

of the senses—highly complex and often imperfect in design—as conduits of information from the external world.

His search for the physical scientific basis of musical phenomena is not unusual for his time, in which the empirical spirit reigned. Nonetheless, Helmholtz never attempted to attribute the full experience of music to nature—as simpler minds were determined to do—but acknowledged the preeminent role of artistic invention and human creativity even in the structure of scales and tuning systems. The following excerpt is taken from the very end of the book; Helmholtz's ruminations on "the wonders of great works of art" provide an especially interesting conclusion to a treatise on physiological acoustics.

FROM *On the Sensations of Tone*

(1877)

ESTHETICAL RELATIONS

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In the last part of my book, I have endeavoured to shew that the construction of scales and of harmonic tissue is a product of artistic invention, and by no means furnished by the natural formation or natural function of our ear, as it has been hitherto most generally asserted. Of course the laws of the natural function of our ear play a great and influential part in this result; these laws are, as it were, the building stones with which the edifice of our musical system has been erected, and the necessity of accurately understanding the nature of these materials in order to understand the construction of the edifice itself, has been clearly shewn by the course of our investigations upon this very subject. But just as people with differently directed tastes can erect extremely different kinds of buildings with the same stones, so also the history of music shews us that the same properties of the human ear could serve as the foundation of very different musical systems. Consequently it seems to me that we cannot doubt, that not merely the composition of perfect musical works of art, but even the construction of our system of scales, keys, chords, in short of all that is usually comprehended in a treatise on Thorough Bass, is the work of artistic invention, and hence must be subject to the laws of artistic beauty. In point of fact, mankind has been at work on the diatonic system for more than 2500 years since the days of Terpander and Pythagoras, and in many cases we are still able to determine that the progressive changes made in the tonal system have been due to the most distinguished composers themselves, partly through

TEXT: *On the Sensations of Tone as a Physiological Basis for the Theory of Music*, translated by Alexander J. Ellis from the fourth (1877) edition of *Lehre von dem Tonempfindungen*; second English edition, 1885, pp. 365–71.

their own independent inventions, and partly through the sanction which they gave to the inventions of others, by employing them artistically.

The esthetic analysis of complete musical works of art, and the comprehension of the reasons of their beauty, encounter apparently invincible obstacles at almost every point. But in the field of elementary musical art we have now gained so much insight into its internal connection that we are able to bring the results of our investigations to bear on the views which have been formed and in modern times nearly universally accepted respecting the cause and character of artistic beauty in general. It is, in fact, not difficult to discover a close connection and agreement between them; nay, there are probably fewer examples more suitable than the theory of musical scales and harmony, to illustrate the darkest and most difficult points of general esthetics. Hence I feel that I should not be justified in passing over these considerations, more especially as they are closely connected with the theory of sensual perception, and hence with physiology in general.

No doubt is now entertained that beauty is subject to laws and rules dependent on the nature of human intelligence. The difficulty consists in the fact that these laws and rules, on whose fulfilment beauty depends and by which it must be judged, are not consciously present to the mind, either of the artist who creates the work, or the observer who contemplates it. Art works with design, but the work of art ought to have the appearance of being undesigned, and must be judged on that ground. Art creates as imagination pictures, regularly without conscious law, designedly without conscious aim. A work, known and acknowledged as the product of mere intelligence, will never be accepted as a work of art, however perfect be its adaptation to its end. Whenever we see that conscious reflection has acted in the arrangement of the whole, we find it poor.

Man fühlt die Absicht, und man wird verstimmt.
(We feel the purpose, and it jars upon us.)¹

And yet we require every work of art to be reasonable, and we shew this by subjecting it to a critical examination, and by seeking to enhance our enjoyment and our interest in it by tracing out the suitability, connection, and equilibrium of all its separate parts. The more we succeed in making the harmony and beauty of all its peculiarities clear and distinct, the richer we find it, and we even regard as the principal characteristic of a great work of art that deeper thought, reiterated observation, and continued reflection shew us more and more clearly the reasonableness of all its individual parts. Our endeavour to comprehend the beauty of such a work by critical examination, in which we partly succeed, shews that we assume a certain adaptation to reason in works of art, which may possibly rise to a conscious understanding, although such understanding is neither necessary for the invention nor for the enjoyment of the beautiful. For what is esthetically beautiful is recognised by the immediate

1. Actually, *So fühlt man Absicht und man ist verstimmt*. Goethe, *Torquato Tasso*, Act 2, scene 1.

judgment of a cultivated taste, which declares it pleasing or displeasing, without any comparison whatever with law or conception.

But that we do not accept delight in the beautiful as something individual, but rather hold it to be in regular accordance with the nature of mind in general, appears by our expecting and requiring from every other healthy human intellect the same homage that we ourselves pay to what we call beautiful. At most we allow that national or individual peculiarities of taste incline to this or that artistic ideal, and are most easily moved by it, precisely in the same way that a certain amount of education and practice in the contemplation of fine works of art is undeniably necessary for penetration into their deeper meaning.

The principal difficulty in pursuing this object, is to understand how regularity can be apprehended by intuition without being consciously felt to exist. And this unconsciousness of regularity is not a mere accident in the effect of the beautiful on our mind, which may indifferently exist or not; it is, on the contrary, most clearly, prominently, and essentially important. For through apprehending everywhere traces of regularity, connection, and order, without being able to grasp the law and plan of the whole, there arises in our mind a feeling that the work of art which we are contemplating is the product of a design which far exceeds anything we can conceive at the moment, and which hence partakes of the character of the illimitable. Remembering the poet's words:

Du gleichst dem Geist, den du begreifst
(Thou'rt like the spirit thou conceivest),²

we feel that those intellectual powers which were at work in the artist, are far above our conscious mental action, and that were it even possible at all, infinite time, meditation, and labour would have been necessary to attain by conscious thought that degree of order, connection, and equilibrium of all parts and all internal relations, which the artist has accomplished under the sole guidance of tact and taste, and which we have in turn to appreciate and comprehend by our own tact and taste, long before we begin a critical analysis of the work.

It is clear that all high appreciation of the artist and his work reposes essentially on this feeling. In the first we honour a genius, a spark of divine creative fire, which far transcends the limits of our intelligent and conscious forecast. And yet the artist is a man as we are, in whom work the same mental powers as in ourselves, only in their own peculiar direction, purer, brighter, steadier; and by the greater or less readiness and completeness with which we grasp the artist's language we measure our own share of those powers which produced the wonder.

Herein is manifestly the cause of that moral elevation and feeling of ecstatic satisfaction which is called forth by thorough absorption in genuine and lofty works of art. We learn from them to feel that even in the obscure depths of a healthy and harmoniously developed human mind, which are at least for the

2. Goethe, *Faust*, Pt 1, l. 511.

present inaccessible to analysis by conscious thought, there slumbers a germ of order that is capable of rich intellectual cultivation, and we learn to recognise and admire in the work of art, though draughted in unimportant material, the picture of a similar arrangement of the universe, governed by law and reason in all its parts. The contemplation of a real work of art awakens our confidence in the originally healthy nature of the human mind, when uncribbed, unharassed, unobscured, and unfalsified.

But for all this it is an essential condition that the whole extent of the regularity and design of a work of art should *not* be apprehended consciously. It is precisely from that part of its regular subjection to reason, which escapes our conscious apprehension, that a work of art exalts and delights us, and that the chief effects of the artistically beautiful proceed, *not* from the part which we are able fully to analyse.

If we now apply these considerations to the system of musical tones and harmony, we see of course that these are objects belonging to an entirely subordinate and elementary domain, but nevertheless they, too, are slowly matured inventions of the artistic taste of musicians, and consequently they, too, must be governed by the general rules of artistic beauty. Precisely because we are here still treading the lower walks of art, and are not dealing with the expression of deep psychological problems, we are able to discover a comparatively simple and transparent solution of that fundamental enigma of esthetics.

The whole of the last part of this book has explained how musicians gradually discovered the relationships between tones and chords, and how the invention of harmonic music rendered these relationships closer, and clearer, and richer. We have been able to deduce the whole system of rules which constitute Thorough Bass, from an endeavour to introduce a clearly sensible connection into the series of tones which form a piece of music.

A feeling for the melodic relationship of consecutive tones, was first developed, commencing with Octave and Fifth and advancing to the Third. We have taken pains to prove that this feeling of relationship was founded on the perception of identical partial tones in the corresponding compound tones. Now these partial tones are of course present in the sensations excited in our auditory apparatus, and yet they are not generally the subject of conscious perception as independent sensations. The conscious perception of everyday life is limited to the apprehension of the tone compounded of these partials, as a whole, just as we apprehend the taste of a very compound dish as a whole, without clearly feeling how much of it is due to the salt, or the pepper, or other spices and condiments. A critical examination of our auditory sensations as such was required before we could discover the existence of upper partial tones. Hence the real reason of the melodic relationship of two tones (with the exception of a few more or less clearly expressed conjectures, as, for example, by Rameau and d'Alembert) remained so long undiscovered, or at least was not in any respect clearly and definitely formulated. I believe that I have been able to furnish the required explanation, and hence clearly to exhibit the whole

connection of the phenomena. The esthetic problem is thus referred to the common property of all sensual perceptions, namely, the apprehension of compound aggregates of sensations as sensible symbols of simple external objects, without analysing them. In our usual observations on external nature our attention is so thoroughly engaged by external objects that we are entirely unpractised in taking for the subjects of conscious observation, any properties of our sensations themselves, which we do not already know as the sensible expression of some individual external object or event.

After musicians had long been content with the melodic relationship of tones, they began in the middle ages to make use of harmonic relationship as shewn in consonance. The effects of various combinations of tones also depend partly on the identity or difference of two of their different partial tones, but they likewise partly depend on their combinational tones. Whereas, however, in melodic relationship the equality of the upper partial tones can only be perceived by *remembering* the preceding compound tone, in harmonic relationship it is determined by *immediate sensation*, by the presence or absence of beats. Hence in harmonic combinations of tone, tonal relationship is felt with that greater liveliness due to a present sensation as compared with the recollection of a past sensation. The wealth of clearly perceptible relations grows with the number of tones combined. Beats are easy to recognise as such when they occur slowly; but those which characterise dissonances are, almost without exception, very rapid, and are partly covered by sustained tones which do not beat, so that a careful comparison of slower and quicker beats is necessary to gain the conviction that the essence of dissonance consists precisely in rapid beats. Slow beats do not create the feeling of dissonance, which does not arise till the rapidity of the beats confuses the ear and makes it unable to distinguish them. In this case also the ear feels the difference between the undisturbed combination of sound in the case of two consonant tones, and the disturbed rough combination resulting from a dissonance. But, as a general rule, the hearer is then perfectly unconscious of the cause to which the disturbance and roughness are due.

The development of harmony gave rise to a much richer opening out of musical art than was previously possible, because the far clearer characterisation of related combinations of tones by means of chords and chordal sequences, allowed of the use of much more distant relationships than were previously available, by modulating into different keys. In this way the means of expression greatly increased as well as the rapidity of the melodic and harmonic transitions which could now be introduced without destroying the musical connection.

As the independent significance of chords came to be appreciated in the fifteenth and sixteenth centuries, a feeling arose for the relationship of chords to one another and to the tonic chord, in accordance with the same law which had long ago unconsciously regulated the relationship of compound tones. The relationship of compound tones depended on the identity of two or more partial tones, that of chords on the identity of two or more notes. For the musician,

of course, the law of the relationship of chords and keys is much more intelligible than that of compound tones. He readily hears the identical tones, or sees them in the notes before him. But the unprejudiced and uninstructed hearer is as little conscious of the reason of the connection of a clear and agreeable series of fluent chords, as he is of the reason of a well-connected melody. He is startled by a false cadence and feels its unexpectedness, but is not at all necessarily conscious of the reason of its unexpectedness.

Then, again, we have seen that the reason why a chord in music appears to be the chord of a determinate root, depends as before upon the analysis of a compound tone into its partial tones, that is, as before upon those elements of a sensation which cannot readily become subjects of conscious perception. This relation between chords is of great importance, both in the relation of the tonic chord to the tonic tone, and in the sequence of chords.

The recognition of these resemblances between compound tones and between chords, reminds us of other exactly analogous circumstances which we must have often experienced. We recognise the resemblance between the faces of two near relations, without being at all able to say in what the resemblance consists, especially when age and sex are different, and the coarser outlines of the features consequently present striking differences. And yet notwithstanding these differences—notwithstanding that we are unable to fix upon a single point in the two countenances which is absolutely alike—the resemblance is often so extraordinarily striking and convincing, that we have not a moment's doubt about it. Precisely the same thing occurs in recognising the relationship between two compound tones.

Again, we are often able to assert with perfect certainty, that a passage not previously heard is due to a particular author or composer whose other works we know. Occasionally, but by no means always, individual mannerisms in verbal or musical phrases determine our judgment, but as a rule we are mostly unable to fix upon the exact points of resemblance between the new piece and the known works of the author or composer.

The analogy of these different cases may be even carried farther. When a father and daughter are strikingly alike in some well-marked feature, as the nose or forehead, we observe it at once, and think no more about it. But if the resemblance is so enigmatically concealed that we cannot detect it, we are fascinated, and cannot help continuing to compare their countenances. And if a painter drew two such heads having, say, a somewhat different expression of character combined with a predominant and striking, though indefinable, resemblance, we should undoubtedly value it as one of the principal beauties of his painting. Our admiration would certainly not be due merely to his technical skill; we should rather look upon his painting as evidencing an unusually delicate feeling for the significance of the human countenance, and find in this the artistic justification of his work.

Now the case is similar for musical intervals. The resemblance of an Octave to its root is so great and striking that the dullest ear perceives it; the Octave seems to be almost a pure repetition of the root, as it, in fact, merely repeats a

part of the compound tone of its root, without adding anything new. Hence the esthetical effect of an Octave is that of a perfectly simple, but little attractive interval. The most attractive of the intervals, melodically and harmonically, are clearly the Thirds and Sixths,—the intervals which lie at the very boundary of those that the ear can grasp. The major Third and the major Sixth cannot be properly appreciated unless the first five partial tones are audible. These are present in good musical qualities of tone. The minor Third and the minor Sixth are for the most part justifiable only as inversions of the former intervals. The more complicated intervals in the scale cease to have any direct or easily intelligible relationship. They have no longer the charm of the Thirds.

Moreover, it is by no means a merely external indifferent regularity which the employment of diatonic scales, founded on the relationship of compound tones, has introduced into the tonal material of music, as, for instance, rhythm introduced some such external arrangement into the words of poetry. I have shewn, on the contrary, in Chapter XIV., that this construction of the scale furnished a means of measuring the intervals of their tones, so that the equality of two intervals lying in different sections of the scale would be recognised by immediate sensation. Thus the melodic step of a Fifth is always characterised by having the second partial tone of the second note identical with the third of the first. This produces a definiteness and certainty in the measurement of intervals for our sensation, such as might be looked for in vain in the system of colours, otherwise so similar, or in the estimation of mere differences of intensity in our various sensual perceptions.

Upon this reposes also the characteristic resemblance between the relations of the musical scale and of space, a resemblance which appears to me of vital importance for the peculiar effects of music. It is an essential character of space that at every position within it like bodies can be placed, and like motions can occur. Everything that is possible to happen in one part of space is equally possible in every other part of space and is perceived by us in precisely the same way. This is the case also with the musical scale. Every melodic phrase, every chord, which can be executed at any pitch, can be also executed at any other pitch in such a way that we immediately perceive the characteristic marks of their similarity. On the other hand, also, different voices, executing the same or different melodic phrases, can move at the same time within the compass of the scale, like two bodies in space, and, provided they are consonant in the accented parts of bars, without creating any musical disturbances. Such a close analogy consequently exists in all essential relations between the musical scale and space, that even alteration of pitch has a readily recognised and unmistakable resemblance to motion in space, and is often metaphorically termed the ascending or descending *motion* or *progression* of a part. Hence, again, it becomes possible for motion in music to imitate the peculiar characteristics of motive forces in space, that is, to form an image of the various impulses and forces which lie at the root of motion. And on this, as I believe, essentially depends the power of music to picture emotion.

It is not my intention to deny that music in its initial state and simplest forms may have been originally an artistic imitation of the instinctive modulations of the voice that correspond to various conditions of the feelings. But I cannot think that this is opposed to the above explanation; for a great part of the natural means of vocal expression may be reduced to such facts as the following: its rhythm and accentuation are an immediate expression of the rapidity or force of the corresponding psychical motives—all effort drives the voice up—a desire to make a pleasant impression on another mind leads to selecting a softer, pleasanter quality of tone—and so forth. An endeavour to imitate the involuntary modulations of the voice and make its recitation richer and more expressive, may therefore very possibly have led our ancestors to the discovery of the first means of musical expression, just as the imitation of weeping, shouting, or sobbing, and other musical delineations may play a part in even cultivated music, (as in operas), although such modifications of the voice are not confined to the action of free mental motives, but embrace really mechanical and even involuntary muscular contractions. But it is quite clear that every completely developed melody goes far beyond an imitation of nature, even if we include the cases of the most varied alteration of voice under the influence of passion. Nay, the very fact that music introduces progression by fixed degrees both in rhythm and in the scale, renders even an approximatively correct representation of nature simply impossible, for most of the passionate affections of the voice are characterised by a gliding transition in pitch. The imitation of nature is thus rendered as imperfect as the imitation of a picture by embroidery on a canvas with separate little squares for each shade of colour. Music, too, departed still further from nature when it introduced the greater compass, the mobility, and the strange qualities of tone belonging to musical instruments, by which the field of attainable musical effects has become so much wider than it was or could be when the human voice alone was employed.

Hence though it is probably correct to say that mankind, in historical development, first learned the means of musical expression from the human voice, it can hardly be denied that these same means of expressing melodic progression act, in artistically developed music, without the slightest reference to the application made of them in the modulations of the human voice, and have a more general significance than any that can be attributed to innate instinctive cries. That this is the case appears above all in the modern development of instrumental music, which possesses an effective power and artistic justification that need not be gainsaid, although we may not yet be able to explain it in all its details.

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Here I close my work. It appears to me that I have carried it as far as the physiological properties of the sensation of hearing exercise a direct influence on the construction of a musical system, that is, as far as the work especially

belongs to natural philosophy. For even if I could not avoid mixing up esthetic problems with physical, the former were comparatively simple, and the latter much more complicated. This relation would necessarily become inverted if I attempted to proceed further into the esthetics of music, and to enter on the theory of rhythm, forms of composition, and means of musical expression. In all these fields the properties of sensual perception would of course have an influence at times, but only in a very subordinate degree. The real difficulty would lie in the development of the psychical motives which here assert themselves. Certainly this is the point where the more interesting part of musical esthetics begins, the aim being to explain the wonders of great works of art, and to learn the utterances and actions of the various affections of the mind. But, however alluring such an aim may be, I prefer leaving others to carry out such investigations, in which I should feel myself too much of an amateur, while I myself remain on the safe ground of natural philosophy, in which I am at home.

166 Amy Fay

Amy Fay was a celebrated American concert pianist as well as a lecturer and teacher. She lived for a time in each of three major musical centers, Boston, Chicago, and New York, and became active in organizations to promote women's participation, such as the Amateur Music Club and the New York Women's Philharmonic Society (which she also served as president).

Fay was born in Louisiana in 1844. At the age of twenty-five she traveled to Germany to continue her musical studies and remained there for six years. Her vivid and perceptive letters home, describing her studies and other musical adventures, were edited for publication by her sister, Melusina Fay Peirce (feminist writer on the reform of domestic architecture and first wife of the philosopher Charles Sanders Peirce). The resulting little book enjoyed great popularity, appearing in twenty-five editions in the United States alone, in several English editions, and in French and German translations.

Women were admitted into European conservatories as performance students in large numbers during the nineteenth century, but many restrictions were placed upon them: instruction was usually segregated by gender, as Amy Fay describes here; the curriculum for women was often a truncated version of that offered to men; and it was not until late in the century that women were admitted as composition students, or that their professional aspirations were taken seriously. Boston composer Mabel Daniels also wrote a memoir, *An American Girl in Munich*, describing her conservatory study a few decades later than Fay's.

FROM *Music-Study in Germany*

(1880)

Berlin, February 8, 1870

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The day after Tausig's concert I went, as usual, to hear him give the lesson to his best class of girls. I got there a little before the hour, and the girls were in the dressing-room waiting for the young men to be through with their lesson. They were talking about the concert. "Was it not beautiful?" said little Timanoff, to me; "I did not sleep the whole night after it!"—a touch of sentiment that quite surprised me in that small personage, and made me feel some compunctions, as I had slept soundly myself. "I have practiced five hours to-day already," she added. Just then the young men came out of the class-room and we passed into it. Tausig was standing by the piano. "Begin!" said he, to Timanoff, more shortly even than usual; "I trust you have brought me a study *this* time." He always insists upon a study in addition to the piece. Timanoff replied in the affirmative, and proceeded to open Chopin's *Etudes*. She played the great A minor "Winter Wind" study, and most magnificently, too, starting off with the greatest brilliancy and "go." I was perfectly amazed at such a feat from such a child, and expected that Tausig would exclaim with admiration. Not so that Rhadamanthus. He heard it through without comment or correction, and when Timanoff had finished, simply remarked very composedly, "So! Have you taken the *next* Etude, also?" as if the great A minor were not enough for one meal! It is eight pages long to begin with, and there is no let up to the difficulty all the way through. Afterward, however, he told the young men that he "could not have done it better" himself.

Tausig is so hasty and impatient that to be in his classes must be a fearful ordeal. He will not bear the slightest fault. The last time I went into his class to hear him teach he was dreadful. Fräulein H. began, and she has remarkable talent, and is far beyond me. She would not play *piano* enough to suit him, and finally he stamped his foot at her, snatched her hand from the piano, and said: "Will you play *piano* or not, for if not we will go no farther?" The second girl sat down and played a few lines. He made her begin over again several times, and finally came up and took her music away and slapped it down on the piano.—"You have been studying this for weeks and you can't play a note of it; practice it for a month and then you can bring it to me again," he said.

The third was Fräulein Timanoff, who is a little genius, I think. She brought a Sonata by Schubert—the one, I believe, in A—and by the way he behaved Tausig must have a particular feeling about that particular Sonata. Timanoff

TEXT: *Music-Study in Germany*, from the *Home Correspondence of Amy Fay* (Chicago, 1880), pp. 39–42, 163–68, 210–14.