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# THOUGHTS UPON THE MUSICAL SENSE IN ANIMALS AND MAN.

MODERN biology depends, as everyone knows, upon the hypothesis of a gradual transformation of all forms of life—the hypothesis of the origin of species by the slow process of evolution, not by a sudden act of creation. Furthermore, most people are aware that biological science holds the chief agent of this transformation to be the principle of natural selection, discovered by Charles Darwin and Alfred Russell Wallace. Out of the vast number of offspring born into the world in each generation, only a very small fraction can survive long enough to become the parents of the succeeding generation; the rest perish from the attacks of enemies, from the inclemency of weather, from hunger or thirst,—in short, they succumb in the struggle for existence. No two individuals are exactly alike, but every one differs in certain respects from all the others: such differences sometimes increase, sometimes diminish the power to succeed in the struggle for life. Those individuals which possess an increased power of resistance will, as a rule, survive and produce offspring, whether their advantage be due to greater muscular strength, keener senses, thicker fur, greater speed or power of flight, &c. This selective process being repeated in each generation, so that only those individuals which possess qualities the most helpful in the struggle for life, are enabled to become the parents of offspring, it follows that such qualities will gradually spread over all the individuals which make up the species and will grow until they have attained the highest perfection.

In this way is explained the evolution of every useful quality and the adaptation which is so manifest in all living beings.

It is, however, very probable that the animal world is also subject to a selective process of another kind,—the sexual selection of Charles Darwin. I will devote a few words to this principle, inasmuch as our main subject is immediately connected with it.

We are all familiar with the song of the grasshopper and cricket. If one walks in the meadows along a little brook on a fine June evening, he will often hear a long-sustained note, even, subdued, and pleasant, which vibrates powerfully without swelling or diminishing, somewhat like that of the nightingale in Haydn's 'Toy Symphony.' A cautious approach will enable us to see a mole-cricket sitting, apparently motionless, in front of its hole in the ground. More careful examination proves that the short wing-covers are in a state of continual vibration, producing friction as they move; and this it is which causes the sound. The microscope shows that minute and delicate teeth are placed at regular intervals along a vein on one of the wing-covers; when these are struck at a certain rate by a vein on the other wing, they emit a whirring note of a definite pitch. One vein acts as the bow, the other as the string of a violin; the mole-cricket is a violinist, and can therefore hold on its note as long as it will.

It is evident that the power of producing a song can be of no value to these animals in the struggle for existence. It neither helps them to find food, nor defends them from their enemies: it is therefore impossible that it can have arisen by the operation of natural selection. Furthermore, when we enquire into its mode of origin we must take into account the fact that only the males possess the gift of song. This is also true of all other singing insects, such for instance as grasshoppers. The ancient Greeks were aware of this, for Xenarchus, in one of his comedies, says, 'Are not the cicadas happy, whose wives have not got an atom of voice<sup>1</sup>.'

Here then we find the solution of the problem; the origin of the sound-producing apparatus receives a simple explanation in the contest between the males for the possession of the females. If we take it for granted that the females are pleased

<sup>1</sup> Εἴτ' εἰσὶν οἱ τέττιγες οὐκ εὐδαίμονες Ἐν ταῖς γυναίξιν οὐδ' ὅτι οὐν φωνῆς ἔνι;

by the song—and this may be accepted as proved,—we can understand the development of an at first imperfect musical apparatus out of the primitive veins of the wing, and its gradual improvement up to its present condition. The females must, at all times, have preferred the males that sang the best : this being the case, according to the law of heredity, the best developed apparatus was, in each generation, transmitted to the males of the next, so that a gradual improvement in the power of performance must have taken place. The continued preference for the best singers necessarily led to improvement in song and in the sound-producing organ, until the latter became incapable of further improvement.

Let us now briefly consider the song of birds. Here, too, the power of song is possessed by the males alone, and its origin cannot be explained by natural selection, inasmuch as it does not help in the preservation of the species, but is rather disadvantageous, for it betrays the presence of the little creatures to their enemies at a distance. But it can be well explained by sexual selection. The males that sang the best being always preferred by the females, we can understand how out of the primitive chirp a kind of song arose in the course of generations, and how, in certain species, it became more and more complex, until at length it developed into songs which delight even man by their beauty, such as those of the linnet, the blackbird, and the nightingale. Hence sexual selection affords a sufficient explanation of the origin of song in birds and insects.

But how can man have acquired the power of making and understanding music, and how can we conceive of the agents by which such a faculty has been developed ?

Can these agents be found in the processes of natural and of sexual selection ? Undoubtedly man is as completely subservient to the influence of natural selection as any other animal or plant. Man, like every other organism, is variable, is bound by the laws of heredity, and wages a constant struggle for existence. Therefore, with him as with them the qualities which aid in that struggle will be retained and improved, while those which are disadvantageous will be lost. And this is natural selection.

It is impossible to doubt that the intelligence of the human

species has been largely increased since the days of primitive man. Intelligence is man's chief weapon,—a weapon which must have been as important for his existence as physical qualities, and this too even in the most primitive times. Think, for instance, of a race that depends solely upon the products of the chase. In such a case, not only are keen senses and bodily strength and endurance essential for the existence of the individual, but he also needs intelligence, cunning, and astuteness in hunting game; boldness and the gift of working in combination in conquering enemies; wise foresight in preventing starvation during unfavourable seasons. Any improvement in these qualities must have given the possessor a greater chance of survival and of leaving offspring. Hence these beneficial attributes would be slowly intensified in the course of generations: the average degree of intelligence would continue to increase so long as the difference between life and death, between failure and success in begetting offspring, was determined by its means.

There can be no reason why this gradual increase in the human intellect should not be going on at the present day: it would at least be difficult to bring forward conclusive arguments against such an opinion. It must be granted that, even under the conditions imposed by modern civilization, the highly intelligent man, in any calling, has, *ceteris paribus*, more chance of founding a family than one with less intelligence. If this be true, although only when large numbers are considered, it must also follow that the average of very many cases would show that the mental power of man is increasing, although very gradually. It is quite true that we fail to detect any historical evidence of this progress, when, for instance, we compare the Greek and Latin poets and philosophers with those of our own day. But this fact does not conflict with the argument, for the leading nations of the present day are not descended from the ancient Greeks. The development of mankind does not proceed along a straight road, but a very interrupted one. The intellectual achievements of the ancient Greeks did not pass into their descendants, but into the Romano-germanic nations, and these only received the intellectual achievement, and not the intellectual power. It is also to be noted that an increase in the intelligence of mankind may

not only take place by a rise in the greatest heights attained by human intellect, but also by a rise in the general average.

We will now leave this aspect of our subject: my object was merely to show that the human intellect must have been improved during many thousands of generations by the process of selection, and this can hardly be doubted.

A very different answer must be given if we ask whether it is possible to conceive of a similar origin for every kind of talent and faculty possessed by civilized man, if we enquire whether the musical, artistic, poetic, and mathematical talents can have originated in a similar process of selection. It is clear that they did not arise in this way. Such talents may, now and then, have been useful or even of decisive importance in the struggle for existence, but as a rule they are not so. And no one will be prepared to assert that musical or poetic gifts mean an unusually good chance of founding a family, although this is perhaps more nearly true to-day than it was in the times of Schiller, Haydn, and Mozart, or still earlier. But even to-day the man with a practical turn of mind stands a greater chance of material success than one whose talents are of a more visionary kind. Talents for music, art, poetry, and mathematics do not contribute towards the preservation of the human species, and therefore they cannot have arisen by the operation of natural selection.

Perhaps, however, the development of the musical sense in man depends on sexual selection, as we have seen that it does in insects and birds. Darwin held this view; he supposed that the primitive song of man originated in courtship. I am doubtful whether this opinion can be sustained, but the point will be referred to further on. If, however, the theory be accepted, if we admit that sexual selection played a decisive part in the first development of human song, even then we have gained very little as an explanation of the origin of our own music, because sexual selection is insufficient to explain the immense growth which must have taken place in the musical sense since the earliest times, if we admit its existence in primitive man.

We might perhaps be inclined to maintain that such a growth of the musical sense has actually occurred, when, without referring to primitive man, we simply compare the

music of the savage with the highest achievements of our own art.

When Europeans first visited the islands of the Pacific, all the natives were found to practise some sort of music. The song of the New Zealanders made a profound impression upon Cook, and Chamisso found the song of the Hawaiians and Tahitians extremely pleasant, although often accompanied by an orchestra of noisy instruments, such as drums, hollow tubes which were struck violently against the ground, and wooden sticks which were knocked together.

The 'music' was confined within the limits of a very few notes, lying between E and G (or, in the case of Tahiti, between C and F), although, at the same time, not only semitones but quarter-tones (or 'semi-semitones') were employed.

The song was pure, and when a hundred sang together, the sound was like that of a single voice. In spite of the limited compass of their scale, they had a rather large repertory of different melodies and themes, which however were always characterized by monotony and unceasing repetition: some of these were used as the accompaniment of work, others for rowing, dancing, marching to battle, and mourning the dead.

We must however remember that the Polynesians are not in a very low state of civilization. Their poetry is by itself sufficient to prove this, for it is full of feeling and abounds in beautiful similes. Hence we can scarcely look upon their music as primitive if this expression implies the lowest form of musical art.

And yet, what an enormous difference, when we compare this with one of the great musical works of our own time, such as Bach's Passion music in all its depth and magnificence, Mozart's G-minor Symphony, or one of the nine 'Revelations' (so to name them) of Beethoven. One would almost hesitate to apply the term 'music' to the primitive successions of notes made use of by 'savages,' so monstrous does the difference between the two entities appear. Yet our own music must have developed itself from similar beginnings,—there is no other way. And, in fact, we find similar elements in both; notes of definite pitch, separated by definite intervals and held for diverse lengths of time, that is to say, distinguished by differences of rhythm. So that, in this manner, we arrive

at the musical theme, the melody, the groundwork of all music.

Even in its savage form music becomes, to a certain extent, the expression of emotion. The funeral dirge is very different from the war-song or the festal song. Of course such melodies are very far from attaining the marvellous precision with which the highest music can not only excite the whole range of human feeling, but can also represent every emotion just as a drawing represents form. And music can achieve this with such fine shades of expression that language is by no means its equal.

Disregarding for the present those highly gifted minds that created such music, and only considering those which enjoy it, it is clear that even for the mere understanding, viz. the appreciative enjoyment, of one of our great performances, there is required a far higher musical sense than is necessary for the comprehension of the monotonous song of a negro tribe, or a simple Chinese melody, or one of those melodies in octaves which played so prominent a part with the ancient Greeks. In order to hear in a symphony of Beethoven or in Bach's Mass in B-minor anything more than a mere confusion of notes, or a roaring, heaving ocean of sound, demands a highly developed musical intelligence.

Considering these facts, the assumption seems at first almost unavoidable that musical talent in man has gradually increased from the condition found in the Polynesians up to the level reached by the most civilized nations; and if for the moment we adopt the Darwinian hypothesis as to the origin of human music, it is clear that the amount of increase which has taken place during this rise from the condition met with in the living savage ought to be sensibly greater than that which took place during the development of primitive man into the living savage. It is at any rate certain that the amount of increase in the musical art itself has been far greater during the second period of its development than it can have been during the first.

Hence we are led back to the question with which we started, viz. how and by what means can this increased refinement and growth of the musical talent have been produced?

Sexual selection cannot possibly afford the required explanation, even if we admit that it played a part in the origin of the primitive song of ancestral man. It is not only true to-day



but has been true from times immemorial, that the choice of husband and of wife are determined by qualities other than musical gifts, viz. by youth, beauty, strength, and not least by mental endowments, not to speak of the various external inducements which are always apt to intervene. No one will be prepared to maintain that men who cannot sing and lack any remarkable musical talent, are or ever were at a disadvantage in gaining wives. On the contrary, we know that such men have no difficulty in finding unmusical partners, and indeed that they not uncommonly marry those in whom this taste is strongly marked. If this be so any increase of the musical talent by means of sexual selection is rendered impossible.

I feel sure that many will at this point inquire whether it is impossible for musical talent to have grown in exact proportion to its exercise. We are all familiar with the fact that by constant practice every organ is improved and its power increased. We cannot doubt this when we think of the marvellous delicacy of touch acquired by the finger-tips of a blind man who attempts to make up for the loss of vision by means of the tactile sense. Why then should not the musical sense have been increased during the course of unnumbered generations in each one of which the mind and ear were exercised in the composition of music and in its enjoyment? And such exercise appears to have actually taken place, for, as far as we are aware, nearly all savage nations, not only the Polynesians, but the American Indians, negroes, and Asiatic tribes,—possess some sort of musical utterance.

This explanation would certainly be a very simple one, and it would be equally useful in many other directions, provided only that it were the true one. Up to the present time it has been regarded as valid, and many, even now, consider it to be so. But the explanation before us involves a supposition which a close examination does not allow us to admit,—the supposition that those modifications of an organ which are due to its exercise during the individual life can be transmitted to offspring. The supposed increase of the musical sense in the course of generations can only have occurred in the manner suggested, provided that this supposition be granted. If however the results of practice cannot be handed down it is clear that the increase of the sense starts in the descendant at the

very point at which it began in the parent, so that growth in the former can only reach as far as it did in the first ancestor, and this in spite of practice continued through any number of generations.

The amount of improvement possible in a life-time is very limited. No athlete can by any amount of practice lift a weight of a hundred or even one of twenty hundredweight, although he may be able to raise three or four. And, if our views on heredity be correct, the son of an athlete will have to start at the point at which his father started. For the son, if indeed he inherits his father's gifts, inherits only those with which his father came into the world and not any increase which they may have undergone during his lifetime. Unlimited training therefore will only enable the son to lift a weight of three or four hundredweight.

Biological science asserts, with ever increasing clearness, that there is absolutely no evidence for the assumption until recently so generally received, that acquired characters can be transmitted. It was believed that mutilations were occasionally *inherited*, but a searching examination has shown that the evidence brought forward will not stand the test of criticism. The results of certain recent experiments, in which the tails of mice were amputated, showed that the offspring, although examined in many hundreds of cases, were invariably normal<sup>1</sup>.

We are therefore compelled to abandon this hypothesis of the transmission of acquired characters, at any rate until it has been supported in some other way. We lose with this view a very convenient principle of explanation, and we must therefore attempt to understand the phenomena without its aid.

The question before us is :—How is it possible that such an increase in the musical sense took place as seems necessary to have raised it from the condition met with in the savage up to *that found among civilized races at the present day*? When we examine this question we are led to inquire *whether it is correct to assume that any increase in musical talent has, as a matter of fact, taken place in the course of ages*. That such an increase has occurred appears to be a matter of course; for how could our highly developed music have arisen unless the musical organ had previously become more efficient?

<sup>1</sup> See Vol. I. pp. 444, 445.

Let us however consider the converse question:—*Is it the case that highly developed music must appear when high musical talent exists?* Let us suppose for instance that a child endowed with the talent of a Mozart were born among some savage nation such as the Samoans before they were influenced by European civilization. Would such a child, after reaching maturity, compose *stringed quartettes and symphonies?* Certainly not. If the Samoans possessed the songs which they have to-day, our aboriginal Mozart must soon have known them all by heart and would have composed new ones. Perhaps, being such a unique genius, he might have produced a great musical reform, introducing changes of a revolutionary character and raising Samoan music to a higher stage. But he would not have raised it to the modern symphony. In order to attain such a height he would have been obliged first to invent the musical notation, and then, rising higher, to pass through polyphonic music, until at last he reached the commencements of that harmonized music to which symphony belongs. The greatest change that he could have introduced would have been an extension of the scale from three or four whole tones to seven, and in association with this, the composition of more elaborately constructed melodies, or at the utmost the invention of music in two parts, which is known to have taken place comparatively recently, viz. in the times of the Troubadours.

It would have been as impossible for the Samoan Mozart to compose symphonies as for one of the great men of science of ancient Greece, such as Archimedes, to invent the modern dynamo as used for the transmission of energy or for electric lighting. To be enabled to construct such a machine, he would have had to work his way through more inventions and discoveries than could have been made during the life-time of the greatest genius who has ever lived. For in ancient times nothing was known of electricity except that amber (electron) when rubbed attracted little pieces of paper. Before a man could arrive at the knowledge by which he could construct a fixed electro-magnet in such a manner as to produce currents in a rotating coil, many other discoveries in physics had first to be made, the investigations of Gray, Dufay, Kleist, Franklin, and others were necessary, Galvani and Volta had to discover

the electric current, Oerstedt electro-magnetism, while it was necessary for Seebeck, Ampère, and Faraday to base upon this still further discoveries. In like manner most of these discoveries had to be made before first Soemmering and then Gauss and Weber could use the electric current for signalling at a distance ; and even then a whole series of practical improvements in telegraphy necessarily preceded Hughes' printing telegraph. One discovery is ever built upon another ; and the history of music is not less a history of inventions than that of the electric telegraph.

It is therefore impossible for even the greatest genius to pass directly from simple melody to symphony.

I should like to suggest the further question whether it is quite certain that Mozarts could not have existed in ancient times ; in other words, whether the supposed increase in musical talent has in reality taken place as a historical fact, or whether the talent was not inherent in man from the beginning, while its expression, i. e. music itself, has undergone progressive increase and development.

At first sight the question may appear to be very strange ; but I believe that it is perfectly justifiable. Indeed I am of the opinion that the suggestion implied in the question is entirely valid. I have shown that from the mere fact that symphonies are not composed by savages, we are not entitled to conclude that Mozarts have not existed among them ; or, to put it still more clearly, we are not entitled without further proof to infer that savages never possess high musical talents because their music is but lowly developed. Such talent might very well exist, but could not produce any marked effect, because of the low level attained by the musical environment.

I am satisfied by the proof afforded by numerous facts that this is really the case, and that therefore the high musical talent which is more or less possessed by civilized man at the present time, does not depend upon a gradual increase in the musical sense, and that such increase being non-existent does not require explanation. No such rise and increase of the musical faculty by itself has taken place. The musical sense is rather an ancient possession of mankind chiefly depending upon the highly developed auditory organ, and this was transferred to man from his animal ancestors and has not

increased at any rate beyond the condition reached by the lowest of existing savages. We have definite proofs of the occurrence among savages of musical talent capable of the same education as our own. We must therefore consider their talent to be as high as ours, although it is generally hidden because untrained during the life-time of its possessor.

Negro races are certainly not at a very high stage of civilization. We see this clearly by their utter carelessness of human life, as shown in the dreadful massacres of the King of Dahomey and other chiefs, by the state of servitude to which women are subjected, and by the lack of real family life. But in spite of these proofs of inferiority it has happened on many occasions that negroes have attained to the full understanding of our highest music.

Brindis y Salas, a Cuban negro, who travelled as a violinist through Europe and America, is a well-known proof of this. He was not merely endowed with excellence of 'technique' along with delicacy of ear, but—as I am told by a distinguished musician<sup>1</sup>—'he possessed musical abilities of a very high order. His playing was that of an artist.' He must therefore have had an inborn musical sense, as high in all essentials as that of our greatest performers. It is impossible to urge the objection that his ancestors had been under European influence for centuries, because such a period of time would be far too short for the growth of a special part of the brain as the result of inherited practice, and also because European music of a high order does not reach the negroes of Cuba.

Another example is afforded by the 'Jubilee Singers,' a company of negro men and women, who in 1887 astonished Europe by their 'very extraordinary performances in four-part singing.' The authority, whose opinion I have already quoted, judges from their performances that there is no doubt whatever as to 'the talent of the negro nation for our music.'

We also find among European musicians and composers many grounds for the belief that musical talent has not been increased by practice in the course of civilization. If this were the case, highly gifted musicians would never have arisen in families living, remote from the great influences of their

<sup>1</sup> This information was kindly placed at my disposal by Herr Otto Lessmann, of Berlin, editor of the 'Allgemeine Musikzeitung.'

time, in places where the only music consisted of national songs accompanied by the guitar or the zither. But, not uncommonly, from these very surroundings have come men with a highly developed musical sense, and even celebrated composers. Martin Luther, who is known to have been a composer, was the son of a poor miner. Palestrina was the son of a peasant. Jacob Callwitz, a sixteenth century composer, was the son of a labourer, and Joseph Fux, who composed in the seventeenth century, was the son of a Styrian peasant. Cimarosa was the son of a washerwoman near Naples: John Gottlieb Naumann, a renowned composer of the eighteenth century, was of peasant extraction, as also was Joachim Quanz. The first known ancestor of the Bach family was born in 1550, in the country near Gotha, and worked all his life as a miller in Wechmar, his native place. Joseph Haydn was also born in a village, and was the son of a poor wheelwright.

In these instances we cannot maintain that all this musical genius sprang out of the earth suddenly and without preparation. On the contrary, I wish to point, for example, to Haydn, whose parents we certainly know to have been musical. They sang when they rested from work, and the father accompanied on the harp. The above-mentioned founder of the Bachs also frequently played on the cythringen, a kind of guitar, which he brought home to the mill from his travels. Sebastian Bach says that 'this was, as it were, the beginning of the music of his descendants.' The highest musical culture of their time was entirely without influence on the musical sense of the ancestors of these two great musicians; the talent existed nevertheless, and appeared in the descendants, sometimes to an increased and sometimes to a diminished extent.

It is no real objection to this argument to urge that only a few out of the large number of musicians in recent centuries came from the lower orders. A great musician not only needs the highest talent, but also stimulus and all the culture that his times can bestow. I previously assumed that the invention of two-part singing would be the highest achievement possible for our supposed Samoan Mozart, and we may safely conclude that Joseph Haydn would never have surpassed his father's national songs and harp had he not chanced to become

a chorister in the little town of Hainburg, and had he not afterwards entered the music-school in Vienna, of which Reutter, the organist of the cathedral, was the head. Haydn possessed musical talent of the highest order, but had it not been trained, he could never have accomplished by himself the whole development of modern music from the national song; he could never have risen from the music of his parents to oratorios and stringed quartettes. Such cases afford interesting evidence that at least a great part of the development of modern music can be accomplished in a lifetime, even when all the ancestors have been strangers to the higher musical culture, so that it was impossible for their musical sense to be raised by it. The musical sense is evidently innate in the human brain, and is independent of all training and practice undergone by ancestors. The predisposition may be strong or feeble, but even the greatest talent does not enable the possessor to climb to the height reached by the music of his time without being raised by instruction. That so great a height can be reached in a life-time by the son of a German peasant, or even by the offspring of a savage race, evidently proves that the musical sense of to-day has been inherent in man since times immemorial, and that it has not been increased by the development of music or by practice. It has nevertheless been brought to a higher stage of development in the most civilized races, as we shall see further on.

We have already seen that musical talent exists in every stratum of society. And yet the upper classes have produced many more eminent musicians than the lower, a fact which we can easily understand when we remember that without early stimulus, and the constant opportunity of hearing and being instructed in the highest music, even the greatest genius must remain undeveloped or, as we may say, latent.

This is proved by many examples: thus out of sixteen renowned German musicians of the sixteenth and seventeenth centuries, no fewer than eight were the sons of organists: the others were the sons of peasants and labourers, but nearly all were choristers when boys. Furthermore, twenty-seven of the greatest German and Italian composers of the eighteenth and nineteenth centuries were the sons of musicians. Examples of these are afforded by Mozart, Beethoven, Weber,

Hummel, Cramer, Abt Vogler, Hasse, Johannes Brahms, Robert Volkmann, Czerny, Karl Reinecke, Cherubini, Bellini, Rossini, Antonio Lotti, and Scarlatti. In all these cases it is clear that a highly-developed musical sense was transmitted from father to son, while the talent of the latter was further developed than that of the father, because it was trained and exercised from earliest youth, although I do not mean to imply that it was not also greater from the very beginning. But the greater force of the inherited talent does not depend upon the weaker talent of the father having been improved by practice during his life-time. Many still believe in the hereditary transmission of improvement acquired by practice; but if such inheritance could take place so rapidly, in a single generation, we should easily find proofs of it in many occupations and pursuits—proofs which are as yet entirely wanting.

I shall, however, be asked: Whence came the increase in the talent of Mozart and Beethoven as contrasted with that of their fathers? It is impossible to give any definite answer to this question, but I can, perhaps, indicate it by another question: Whence came the high poetic genius of Goethe, whose father had no taste for poetry, while his mother without ever having written, exhibited, in her whole character, the most distinct endowments in this direction? How could the poetic genius of the mother, which had never been exercised, attain so high a level in the son? We must not forget that poetic talent is by no means a simple power but a very complex one, depending on a happy combination of many intellectual and emotional gifts, which in Goethe's case were derived, as he himself tells us, partly from the father and partly from the mother.

‘Vom Vater hab’ ich die Statur,  
Des Lebens ernstes Führen;  
Vom Mütterchen die Frohnatur,  
Die Lust zum Fabuliren,’ &c.

Similarly, I should be inclined to explain the genius of Mozart as a very complex power made up of the fine ear, the strength of will and energy of his father, and the bright and cheerful disposition, the gentleness and refinement of feeling of his mother. From this constitution may have arisen the infinite flexibility of that wonderful mind which, with unwearied



activity, ever led to fresh combinations of the emotions which became the subjects of musical themes. A psychologist might be able to show us more of the constitution of this marvellous mind. I will not attempt it; I merely wish to show that the increase in the musical faculty, which appears to pass from father to son, can be explained, as in so many other cases, entirely without the unproved assumption of the inherited effects of practice. Even when the musical sense itself is transmitted unaltered, viz. without increase, from father to son, a considerable increase in the power of composition may nevertheless be brought about by the combination of mental gifts derived from the mother with the musical sense inherited from the father; and this sense will therefore gain in the son a higher expression. There are many highly-gifted people who are unable to compose anything original: even remarkable musical talent may co-exist with an utter inability to produce anything new. Examples of this are perfectly familiar. But in the descendant of such person, the strong receptive musical talent may be united to such a complete flexibility of the mind and temperament, derived from the mother, that new combinations of ideas will ever arise. This latter gift will then seize upon the musical sense, and ideas which were perhaps of an entirely different nature in the mother, will become musical ideas in the son.

The composer not only needs the musical faculty, the gift of originality is also indispensable. I believe that an increase in the *genius for music* which passes from father to son depends upon a new combination of mental gifts, with which of course an increase in the delicacy of the musical ear itself may be united; for every inherited quality varies, and may be feebler or stronger than it was in the parent.

Let us now return to the argument that some external stimulus is necessary for the development of an existing musical faculty. Two facts seem to me to favour this opinion; first, that nearly all the renowned composers and singers of the present century have come from large towns, and have thus been brought up where from earliest youth they have been subject to musical influences of all kinds. I have made a list of ninety-eight such cases. Secondly, the fact that during the nineteenth century the Jewish race first began to take part in

the development of music. In this century composers of Jewish descent first begin to appear, and among them we find very great names, such as Meyerbeer, Mendelssohn, Halévy, Rubinstein, Moscheles, Félicien David, and others. This fact is probably associated with the emancipation of the Jews, which afforded them the opportunity of developing the rich musical faculty which they possessed by nature. In this we find a further proof that it is impossible for the musical sense of modern nations to have been raised by practice during earlier centuries; for the Jews were entirely without adequate musical training, so long as all the higher music was bound up with religious service. The introduction of music into the Jewish synagogue is of quite modern date. Throughout the eighteen centuries preceding our own, music had played no part in Jewish life, and yet this nation possessed the musical faculty in a very high degree, and as soon as the Jews began to cultivate their talent they were not only able to reach the summit of modern musical achievement, but also to contribute towards the progress of the art. This is certainly clear evidence for the hypothesis that the musical faculty has been latent in mankind from times immemorial, at least in many races, and that it can be evoked at any time and raised to any height.

But if the mental instrument with which we make—I mean invent and enjoy—music, existed at all times, why did not man perform symphonies and oratorios in the age of the Pharaohs? The answer is clear—*Because music is an invention*, and one which could reach its present height only very slowly in the course of centuries. And here we meet with the great difference between man and animals. Man possesses a *tradition*; he improves and perfects his performances by passing on the gains of each generation to those which follow. The higher animals are not entirely devoid of the power of learning from preceding generations, but they possess it in a much lower degree. A young goldfinch, when brought up by hand, sings untaught the song of its kind, but not so perfectly as when it has had an accomplished songster for its teacher. It also learns by tradition, but the essential basis of the song was present in its organization beforehand, and is inherent. The bird speaks, even when untaught, the language of its species.

Sexual selection, as we may suppose, has made this language an essential part of its being.

It is otherwise with man: his language does not exist as a perfected faculty, as a part of his physical nature; but only as a possible expression of it which only becomes actual when the individual preserves communication with those who preceded him, viz. when he is taught to speak. Hence it is that every human child can learn any language: hence it is that there is not one single human language but hundreds of them, each of which has had its own developmental history—its origin, climax, and decline. Each of these different modes of expression of the human mind seems, as it were, a distinct mental entity, independent of the individual, and possessing its own history. And this is not only true of language, but also of the arts and sciences. Not one of these could have existed had not man possessed that advantage over animals which enables him to transmit the knowledge he has gained to his descendants, so that these latter are benefited by building, from the very first, upon the high level reached by previous generations, from which they can rise still higher.

All this is far from new: it has long been known that the chief difference between man and animals consists in the fact that man is capable of mental development while animals are not. But I doubt whether the exact difference has ever been clearly conceived. The statement just made is not a satisfactory expression of it; for common knowledge of the day asserts that animals are certainly capable of development although in a sense entirely different from that which is intended above. We have every reason for the belief that the unceasing transformation of species which took place during the earlier epochs of the world's history, is also proceeding to-day—that to-day, wherever circumstances are favourable, the transformation of species is taking place, although slowly and insensibly. But such a process of development of one species of animal into a new one, even when combined with an improvement and increase in efficiency, is entirely different from what we mean by the development of mankind.

The development of animals transforms one species into another and changes the physical nature: but what we generally understand by the intellectual development of man-

kind by no means necessarily entails any physical alteration even in the brain itself: it is indeed quite independent of any such change. Such development represents *an increase in the intellectual acquirements of mankind as a whole*: this is the origin of civilization, using the term in its widest sense and applying it to all the numberless directions taken by civilizing forces<sup>1</sup>. Man, availing himself of tradition, is able, in every part of the intellectual domain, to seize upon the acquirements of his ancestors at the point where they left them, and to pursue them further, finally himself leaving the results of his own experience and the knowledge acquired during his lifetime to his descendants, that they may carry on the same process. This method of progress is most clearly shown in the history of science, and especially in that of natural science, which deals with an immense number of facts and experiences which have been very slowly acquired, collected, and transmitted to descendants during many centuries of civilization; and in this way alone could the present state of our knowledge have been reached. The human being of to-day can be easily raised, by a short period of training, to this stage from which, if he be successful, he may perhaps make one or more onward steps.

This consideration affords especially clear evidence for the assertion upon which I have already laid great emphasis—*that the development of any mental faculty is not necessarily connected with any elevation of the mental capacity of the individual*. Hardly any greater power of observation or more acuteness is required to observe the development of an Infusorian under the microscope, than was needed in Aristotle's time to make out the anatomy of a Cuttlefish, with the naked eye and simple

<sup>1</sup> Very similar ideas have been recently expressed by D. G. Ritchie in his '*Darwinism and Politics*' (London: 1891). Thus on pp. 100, 101 he writes as follows. 'Language renders possible the transmission of experience irrespective of transmission by heredity. By means of language and of social institutions we inherit the acquired experience, not of our ancestors only, but of other races in the same sense of "inheritance" in which we talk of people inheriting land or furniture or railway shares. Language renders possible an accumulation of experience, a storing-up of achievements, which makes advance rapid and secure among human beings in a way impossible among the lower animals. Indeed, might we not define civilisation in general as the sum of those contrivances which enable human beings to advance independently of heredity?'—E. B. P.

dissecting instruments. The fact that we can now solve more difficult problems than at the beginning of this century, or in Aristotle's day, does not depend upon any increase in the capacity of the human brain or any improvement in the delicacy of the faculty of observation ; but it depends upon the heritage which we have received from our ancestors, viz. higher problems left for our solution together with better means and appliances for their investigation. *It is as impossible to explain the development of music by an increase and perfecting of the musical talent, as to explain the superiority of our pianists over those of Mozart's time by a recent improvement in the dexterity of the human hand.* The very hands which, in Bach's day, could only give a bald and imperfect performance on the spinet, would now, upon a Steinway's or Bechstein's grand piano, produce all the enchanting effect of an orchestra. The causes of this immense change are manifold. First, a gradual improvement in the instrument,—itself a result of tradition which permitted an advance upon the acquirements of earlier generations ; secondly, parallel with this advance, the development of appropriate music ; lastly, the immense improvement in pianoforte technique which we associate with the names of Haydn, Mozart, Clementi, Hummel, Moscheles, Thalberg, and Liszt. No one would dream of suggesting that this advance in 'technique' is due to an improvement, as regards piano-playing, in the powers of the human hand, produced by the practice of several consecutive generations. Such an origin is indeed impossible, because, happily, every one does not play the piano, because every pianist is not a performer of eminence, and because the children of such performers rarely become performers themselves. Liszt's father was a clerk in an accountant's office. Among all our living performers I only know one, Pauer of London, whose son is a pianist. It is clear that in this case also the possibility of higher performance does not depend on higher talent, but upon the tradition of improved technique which enables the young artist to strive, from the very first, after a higher ideal.

It is the same, I believe, with music itself—nay with all the arts. That emotional instrument wherewith we make music, whether developed within us or received from without, has been innate in man, and has undergone hardly any

improvement from times immemorial. But in these days we know how to employ it more fully because we have trained it to higher achievement from the very beginning of life. The musical talent, like every other, is capable of vast improvement by life-long training. I well remember hearing for the first time, as a boy of thirteen, a great performance—the Pastoral Symphony of Beethoven. How clear and distinct is the meaning of such a composition now that we are accustomed to hear far more intricately written orchestral works! I was even then impressed by the mighty ocean of music, and listened with the greatest interest; but I was unable to disentangle the theme from the maze of notes and to understand its ideas. It was only by practice of my mental sense, through frequently listening to this symphony, that my power of musical perception acquired the capacity of picking out, and distinguishing, particular passages more and more clearly from the totality of the composition, and placing those passages into their due relation to the swell of the waves of music which surged along beside them.

Although the average musical faculty has not undergone any increase, in the course of ages, it must at one time have originated; and the question arises whether we can explain this from a scientific standpoint. *How can we conceive the existence of a musical sense?*

Attempts in this direction have been repeatedly made, not only since the doctrine of evolution has become prevalent, but also during past centuries. The able psychologist C. Stumpf has recently directed attention to the fact that the question of the origin of music greatly occupied men's minds, especially in France, during the middle of the last century. Jean Jacques Rousseau had already formed the opinion that music originated in language, in excited speech, a view that was simultaneously brought forward in Germany by Scheibe. This hypothesis must have been forgotten later on, or Herbert Spencer would never have enunciated and supported it without reference to his predecessors. It has met with little acceptance, and has been refuted in detail; it may now be looked upon as an abandoned position. This can hardly be said of the hypothesis brought forward by Darwin, who held the antagonistic view that song is older than language, and arose by sexual selection.

Important objections have however been raised against this hypothesis by many writers, and especially by Stumpf. And yet I would freely admit that at present it is difficult, nay impossible, to decide whether sexual selection has or has not had any part in the origin of human song. But even if it has played this part, it by no means follows that there was a similar origin for the musical sense also: this faculty might have been present beforehand.

It would lead me too far if I were to attempt any detailed exposition of the reasons which, as I think, oppose the hypothesis of the origin of the musical sense by sexual selection. They partly depend upon the above-mentioned fact that any increase in this faculty has not taken place since the stage reached by man in a savage state. Other objections depend upon certain considerations of which I will now speak. The explanation of the musical sense is to be looked for in an entirely different direction; I do not believe that it originated as something independent and as it were intended for the duty it performs, but that it is simply a bye-product or accessory of the auditory organ. This organ was a necessity in the struggle for existence and has therefore been developed by selective processes, and raised to the highest pitch of perfection. The musical sense is, I believe, a merely incidental production and thus in a certain sense, an unintended one.

No one can believe that the human hand was created for playing on the piano,—that it became what it now is in order that man might be able to make use of this instrument. It is, as we know, fitted for grasping and for the power of delicate touch; and as these are very useful qualities, of high importance in the struggle for life, we feel no difficulty in explaining the gradual perfecting, by processes of selection, of that form of hand which the higher animals had already gained. By means of selection, the hand became the perfectly articulated, sensitive, and mobile structure that we find, not only in ourselves, but in the very lowest savages. But we can do many things with our fingers which were never intended, if I may use the expression; we can, for instance, play on the piano, now that this instrument has been invented. And furthermore a native African could, if trained as a child and under certain conditions, learn all the technique of the modern piano as thoroughly as a European.

*I believe it to be much the same with the musical sense and the artistic faculty in general.* This faculty is, as it were, the mental hand with which we play on our emotional nature,— a hand not shaped for this purpose, not due to the necessity for the enjoyment of music, but owing its origin to entirely different requirements.

I will give more detailed evidence in support of this view. Our musical organization consists of two parts:—first, the auditory organ proper, viz. the outer, middle, and inner ear, by which the various sounds become nervous stimuli, each producing its corresponding nerve-impulse: secondly, that part of the brain which transforms the impulses conveyed to it by the auditory nerve into sensations of sound; this is the auditory centre of our brain.

The first part of this twofold organ, the auditory organ proper, is, so far as we know, not much higher in organization than that of many animals, and it does not possess any peculiarity of construction which would justify us in the assumption that the power of *hearing* music is greater than in animals. The higher animals can certainly hear music: the behaviour of my cat is sufficient evidence for this, for she comes near whenever the piano is played and sits quietly near the performer, sometimes jumping up into his lap or even upon the keyboard of the instrument. I know of a dog, kept by a family in Berlin, which always approached when music was played, often coming from distant rooms and opening the doors with his paw. I hear, on good authority, of a dog which generally stayed at home, but wandered about every now and then in order to indulge his love of music. This dog could never be kept at home during the fair which is held twice a year at Frankfort-on-the-Main. As soon as the street bands appeared and began to play the dog ran off and followed them through the streets of Frankfort from morning till night. This habit was well known by his owners who were accustomed to keep dinner for him in the evening at the time of the fair.

It is sufficiently clear that neither cats nor dogs nor any of the other animals which hear the music of man were formed with a view to the perception of such sounds. I mean that the auditory organ which they possess, arising under the guidance of natural selection, *cannot have assumed its present form in*



*order that these animals might perceive music*; for such an experience confers absolutely no advantage in the struggle for existence. Besides, the animals and their auditory organs are far older than man and his music. The faculty of hearing music possessed by these animals must be an incidental accessory power possessed by an auditory apparatus which assumed its present form under the operation of other causes.

Now I believe that it is the same with man. Man, too, did not acquire his power of hearing music as something by itself, but he received, by processes of selection, a very delicate and highly elaborate auditory organ; for this organ has been necessary in the struggle. And furthermore, it so happens that this organ can also be used for hearing music. By the assertion that the auditory organ of man was produced by natural selection, I do not mean to imply that it was not already formed in the pre-human period. We have never found the direct ancestors of man, and even if we were fortunate enough to meet with their remains it would be impossible to make out the minute microscopic structure of the soft tissues which, during life, covered the osseous parts of the auditory apparatus deeply buried in one of the bones of the skull. But it is most probable that our direct ancestors possessed an auditory organ nearly similar to that which we possess to-day; for in the living caricatures of men, the apes, it reaches almost the same degree of perfection. It must be admitted that there are no researches into the minute details of the ape's ear like those of Hasse and Retzius on the auditory organ of certain other *Mammalia*. Hence we cannot decide whether the length of the scale which can be heard by an ape is as great as that heard by a man; but we may assume that it is nearly the same.

The power of appreciating the interval between musical notes depends, as we know, upon a wonderfully complex apparatus placed in the so-called cochlea. This structure called after its discoverer, Corti's Organ, consists of thousands of cells which form the terminations of auditory nerve-fibres: each cell can only be made to vibrate by a single note of a certain pitch. This is brought about by the fact that each cell rests upon part of an elastic membrane of microscopic delicacy which passes across the cavity of the cochlea, just as upon a stretched string which only vibrates with a particular note. If Helmholtz's in-

terpretation of the apparatus be correct, we can judge of the delicacy of any auditory apparatus by the number of such cells. The greater the number of cells the more delicate will be the hearing of the animal and the wider will be its range. The exact measurement and enumeration of Retzius have shown us that the human cochlea contains 15,500 such cells, that of the cat 12,500, that of the rabbit 7,800. Hence man has a more perfect sense of hearing than either of these two animals, but we cannot determine with certainty whether he can better appreciate minute differences, or whether he can hear more notes: probably he is superior in both these respects. There are also individual differences in the number of cells in the human species, although perhaps only within narrow limits. Such differences explain why some individuals do not hear so well, or cannot distinguish so many deep or high notes, as others. I myself possess a rather fine ear, but I can never hear the high notes of certain species of grasshoppers, even when hundreds of them chirp together, although others can hear them easily.

If then the apparatus by which music is heard in the cat and the rabbit be essentially the same as that of man, only differing in degree, the following question is naturally suggested:—*Knowing that nothing can arise unless it be useful, how has it been possible for this apparatus to originate?* The power of hearing music must have been utterly useless to those animals which do not make music, and hence the origin of their auditory apparatus must have proceeded from other necessities. What can these necessities be?

Why has it been useful to Mammalia in the struggle for existence to hear with distinctness all the large number of notes for which their auditory apparatus is fitted, and which renders the hearing of music a possibility? This question has probably never been asked before, and I must admit that the answer is by no means easy; at any rate if a complete and detailed explanation be expected. But I believe that it is easy to understand in a general way how the ear of these animals could have been elaborated and raised to so high a pitch by natural selection. Wild animals stand in need of a very fine ear. Beasts of prey, such as cats, must in the first place be able to hear and distinguish between all the sounds made by

their prey. But this means that they must hear a scale of considerable length; that, for instance, of the cat must pass through all the interval between the cooing of the wood-pigeon the call of the cuckoo, and the notes produced by the blackbird, the chaffinch, the linnet, the siskin, the thrush, and the pheasant. But the wild animal must also be able to hear the sounds made by its enemies and distinguish them from others. And not only is this the case with the animal sought after by many enemies, such as the rabbit, but the enemy itself must also be upon its guard against other enemies which endanger its life and that of its young. It must distinguish the howl of the hungry wolf from the bark of the fox or dog, the deep note of the eagle owl from the cry of the eagle and vulture. We need not here take man into account, because his existence only began long after the development of the auditory organ in these animals, and because his influence upon them has been annihilating rather than transforming.

It was therefore necessary for the auditory organs of these animals to have a very extensive range, stretching from rather low notes on the one side to very high ones on the other. It was essential that the organ should be adapted for a continuous scale without breaks; for otherwise the position of the various notes could not have been accurately estimated. Indeed we feel a sense of admiration and wonder when we see the exceedingly high development of the cochlea adapted for hearing a continuous scale in the mammalian ear, and we can only understand it when we realize how completely the very existence of wild animals depends on the utmost delicacy of their organs of special sense. It is absolutely essential for them to know with certainty whether any particular sound proceeds from an enemy or from their prey. While a single mistake might be fatal to them, one often repeated would be inevitably punished with death. If they mistook the sound made by an enemy for that of their prey they would of course go to certain destruction, but the opposite mistake would also be fatal; for the food of a beast of prey is nearly always scarce, and if many opportunities were missed the animal would die of starvation. It is not in vain that the fox roves about by night and day searching for food, listening for the faintest sound, and ever ready to rush upon its prey or to fly; it is not in vain that the hare is so

timid ; it needs to be extremely sensitive to every sound if it is to continue to exist as a species. Hence we can perhaps to some extent understand why the rabbit has 7800 cells in its auditory organ, although this implies the most astonishing delicacy of ear. We must not however assume that each of these cells is set to a different note, but rather that the four cells of each transverse row are fitted to receive the same vibration. There remains, however, a surprisingly large number of different note-sensations, i. e. nearly 2000. We can realize how very delicate hearing must be, which can appreciate only 1000 different notes, when we remember that a concert grand piano contains only 87 different notes. If we reckon that the auditory organ can appreciate a somewhat longer scale, namely that of a hundred notes situated at the distance of semitones, it follows that the interval between two consecutive semitones would contain nearly 19 intermediate sounds. The human ear, when very highly trained, can distinguish nearly 30 intermediate notes between A and B-flat, a rather larger number than the difference between the numbers of their respective vibrations in a second,—(A = 440, B-flat = 467.5).

If then the mammalian auditory organ must attain so high a pitch of perfection lest it should be inadequate in the struggle for life, it is clear that the part of the brain by which notes are perceived, the auditory centre, must possess a corresponding degree of organization. We may indeed assume it to be certain that a corresponding degree of development is found in those layers of nerve-cells and nerve-fibres in the auditory centre, the so-called 'field of memory,' which serve as the material basis of the memory of auditory perceptions. Aristotle was quite correct in maintaining that 'animals devoid of memory would be unable to perceive even the difference between two successive notes'.<sup>1</sup> But an elaborate auditory organ would be of little or no value to such animals ; they would be unable to discriminate between the sound of an enemy and that of their prey, for they could not compare the note they were hearing with that previously heard, the latter having wholly faded from their consciousness.

It is much to be regretted that we can know with certainty in but few cases how far an animal is capable of perceiving

<sup>1</sup> I quote from C. Stumpf, 'Tonpsychologie,' Bd. i, p. 279.

music. The capacity seems to be present in a tolerably high degree; for it is known that cavalry horses often recognize the signals as well as their riders and begin the appropriate movements before being directed.

The evidence is especially clear in the case of certain birds, far below the above mentioned mammals in mental power, that music may be heard and properly understood by organisms which cannot have acquired their auditory apparatus for this purpose. I am here referring to those birds which either have no song of their own or a very simple one, but which are nevertheless capable of imitating the more beautiful song of other birds or even the melodies of human music.

This is especially remarkable in the case of parrots, which can learn to sing short melodies quite correctly. It is therefore certain that they possess the apparatus necessary for hearing music, although they do not sing unless taught.

Hence the supposition appears to be well founded that man possessed the auditory apparatus necessary for music before he made music, and that the apparatus did not, by making music, attain the degree of development it has reached. It is not necessary to assume that the capacity of hearing music<sup>d</sup> was a primitive faculty acquired for its own sake; it may rather be conceived of as a secondary, an 'unintended,' accessory, as a mere incident in the evolution of the auditory organ which reached its high development by ministering to other necessities.

It might perhaps be objected that neither the minute structure of the cochlea nor the power of hearing an extensive scale proves that music is perceived as music, or that we do as a matter of fact hear the third or fifth which is sounded. It might be conceived that the musical sense depends upon yet another and unknown peculiarity of the auditory apparatus, a peculiarity which has been added to the function of hearing and the origin of which therefore demands some special explanation. But this objection will not hold, because animals such as the horse and parrot, can as a matter of fact hear music, although we cannot assume that they possess any special contrivance for it. The basis on which this objection rests is nevertheless sound, for we can never explain the faculty of hearing music by the knowledge of our auditory apparatus alone. But to use this

undoubted fact as an argument for the conclusion stated above, would be like maintaining that the hand was specially created in order to play the piano, because we can never explain, by a mere examination of its structure, the infinitely rapid movements made by a performer. It might be argued that inasmuch as the hand and fingers were never required to make such swift movements when man existed in a primitive state, they could not have been originally capable of such movements, and that therefore the faculty which they now possess must have depended upon sexual selection or the results of inherited practice.

The same might be said with regard to the swift movements of the fingers in writing. Such arguments depend upon a mistaken application of the principles of utility, a principle which certainly excludes the possibility of raising an organ by the process of selection above the highest point of actual utility, but which by no means prevents it from acquiring new uses as the result of life-long practice.

A more serious objection may be derived from the consideration of those who are utterly unmusical. We cannot doubt that many such people exist, even if most of them are to be accounted for by want of training at the right time. Those who are totally devoid of the faculty of music, can apparently hear sounds and notes of every kind as fully as musical people, but they are unable to discern the intervals, or to perceive and reproduce a melody, much less to analyse a harmony. If then their auditory organ be normally developed we are apparently confronted with the proof that musical hearing is different from ordinary hearing, and has been superadded to the latter,—that therefore it cannot be merely an inevitable accessory, but has sprung from a source which demands some special explanation.

This argument appears to be sound, but I do not believe that it is so. The assumption that the hearing of unmusical people is as highly developed as that of the musical is utterly unproved, and I believe that it is most improbable. It is to be regretted that there are no sufficiently exact researches into the ordinary hearing of unmusical persons, and that we have even less knowledge of the minute structure of their auditory apparatus. But from what we know of musical hearing it follows that the

ordinary hearing of such people must be imperfect and their auditory apparatus abnormal in structure.

The meaning of the word 'unmusical' is merely relative. Mozart possessed such a wonderful memory for absolute pitch that he once remarked, directly he began to play his own violin, that it was tuned half of a quarter-tone higher than one he had played two days before. But many people, although admitted to be very musical, have the feeblest memory, or almost none at all, for absolute pitch. They cannot tell whether the performance they are listening to is in the key of A, C, or F: their memory deals with intervals alone, and they are satisfied if only the relations of the notes in any piece of music are correct. This is certainly often due to want of practice, and it is also connected with the important part played by the pianoforte in the musical education of mankind. The note A is much more firmly fixed in the mind of a violinist and has a far more individual character for him than any particular note of the pianoforte scale has for the pianist. But it is equally certain that there are also differences of talent as regards the memory for absolute pitch. Leaving the greatest heights of musical genius, we find that the perception of intervals may also be deficient, and that such deficiency increases gradually in different individuals until we reach a case like that described by Grant Allen in which the notes sounded by two successive keys on the piano seem to be absolutely the same. Such defects in hearing can only be explained by some imperfection in the structure of the auditory organ, in this case in the organ of Corti. Hence such an auditory organ would not represent what we may suppose to have been the primitive ear of man before he began to be musical; it is merely an example of degeneration. A perfectly normal auditory organ must always be musical, and this not only with regard to the perception of intervals, but also to the recognition of absolute pitch. For even animals must possess the power of distinguishing a note as higher or lower than some other note of which the pitch is retained in their memory, and if they were incapable of this they would be exposed to countless dangerous mistakes. We certainly cannot regard the ear of Mozart as the primitive normal ear of mankind; we must rather regard it as an abnormality as much above the average as the ear of a moderately unmusical person is below it. But even Grant

Allen's extreme case proves that the perception of absolute pitch is retained by civilized man; for this individual distinguished high and low notes, although he could not perceive any difference between the successive notes of the scale when he played it.

Hence the different degrees of imperfection in the musical faculty seem to me to be traceable to defects in the structure of the auditory organ, to a more or less complete degeneration from its original and normal state. Defect and degeneration are, as everyone knows, apt to occur in any part of the body, and should occasion the least surprise in an organ which, like the human ear, no longer plays a decisive part in the preservation of the species,—a part which it must certainly have played ages ago when man lived under more natural conditions. In such times he needed a perfect ear just as wild animals need it now. The civilized man of the present day no longer depends on the acuteness and perfection of this sense; it is, to a certain extent, of no importance whether he has or has not the full number of 15,500 cells in his cochlea. But those persons in whom the number or perhaps the minute structure of these cells is below the average, or in whom the tension of the membranes is abnormal, will probably be unable to perceive musical intervals correctly or may be unable to perceive them at all; such persons are unmusical.

I do not mean this statement to imply that defects in Corti's organ are the only cause of a deficient musical faculty. In some cases perhaps the cause may lie in the auditory centre, viz. the part of the brain where the impulses of nerves, produced by the stimuli of sound-waves, are transformed into the perceptions which we call notes. Certain kinds of deficiency in the faculty even suggest that the auditory organ and centre may be quite normal, but that there is merely a less perfect and less complex interconnection between this and the other brain-centres, so that the mental perception of music is not possible although the music itself is correctly heard. It is especially interesting to compare such cases with the remarkable and extremely variable phenomena witnessed in those who, from the lesion of a small part of the brain, have lost, either wholly or in part, the faculty of perceiving and producing music, such loss being frequently associated with defects of speech. In addition to



Kusmaul's admirably explained observations, Kast, Knoblauch, and Oppenheim, among German pathologists, have offered interesting contributions to this difficult and complex subject, into which of course I cannot enter upon the present occasion.

For the present purpose I merely wish to show that deficiency in the musical faculty must always depend upon defect in the anatomical structure of the auditory apparatus, the auditory centre, or their means of connection. If this be so, the existence of unmusical people constitutes no objection to the view I have propounded as to the origin of the musical sense.

But must we really admit that the musical talent of primitive man was the same as our own? Can it be conceived that, in these remote times, there were born men who, educated in one of our schools of music, would have produced a Haydn, a Mozart, or Beethoven, or even an ordinary musician of to-day?

I am quite sure that this admission will never be made. For it is clear that the understanding of our highest music not only needs the auditory apparatus and auditory centre, together with the life-long training of these: something besides is absolutely indispensable, *a mind that is sensitive, impressionable, and highly developed.*

I will enter rather more fully into this point. The frequently mentioned auditory centre is not a mere supposition; it is known with tolerable certainty. When a certain part of the temporal lobe of the cerebrum is destroyed in a dog or monkey, deafness ensues, *although the auditory apparatus remains uninjured.* Such animals do not suffer greatly in health; they continue to live, but remain permanently deaf. And all the while the sound-waves are still converted into nerve-impulses by the auditory apparatus, and the impulses corresponding to the several notes are still conveyed to the brain by the fibres of the auditory nerve. But in the brain that organ is wanting by which these impulses are transformed into sensations and are brought into relation with consciousness; the animal is 'psychically deaf,' as the technical expression goes.

If on the other hand we were able to remove every part of the cerebrum except the auditory centre, then the mechanical conditions necessary for the production of sound-sensations would still remain, but the animal or the man would neverthe-

less be unable to hear, because nothing capable of becoming conscious of sound-sensations would be left in the brain. In removing nearly the whole cerebrum the mind would be lost together with all its accessory powers, thought, imagination, will, and self-consciousness. The 'soul' would be wanting, and hence even the most beautiful of the sound-sensations produced in the auditory centre could not be perceived because there would be nothing capable of perception.

I have only mentioned this hypothetical case in order to show that the way in which music is perceived depends not only upon the auditory centre, but quite as fully upon the organ which lies behind, receives the sound-pictures, and allows them to have their full effect upon it. If, as in the case supposed above, there be no mind, then not a single sound-image can be perceived; but with a highly developed human mind of infinite freedom and flexibility and rich in ideas, the 'parts' of a polyphonic composition which run through each other, and proceed by contrary movement, can be perceived as the most charming musical architecture; they make up an artistic structure of rich form, the several parts of which exhibit the most significant relationship, rising from and returning into each other, and ever presenting in each of its separate parts fresh features and new and interesting combinations. But the case is very different with the comparatively lowly organized brain of an animal such as a parrot; for the power of mind is insufficient to take in such an elaborate sound-picture, and the animal can only perceive a confusion of notes, although perhaps a pleasing one. Even after constant practice the parrot would be unable to follow the movements of the 'parts' of the composition, because it lacks the necessary intelligence. We know by its whistling that it can hear music, but even in this it makes but little progress, and can only repeat short pieces, because it does not understand the connection between the parts. There is of course a very marked difference between the musical perception of a parrot's brain and that of a man. But a comparison between the two is perhaps on this very account best qualified to render evident the conclusion with which we are here concerned, *viz. that one and the same auditory organ together with its auditory centre must produce an entirely different effect upon the mind according as this is more*

*highly or lowly organized.* The 'soul' is, as it were, played upon like an instrument by the musical nerve-vibrations of the auditory centre. The more perfect this instrument is the greater is the effect produced. The perception of music by the highest animals, such as the dog, cat, or horse, must be very imperfect as regards the purely formal relation between chords and successions of simple notes, because their mind is lowly developed, because their intellect cannot find any interest in following the manifold intricacies of the progress of 'parts.' It is not keen and acute enough even to perceive the varying distinctions between one 'timbre' of sound and another, for it has no purely mental interests. Only in the most crude and general manner are the souls of animals open to the emotional effects of music. Music impresses them as agreeable or disagreeable, and attracts them entirely irrespective of what we call the 'character' of a performance. The above-mentioned dog which followed the music of the fair was probably agreeably affected by every performance of the street band, whether it was in a major or minor key, whether it was a polka or a funeral march. So far as the dog was concerned the finer shades of difference, by which we are affected so powerfully, had no existence at all; it was only impressed by the sound, the mere pure *matter* of music, a thing which is of no importance to us as compared with the *form* of it. That which we admire most in music, and which chiefly excites our interest, is the originality and richness of musical forms, as Hanslick has so admirably shown in his interesting essay on 'The Beautiful in Music'.<sup>1</sup> We are able to enjoy a symphony in a pianoforte arrangement, or, with sufficient practice, by merely reading the notes; and we appreciate not merely its formal relationship, but also its emotional effect and significance. By reading it we can be sent into a happy or a melancholy frame of mind, and we can fancy that we see in the composition the representation of moods of mind as distinguished from particular 'feelings.' Everyone will admit that, at any rate as regards this latter effect of music, even the highest animal can never have any idea, even though its hearing and its auditory centre were practised for the whole of its life; and this must be

<sup>1</sup> See also 'Sensation and Intuition' by James Sully, and 'The Power of Sound' by Edmund Gurney.

so because behind its auditory and musical sense there lies no correspondingly developed mind.

The same thing holds, although not to an equal extent, between the varied degrees of development reached by the human mind. If primitive man did not possess a mind like that of his descendants, if his intellect and every dependent power became far keener and deeper as the struggle for life went on through the course of ages, it follows that the faculty of perceiving music must also have been augmented.

It is therefore impossible that a lost Beethoven ever existed among primitive man, nay, I should even doubt whether one could be found among existing Australians or negroes. For the production of a Beethoven there is needed not only a highly developed musical sense, but also a rich and great soul, one that is infinitely sensitive; and we know by experience that such a nature is only to be found among the very highest intellects. But I will go further; I do not believe that the child of primitive man, if he were alive to-day, could be raised by education to the same level of musical understanding as that reached by our own children. He would fail for want of inherent power of mind.

Of course these opinions can never be confirmed, because primitive man is not to be found. But we still have the Australian native, although, so far as I am aware, the necessary investigations have never yet been made. But even if they were never carried out, it would nevertheless be certain that primitive man must have possessed lower mental faculties and especially a humbler intellect than civilized man: this conclusion is commonly accepted, and it is sufficient for my argument.

Hence we may assume that susceptibility to music must have increased during the intellectual evolution of mankind, so long, in fact, as the essential nature of the human mind was capable of being raised. It is impossible to decide upon the precise period in the history of a certain nation or group of nations at which the climax was reached; for we are by no means sure that the human intellect is not even now undergoing slow and imperceptible development. But as a mere suggestion, without any pretence to exactness, I will state that the people of 'antiquity,' viz. the ancient civilized nations of

the Mediterranean, had already, at the very dawn of their history, attained the highest level of intellectual development. If any further growth has occurred since then in European nations, it has certainly been so imperceptibly small that it could cause no sensible difference in the susceptibility of the human soul to music. The times which produced such legislators as Moses and Solon, poets like Homer and Sophocles, philosophers and men of science like Aristotle, Plato, and Archimedes,—times which created the Egyptian temples and pyramids and the statues of Greek gods, most undoubtedly display the achievements of the human intellect at its best. And an age which produced the gentle and forgiving Christian philosophy shows us that, as regards character and feeling, the human mind had attained the highest development.

We may therefore safely assume that the nations of ‘antiquity’ possessed a capacity for music in all respects equal to our own, and that the times during which the human intellect was raised, at least to any considerable extent, lie far behind them.

The fact however that the music of antiquity was so poor, depends, as we have seen, upon the complete distinction between music and musical talent: the latter is due, and due only, to the nature of the individual body and mind, while the former is also due to a slow process of development by means of tradition. Music is an invention and rests upon tradition,—the power on which depend the entire growth of culture, the development of language, of the sciences and their practical applications, and of every kind of art.

Painting and sculpture also have not been developed, viz. increased and perfected, because of any growth in the physical means by which we practise them. The human eye and the corresponding part of the brain, the visual centre, have certainly not been improved since the age of the lowest culture, or even since the times of primitive man. But the artistic acquirements of generations have been built one upon another until there arose the great art-palace of the present day with all its varied chambers. In this case it is even easier to prove that the instrument by which art has been invented existed in all its present perfection long before the invention had been made, and that it did not originate for the sake of art, but to be used as

a weapon in the great struggle for life. It is evident that the keenest vision is of vast importance for the preservation of the human species. Hence the arts of painting and sculpture are, in the sense above mentioned, merely the incidental accessory performance of a faculty never intended for such a purpose.

It is quite true that the beginnings of art can be traced far back to the times of the cave-dwellers; but whenever it began an immense period was required for its development,—a period which must have been especially long in the case of music.

It is almost impossible to realize that men with such high æsthetic instincts as those possessed by the ancient Greeks could have enjoyed the unisonal effect of accompaniment in the octave; and we can hardly believe that they were unable to invent music in two parts. And yet a long time elapsed before the gallant troubadours of Provence hit upon the idea of letting the melody be accompanied by another deeper-pitched voice, originally moreover in succession of fourths and fifths, so very unpleasant to us at the present day, but which may even now be occasionally heard in the street music of Brittany.

It is not my intention to follow the slow and gradual evolution of music; for this has been clearly shown by the excellent work of other writers. But in concluding I wish to repeat that this evolution does not depend upon any increase of the musical faculty or any alteration in the inherent physical nature of man, but solely upon the power of transmitting the intellectual achievements of each generation to those which follow.

This, more than anything, is the cause of the superiority of man over animals—this, and not merely human faculty, although it may be admitted that the latter is much higher than in animals. And even if we were compelled to believe that human faculty has reached its limits and can never be increased again, even then we need not despair of the almost boundless progress of mankind. For each generation always starts from the acquirements of the preceding one; and the living child placed from the very first by tradition upon a somewhat greater height of intellectual achievement than that of his predecessors, is then able, with the same powers, to climb yet higher up the steep slope of the most advanced civilization. Hence, even if our intellectual powers have reached the highest possible stage, human civilization will nevertheless advance, however far we

may look forward,—the conquests of the mind of man will never cease.

Lastly I trust that the scientific man may be excused if, in this essay, he has entered into what may appear to be a very distant region. Nevertheless it was a purely scientific question which led him into this inquiry—the question of the hereditary transmission of acquired characters. He attempted to explain, without any transmission of the results of practice, the existence of those human faculties which cannot be explained by the process of selection. This led to the explanation of the origin of the musical sense which has been adopted in this essay. Perhaps the opinions of a biologist may not be altogether devoid of interest for the philosopher and the musical critic. The questions treated of lie on the boundary between science and philosophy, and can hardly be solved from either province alone.