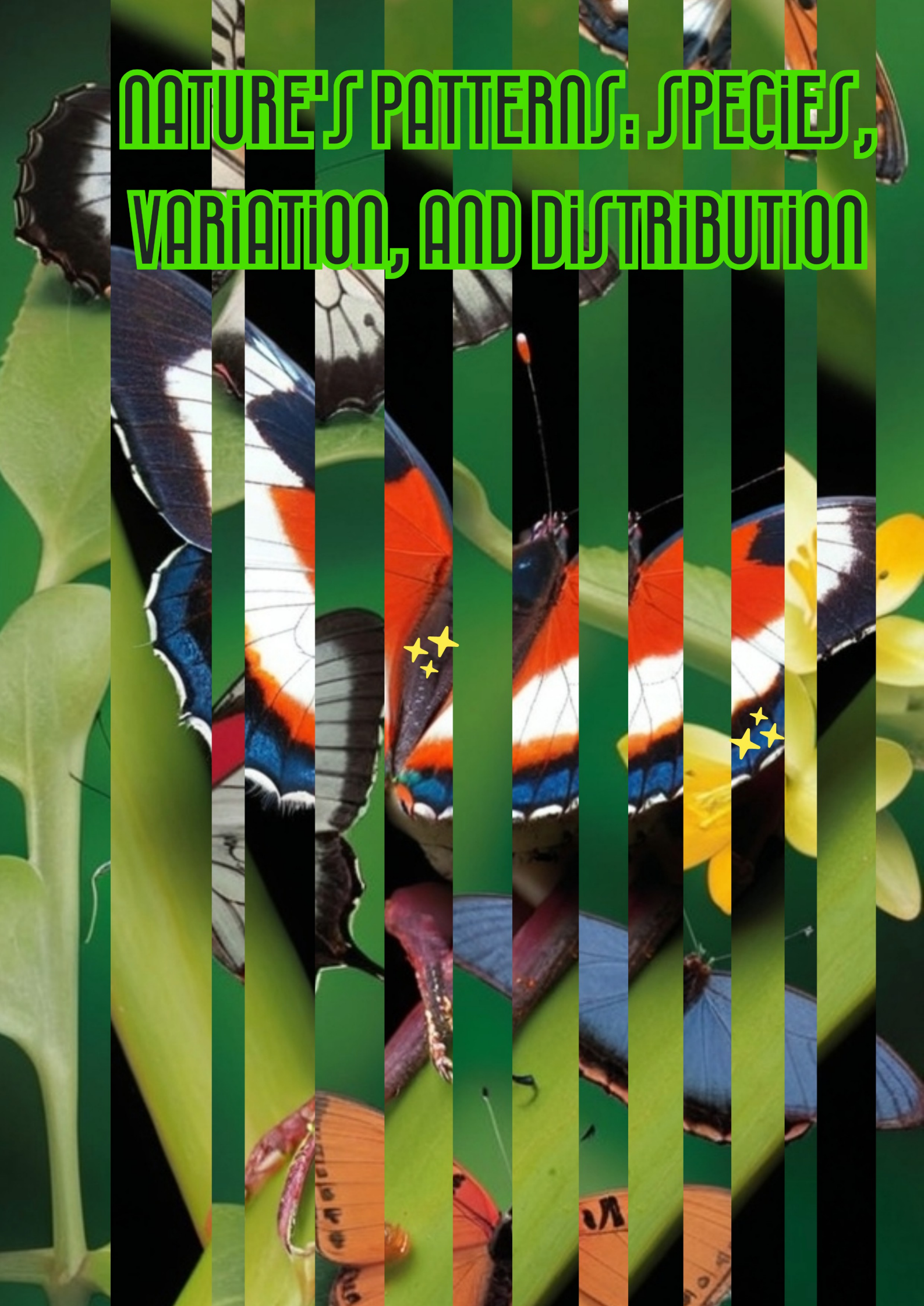
NATURE'S PATTERNS: SPECIES, VARIATION, AND DISTRIBUTION

The nature of species, the laws of variation, the mysterious influence of locality on both form and colour, the phenomena of dimorphism and of mimicry, the modifying influence of sex, the general laws of geographical distribution, and the interpretation of past changes of the earth's surface, have all been more or less fully illustrated by the very limited group of the Malayan Papilionidæ; while, at the same time, the deductions drawn therefrom have been shown to be supported by analogous facts, occurring in other and often widely- separated groups of animals. The most perfect and most striking examples of what is termed instinct, those in which reason or observation appear to have the least influence, and which seem to imply the possession of faculties farthest removed from our own, are to be found among insects. The marvellous constructive powers of bees and wasps, the social economy of ants, the careful provision for the safety of a progeny they are never to see manifested by many beetles and flies, and the curious preparations for the pupa state by the larvæ of butterflies and moths, are typical examples of this faculty, and are supposed to be conclusive as to the existence of some power or intelligence, very different from that which we derive from our senses or from our reason. How Instinct may be best Studied. Whatever we may define instinct to be, it is evidently some form of mental manifestation, and as we can only judge of mind by the analogy of our own mental functions and by observation of the results of mental action in other men and in animals, it is incumbent on us, first, to study and endeavour to comprehend the minds of infants, of savage men, and of animals not very far removed from ourselves, before we pronounce positively as to the nature of the mental operations in creatures so radically different from us as insects. We have not yet even been able to ascertain what are the senses they possess, or what relation their powers of seeing, hearing, and feeling have to ours. Their sight may far exceed ours both in delicacy and in range, and may possibly give them knowledge of the internal constitution of bodies analogous to that which we obtain by the spectroscope; and that their visual organs do possess some powers which ours do not, is indicated by the extraordinary crystalline rods radiating from the optic ganglion to the facets of the compound eye, which rods vary in form and thickness in different parts of their length, and possess distinctive characters in each group of insects. This complex apparatus, so different from anything in the eyes of vertebrates, may subserve some function quite inconceivable by us, as well as that which we know as vision. There is reason to believe that insects appreciate sounds of extreme delicacy, and it is supposed that certain minute organs, plentifully supplied with nerves, and situated in the subcostal vein of the wing in most insects, are the organs of hearing. But besides these, the Orthoptera (such as grasshoppers, &c.) have what are supposed to be ears on their fore legs, and believes that the little stalked balls, which are the sole remnants of the hind wings in flies, are also organs of hearing or of some analogous sense. In flies, too, the third joint of the antennæ contains thousands of nerve-fibres, which terminate in small open cells, and this believes to be the organ of smell, or of some other, perhaps new, sense. It is quite evident, therefore, that insects may possess senses which give them a knowledge of that which we can never perceive, and enable them to perform acts which to us are incomprehensible. In the midst of this complete ignorance of their faculties and inner nature, is it wise for us to judge so boldly of their powers by a comparison with our own? How can we pretend to fathom the profound mystery of their mental nature, and decide what, and how much, they can perceive or remember, reason or reflect! To leap at one bound from our own consciousness to that of an insect's, is as unreasonable and absurd as if, with a pretty good knowledge of the multiplication table, we were to go straight to the study of the calculus of functions, or as if our comparative anatomists should pass from the study of man's bony structure to that of the fish, and, without any knowledge of the numerous intermediate forms, were to attempt to determine the homologies between these distant types of vertebrata. In such a case would not error be inevitable, and would not continued study in the same direction only render the erroneous conclusions more ingrained and more irremovable.

Definition of Instinct. Before going further into this subject, we must determine what we mean by the term instinct. It has been variously defined as—"disposition operating without the aid of instruction or experience," "a mental power totally independent of organization," or "a power enabling an animal to do that which, in those things man can do, results from a chain of reasoning, and in things which man cannot do, is not to be explained by any efforts of the intellectual faculties." We find, too, that the word instinct is very frequently applied to acts which are evidently the result either of organization or of habit. The colt or calf is said to walk instinctively, almost as soon as it is born; but this is solely due to its organization, which renders walking both possible and pleasurable to it. So we are said instinctively to hold out our hands to save ourselves from falling, but this is an acquired habit, which the infant does not possess. It appears to me that instinct should be defined as—"the performance by an animal of complex acts, absolutely without instruction or previously-acquired knowledge." Thus, acts are said to be performed by birds in building their nests, by bees in constructing their cells, and by many insects in providing for the future wants of themselves or their progeny, without ever having seen such acts performed by others, and without any knowledge of why they perform them themselves. This is expressed by the very common term "blind instinct." But we have here a number of assertions of matters of fact, which, strange to say, have never been proved to be facts at all. They are thought to be so self-evident that they may be taken for granted. No one has ever yet obtained the eggs of some bird which builds an elaborate nest, hatched these eggs by steam or under a quite distinct parent, placed them afterwards in an extensive aviary or covered garden, where the situation and the materials of a nest similar to that of the parent birds may be found, and then seen what kind of nest these birds would build. If under these rigorous conditions they choose the same materials, the same situation, and construct the nest in the same way and as perfectly as their parents did, instinct would be proved in their case; now it is only assumed, and assumed, as I shall show further on, without any sufficient reason. So, no one has ever carefully taken the pupæ of a hive of bees out of the comb, removed them from the presence of other bees, and loosed them in a large conservatory with plenty of flowers and food, and observed what kind of cells they would construct. But till this is done, no one can say that bees build without instruction, no one can say that with every new swarm there are no bees older than those of the same year, who may be the teachers in forming the new comb. Now, in a scientific inquiry, a point which can be proved should not be assumed, and a totally unknown power should not be brought in to explain facts, when known powers may be sufficient. For both these reasons I decline to accept the theory of instinct in any case where all other possible modes of explanation have not been exhausted. Does Man possess Instincts. Many of the upholders of the instinctive theory maintain, that man has instincts exactly of the same nature as those of animals, but more or less liable to be obscured by his reasoning powers; and as this is a case more open to our observation than any other, I will devote a few pages to its consideration. Infants are said to suck by instinct, and afterwards to walk by the same power, while in adult man the most prominent case of instinct is supposed to be, the powers possessed by savage races to find their way across a trackless and previously unknown wilderness. Let us take first the case of the infant's sucking. It is sometimes absurdly stated that the new-born infant "seeks the breast," and this is held to be a wonderful proof of instinct. No doubt it would be if true, but unfortunately for the theory it is totally false, as every nurse and medical man can testify. Still, the child undoubtedly sucks without teaching, but this is one of those simple acts dependent upon organization, which cannot properly be termed instinct, any more than breathing or muscular motion. Any object of suitable size in the mouth of an infant excites the nerves and muscles so as to produce the act of suction, and when at a little later period, the will comes into play, the pleasurable sensations consequent on the act lead to its continuance. So, walking is evidently dependent on the arrangement of the bones and joints, and the pleasurable exertion of the muscles, which lead to the vertical posture becoming gradually the most agreeable one; and there can be little doubt that an infant would learn of itself to walk, even if suckled by a wild beast.

How Indians travel through unknown and trackless Forests. Let us now consider the fact, of Indians finding their way through forests they have never traversed before. This is much misunderstood, for I believe it is only performed under such special conditions, as at once to show that instinct has nothing to do with it. A savage, it is true, can find his way through his native forests in a direction in which he has never traversed them before; but this is because from infancy he has been used to wander in them, and to find his way by indications which he has observed himself or learnt from others. Savages make long journeys in many directions, and, their whole faculties being directed to the subject, they gain a wide and accurate knowledge of the topography, not only of their own district, but of all the regions round about. Every one who has travelled in a new direction communicates his knowledge to those who have travelled less, and descriptions of routes and localities, and minute incidents of travel, form one of the main staples of conversation round the evening fire. Every wanderer or captive from another tribe adds to the store of information, and as the very existence of individuals and of whole families and tribes, depends upon the completeness of this knowledge, all the acute perceptive faculties of the adult savage are devoted to acquiring and perfecting it. The good hunter or warrior thus comes to know the bearing of every hill and mountain range, the directions and junctions of all the streams, the situation of each tract characterized by peculiar vegetation, not only within the area he has himself traversed, but for perhaps a hundred miles around it. His acute observation enables him to detect the slightest undulations of the surface, the various changes of subsoil and alterations in the character of the vegetation, that would be quite imperceptible to a stranger. His eye is always open to the direction in which he is going; the mossy side of trees, the presence of certain plants under the shade of rocks, the morning and evening flight of birds, are to him indications of direction, almost as sure as the sun in the heavens. Now, if such a savage is required to find his way across this country in a direction in which he has never been before, he is quite equal to the task. By however circuitous a route he has come to the point he is to start from, he has observed all the bearings and distances so well, that he knows pretty nearly where he is, the direction of his own home and that of the place he is required to go to. He starts towards it, and knows that by a certain time he must cross an upland or a river, that the streams should flow in a certain direction, and that he should cross some of them at a certain distance from their sources. The nature of the soil throughout the whole region is known to him, as well as all the great features of the vegetation. As he approaches any tract of country he has been in or near before, many minute indications guide him, but he observes them so cautiously that his white companions cannot perceive by what he has directed his course. Every now and then he slightly changes his direction, but he is never confused, never loses himself, for he always feels at home; till at last he arrives at a well-known country, and directs his course so as to reach the exact spot desired. To the Europeans whom he guides, he seems to have come without trouble, without any special observation, and in a nearly straight unchanging course. They are astonished, and ask if he has ever been the same route before, and when he answers “No,” conclude that some unerring instinct could alone have guided him. But take this same man into another country very similar to his own, but with other streams and hills, another kind of soil, with a somewhat different vegetation and animal life; and after bringing him by a circuitous route to a given point, ask him to return to his starting place, by a straight line of fifty miles through the forest, and he will certainly decline to attempt it, or, attempting it, will more or less completely fail. His supposed instinct does not act out of his own country. A savage, even in a new country, has, however, undoubted advantages, from his familiarity with forest life, his entire fearlessness of being lost, his accurate perception of direction and of distance, and he is thus able very soon to acquire a knowledge of the district that seems marvellous to a civilized man; but my own observation of savages in forest countries has convinced me, that they find their way by the use of no other faculties than those which we ourselves possess.

It appears to me, therefore, that to call in the aid of a new and mysterious power to account for savages being able to do that which, under similar conditions, we could almost all of us perform, although perhaps less perfectly, is almost ludicrously unnecessary. In the next essay I shall attempt to show, that much of what has been attributed to instinct in birds, can be also very well explained by crediting them with those faculties of observation, memory, and imitation, and with that limited amount of reason, which they undoubtedly exhibit. Birds, we are told, build their nests by instinct, while man constructs his dwelling by the exercise of reason. Birds never change, but continue to build for ever on the self-same plan; man alters and improves his houses continually. Reason advances; instinct is stationary. This doctrine is so very general that it may almost be said to be universally adopted. Men who agree on nothing else, accept this as a good explanation of the facts. Philosophers and poets, metaphysicians and divines, naturalists and the general public, not only agree in believing this to be probable, but even adopt it as a sort of axiom that is so self-evident as to need no proof, and use it as the very foundation of their speculations on instinct and reason. A belief so general, one would think, must rest on indisputable facts, and be a logical deduction from them. Yet I have come to the conclusion that not only is it very doubtful, but absolutely erroneous; that it not only deviates widely from the truth, but is in almost every particular exactly opposed to it. I believe, in short, that birds do not build their nests by instinct; that man does not construct his dwelling by reason; that birds do change and improve when affected by the same causes that make men do so; and that mankind neither alter nor improve when they exist under conditions similar to those which are almost universal among birds. Do Men build by Reason or by Imitation? Let us first consider the theory of reason, as alone determining the domestic architecture of the human race. Man, as a reasonable animal, it is said, continually alters and improves his dwelling. This I entirely deny. As a rule, he neither alters nor improves, any more than the birds do. What have the houses of most savage tribes improved from, each as invariable as the nest of a species of bird? The tents of the Arab are the same now as they were two or three thousand years ago, and the mud villages of Egypt can scarcely have improved since the time of the Pharaohs. The palm-leaf huts and hovels of the various tribes of South America and the Malay Archipelago, what have they improved from since those regions were first inhabited? The Patagonian's rude shelter of leaves, the hollowed bank of the South African Earthmen, we cannot even conceive to have been ever inferior to what they now are. Even nearer home, the Irish turf cabin and the Highland stone shelty can hardly have advanced much during the last two thousand years. Now, no one imputes this stationary condition of domestic architecture among these savage tribes to instinct, but to simple imitation from one generation to another, and the absence of any sufficiently powerful stimulus to change or improvement. No one imagines that if an infant Arab could be transferred to Patagonia, or to the Highlands, it would, when it grew up, astonish its foster-parents by constructing a tent of skins. On the other hand, it is quite clear that physical conditions, combined with the degree of civilization arrived at, almost necessitate certain types of structure. The turf, or stones, or snow—the palm-leaves, bamboo, or branches, which are the materials of houses in various countries, are used because nothing else is so readily to be obtained. The Egyptian peasant has none of these, not even wood. What, then, can he use but mud? In tropical forest-countries, the bamboo and the broad palm-leaves are the natural material for houses, and the form and mode of structure will be decided in part by the nature of the country, whether hot or cool, whether swampy or dry, whether rocky or plain, whether frequented by wild beasts, or whether subject to the attacks of enemies. When once a particular mode of building has been adopted, and has become confirmed by habit and by hereditary custom, it will be long retained, even when its utility has been lost through changed conditions, or through migration into a very different region.

As a general rule, throughout the whole continent of America, native houses are built directly upon the ground—strength and security being given by thickening the low walls and the roof. In almost the whole of the Malay Islands, on the contrary, the houses are raised on posts, often to a great height, with an open bamboo floor; and the whole structure is exceedingly slight and thin. Now, what can be the reason of this remarkable difference between countries, many parts of which are strikingly similar in physical conditions, natural productions, and the state of civilization of their inhabitants? We appear to have some clue to it in the supposed origin and migrations of their respective populations. The indigenes of tropical America are believed to have immigrated from the north—from a country where the winters are severe, and raised houses with open floors would be hardly habitable. They moved southwards by land along the mountain ranges and uplands, and in an altered climate continued the mode of construction of their forefathers, modified only by the new materials they met with. By minute observations of the Indians of the Amazon Valley, arrived at the conclusion that they were comparatively recent immigrants from a colder climate. He says:—"No one could live long among the Indians of the Upper Amazon without being struck with their constitutional dislike to the heat ... Their skin is hot to the touch, and they perspire little ... They are restless and discontented in hot, dry weather, but cheerful on cool days, when the rain is pouring down their naked backs." And, after giving many other details, he concludes, "How different all this is with the Negro, the true child of tropical climes! The impression gradually forced itself on my mind that the Red Indian lives as an immigrant or stranger in these hot regions, and that his constitution was not originally adapted, and has not since become perfectly adapted, to the climate." The Malay races, on the other hand, are no doubt very ancient inhabitants of the hottest regions, and are particularly addicted to forming their first settlements at the mouths of rivers or creeks, or in land-locked bays and inlets. They are a pre-eminently maritime or semi-aquatic people, to whom a canoe is a necessary of life, and who will never travel by land if they can do so by water. In accordance with these tastes, they have built their houses on posts in the water, after the manner of the lake-dwellers of ancient Europe; and this mode of construction has become so confirmed, that even those tribes who have spread far into the interior, on dry plains and rocky mountains, continue to build in exactly the same manner, and find safety in the height to which they elevate their dwellings above the ground. Why does each Bird build a peculiar kind of Nest? These general characteristics of the abode of savage man will be found to be exactly paralleled by the nests of birds. Each species uses the materials it can most readily obtain, and builds in situations most congenial to its habits. The wren, for example, frequenting hedgerows and low thickets, builds its nest generally of moss, a material always found where it lives, and among which it probably obtains much of its insect food; but it varies sometimes, using hay or feathers when these are at hand. Rooks dig in pastures and ploughed fields for grubs, and in doing so must continually encounter roots and fibres. These are used to line its nest. What more natural! The crow feeding on carrion, dead rabbits, and lambs, and frequenting sheep-walks and warrens, chooses fur and wool to line its nest. The lark frequents cultivated fields, and makes its nest, on the ground, of grass lined with horsehair—materials the most easy to meet with, and the best adapted to its needs. The kingfisher makes its nest of the bones of the fish which it has eaten. Swallows use clay and mud from the margins of the ponds and rivers over which they find their insect food. The materials of birds' nests, like those used by savage man for his house, are, then, those which come first to hand; and it certainly requires no more special instinct to select them in one case than in the other. But, it will be said, it is not so much the materials as the form and structure of nests, that vary so much, and are so wonderfully adapted to the wants and habits of each species; how are these to be accounted for except by instinct? I reply, they may be in a great measure explained by the general habits of the species, the nature of the tools they have to work with, and the materials they can most easily obtain, with the very simplest adaptations of means to an end, quite within the mental capacities of birds.

The delicacy and perfection of the nest will bear a direct relation to the size of the bird, its structure and habits. That of the wren or the humming-bird is perhaps not finer or more beautiful in proportion than that of the blackbird, the magpie, or the crow. The wren, having a slender beak, long legs, and great activity, is able with great ease to form a well-woven nest of the finest materials, and places it in thickets and hedgerows which it frequents in its search for food. The titmouse, haunting fruit-trees and walls, and searching in cracks and crannies for insects, is naturally led to build in holes where it has shelter and security; while its great activity, and the perfection of its tools (bill and feet), enable it readily to form a beautiful receptacle for its eggs and young. Pigeons having heavy bodies and weak feet and bills (imperfect tools for forming a delicate structure) build rude, flat nests of sticks, laid across strong branches which will bear their weight and that of their bulky young. They can do no better. The Caprimulgidæ have the most imperfect tools of all, feet that will not support them except on a flat surface (for they cannot truly perch) and a bill excessively broad, short, and weak, and almost hidden by feathers and bristles. They cannot build a nest of twigs or fibres, hair or moss, like other birds, and they therefore generally dispense with one altogether, laying their eggs on the bare ground, or on the stump or flat limb of a tree. The clumsy hooked bills, short necks and feet, and heavy bodies of Parrots, render them quite incapable of building a nest like most other birds. They cannot climb up a branch without using both bill and feet; they cannot even turn round on a perch without holding on with their bill. How, then, could they inlay, or weave, or twist the materials of a nest? Consequently, they all lay in holes of trees, the tops of rotten stumps, or in deserted ants' nests, the soft materials of which they can easily hollow out. Many terns and sandpipers lay their eggs on the bare sand of the sea-shore, and no doubt the Duke of Argyll is correct when he says, that the cause of this habit is not that they are unable to form a nest, but that, in such situations, any nest would be conspicuous and lead to the discovery of the eggs. The choice of place is, however, evidently determined by the habits of the birds, who, in their daily search for food, are continually roaming over extensive tide-washed flats. Gulls vary considerably in their mode of nesting, but it is always in accordance with their structure and habits. The situation is either on a bare rock or on ledges of sea-cliffs, in marshes or on weedy shores. The materials are sea-weed, tufts of grass or rushes, or the débris of the shore, heaped together with as little order and constructive art as might be expected from the webbed feet and clumsy bill of these birds, the latter better adapted for seizing fish than for forming a delicate nest. The long-legged, broad-billed flamingo, who is continually stalking over muddy flats in search of food, heaps up the mud into a conical stool, on the top of which it lays its eggs. The bird can thus sit upon them conveniently, and they are kept dry, out of reach of the tides. Now I believe that throughout the whole class of birds the same general principles will be found to hold good, sometimes distinctly, sometimes more obscurely apparent, according as the habits of the species are more marked, or their structure more peculiar. It is true that, among birds differing but little in structure or habits, we see considerable diversity in the mode of nesting, but we are now so well assured that important changes of climate and of surface have occurred within the period of existing species, that it is by no means difficult to see how such differences have arisen. Simple habits are known to be hereditary, and as the area now occupied by each species is different from that of every other, we may be sure that such changes would act differently upon each, and would often bring together species which had acquired their peculiar habits in distinct regions and under different conditions. How do Young Birds learn to Build their First Nest? But it is objected, birds do not learn to make their nest as man does to build, for all birds will make exactly the same nest as the rest of their species, even if they have never seen one, and it is instinct alone that can enable them to do this. No doubt this would be instinct if it were true, and I simply ask for proof of the fact.

This point, although so important to the question at issue, is always assumed without proof, and even against proof, for what facts there are, are opposed to it. Birds brought up from the egg in cages do not make the characteristic nest of their species, even though the proper materials are supplied them, and often make no nest at all, but rudely heap together a quantity of materials; and the experiment has never been fairly tried, of turning out a pair of birds so brought up, into an enclosure covered with netting, and watching the result of their untaught attempts at nest-making. With regard to the songs of birds, however, which is thought to be equally instinctive, the experiment has been tried, and it is found that young birds never have the song peculiar to their species if they have not heard it, whereas they acquire very easily the song of almost any other bird with which they are associated. Do Birds sing by Instinct or by Imitation? The Hon. Daines Barrington was of opinion that "notes in birds are no more innate than language is in man, and depend entirely on the master under which they are bred, as far as their organs will enable them to imitate the sounds which they have frequent opportunities of hearing." He has given an account of his experiments in the "Philosophical Transactions" for; he says: "I have educated nestling linnets under the three best singing larks—the skylark, woodlark, and titlark, every one of which, instead of the linnet's song, adhered entirely to that of their respective instructors. When the note of the titlark linnet was thoroughly fixed, I hung the bird in a room with two common linnets for a quarter of a year, which were full in song; the titlark linnet, however, did not borrow any passage from the linnet's song, but adhered stedfastly to that of the titlark." He then goes on to say that birds taken from the nest at two or three weeks old have already learnt the call-note of their species. To prevent this the birds must be taken from the nest when a day or two old, and he gives an account of a goldfinch which he saw at Knighton in Radnorshire, and which sang exactly like a wren, without any portion of the proper note of its species. This bird had been taken from the nest at two or three days old, and had been hung at a window opposite a small garden, where it had undoubtedly acquired the notes of the wren without having any opportunity of learning even the call of the goldfinch. He also saw a linnet, which had been taken from the nest when only two or three days old, and which, not having any other sounds to imitate, had learnt almost to articulate, and could repeat the words "Pretty Boy," and some other short sentences. Another linnet was educated by himself under a vengolina (a small African finch, which he says sings better than any foreign bird but the American mocking bird), and it imitated its African master so exactly that it was impossible to distinguish the one from the other. Still more extraordinary was the case of a common house sparrow, which only chirps in a wild state, but which learnt the song of the linnet and goldfinch by being brought up near those birds. The Rev. W. H. Herbert made similar observations, and states that the young whinchat and wheatear, which have naturally little variety of song, are ready in confinement to learn from other species, and become much better songsters. The bullfinch, whose natural notes are weak, harsh, and insignificant, has nevertheless a wonderful musical faculty, since it can be taught to whistle complete tunes. The nightingale, on the other hand, whose natural song is so beautiful, is exceedingly apt in confinement to learn that of other birds instead. Bechstein gives an account of a redstart which had built under the eaves of his house, which imitated the song of a caged chaffinch in a window underneath, while another in his neighbour's garden repeated some of the notes of a blackcap, which had a nest close by. These facts, and many others which might be quoted, render it certain that the peculiar notes of birds are acquired by imitation, as surely as a child learns English or French, not by instinct, but by hearing the language spoken by its parents. It is especially worthy of remark that, for young birds to acquire a new song correctly, they must be taken out of hearing of their parents very soon, for in the first three or four days they have already acquired some knowledge of the parent notes, which they will afterwards imitate.

This shows that very young birds can both hear and remember, and it would be very extraordinary if, after they could see, they could neither observe nor recollect, and could live for days and weeks in a nest and know nothing of its materials and the manner of its construction. During the time they are learning to fly and return often to the nest, they must be able to examine it inside and out in every detail, and as we have seen that their daily search for food invariably leads them among the materials of which it is constructed, and among places similar to that in which it is placed, is it so very wonderful that when they want one themselves they should make one like it? How else, in fact, should they make it? Would it not be much more remarkable if they went out of their way to get materials quite different from those used in the parent nest, if they arranged them in a way they had seen no example of, and formed the whole structure differently from that in which they themselves were reared, and which we may fairly presume is that which their whole organization is best adapted to put together with celerity and ease? It has, however, been objected that observation, imitation, or memory, can have nothing to do with a bird's architectural powers, because the young birds, which in England are born in May or June, will proceed in the following April or May to build a nest as perfect and as beautiful as that in which it was hatched, although it could never have seen one built. But surely the young birds before they left the nest had ample opportunities of observing its form, its size, its position, the materials of which it was constructed, and the manner in which those materials were arranged. Memory would retain these observations till the following spring, when the materials would come in their way during their daily search for food, and it seems highly probable that the older birds would begin building first, and that those born the preceding summer would follow their example, learning from them how the foundations of the nest are laid and the materials put together. [H] Again, we have no right to assume that young birds generally pair together. It seems probable that in each pair there is most frequently only one bird born the preceding summer, who would be guided, to some extent, by its partner. My friend, the well-known traveller and botanist, thinks this is the case, and has kindly allowed me to publish the following observations, which he sent me after reading my book. How young Birds may learn to build Nests. "Among the Indians of Peru and Ecuador, many of whose customs are relics of the semi-civilisation that prevailed before the Spanish conquest, it is usual for the young men to marry old women, and the young women old men. A young man, they say, accustomed to be tended by his mother, would fare ill if he had only an ignorant young girl to take care of him; and the girl herself would be better off with a man of mature years, capable of supplying the place of a father to her. "Something like this custom prevails among many animals. A stout old buck can generally fight his way to the doe of his choice, and indeed of as many does as he can manage; but a young buck 'of his first horns,' must either content himself with celibacy, or with some dame well-stricken in years. "Compare the nearly parallel case of the domestic cock and of many other birds. Then consider the consequences amongst birds that pair, if an old cock sorts with a young hen and an old hen with a young cock, as I think is certainly the case with blackbirds and others that are known to fight for the youngest and handsomest females. One of each pair being already an 'old bird,' will be competent to instruct its younger partner (not only in the futility of 'chaff,' but) in the selection of a site for a nest and how to build it; then, how eggs are hatched and young birds reared. "Such, in brief, is my idea of how a bird on its first espousals may be taught the Whole Duty of the married state." On this difficult point I have sought for information from some of our best field ornithologists, but without success, as it is in most cases impossible to distinguish old from young birds after the first year. I am informed, however, that the males of blackbirds, sparrows, and many other kinds fight furiously, and the conqueror of course has the choice of a mate. view is at least as probable as the contrary one (that young birds, as a rule, pair together), and it is to some extent supported by the celebrated American observer, Wilson, who strongly insists on the variety in the nests of birds of the same species, some being so much better finished than others; and he believes that the less perfect nests are built by the younger, the more perfect by the older, birds.

At all events, till the crucial experiment is made, and a pair of birds raised from the egg without ever seeing a nest are shown to be capable of making one exactly of the parental type, I do not think we are justified in calling in the aid of an unknown and mysterious faculty to do that which is so strictly analogous to the house-building of savage man. Again, we always assume that because a nest appears to us delicately and artfully built, that it therefore requires much special knowledge and acquired skill (or their substitute, instinct) in the bird who builds it. We forget that it is formed twig by twig and fibre by fibre, rudely enough at first, but crevices and irregularities, which must seem huge gaps and chasms in the eyes of the little builders, are filled up by twigs and stalks pushed in by slender beak and active foot, and that the wool, feathers, or horsehair are laid thread by thread, so that the result seems a marvel of ingenuity to us, just as would the rudest Iinand hut to a native of Brobdignag. Levaillant has given an account of the process of nestbuilding by a little African warbler, which sufficiently shows that a very beautiful structure may be produced with very little art. The foundation was laid of moss and flax interwoven with grass and tufts of cotton, and presented a rude mass, five or six inches in diameter, and four inches thick. This was pressed and trampled down repeatedly, so as at last to make it into a kind of felt. The birds pressed it with their bodies, turning round upon them in every direction, so as to get it quite firm and smooth before raising the sides. These were added bit by bit, trimmed and beaten with the wings and feet, so as to felt the whole together, projecting fibres being now and then worked in with the bill. By these simple and apparently inefficient means, the inner surface of the nest was rendered almost as smooth and compact as a piece of cloth. Man's Works mainly Imitative. But look at civilised man! it is said; look at Grecian, and Egyptian, and Roman, and Gothic, and modern Architecture! What advance! what improvement! what refinements! This is what reason leads to, whereas birds remain for ever stationary. If, however, such advances as these are required, to prove the effects of reason as contrasted with instinct, then all savage and many half-civilized tribes have no reason, but build instinctively quite as much as birds do. Man ranges over the whole earth, and exists under the most varied conditions, leading necessarily to equally varied habits. He migrates—he makes wars and conquests—one race mingles with another—different customs are brought into contact—the habits of a migrating or conquering race are modified by the different circumstances of a new country. The civilized race which conquered Egypt must have developed its mode of building in a forest country where timber was abundant, for it is not probable, that the idea of cylindrical columns originated in a country destitute of trees. The pyramids might have been built by an indigenous race, but not the temples of El Uksor and Karnak. In Grecian architecture, almost every characteristic feature can be traced to an origin in wooden buildings. The columns, the architrave, the frieze, the fillets, the cantelevers, the form of the roof, all point to an origin in some southern forest-clad country, and strikingly corroborate the view derived from philology, that Greece was colonised from north-western India. But to erect columns and span them with huge blocks of stone, or marble, is not an act of reason, but one of pure unreasoning imitation. The arch is the only true and reasonable mode of covering over wide spaces with stone, and therefore, Grecian architecture, however exquisitely beautiful, is false in principle, and is by no means a good example of the application of reason to the art of building. And what do most of us do at the present day but imitate the buildings of those that have gone before us? We have not even been able to discover or develope any definite style of building best suited for us. We have no characteristic national style of architecture, and to that extent are even below the birds, who have each their characteristic form of nest, exactly adapted to their wants and habits. Birds do Alter and Improve their Nests when altered Conditions require it. The great uniformity in the architecture of each species of bird which has been supposed to prove a nest-building instinct, we may, therefore, fairly impute to the uniformity of the conditions under which each species lives. Their range is often very limited, and they very seldom permanently change their country, so as to be placed in new conditions. When, however, new conditions do occur, they take advantage of them just as freely and wisely as man could do.

The chimney and house-swallows are a standing proof of a change of habit since chimneys and houses were built, and in America this change has taken place within about three hundred years. Thread and worsted are now used in many nests instead of wool and horsehair, and the jackdaw shows an affection for the church steeple which can hardly be explained by instinct. In the more thickly populated parts of the United States, the Baltimore oriole uses all sorts of pieces of string, skeins of silk, or the gardener's bass, to weave into its fine pensile nest, instead of the single hairs and vegetable fibres it has painfully to seek in wilder regions; and Wilson, a most careful observer, believes that it improves in nest-building by practice—the older birds making the best nests. The purple martin takes possession of empty gourds or small boxes, stuck up for its reception in almost every village and farm in America; and several of the American wrens will also build in cigar boxes, with a small hole cut in them, if placed in a suitable situation. The orchard oriole of the United States offers us an excellent example of a bird which modifies its nest according to circumstances. When built among firm and stiff branches the nest is very shallow, but if, as is often the case, it is suspended from the slender twigs of the weeping willow, it is made much deeper, so that when swayed about violently by the wind the young may not tumble out. It has been observed also, that the nests built in the warm Southern States are much slighter and more porous in texture than those in the colder regions of the north. Our own house-sparrow equally well adapts himself to circumstances. When he builds in trees, as he, no doubt, always did originally, he constructs a well-made domed nest, perfectly fitted to protect his young ones; but when he can find a convenient hole in a building or among thatch, or in any well-sheltered place, he takes much less trouble, and forms a very loosely-built nest. A curious example of a recent change of habits has occurred in Jamaica. Previous to, the palm swift (Tachornis phænicobea) inhabited exclusively the palm trees in a few districts in the island. A colony then established themselves in two cocoa-nut palms in Spanish Town, and remained there till when one tree was blown down, and the other stripped of its foliage. Instead of now seeking out other palm trees, the swifts drove out the swallows who built in the Piazza of the House of Assembly, and took possession of it, building their nests on the tops of the end walls and at the angles formed by the beams and joists, a place which they continue to occupy in considerable numbers. It is remarked that here they form their nest with much less elaboration than when built in the palms, probably from being less exposed. A still more curious example of change and improvement in nest building was published by in the tenth number of the Comptes Rendus for, just as the first edition of this work appeared. Forty years ago M. Pouchet had himself collected nests of the House-Martin or Window-Swallow (Hirundo urbica) from old buildings at Rouen, and deposited them in the museum of that city. On recently obtaining some more nests he was surprised, on comparing them with the old ones, to find that they exhibited a decided change of form and structure. This led him to investigate the matter more closely. The changed nests had been obtained from houses in a newly erected quarter of the city, and he found that all the nests in the newly-built streets were of the new form. But on visiting the churches and older buildings, and some rocks where these birds build, he found many nests of the old type along with some of the new pattern. He then examined all the figures and descriptions of the older naturalists, and found that they invariably represented the older form only. The difference between the two forms he states to be as follows. In the old form the nest is a portion of a globe—when situated in the upper angle of a window one-fourth of a hemisphere—and the opening is very small and circular, being of a size just sufficient to allow the body of the bird to pass. In the new form the nest is much wider in proportion to its height, being a segment of a depressed spheroid, and the aperture is very wide and shallow, and close to the horizontal surface to which the nest is attached above. M. Pouchet thinks that the new form is an undoubted improvement on the old. The nest has a wider bottom and must allow the young ones to have more freedom of motion than in the old narrower, and deeper nests, and its wide aperture allows the young birds to peep out and breathe the fresh air.

This is so wide as to serve as a sort of balcony for them, and two young ones can often be seen on it without interfering with the passage in and out of the old birds. At the same time, by being so close to the roof, it is a better protection against rain, against cold, and against enemies, than the small round hole of the old nests. Here, then, we have an improvement in nest building, as well marked as any improvement that takes place in human dwellings in so short a time. But perfection of structure and adaptation to purpose, are not universal characteristics of birds' nests, since there are decided imperfections in the nesting of many birds which are quite compatible with our present theory, but are hardly so with that of instinct, which is supposed to be infallible. The Passenger pigeon of America often crowds the branches with its nests till they break, and the ground is strewn with shattered nests, eggs, and young birds. Rooks' nests are often so imperfect that during high winds the eggs fall out; but the Window-Swallow is the most unfortunate in this respect, for White, of Selborne, informs us that he has seen them build, year after year, in places where their nests are liable to be washed away by a heavy rain and their young ones destroyed. Conclusion. A fair consideration of all these facts will, I think, fully support the statement with which I commenced, and show, that the mental faculties exhibited by birds in the construction of their nests, are the same in kind as those manifested by mankind in the formation of their dwellings. These are, essentially, imitation, and a slow and partial adaptation to new conditions. To compare the work of birds with the highest manifestations of human art and science, is totally beside the question. I do not maintain that birds are gifted with reasoning faculties at all approaching in variety and extent to those of man. I simply hold that the phenomena presented by their mode of building their nests, when fairly compared with those exhibited by the great mass of mankind in building their houses, indicate no essential difference in the kind or nature of the mental faculties employed. If instinct means anything, it means the capacity to perform some complex act without teaching or experience. It implies innate ideas of a very definite kind, and, if established, would overthrow Mr. Mill's sensationalism and all the modern philosophy of experience. That the existence of true instinct may be established in other cases is not impossible, but in the particular instance of birds' nests, which is usually considered one of its strongholds, I cannot find a particle of evidence to show the existence of anything beyond those lower reasoning and imitative powers, which animals are universally admitted to possess. The habit of forming a more or less elaborate structure for the reception of their eggs and young, must undoubtedly be looked upon as one of the most remarkable and interesting characteristics of the class of birds. In other classes of vertebrate animals, such structures are few and exceptional, and never attain to the same degree of completeness and beauty. Birds' nests have, accordingly, attracted much attention, and have furnished one of the stock arguments to prove the existence of a blind but unerring instinct in the lower animals. The very general belief that every bird is enabled to build its nest, not by the ordinary faculties of observation, memory, and imitation, but by means of some innate and mysterious impulse, has had the bad effect of withdrawing attention from the very evident relation that exists between the structure, habits, and intelligence of birds, and the kind of nests they construct. In the preceding essay I have detailed several of these relations, and they teach us, that a consideration of the structure, the food, and other specialities of a bird's existence, will give a clue, and sometimes a very complete one, to the reason why it builds its nest of certain materials, in a definite situation, and in a more or less elaborate manner. I now propose to consider the question from a more general point of view, and to discuss its application to some important problems in the natural history of birds. Changed Conditions and persistent Habits as influencing Nidification. Besides the causes above alluded to, there are two other factors whose effect in any particular case we can only vaguely guess at, but which must have had an important influence in determining the existing details of nidification.

These are —changed conditions of existence, whether internal or external, and the influence of hereditary or imitative habit; the first inducing alterations in accordance with changes of organic structure, of climate, or of the surrounding fauna and flora; the other preserving the peculiarities so produced, even when changed conditions render them no longer necessary. Many facts have been already given which show that birds do adapt their nests to the situations in which they place them, and the adoption of eaves, chimneys, and boxes, by swallows, wrens, and many other birds, shows that they are always ready to take advantage of changed conditions. It is probable, therefore, that a permanent change of climate would cause many birds to modify the form or materials of their abodes, so as better to protect their young. The introduction of new enemies to eggs or young birds, might introduce many alterations tending to their better concealment. A change in the vegetation of a country, would often necessitate the use of new materials. So, also, we may be sure, that as a species slowly became modified in any external or internal characters, it would necessarily change in some degree its mode of building. This effect would be produced by modifications of the most varied nature; such as the power and rapidity of flight, which must often determine the distance to which a bird will go to obtain materials for its nest; the capacity of sustaining itself almost motionless in the air, which must sometimes determine the position in which a nest can be built; the strength and grasping power of the foot in relation to the weight of the bird, a power absolutely essential to the constructor of a delicately-woven and wellfinished nest; the length and fineness of the beak, which has to be used like a needle in building the best textile nests; the length and mobility of the neck, which is needful for the same purpose; the possession of a salivary secretion like that used in the nests of many of the swifts and swallows, as well as that of the song-thrush—peculiarities of habits, which ultimately depend on structure, and which often determine the material most frequently met with or most easily to be obtained. Modifications in any of these characters would necessarily lead, either to a change in the materials of the nest, or in the mode of combining them in the finished structure, or in the form or position of that structure. During all these changes, however, certain specialities of nest-building would continue, for a shorter or a longer time after the causes which had necessitated them had passed away. Such records of a vanished past meet us everywhere, even in man's works, notwithstanding his boasted reason. Not only are the main features of Greek architecture, mere reproductions in stone of what were originally parts of a wooden building, but our modern copyists of Gothic architecture often build solid buttresses capped with weighty pinnacles, to support a wooden roof which has no outward thrust to render them necessary; and even think they ornament their buildings by adding sham spouts of carved stone, while modern waterpipes, stuck on without any attempt at harmony, do the real duty. So, when railways superseded coaches, it was thought necessary to build the first-class carriages to imitate a number of coach-bodies joined together; and the arm-loops for each passenger to hold on by, which were useful when bad roads made every journey a succession of jolts and lurches, were continued on our smooth macadamised mail-routes, and, still more absurdly, remain to this day in our railway carriages, the relic of a kind of locomotion we can now hardly realize. Another good example is to be seen in our boots. When elastic sides came into fashion we had been so long used to fasten them with buttons or laces, that a boot without either looked bare and unfinished, and accordingly the makers often put on a row of useless buttons or imitation laces, because habit rendered the appearance of them necessary to us. It is universally admitted that the habits of children and of savages give us the best clue to the habits and mode of thought of animals; and every one must have observed how children at first imitate the actions of their elders, without any regard to the use or applicability of the particular acts. So, in savages, many customs peculiar to each tribe are handed down from father to son merely by the force of habit, and are continued long after the purpose which they originally served has ceased to exist.

With these and a hundred similar facts everywhere around us, we may fairly impute much of what we cannot understand in the details of BirdArchitecture to an analogous cause. If we do not do so, we must assume, either that birds are guided in every action by pure reason to a far greater extent than men are, or that an infallible instinct leads them to the same result by a different road. The first theory has never, that I am aware of, been maintained by any author, and I have already shown that the second, although constantly assumed, has never been proved, and that a large body of facts is entirely opposed to it. One of my critics has, indeed, maintained that I admit "instinct" under the term "hereditary habit;" but the whole course of my argument shows that I do not do so. Hereditary habit is, indeed, the same as instinct when the term is applied to some simple action dependent upon a peculiarity of structure which is hereditary; as when the descendants of tumbler pigeons tumble, and the descendants of pouter pigeons pout. In the present case, however, I compare it strictly to the hereditary, or more properly, persistent or imitative, habits of savages, in building their houses as their fathers did. Imitation is a lower faculty than invention. Children and savages imitate before they originate; birds, as well as all other animals, do the same. The preceding observations are intended to show, that the exact mode of nidification of each species of bird is probably the result of a variety of causes, which have been continually inducing changes in accordance with changed organic or physical conditions. The most important of these causes seem to be, in the first place, the structure of the species, and, in the second, its environment or conditions of existence. Now we know, that every one of the characters or conditions included under these two heads is variable. We have seen that, on the large scale, the main features of the nest built by each group of birds, bears a relation to the organic structure of that group, and we have, therefore, a right to infer, that as structure varies, the nest will vary also in some particular corresponding to the changes of structure. We have seen also, that birds change the position, the form, and the construction of their nest, whenever the available materials or the available situations, vary naturally or have been altered by man; and we have, therefore, a right to infer that similar changes have taken place, when, by a natural process, external conditions have become in any way permanently altered. We must remember, however, that all these factors are very stable during many generations, and only change at a rate commensurate with those of the great physical features of the earth as revealed to us by geology; and we may, therefore, infer that the form and construction of nests, which we have shown to be dependent on them, are equally stable. If, therefore, we find less important and more easily modified characters than these, so correlated with peculiarities of nidification as to indicate that one is probably the cause of the other, we shall be justified in concluding that these variable characters are dependent on the mode of nidification, and not that the form of the nest has been determined by these variable characters. Such a correlation I am now about to point out. Classification of Nests. For the purpose of this inquiry it is necessary to group nests into two great classes, without any regard to their most obvious differences or resemblances, but solely looking to the fact of whether the contents (eggs, young, or sitting bird) are hidden or exposed to view. In the first class we place all those in which the eggs and young are completely hidden, no matter whether this is effected by an elaborate covered structure, or by depositing the eggs in some hollow tree or burrow underground. In the second, we group all in which the eggs, young, and sitting bird are exposed to view, no matter whether there is the most beautifully formed nest, or none at all. Kingfishers, which build almost invariably in holes in banks; Woodpeckers and Parrots, which build in hollow trees; the Icteridæ of America, which all make beautiful covered and suspended nests; and our own Wren, which builds a domed nest, are examples of the former; while our Thrushes, Warblers, and Finches, as well as the Crowshrikes, Chatterers, and Tanagers of the tropics, together with all Raptorial birds and Pigeons, and a vast number of others in every part of the world, all adopt the latter mode of building. It will be seen that this division of birds according to their nidification, bears little relation to the character of the nest itself.

It is a functional not a structural classification. The most rude and the most perfect specimens of bird-architecture are to be found in both sections. It has, however, a certain relation to natural affinities, for large groups of birds, undoubtedly allied, fall into one or the other division exclusively. The species of a genus or of a family are rarely divided between the two primary classes, although they are frequently divided between the two very distinct modes of nidification that exist in the first of them. All the Scansorial or climbing, and most of the Fissirostral or wide-gaped birds, for example, build concealed nests; and, in the latter group, the two families which build open nests, the Swifts and the Goat-suckers, are undoubtedly very widely separated from the other families with which they are associated in our classifications. The Tits vary much in their mode of nesting, some making open nests concealed in a hole, while others build domed or even pendulous covered nests, but they all come under the same class. Starlings vary in a similar way. The talking Mynahs, like our own starlings, build in holes, the glossy starlings of the East (of the genus Calornis) form a hanging covered nest, while the genus Sturnopastor builds in a hollow tree. One of the most striking cases in which one family of birds is divided between the two classes, is that of the Finches; for while most of the European species build exposed nests, many of the Australian finches make them dome-shaped. Sexual differences of Colour in Birds. Turning now from the nests to the creatures who make them, let us consider birds themselves from a somewhat unusual point of view, and form them into separate groups, according as both sexes, or the males only, are adorned with conspicuous colours. The sexual differences of colour and plumage in birds are very remarkable, and have attracted much attention; and, in the case of polygamous birds, have been well explained by principle of sexual selection. We can, to a great extent, understand how male Pheasants and Grouse have acquired their more brilliant plumage and greater size, by the continual rivalry of the males both in strength and beauty; but this theory does not throw any light on the causes which have made the female Toucan, Bee-eater, Parroquet, Macaw and Tit, in almost every case as gay and brilliant as the male, while the gorgeous Chatterers, Manakins, Tanagers, and Birds of Paradise, as well as our own Blackbird, have mates so dull and inconspicuous that they can hardly be recognised as belonging to the same species. The Law which connects the Colours of Female Birds with the mode of Nidification. The above-stated anomaly can, however, now be explained by the influence of the mode of nidification, since I find that, with but very few exceptions, it is the rule—that when both sexes are of strikingly gay and conspicuous colours, the nest is of the first class, or such as to conceal the sitting bird; while, whenever there is a striking contrast of colours, the male being gay and conspicuous, the female dull and obscure, the nest is open and the sitting bird exposed to view. I will now proceed to indicate the chief facts that support this statement, and will afterwards explain the manner in which I conceive the relation has been brought about. We will first consider those groups of birds in which the female is gaily or at least conspicuously coloured, and is in most cases exactly like the male. Kingfishers (Alcedinidæ). In some of the most brilliant species of this family the female exactly resembles the male; in others there is a sexual difference, but it rarely tends to make the female less conspicuous. In some, the female has a band across the breast, which is wanting in the male, as in the beautiful Halcyon diops of Ternate. In others the band is rufous in the female, as in several of the American species; while in Dacelo gaudichaudii, and others of the same genus, the tail of the female is rufous, while that of the male is blue. In most kingfishers the nest is in a deep hole in the ground; in Tanysiptera it is said to be in a hole in the nests of termites, or sometimes in crevices under overhanging rocks. Motmots (Momotidæ). In these showy birds the sexes are exactly alike, and the nest in a hole under ground. Puff-birds (Bucconidæ). These birds are often gaily coloured; some have coral-red bills; the sexes are exactly alike, and the nest is in a hole in sloping ground. Trogons (Trogonidæ). In these magnificent birds the females are generally less brightly coloured than the males, but are yet often gay and conspicuous. The nest is in a hole of a tree. Hoopoes (Upupidæ). The barred plumage and long crests of these birds render them conspicuous. The sexes are exactly alike, and the nest is in a hollow tree. Hornbills (Bucerotidæ). These large birds have enormous coloured bills, which are generally quite as well coloured and conspicuous in the females. Their nests are always in hollow trees, where the female is entirely concealed. Barbets (Capitonidæ). These birds are all very gaily-coloured, and, what is remarkable, the most brilliant patches of colour are disposed about the head and neck, and are very conspicuous.

The sexes are exactly alike, and the nest is in a hole of a tree. Toucans (Rhamphastidæ). These fine birds are coloured in the most conspicuous parts of their body, especially on the large bill, and on the upper and lower tail coverts, which are crimson, white, or yellow. The sexes are exactly alike, and they always build in a hollow tree. Plaintain-eaters (Musophagidæ). Here again the head and bill are most brilliantly coloured in both sexes, and the nest is in a hole of a tree. Ground cuckoos (Centropus). These birds are often of conspicuous colours, and are alike in both sexes. They build a domed nest. Woodpeckers (Picidæ). In this family the females often differ from the males, in having a yellow or white, instead of a crimson crest, but are almost as conspicuous. They all nest in holes in trees. Parrots (Psittaci). In this great tribe, adorned with the most brilliant and varied colours, the rule is, that the sexes are precisely alike, and this is the case in the most gorgeous families, the lories, the cockatoos, and the macaws; but in some there is a sexual difference of colour to a slight extent. All build in holes, mostly in trees, but sometimes in the ground, or in white ants' nests. In the single case in which the nest is exposed, that of the Australian ground parrot, Pezoporus formosus, the bird has lost the gay colouring of its allies, and is clothed in sombre and completely protective tints of dusky green and black. Gapers (Eurylæmidæ). In these beautiful Eastern birds, somewhat allied to the American chatterers, the sexes are exactly alike, and are adorned with the most gay and conspicuous markings. The nest is a woven structure, covered over, and suspended from the extremities of branches over water. Pardalotus (Ampelidæ). In these Australian birds the females differ from the males, but are often very conspicuous, having brightly-spotted heads. Their nests are sometimes dome-shaped, sometimes in holes of trees, or in burrows in the ground. Tits (Paridæ). These little birds are always pretty, and many (especially among the Indian species) are very conspicuous. They always have the sexes alike, a circumstance very unusual among the smaller gaily-coloured birds of our own country. The nest is always covered over or concealed in a hole. Nuthatches (Sitta). Often very pretty birds, the sexes alike, and the nest in a hole. —— (Sittella). The female of these Australian nuthatches is often the most conspicuous, being white-and black-marked. The nest is, according to Gould, "completely concealed among upright twigs connected together." Creepers (Climacteris). In these Australian creepers the sexes are alike, or the female most conspicuous, and the nest is in a hole of a tree. Estrelda, Amadina. In these genera of Eastern and Australian finches the females, although more or less different from the males, are still very conspicuous having a red rump, or being white spotted. They differ from most others of the family in building domed nests. Certhiola. In these pretty little American creepers the sexes are alike, and they build a domed nest. Mynahs (Sturnidæ). These showy Eastern starlings have the sexes exactly alike. They build in holes of trees. Calornis (Sturnidæ). These brilliant metallic starlings have no sexual differences. They build a pensile covered nest. Hangnests (Icteridæ). The red or yellow and black plumage of most of these birds is very conspicuous, and is exactly alike in both sexes. They are celebrated for their fine purse-shaped pensile nests. It will be seen that this list comprehends six important families of Fissirostres, four of Scansores, the Psittaci, and several genera, with three entire families of Passeres, comprising about twelve hundred species, or about oneseventh of all known birds. The cases in which, whenever the male is gaily coloured, the female is much less gay or quite inconspicuous, are exceedingly numerous, comprising, in fact, almost all the bright-coloured Passeres, except those enumerated in the preceding class. The following are the most remarkable:— Chatterers (Cotingidæ). These comprise some of the most gorgeous birds in the world, vivid blues, rich purples, and bright reds, being the most characteristic colours. The females are always obscurely tinted, and are often of a greenish hue, not easily visible among the foliage. Manakins (Pipridæ). These elegant birds, whose caps or crests are of the most brilliant colours, are usually of a sombre green in the female sex. Tanagers (Tanagridæ). These rival the chatterers in the brilliancy of their colours, and are even more varied. The females are generally of plain and sombre hues, and always less conspicuous than the males. In the extensive families of the warblers (Sylviadæ), thrushes (Turdidæ), flycatchers (Muscicapidæ), and shrikes (Laniadæ), a considerable proportion of the species are beautifully marked with gay and conspicuous tints, as is also the case in the Pheasants and Grouse; but in every case the females are less gay, and are most frequently of the very plainest and least conspicuous hues.