks of any sort or anywhere either on paper or on the tablets of his imagination? Hand activity seems to be as indispensable to mathematics as is brain and mind activity; and the higher, more involved and recondite the reasoning involved, i.e., the more elaborate the equations or other

* E. T. Bell, "The Queen of the Sciences," p. 21, 1931.



language employed, the more indispensable the hand activities, for the more difficult it becomes to carry the language in the mind exclusively. This probably explains the fact that a professedly idealistic philosopher or "thinker" banks more on the pure reason theory of mathematics than does a working mathematician himself.

Once the idea of a living animal organism is seen to involve the coordinate idea of a whole-with-its-correlated-parts, adapted to its environment, it becomes clear that all manual activity, including every phase of scientific research, expended upon any part of the environment, is basically and organically in behalf of the welfare of the acting being and its kind. All such activity is adaptive or mal-adaptive. It affects in some way, either for good, bad or indifferent, the acting individual or its race or both.

Pure science, pure art, pure thought, pure anything in the sense of being no part of the way of life of living individuals seems to be pure fiction; that is to say, is objectively non-existent, no less for humans than for birds or any other species. The deepest responses to stimuli, impulses and acts put forth by every animal being is really for well-being—well-being of the individual *qua* individual and *qua* race or kind or species.

Returning to our concrete examples—California woodpeckers, California Indians, and my own self—the question arises: How is it that I can utilize my head and fore limbs toward knowing and understanding the others of the trio so much more extensively than either of them can or at least do?

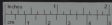
Taking the woodpeckers first, I approach the general question through a particular question: How is it that I could show the birds how to act for their own good in the acorn business much more effectively than they frequently do act, despite the fact that their good and not mine is concerned? For instance, I could easily tell—even show them—that

there is no necessity to store nuts (as they quite often do) in places where they can not possibly get them, however much they may need them, for food. Or I could easily inform the birds of the risks they run from the orchardist's shotgun, in raiding his almond orchard. This risk is the more deplorable when taken, as it often is, with an abundance of acorns easily accessible. The truth is I am really disturbed over this conduct of theirs. I would go to considerable trouble to warn the birds if they could understand me and would heed my warning.

A noteworthy point about these and other kinds of unfortunate or maladaptive performances by the birds is that their inability to handle the nuts with their wings is not involved. So far as their "baking" (instead of "handling") the nuts is concerned they could do the right or safe thing as well as the wrong and dangerous thing.

The long and short of the matter is that the beggarly development of the new brain proportionately to the rest of the brain in woodpeckers as in all other birds is a dreadful handicap to them when situations are met that call for choice and decision as between particular acts and ends. Any hole in wood about the size of an acorn seems to look to these woodpeckers like a proper receptacle for a nut, no question being raised as to where the hole may lead from the standpoint of the recovery of the nut at some future time. The brain-mind endowment of the birds is sufficient to make them aware that acorns will contribute to their later as well as to their present state of existence. But it is not sufficient to make them aware of many of the conditions upon which the later availability of the nuts depends. Turn now to the Indians.

So far as recognizing the substantive quality of the acorns is concerned, these humans would not appear to differ greatly in brain-mind endowment, just as they do not differ in digestive and assimilative endowment, from the woodpeckers.



Both obviously trust implicitly, on the strength of much experience, in the sustentative quality of the nuts. Undoubtedly the fact that the birds eat the nuts with no sort of culinary preparation, while the Indians put them through quite elaborate preparation, has some mental influence. But that the vital nutritive and biochemical significance is fundamentally alike for both, is undoubted. When it comes to the conditions upon which the later availability of the nuts depends, the difference between the two groups is enormous—as shown, for one thing, by what the Indians do in storing the nuts with reference to assuring their later availability, and to preparing them as food. In the first place they would never deliberately put their acorns in places entirely inaccessible to them—as we have noted the birds do rather often.

Then the bins, or granaries constructed of sticks, brush, grass, etc., by some of the Indian tribes for storing, simple and crude though they are, are truly designed to keep the stores dry and in some measure safe from predatory animals.

All this involves correlated brain-hand activity of no mean order. The equipment required for much of the action involved is such as to make it available for many other kinds of action to many other ends.

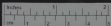
We may now turn to the previous question about my humble self and my ability to instruct the birds how to improve their work to their advantage, even though my work and my advantage were not involved—at least in any direct way. Again how is it that I could instruct the Indians on ways of improving their work of harvesting and storing acorns and of using them for food even though my own food needs were not at all involved? How is it that I cogitate for hours over this general problem and try hard and long to write about it in a fashion that will help to clarify my own cogitation and that of others should they be interested in such matters and happen to read what I write?

The question about helping the Indians in the various aspects of their acorn business can be partially answered with ease. Whatever is at my command but not at theirs through the industrial arts, invention, scientific discovery, and so on, is unquestionably first and foremost of head-and-hand activities that were at their command originally but have since developed in our civilization far beyond their original status. Whatever improved methods of harvesting, building, dish-making, grinding, cooking and food-serving I and my fellow immigrants could teach the native residents, these were unquestionably potential in their own simple and crude harvesting, storage-places constructing, basket-weaving, mortar-making, water-using, fire-starting and using, spoon-making and feeding. Such unquestionable potentiality is proved by the fact that once shown how to do these things, moderately, the Indians do them sometimes quite as well, sometimes not quite as well, but sometimes rather better than we highly cultured newcomers can do them.

In other words, the question that now confronts me is: How is it that I am so vastly better off in my way of life as to food than are either the California woodpeckers or the California Indians?

As for the woodpeckers the answer is, as this whole presentation makes clear, because my sensori-motor equipment, represented especially by my brain-hands combination, is so vastly better fitted than is that of the birds for dealing with the general food problem.

But when it comes to the portions of the question about the Indians not included in the easy answer as above indicated, serious difficulties loom up. These may be more sharply stated as follows: How is it that although my sensori-motor equipment, also represented especially by my brain-hands combination, is little if any superior to that possessed by the Indians, nevertheless I (with my cultured group) actually do surpass the



Indians enormously in dealing with the food problem.

The size of the debt we humans to-day owe our ancestors in the earliest stages of human evolution is measurable only with reference to our valuation of our own lives at our present evolutionary level, physical and cultural. For included in that debt is not merely the basic stages and elements of our culture, but the basic stages and elements of our sensori-motor equipment for performing the activities on which our cultural evolution depends.

Not many aspects of the problem of mankind are found to surpass in importance and difficulty that here indicated, once serious effort is made to deal with the complete reality of *Homo sapiens* in accordance with the Darwinian principle of descent with modification (evolution). As might be expected, anthropologists seem to have felt the problem with special concreteness. One of them has expressed it in striking epigrammatic fashion: . . . "even now nobody knows whether man's brain is so large because he is so intelligent or whether he is so intelligent because his brain is so large."⁵

One cardinal aim of this article is to show that we moderns are not, or need not be, so much in the dark on this matter as such utterances indicate. If "intelligent" in such a context be viewed as a descriptive term for a quality of an individual, which quality depends on the functioning of its parts, then such an antithesis as that implied by the epigram does not exist. The sentence is really meaningless. Neither in biotic metabolism nor logic can an organ or its function exist, strictly speaking, the one before the other.

That such a view of "intelligent" is implied by this entire discussion of mine can, I trust, not be missed by any reader. According to my view for an individual animal, a woodpecker, an Indian or myself, for example, to be intelligent is to

⁵ E. A. Hooten, "Up from the Ape," p. 141, 1935.

use its entire sensori-motor equipment (of which the brain-hand combination is of first importance) so as to secure its continued existence and that in the highest measure possible for the individual itself and as a member of its species and, generally, for its particular group.

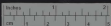
By approaching the whole vast subject from the side of natural history as Mr. Darwin conceived natural history, and from the view-point of the organismal conception as it is being developed in present-day zoology especially, it is possible, I believe, to go a long way toward solving the puzzle.

On the basis of the fundamental truth contained in the maxim "self-preservation is the first law of life" it is now recognizable that awareness by an individual animal of the advantage of avoiding particular acts that might result in its own death or serious injury, is the initial step toward modifying the kind of selection called natural by Darwin into what is familiar to almost everybody as conscious, rational or (in Darwinian terminology) artificial selection. Artificial selection may be called natural selection raised to the *n*th degree of effectiveness.

Another expression for much the same thing is possible by utilizing the phrase trial and error, especially familiar to zoologists: Artificial selection is nature's method of increasing success to a maximum and reducing error to a minimum, in individual activity.

In these few brazenly dogmatic sentences I have tried to cram the essence of much that is contained in the two books mentioned on the first page of this article.

Nearly central to the book entitled "Nature" is a discussion of something like 70,000 words of the problem of getting and using natural knowledge (epistemology of traditional philosophy) approached from the side of natural history and the organismal conception. The undertaking follows the lead of Mr. Darwin in his approach to the subject of the moral sense or conscience, from the



side of natural history. Still more fundamentally, it follows Darwin's lead in conceiving man as natural in every quality of his being in the same sense that he is natural in any other quality of his being.

This insight by Darwin, although only partial and dim in some of its aspects, marks him as indeed an "intellectual colossus" and places him among the very foremost persons of all time who have contributed to the carrying out of the Delphic Oracle's command, Know thyself. Whether "anthropology is the child of Darwin," as viewed by some anthropologists,⁶ I venture no opinion, not being an anthropologist myself. I do not hesitate, however, to say as a zoologist that until man could be viewed as natural in the same sense that every other zoological species is natural, no trustworthy general knowledge, much less understanding and theory, of man was possible.

So long as men (the males of the species, I mean; what I am about to say applies less to the females) consider themselves as *not* natural, i.e., as supernatural, in certain of their qualities while natural in other qualities; or consider that certain individuals among them are wholly supernatural, they are in the same boat with those "savages" and culturally backward peoples (the Hindus, for example) who regard certain sub-human animals as sacred and proper objects of worship. Here is another of the almost endlessly varied outcroppings of what seems to have been one of the earliest efforts of the human species at theorizing about its own nature, namely, the effort that has produced the familiar doctrine of "mind or soul versus body."

⁶ R. E. Marett, "Anthropology," p. 8.

One of the foremost results of the epistemological enterprise referred to is highly remedial for this tragically disintegrative conception of humans and other kinds of animals. This result depends largely on recognizing that all the most definitive qualities of humans—those powers and activities of theirs named thinking, reasoning and understanding, are inseparable (as far as all trustworthy evidence is concerned) from certain qualities manifested by all bodies known as living from bacteria to oaks and redwoods, and from amoebae to woodpeckers and my precious self.

Here, then, is what the "mutually interpretative relation between human and avian natural history" comes to as exemplified by the couplet of myself and the California woodpeckers: My wonderful superiority over them in anatomical-physiological equipment for acting for the welfare, on the whole, of myself and of my kind makes me also an illustration of the classificatory view expressed by Mr. Darwin that the quality by which the species, *Homo sapiens*, is most distinctly differentiated from all other animal species is the "moral sense or conscience."

However, this wonderful anatomical-physiological superiority of mine for acting adaptively entitles me to no such ranking in the moral realm unless I use the equipment in accordance with its own nature, namely, that of acting for my own welfare and that of my kind to the fullest extent possible in every situation in which I act consciously at all.

Exceedingly greater personal responsibility for my own acts as compared with that of any bird for its acts may be comprehendimized as the sum and substance of this essay.