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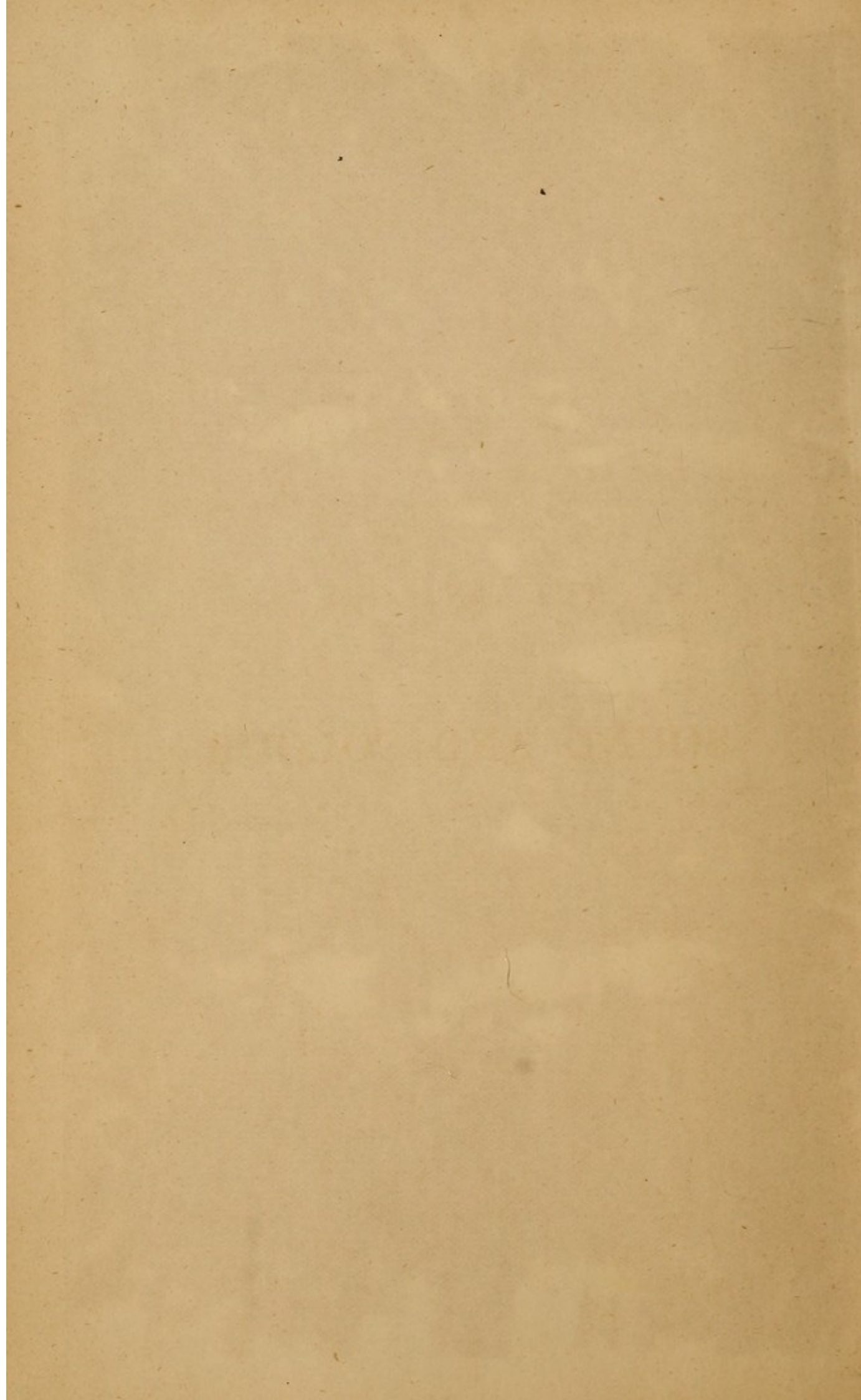
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ANALOGY
OF
SOUND & COLOUR



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THE ANALOGY
OF
SOUND AND COLOUR.

THE ANNALS

OF

ROUND AND COMB

GOSPORT:

Printed by E. Groves, 31, High Street.

SOUND & COLOUR,

THEIR

Relations, Analogies & Harmonies,

BY

JOHN DENIS MACDONALD, M.D., F.R.S.,

STAFF-SURGEON, R.N.



LONDON:

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—
1869.



8075

TO
SIR DAVID PEAS, K.C.B., M.D.,
&c., &c., &c.,

INSPECTOR GENERAL OF HOSPITALS AND FLEETS,

THIS WORK IS DEDICATED,

WITH THE WARMEST ESTEEM
OF

THE AUTHOR.

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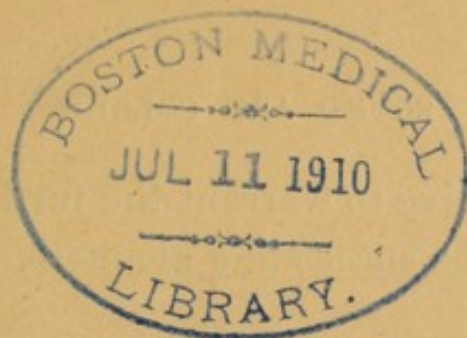
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PREFACE.

It has long impressed the Author, that, if the undulatory theory were applicable to Light and Sound, in all their bearings, the seven colours of the rainbow and the seven notes in the musical scale might prove to be perfectly analogous in their relative properties and effects, either in single sequence, or in combination. Thus, the law of interference, which so fully explains the nature of consonance and dissonance in music, if it be alike applicable to colours, will enable us to make practical use of the principles of Musical Harmony in Painting, or the association of colours in matters of dress or decoration. It will be perceived however, that unless the particular number of vibrations producing the several notes of the musical scale can be shewn to hold an exact relation to the ratio of vibrations calculated in the intervals of the prismatic series, there would be no premiss from which an inference like the above could be drawn. To this desideratum special attention has been given in the first chapter, and it is presumed that the arguments there adduced, are

sufficiently conclusive to warrant the further development of the subject in the succeeding chapters.

Painting, as an Art, may be at least on a par with Music; but Music as a Science, is certainly in advance of the fine Arts, its most essential principles admitting of mathematical expression. This last remark, however, has special reference to harmony, for we are still almost quite ignorant of the philosophy of the representative or allegorical power of music; and design and drawing in the arts, as regulated by precept and principle, are much more intelligible than the essential nature of subject and theme in music.

Coincidentally with the reception of Painting and Music, as sister arts, their votaries have intuitively felt the existence of a striking analogy between them, an analogy which is more particularly traceable in the phenomena of sound and colour. Since the time of Newton, various systems have been advanced in elucidation of this analogy, each assuming a colorific scale of its own, but, with the exception of the remarkable results obtained by Newton himself, with the prism and monochord, no purely scientific application of the principles of Musical Harmony to Painting appears to have been made. A reliable theory of harmonious colouring is therefore most desirable in the Arts, as there exists at present no rule to guide the Painter in his selection of colours, but a certain notion of a beau idéal, gained from the example of others, or originating in his own taste, fancy, or caprice.

SOUND AND COLOUR.

CHAPTER I.

AGREEMENT OF THE MUSICAL AND COLORIFIC RATIOS OF VIBRATION, THE BASIS OF THE ANALOGY OF SOUND AND COLOUR.

SECTION I.

Introductory Remarks, and exposition of the ratios of Musical Vibration.

The phenomena of Light and Sound mutually illustrate each other, and the more they are studied and compared, the more it becomes manifest that both are obedient to the same essential laws and governing principles, though the vibrations of the one may be represented as almost infinitely more minute and subtle than those of the other. A great interval, therefore, may be said to exist between the smallest sonorous and the largest colorific vibration. Moreover, the vibrations of the colorific scale are within very narrow limits, embracing but a single octave, whilst musical vibrations, extending over numerous octaves, take a much wider range. Nevertheless, the internal

constitution of the eight intervals of a diatonic musical scale, founded upon any note, will be seen, on close investigation to be represented in striking analogy by the prismatic series.

Admitting the application of the undulatory theory to both Light and Sound, the broad principle has long been admitted, that the undulations of the colours of the iris increase in number and diminish in size, as they ascend from the base red to the violet, just as happens in the musical scale, in passing from the graver to the more acute sounds. But the precise relationships existing between the two scales have never been satisfactorily worked out, which, if it could be done, would elevate painting to the status of a science, based like Music, upon mathematical principles.

Pythagoras, on his death bed, is said to have recommended the monochord as the only test of Musical perfection; and certainly, the facility with which the several intervals of the diatonic scale can be measured and determined by its use, gives it an importance that can scarcely be attached to any means of answering a similar purpose. The practical utility of such measurements is to afford a precise idea of the relation borne by the different notes of the scale, both to the key note and to each other, as also to make the nature of consonance and dissonance intelligible, in connection with the law of interference. Referring to the annexed table, if we assume for illustration merely, that the whole string

vibrates once in a second, so that if audible it would give the note C, many octaves below that of 32 feet organ pipe,

TABLE I.

Length of String,	Complements.	No. of Vibrations.	Note.
1	0	1	C
$\frac{8}{9}$	$\frac{1}{9}$	$1\frac{1}{8}$	D
$\frac{4}{5}$	$\frac{1}{5}$	$1\frac{1}{4}$	E
$\frac{3}{4}$	$\frac{1}{4}$	$1\frac{1}{3}$	F
$\frac{2}{3}$	$\frac{1}{3}$	$1\frac{1}{2}$	G
$\frac{3}{5}$	$\frac{2}{5}$	$1\frac{2}{3}$	A
$\frac{8}{15}$	$\frac{7}{15}$	$1\frac{7}{8}$	B
$\frac{1}{2}$	$\frac{1}{2}$	2	C 8ve.

$\frac{8}{9}$ ths of the string, with a complement of $\frac{1}{9}$ th, will yield 1 and $\frac{1}{8}$ th vibrations in a second, producing D, the next note, and so of the rest. With reference to the third column, it may be noticed in explanation, that $\frac{1}{8}$ th of $\frac{8}{9}$ ths, or, of the whole length required to make D, being equivalent to the complement, $\frac{1}{9}$ th of the whole string has been added to express the fractional part of the second vibration, and so of the other fractions following.

SECTION II.

The ratios of Colorific vibration, and their comparison with those of the Musical Scale.

From the measurements of Newton, Sir John Herschell was enabled to calculate tables of the vibrations of coloured light, shewing their relative rapidity and minuteness, founded upon the estimated velocity of light, and the assumed distance of the earth from the sun.

TABLE II.

Colours of the Spectrum.	Number of undulations per second.
Extreme Red	457,000,000,000,000
Red	477, ' ' ' '
Intermediate	495, ' ' ' '
Orange	506, ' ' ' '
Intermediate	517, ' ' ' '
Yellow	535, ' ' ' '
Intermediate	555, ' ' ' '
Green	577, ' ' ' '
Intermediate	600, ' ' ' '
Blue	622, ' ' ' '
Intermediate	644, ' ' ' '
Indigo	658, ' ' ' '
Intermediate	672, ' ' ' '
Violet	699, ' ' ' '
Extreme Violet	727, ' ' ' '

A superficial inspection of table 2, selected for reference, would afford but little hope of reconciling the musical with the colorific ratios of vibration, but we find that extreme and intermediate tints have been calculated, without any apparent reference to the constitution of the Musical scale. Yet the great latitude of vibration permitted both in and between the intermediate and principal colours, indicate the possibility of making a right selection of the exceedingly limited spaces within which indubitable ratios may be found. It will be seen, however, that by adding the complements of the musical ratios, (Table I, column 2) instead of the ratios themselves (column 1) to the number of vibrations for the principal colours, a close approximation will result. But this approximation will be still more remarkable on adopting the number 467, (minus the cyphers) instead of 477, the number for Red, which may well be admitted by the wide range existing between the extreme Red and the intermediate Orange. (See Table III).

A cursory glance at the following table will suffice to show that there must be something more than simple coincidence in the near resemblance of the two columns of figures, inspiring a hope that all existing doubt of the truth of the analogy may yet be removed by well directed experiment. The employment of the musical ratios themselves would overshoot the mark, but however, this is to be accounted for, they may be more satisfactorily applied to the numbers given by Ganot, expressing in corresponding parts of an inch, the relative size of the

undulations taken at the principal dark lines of the spectrum.

TABLE III.

Prismatic Colours.	No. of undulations per second.	Complements of the Musical ratios applied to 467.
Red	477	467
Orange	506	518
Yellow	535	560
Green	577	583
Blue	622	622
Indigo	658	653
Violet	699	684

To Professor Ganot's diagram of the spectrum,* I have added: first, his measurements of the undulations occurring at the principal dark lines seriatim, secondly, Sir J. Herschell's more extended series on the same scale, and thirdly, the Musical ratios applied to the principal colours, assuming 300 to represent the base red.

* Elementary Treatise on Physics, Coloured Plate I. (Atkinson's translation.)

TABLE IV.

A a B C D E b F G H																
																
		Red		Orange		Yellow		Green		Blue		Indigo		Violet		
1st series.		271	256		244		207		191			169		155		
2nd.	{	E.R.	R.	I.	O.	I.	Y.	I.	G.	I.	B.	I.	Ind.	I.	V.	E.V.
		266	256	246	240	235	227	219	211	203	196	189	185	181	174	167
3rd.		300		264		240		225		200		180		160	150	

The positions occupied by the dark lines only give a rough idea of the true localization of the prismatic colours. But on comparing the 1st and 2nd series with each other, there would appear to be no valid objection to the possible truth of the 3rd. Thus, the range of measurements embraced by the two former, cannot oppose the provisional selection of 0,0000,300 of an inch, as the length of the wave of the base red, and half that number for its octave, so that all the other colours may have the ratios applied to them in the 3rd series, by the musical analogy. It will be observed that any wide deviation occurring in the 1st series is compensated in the 2nd, and *vice versa*. The inference is therefore legitimate, that, if the analogy of the musical scale were taken as a guide, the special points of the spectrum, whose respective vibrations would compose a well tempered diatonic scale of colour, may be readily chosen. It is probable also, that the musical ratios alone can be the test of the truth

of such a scale, for by shifting ever so little above or below the precise locality required, a difference of millions of millions of vibrations must result.

SECTION III.

The probable nonexistence of a Luminiferous Ether, and the consistency of such a doctrine with the exposition of all the known phenomena of light.

Ganot remarks "that in the case of sound, there is
"independent evidence of the existence and vibration of
"the medium (air) which propagates the undulation,
"whereas, in the case of light, the existence of the medium
"and its vibrations are assumed, because the supposition
"connects and explains in the most complete manner, a
"long series of very various phenomena. There is how-
"ever, no independent evidence of the existence of the
"luminiferous ether." And indeed it is just as easy to
conceive that common matter may be the subject of
luminous vibration, as to assume the necessary existence
of a luminiferous ether, in which similar vibration must
be excited, in order to induce in us the sensation of
vision. Sonorous vibration, obeying precisely the same
general laws, has never suggested to the philosopher the
presence of any such special medium, apart from common
matter. Again, if waves of light are measurable, and we
can estimate the rapidity of their sequence, there is still a
wide margin for the play of the so called ultimate atoms
of even the grossest form of matter. It might be sup-

posed that any change wrought in the component atoms of a body by chemical force would exert some influence upon the ether flowing between them, yet, in ordinary coloured substances, this is not enough to produce luminous vibration in the dark, and can only respond to the impression of common light from some other source. But it would seem much more rational to refer the cause of this reaction, so to speak, to the chemical constitution of the atoms themselves, and their resident chemical forces, than to the play of any hypothetical medium, which, after all must be the subjective, and not the governing agent, if it exist at all. Setting aside cases of interference, there appears to be as intimate a relation between *chemical force* and those occult conditions giving rise to colorific vibration in coloured bodies, as there is between *mechanical force* and the conditions of sonorous vibration.

This view of the case will explain to us why mechanical mixtures of coloured bodies develop intermediate compounds of the original tints, while those of colourless bodies remain colourless. On the other hand, when progressive chemical changes are attended with the evolution of colours, they generally occur in consecutive order, ascending or descending the scale, thus: the green iodide of mercury, which assumes a darker hue on exposure to light, yields a yellow sublimate when gradually heated, and thus, in turn becomes red, either by friction or after cooling; again, while the red iodide of mercury becomes yellow by the application of a gentle heat, at a

higher grade, lemon chrome changes to orange chrome, and yellow ochre to light red. Autumnal tints also descending in the scale, admit of the same explanation, and many other instances might be adduced; indeed, the subject admits of a very wide application, and might be extensively treated.

If we only assume the transmission of force, from atom to atom in ordinary matter with integral vibratory motion, we have a simple principle perfectly analogous to what we know to take place in the production and propagation of sound, superseding the necessity of corpuscular emission, or ethereal undulation, while it is quite as consistent with the exposition of all optical phenomena.

As long as chemical affinity holds the constituent atoms of a substance in union, they may be said to be in a state of tension involving specific vibration, and the persistence of this force is evidenced by their colorific reaction in the presence of common light or achromatic vibration. A musical string of definite diameter and length, in a certain state of tension, or a pipe of the necessary length and calibre will sound C, but a red substance may be divided almost infinitesimally, and all the molecules are red still, so that practically, as well as theoretically, we are obliged to acknowledge that the force in the latter instance is resident in the atomic constitution of the body. Is it not, therefore, more reasonable to look for this exquisitely fine vibration in the atoms themselves than in an interstitial ether, which would appear to carry the

mystery one point further than the ultimate fact? A similar theory may yet be found applicable to all the so called imponderable agents.

CHAPTER II.

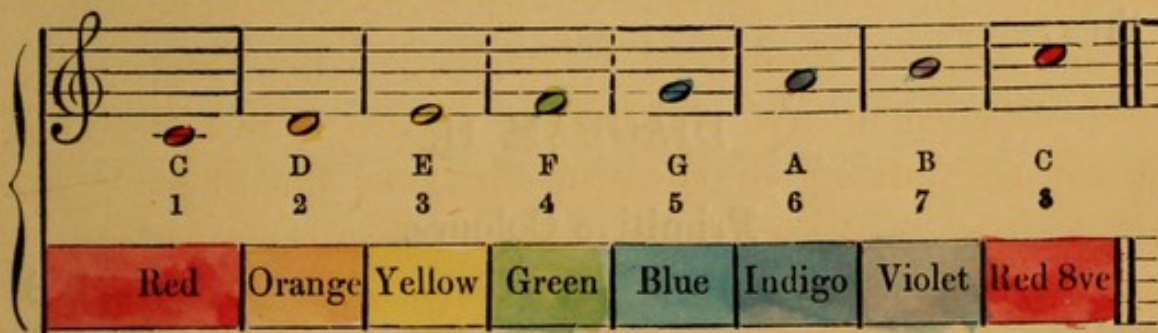
ANALOGY OF SOUND AND COLOUR.

SECTION I.

Agreement of the Musical and Colorific Scales.

Like the notes of the musical scale, the prismatic colours are seven, as shewn in the following diagram.

DIAGRAM I. (Compound Gamut.)



The staff, or stave of five lines, gives the musical notation of the natural scale; below this are the names and numbers of the notes, and next follow the corresponding colours as they occur in the iris. Now of the above series of colours, the red, yellow and blue are said to be primitives, as they are incapable of further analysis, whilst

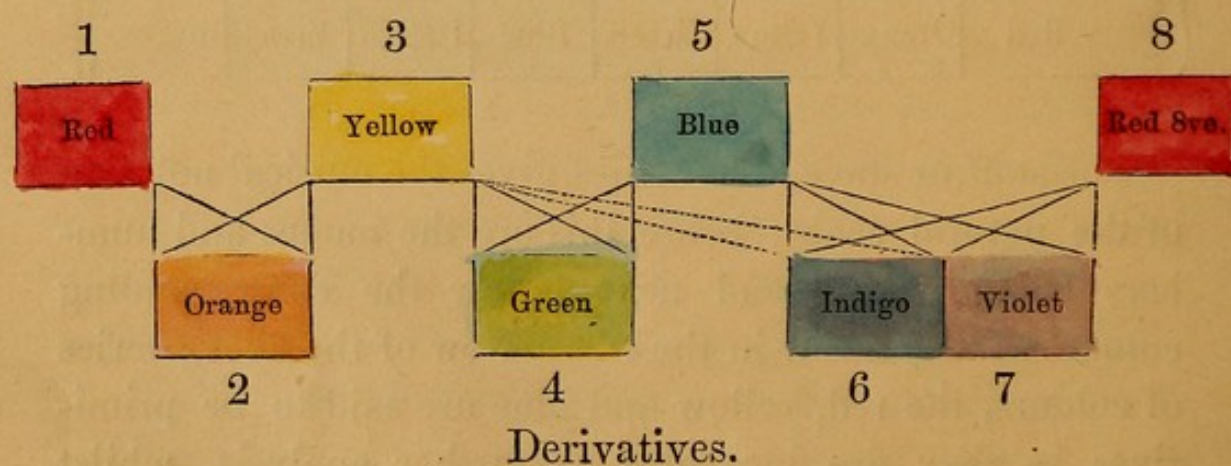
they themselves are variously combined, so as to produce all the remaining colours, which are therefore denominated compounds or derivatives.

The primitive colours, red, yellow and blue, occurring respectively upon the first, third and fifth intervals, in truthful analogy, independent of coincidence, or fortuity of any kind, may be said to compose the perfect chord of colour, answerable to that in music which all musicians admit to be the very ground work and basis of harmony. In favour of this combination, we have the most conclusive natural indications in the harmonics of strings and membranes, the open notes of musical instruments of inflation, and indeed under any circumstances in which the conditions for vibration exist.

The primitives, therefore, may be regarded as one family, in relation with the derivatives as in pedigree, thus:—

DIAGRAM II.

Primitive Colours.



Here the derivatives are marshalled in line, in the respective order of their descent, and including them with the primitives, we have the whole prismatic scale as given in the preceeding diagram (I.)

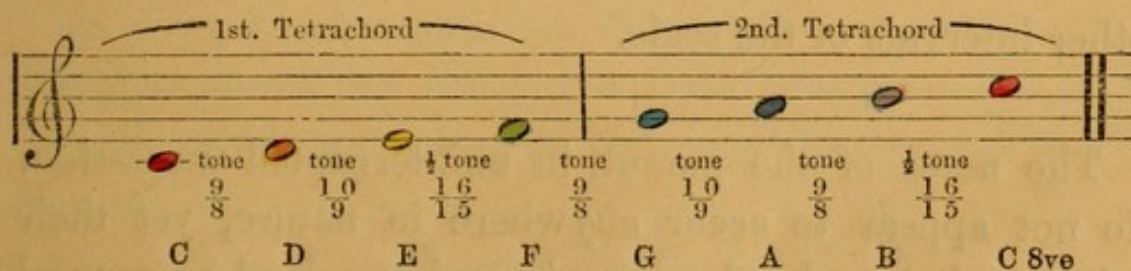
In mechanical mixture, red and yellow make orange, yellow and blue make green, and blue and red make pure purple; but, in the spectrum, arising from the diffusibility of the yellow ray, (as indicated in the diagram) instead of simple purple, we find the two colours, indigo and violet, interposed between blue and the 8ve red, and so the number is made up.

SECTION II.

Constitution of the Musical Scale.

The diatonic musical scale, consisting (with the octave) of eight notes, is divided into two lesser scales or tetrachords, each consisting of four notes, and terminating in a semitone, as shewn in the following stave.

DIAGRAM III.



Although the intervals between C and D, and between

D and E, are said to be whole tones. The first is a little larger than the second, as expressed by the fractions, but in the second tetrachord the relative size of the corresponding intervals is reversed; that between G and A being a little smaller than that between A and B. On the other hand, the semitones between E and F, and between B and C, hold a corresponding relationship, or are, in other words, of equal value.

It may be fairly argued that *tint* or *hue* in colours determining their relations to each other, is equivalent to *pitch* in sounds, which is in like manner due to the rate or number of vibrations in a given time, as previously alluded to.

In this inquiry we shall confine our attention to the natural key of music, or that commencing with the note C, assuming red to be its analogue in the colorific scale, in favour of which position, several arguments may be adduced. Thus, red is by position the first of its own series; it is the least refrangible constituent, and the vibrations producing it occupy more time and space than those of the succeeding colours, as also may be affirmed of the musical tonic or key note, with reference to the other intervals of the scale.

The notes of the gamut, in uninterrupted succession, do not appear to occur anywhere in nature, yet their relative pitch and order have been determined by natural indications, mathematical calculation and the test of the

ear. On the other hand, the order of colours occurring in the rainbow and the prismatic spectrum, may be assumed to be the right one, from what has been already stated.

We are now prepared to enter upon the subject of musical harmony, with the view of tabulating the colorific agreements, so as on the one hand to submit the truth of the analogy to further test, and on the other, should the foregoing premises be correct, to afford useful examples and practical hints for the painter's guidance.

Practical music is of little use to painters, consisting chiefly of digital performance, which, like laying on colour, is simply mechanical or operative. They may, however, profit much by the study of musical principles, including a knowledge of the properties and relations of sounds, both in single sequence and in combination, governed by rhythm.

SECTION III.

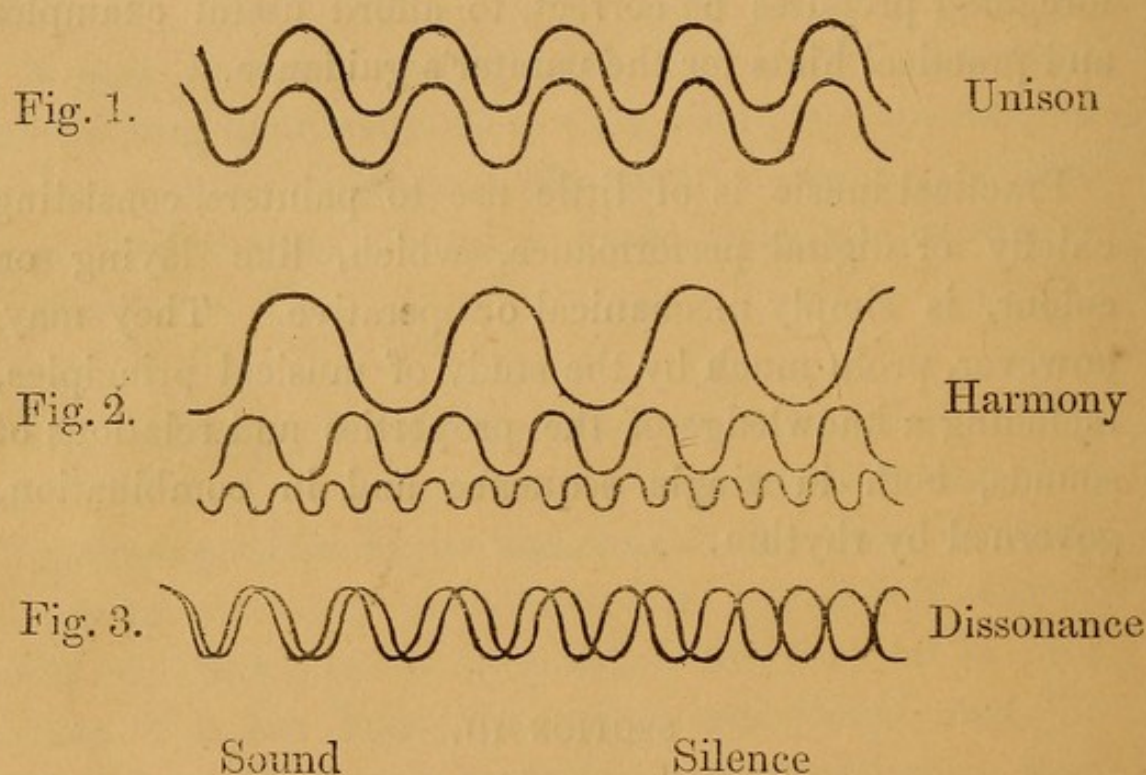
Rudiments of Harmony.

1.—Sounds in unison are those whose respective undulations are of the same size and number, so that they occupy equal portions of time and space. Fig. 1, diagram IV. (starting together)

2.—All other concords must hold a relation between

the numbers of their vibrations as to render it possible for them to act freely together without interfering with one another; and while this is the case, any number of notes may be combined, and they will all be in harmony. Fig. 2, diagram IV.

DIAGRAM IV.



3.—Should the vibrations of one note be in irregular proportion to those of another, a coincidence between them can only happen occasionally, and they will interfere with, and neutralize each other in the intervals. This is the true nature of dissonance and the element of discord. (Fig. 3, diagram IV.) Such is the law of

“interference,” and the lines of *light* and *shade* occurring where two sets of luminous undulations so interfere, are analogous to the alteration of *sound* and *silence*, taking place where two notes not perfectly in tune are sounding together.

From the study of their properties and offices, the different intervals of the musical scale have received appropriate names, thus: C is denominated the tonic, D the super-tonic, E the mediant, F the sub-dominant, G the dominant, A the sub-mediant, and B the sub-tonic.

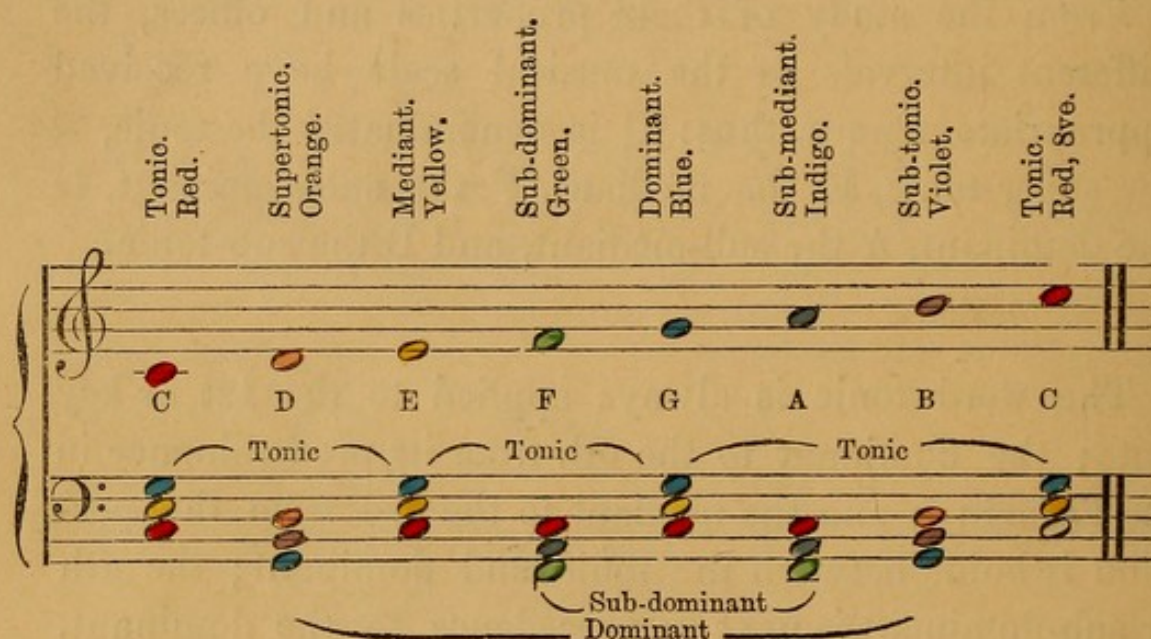
The word tonic is always applied to the 1st or key note; the dominant to the 5th from its predominance in the harmony; and the mediant to the 3rd from the position it holds between the tonic and dominant; the 4th or sub-dominant is next in precedence to the dominant, and the sub-mediant though above the mediant in position, is yet musically speaking subordinate to it, as its name implies.

The super and sub-tonic, or the 2nd and the 7th need no special remark at present, but that they are dissonant with the tonic.

The technical names of the notes here briefly alluded to, are given seriatim in the following diagram, which is also intended to show that every note in the gamut may be supported by a fundamental bass note with its third

and fifth, forming what is denominated a common chord. The equivalent colours have also been supplied to the musical characters.

DIAGRAM V.



It will be observed that, only three common chords occur on the bass clef, and these are all that are required for common purposes without change of key. The first is founded on the tonic, C (red), E (yellow), and G (blue), the second on the sub-dominant, F (green), A (indigo), C (red), and the third on the dominant, G (blue), B (violet), & D (orange.) The first note of each is its fundamental bass, but this gives place to the others in the changes of position or inversions of the chords, as in the annexed diagrams

DIAGRAM VI.

Changes of position of the common chords of the tonic.

1 2 3

Natural Position First Inversion Second Inversion

The image shows a musical staff with a treble clef and a bass clef. The treble staff contains three measures of music, each representing a different position of a triad. The first measure is labeled 'Natural Position' and shows a triad of three notes (red, blue, and yellow) on the first three lines of the staff. The second measure is labeled 'First Inversion' and shows a triad of three notes (red, blue, and yellow) on the second, third, and fourth lines of the staff. The third measure is labeled 'Second Inversion' and shows a triad of three notes (red, blue, and yellow) on the third, fourth, and fifth lines of the staff. The bass staff is empty, except for a few notes at the bottom of the page.

DIAGRAM VII.

Changes of position of the common chord of the dominant.

DIAGRAM VIII.

Changes of position of the common chord of the
sub-dominant.

1 2 3

Natural Position First Inversion Second Inversion

That the three common chords as given, include all the intervals of the scale may be thus simply shown.

Chord of the tonic	¹ C.... ³ E.... ⁵ G
Chord of the dominant	² D..... ⁷ G.... ⁴ B
Chord of the sub-dominant	⁶ F.... ³ A.... ⁸ C
Total	¹ C ² D ³ E ⁴ F ⁵ G ⁶ A ⁷ B ⁸ C

From this it will be apparent that any plain melody may be readily harmonised, with the proviso that each note must itself occur as a component of the particular chord selected to sustain it.

To the fore-going may be added the minor common chord of the super-tonic, the imperfect common chord of the sub-tonic, and the chord of the dominant seventh.

DIAGRAM IX.

Minor common chord of the super-tonic.

1 2 3

Natural Position First Inversion Second Inversion

DIAGRAM X.

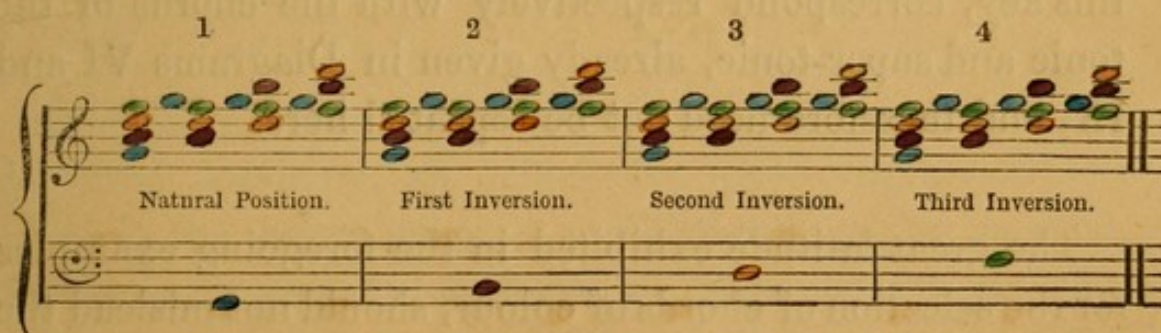
Imperfect common chord of the sub-tonic.



As B and D the first and third of the last chord form respectively the third and fifth of the common chord of the dominant, it is more usual to combine the two triads in the form, known as the chord of the seventh, consisting of the dominant with its third, fifth and seventh as follows:—

DIAGRAM XI.

Chord of the dominant seventh.



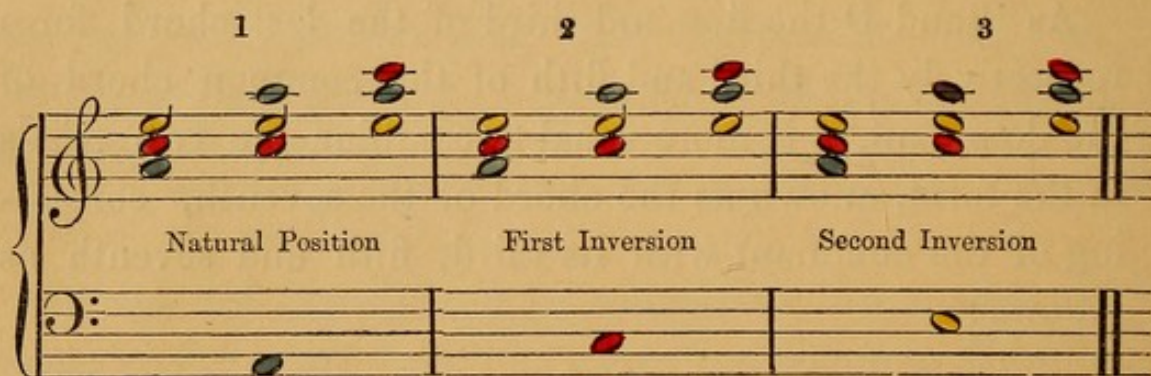
As there are four distinct notes in this chord it admits of four positions, moreover, the painter should observe the musical rule that it always requires preparation; (*i.e.*), a

particular chord to precede it, and resolution, (*i.e.*), another to follow it, which must be that of the tonic as a close.

The common chord of A minor, which is the relative minor to C, having no signature at the commencement of the staff, stands thus:—

DIAGRAM XII.

Common chord of A minor.



The sub-dominant and dominant common chords of this key, correspond respectively with the chords of the tonic and super-tonic, already given in Diagrams VI and IX, and therefore need not be repeated here.

The great latitude exhibited in the foregoing examples for the selection of chords of colour, should not mislead the painter in their promiscuous use. He should first determine his key, and then translate some good harmonic phrases into colours most befitting the nature of his subject. The method to be followed in their distribution,

and other readings of the rules of art, where they can be sustained by the musical analogy, will be found in a more advanced part of this essay. I shall now merely append some of the leading principles of counter point to assist the painter in harmonizing a theme, or phrase for pictorial purposes.

Euphony in music is analogous to euphony in language, and determines the most easy transition, or sequence of accordant intervals, consistently with the physiology of hearing. The following principles are involved in it.

1.—A clear perception of the fifth interval is essential to the determination of a key. Hence a sequence of octaves ~~and~~ fifths in similar motion, when the parts uniformly ascend or descend together, having a tendency to assimilate a change of key, is prohibited by the rules of harmony.

2.—Skips from a given note to any wide interval, and dispersed harmony, so called, for the reason already given in the preceding paragraph are also to be avoided. Hence compressed harmony, or the closest possible arrangement of the parts is to be studied in composition.

3.—In supplying harmonies to an air in C major, the

chords in Diagrams V to X, inclusive, are available, and they will afford the composer sufficient materials to furnish parts with the double advantage of having a theme in themselves, without infringing rules. Those chords taken singly will support any of their own parts. Hence any note in the scale taken singly will agree, or harmonize with any chord, in which, it occurs as an ingredient. See annexed diagram.

DIAGRAM XIII.

Shewing the chords in agreement with each note in the Scale.



In plain counter point, the notes of the parts added are of uniform length with those of the subject; but where it is "florid" the notes are of different lengths, and variously intermixed at least in one of the parts. In the latter case attention must be paid to the accented parts of each bar, so as to know where the harmonies should be supplied, without involving the passing notes and embellishments.

I have dwelt thus long on the subject of harmony, seeing that frequent allusion to its principles must be made in the course of this essay, moreover, even a slight primary knowledge of music will greatly facilitate the comprehension of the views and arguments advanced; while the examples given in the diagrams will stand for reference.

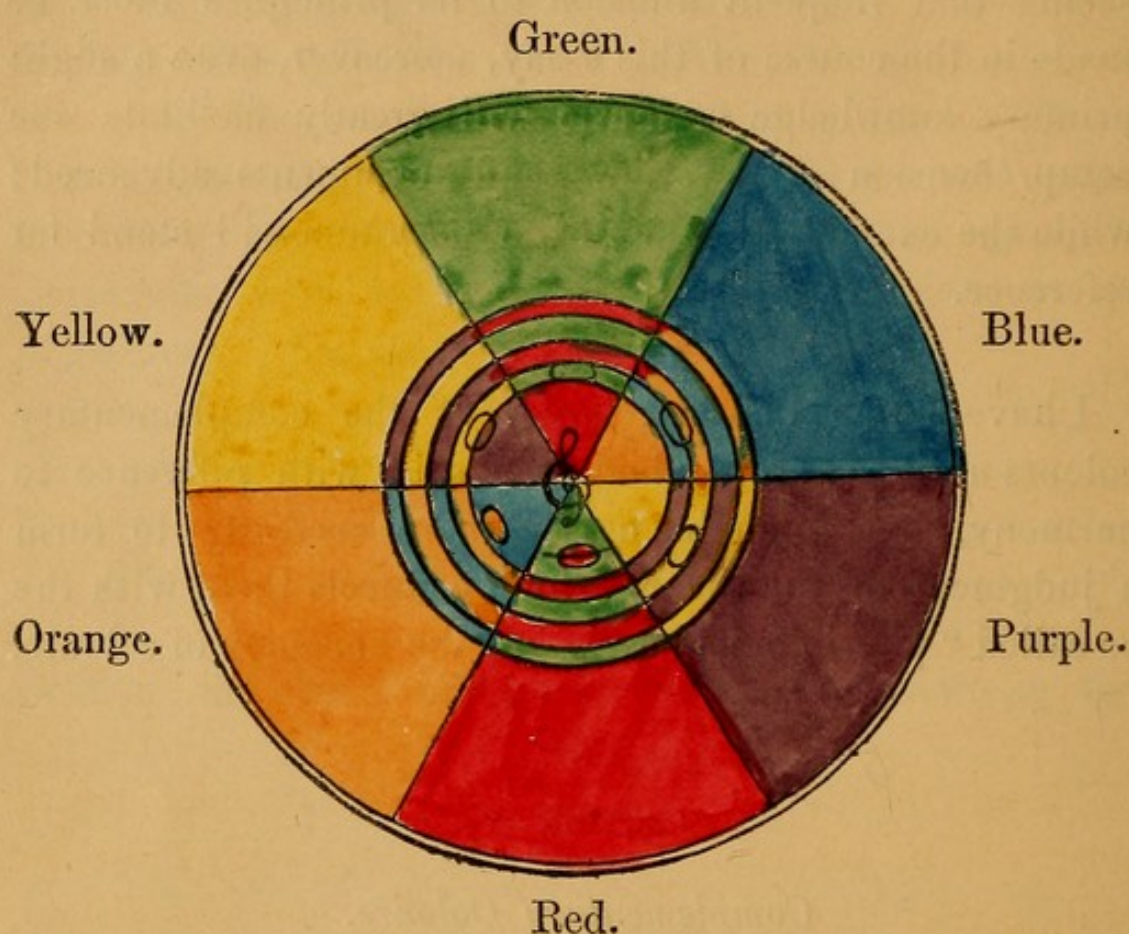
I have reserved special notice of the complementary colours until something had been said with reference to harmony, so as to enable us the more correctly to form a judgment of the theory which connects them with the so called "physiological basis" of the harmony of colours.

SECTION IV.

Complementary Colours.

In giving an account of the complementary colours, it is usual to adduce the series resulting from the binary mixture of the primitives, forming a sort of colorific hexachord, like the old musical one, in which the 7th interval equivalent to violet was wanting. Had Guido the monk taken the prismatic scale for his guide, instead of, in effect, making a mechanical mixture of the three major constituents of the diatonic scale, he would have transmitted a still greater name to posterity. The hexachord arranged in a circular manner, forms an instructive diagram, showing at a glance the colours that are complementary to each other.

DIAGRAM XIV.



The alternate colours compose two common chords, one on the first and the other on the second interval of the scale. The opposite colours are also concords, standing in the double relation of fourths and fifths to each other, one being primitive and the other compound. Now in all the relations just mentioned, namely, the alternate simple and alternate compound, or any two opposite colours, the components are complementary, (*i.e.*), in the proportions to neutralize each other, and produce white or colourless light. It being assumed that the latter is in all cases composed of the three primitive colours in achromatic combination. Thus, if we take one primitive,

say red, the other two, yellow and blue must exist in its complementary green, or separately. Or taking a compound colour, say green, composed of yellow and blue, its complementary will be found either in the opposite colour, red, or in the alternate compounds, orange and purple taken together. The complementary colours therefore, may be divided into two groups, as under :

- | | | |
|------------------|---|---|
| 1.—Binary group | { | Red—Green
Yellow—Purple
Blue—Orange |
| 2.—Ternary group | { | Red—Yellow—Blue
Green—Purple—Orange |

Though the musical analogy declares all complementary colours to be accordances, I cannot think with Professor Muller, that all other combinations of colour are disharmonic, or where he says that “ combinations of two of the “ simple colours, the third which would render them complementary being deficient, are the most offensive to the “ eye; for instance, combinations of yellow and red, blue “ and red, or yellow and blue.” Instead of “ complete disharmony,” as components of the perfect chord of colour, the examples here given ought to produce rather an agreeable effect. He further states that “ in the “ association of two colours of which one forms a transition “ to the other, there is neither harmony nor disharmony “—such colours are indifferent to each other—as yellow “ to green, red to orange, or violet to blue” (probably indigo). So far as indifference goes, these intervals,

musically speaking, being seconds are positive dischords. Finally he writes "the disharmony between two colours "may, however, be removed by the interposition of a "third colour, which is the harmonic of one of them, and "is indifferent with relation to the other. We have "examples of this in such combinations as red, green and "yellow; yellow, violet and red; blue, orange and red; "or red, green and blue, &c." But this doctrine, and the discordant colours suggested by it are quite opposed to the musical analogy, which teaches us to look for agreements in concordant or coincident vibrations without "interference," rather than to submit to any arbitrary rule however plausible, that may be antagonistic to so philosophical a principle.

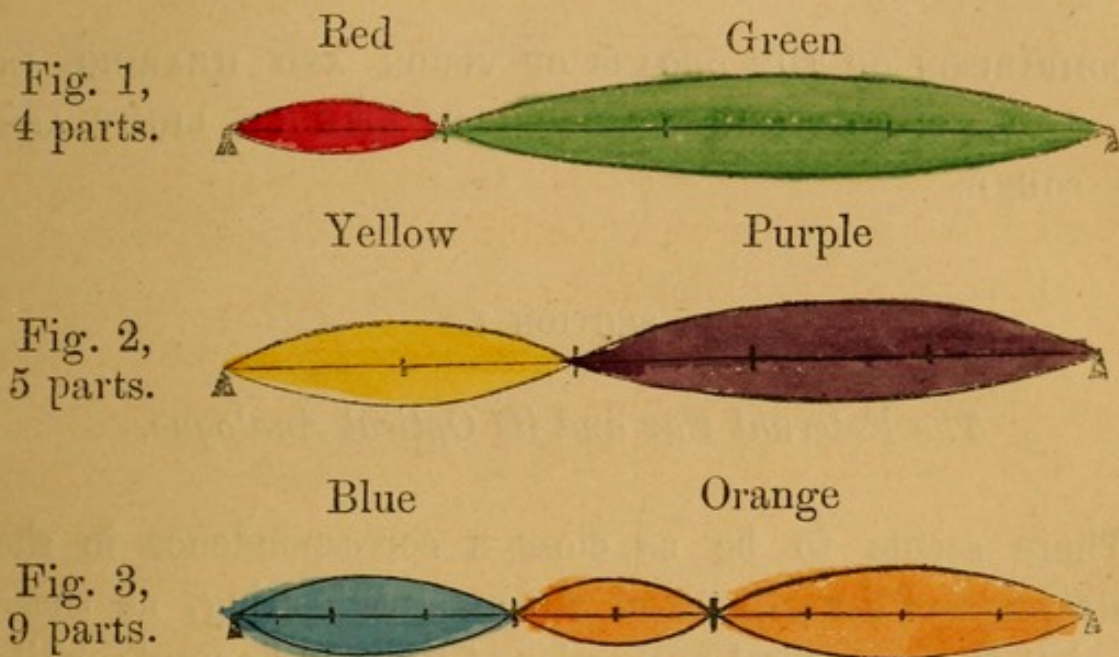
SECTION V.

Complementary Sounds.

As before explained, musical strings have a physical tendency to divide in the production of harmonic sounds, into parts of 4, 5 and 9, so as to embrace all the intervals of the diatonic scale; and the complementary sounds so developed, when translated to colours, correspond in every instance with what the colorific analogy would demand of them.

If a string sounding C, answerable to red, be divided into 4 parts, $\frac{1}{4}$ th and $\frac{2}{4}$ ths will also produce C, but the complement of $\frac{1}{4}$ th are $\frac{3}{4}$ ths yielding F, which is equivalent to green, the complementary colour to red. Diagram XV, Fig. 1.

DIAGRAM XV.



Divide the string into five parts, and $\frac{1}{5}$ th, $\frac{2}{5}$ ths and $\frac{4}{5}$ ths will produce E, (yellow), but the complement of $\frac{2}{5}$ ths are $\frac{3}{5}$ ths, yielding A, the equivalent of indigo or purple, which is the colour required. Diagram XV, Fig. 2. Again, dividing the string into nine parts, $\frac{1}{9}$ th, $\frac{2}{9}$ ths, $\frac{4}{9}$ ths and $\frac{8}{9}$ ths produce D, (orange), but $\frac{3}{9}$ ths & $\frac{6}{9}$ ths make G, (blue), and the complements, whether single or double make only these two notes, whose equivalent colours, orange and blue, are complementaries (Fig. 3). These facts lead to the inference that complementary colours are, as it were, chromatic harmonics; and perhaps it is in this way that complementary sensations arise in the retina, whose surface being long excited by the influence of a particular colour would appear to be more susceptible of the vibrations of the complementary in white light, but, it is not at all improbable that these are actually included in the way of harmonic vibrations in general.

CHAPTER III.

COMPARISON OF THE ORGANS OF VISION AND HEARING, IN
RELATION TO THEIR APPROPRIATE STIMULI, LIGHT AND
SOUND.

SECTION I.

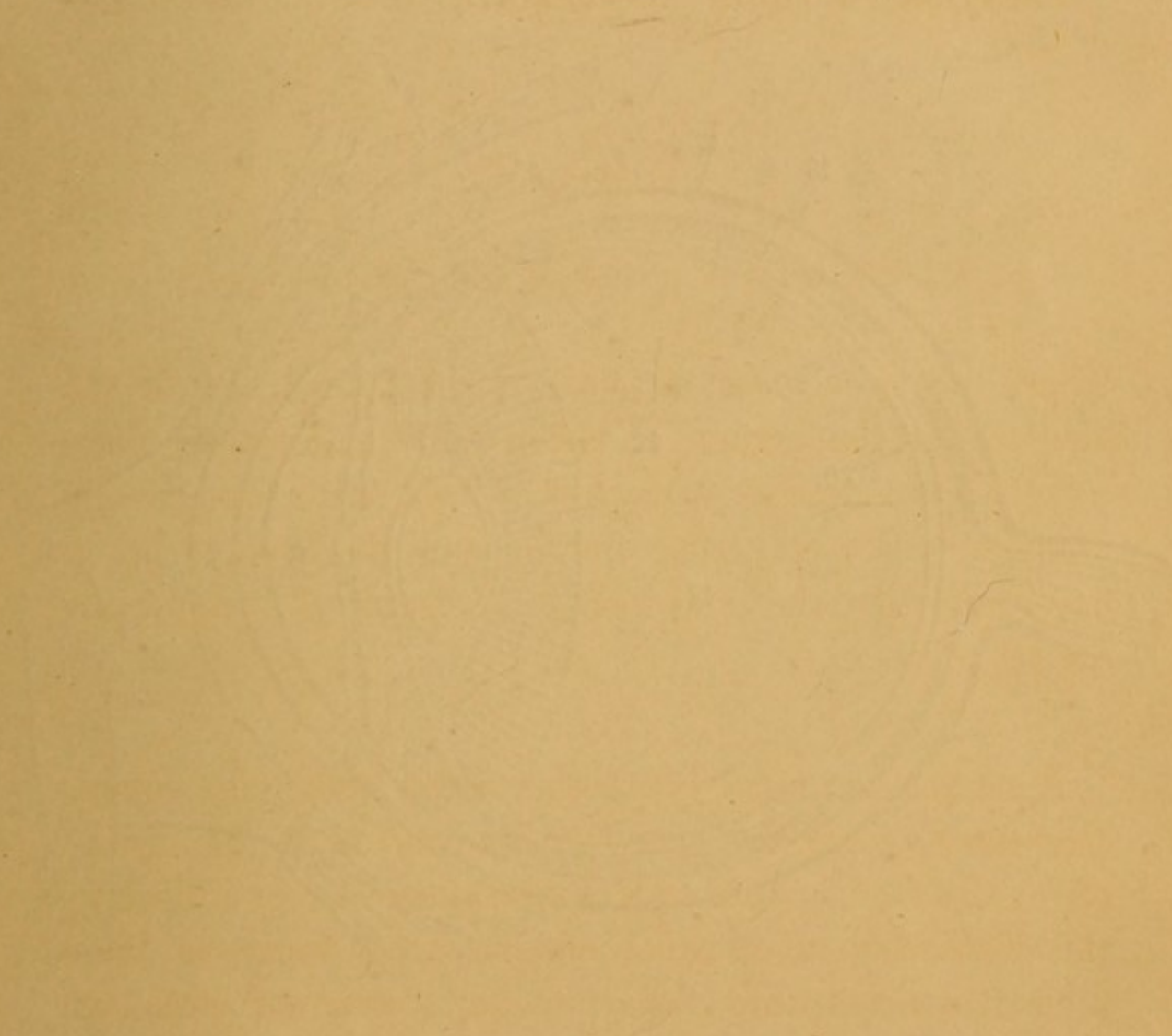
The External Ear and its Optical Analogue.

There seems to be as close a correspondence in the structure of the organs of vision and hearing, as there exists in the general properties of light and sound; while any peculiarity occurring in either will be found to be in accordance with some special requirement of its appropriate stimulus.

Agreeably with the law common to light and sound, that their power and intensity diminish with the square of the distance, nature adopts suitable means for collecting the diffused rays of those agents, preparatory to their further concentration, that an impression of sufficient strength may be conveyed to the seat of perception. Thus, in the eye the collection of the rays of light is effected by dense refracting media, (the cornea and aqueous humour), presenting an expanded convex surface anteriorly, while a funnel-shaped apparatus (the extended and generally concave surface of the auricle, with the external auditory canal) is employed for a similar purpose in the ear.

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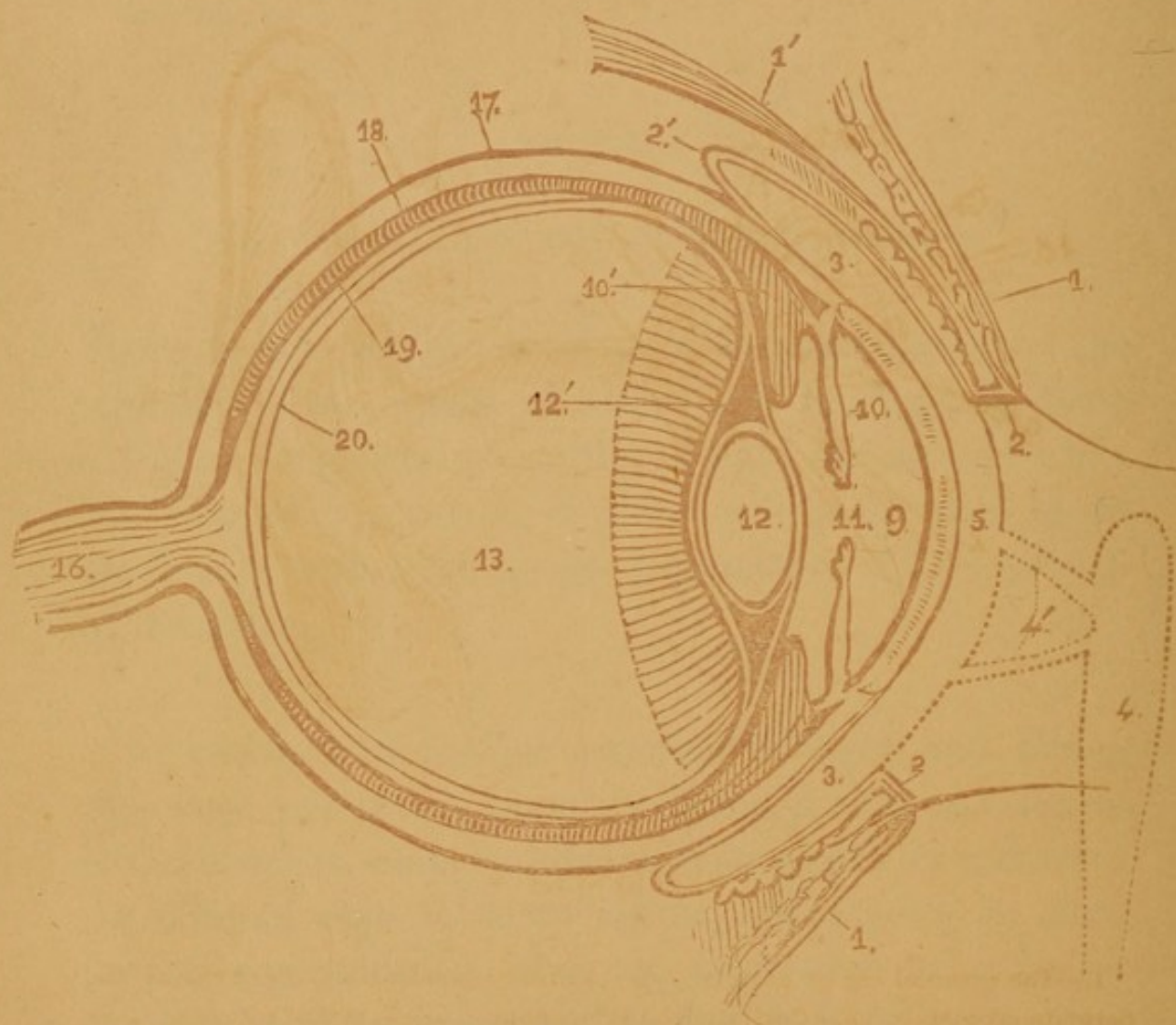
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PLATE I.

Vertical section of the Eye.

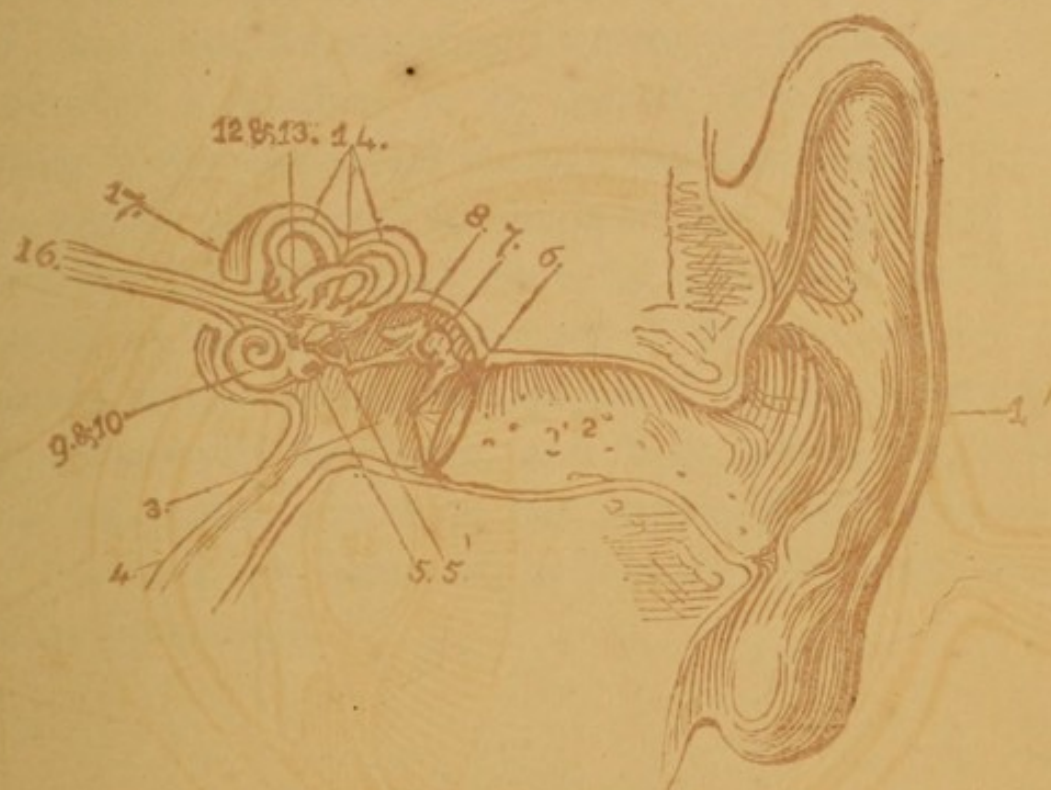


REFERENCES :—

- 1.—The eye lids with their different structures in section. 1'.—The elevator of the upper eye lid. 2.—The free margins of the eye lids with the eye lashes, and the orifices of the meibomian glands. 2'.—Conjunctival membrane. 3.—Cavity corresponding with the oculo-palpebral chamber of serpents. 4.—Nasal duct. 4'.—Lachrymal canals. 5.—Cornea. 9.—Aqueous humour. 10.—Iris. 10'.—Ciliary processes. 12.—Lens. 12'.—Canal of Petit. 13.—Vitreous humour. 16.—Optic nerve. 17.—Sclerotic coat. 19.—Retina. 20.—Hyaloid membrane.

PLATE II.

Scheme of the structure of the Ear.



REFERENCES:—

1.—The external ear or auricle. 2.—Auditory canal with the orifices of the ceruminous glands. 3.—Cavity of the tympanum. 5.—Fenestra rotunda. 6.—Fenestra ovalis closed by its membrane, with which the base of the stapes is connected. 6.—Membrana tympani. 7.—Malleus. 8.—Incus. 9 & 10.—The cochlea, containing the perilymph and spiral lamina. 12 & 13.—The vestibule, containing the octoconia and endolymph. 14.—Semicircular canals. 16.—Auditory nerve. 17.—Petrous portion of the temporal bone, forming the bony labyrinth.

As analogous parts are indicated by corresponding figures in this and the preceding plate, illustrating Chapter III, it has not been considered necessary to introduce special references in the text.

REMARKS

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Now although the *auricle and external auditory passage*, with its short hairs and glandular apparatus (anatomically considered), correspond with the eye lids, comprehending especially the *tersal fibro-catiliges*, the *cilia* and *meibomian follicles*, yet, the office of the auricle in receiving the rays of sound, and transmitting them to the middle ear, is too important a function to be passed over in the simple notice of the anatomical analogy just mentioned. Indeed, the eyelids rather tend to diminish the quantity of light entering the eye, being watchful guardians against its excess, or the injurious contact of foreign matters. In certain savage tribes, the muscles of the auricular region are remarkably developed, and their action in perking, and otherwise adjusting the auricle, bears relation to its reception of sonorous undulations for transmission to the tympanum.

SECTION II.

The Middle Ear and its Optical Analogue.

A further concentration of the rays of light and sound respectively, is necessary for distinct vision and hearing.

In the eye this requirement is fulfilled by a body (the lens) of greater density and refracting power than those employed primarily in collecting the luminous rays; and in the ear, by a membranous expansion, (the *membrana tympani*) having a conically depressed external surface, beautifully adapted for convening the rays falling upon it.

This membrane is connected with another of much smaller size, (the *membrana fenestræ ovalis*) through the medium of several small and dense bones, (the *ossicula auditus*) and thus a communication is established with the internal ear. Some consider the *membrana tympani* overlaid with the lining membrane of the *meatus auditorius*, to represent the cornea of the eye, with its conjunctival investment; but Dr. Wharton Jones ingeniously supposes it to represent a natural "*mediate anchyloblepharon*," and such appears to be the correct view. The outer cornea in serpents therefore being a natural *anchyloblepharon*, may be regarded as homologous with the *membrana tympani*. Between it and the eye ball itself a space exists corresponding with the cavity of the tympanum, and this space is lined by the true conjunctiva, (the oculo-palpebral sac of Cloquet) agreeing with the lining of the tympanum. The lachrymal canals opening into it, and the lachrymal duct communicating with the nose are answerable to the eustachian tube which connects the cavity of the tympanum with the fauces.

SECTION III.

The Internal Ear and its Optical Analogue.

The most essential portion of the organ of hearing, or the internal ear, has been appropriately termed the ear bulb, bearing analogy to the eye ball in nearly every particular. There are however certain peculiarities in the figure and repetition of the parts of the former, rendering

the subject complex.

The *membrana rotunda*, called also the *membrana tympani secundarina*, has been likened to the cornea. The *scala tympani* and *scala vestibuli* of the *cochlea*, have been respectively conceived to correspond to the anterior and posterior chambers of the eye; the perilymph being analogous to the aqueous humour, and the helicotrema to the pupil. The endolymph is answerable to the vitreous humour; and the otoconia, or calcareous concretions have been compared to the lens; while the several divisions of the auditory nerve taken collectively, represent the retina. A direct current of sonorous undulations passes along the dense chain of ossicles to the labyrinth, through the *membrana fenestra ovalis*; and the mere consideration of its yielding character, as bearing an analogy to the thinning of the *sclerotica* in the eye of the Greenland seal, is not satisfactory, for the functional parallel will distinctly shew that it must be recognised as fulfilling the office of cornea to the ear, as well as the *membrana rotunda*. The sonorous current entering by the *fenestra rotunda* may be strengthened or modified in *scala tympani*, by that of the *scala vestibuli*, entering by the *fenestra ovalis*, and finally descending in the *scala tympani*. This is an important consideration in relation to the cochlea; and may possibly be connected with the perception of the pitch of musical sounds. The question may be: whether by a property of refrangibility analogous to that of colours, or by the simple law of interference, a collision of the two sonorous currents above noticed may take place at special points of the spiral lamina, according

to the pitch, and thus (impressing the visicular matter of the middle scala in different localities) enable the mind to perceive the relation that one note bears to another in the musical scale. This supposition is strengthened by the fact that the most exalted function which the human ear, as well as that of the lower animals possesses, is the discrimination of the pitch of sounds; and the existence of the cochlea is the highest mark of perfection in the organization of the ear.

SECTION IV.

Perception of the Pitch, Distance and Position of Sounds by the Ear ; and analogous faculties of Vision.

The perception of the distance and of the locality from whence sound originates must be regarded as two special functions of audition, and quite distinct from the sense of pitch which discriminates the relative graveness or acuteness of sounds. In the eye we also notice similar endowments, for while we form a judgment of the distance and position of objects by the light which they reflect, we can also appreciate their colours, but individuals are to be found in whom one or other of these functions is defective, either as regards the eye or ear. Thus, a person may have no power of judging the distance through which a sound may have travelled in order to reach his ear; or, what is analogous with respect to the organ of vision, he may not be able to conceive how far an object is distant from him by its image

depicted on his retina. Again, he may have acute hearing in every respect, but no power of ascertaining the pitch of a musical sound, or its relative position in a scale of eight notes; or what is similar with regard to the eye, he may not be able to discriminate between one colour and another, although every object as to outline, light and shade, is distinctly perceived; so that the power of distinguishing the pitch of sounds by the ear, and the species of colour by the eye are analogous functions.

SECTION V.

Sympathetic Vibration.

When the active motion of a sonorous body excites the passing vibration of surrounding substances, they are said to vibrate sympathetically. This sympathetic vibration may be of two kinds, viz. : 1st., when the tremors of a sounding body are communicated by the atmosphere or other means, to an adjacent surface or substance, in the particles of which a corresponding motion is excited, and secondly, where sonorous bodies give out their own peculiar sound, when the vibrations of others are conducted to them in the manner just named. The motion of the fore part of the violin, occasioned by the tremor of the strings, is an instance of the former; and the excitement of one string on a harp by the vibration of another would illustrate the latter. Here the string sympathetically affected sounds its own note, and not that of the string which thus excited it.

It is probable that the *membrana tympani* (while it collects and transmits the sounds that subsequently impinge on the auditory nerve), may be sympathetically affected in both these ways, for in its passive state it is susceptible of the vibrations of any note falling upon it within a certain sphere, but, by its muscular adaptation it may commingle its own proper vibration with that of the sound affecting it, and thus augment the sonorous impression.

The strings of a piano-forte communicate their vibration to the sound board so accurately that their notes may be reproduced by the percussions of any loose dense body, as a small piece of steel placed upon it; and that the same particles may be simultaneously affected by two or more notes, is proved by the fact that the separate intervals of any chord, C E G, for example, may be distinctly traced in what we may call the compound percussions of the dense body. This experiment shows how the *membrana tympani* at the same degree of tension may transmit to the internal ear many different sounds, either simultaneously, as in a harmonious chord, or in succession, as in a melody. But as in the case of the sound-board just instanced, the drum of the ear will respond in some situations better than in others, according to the pitch of the note, suggesting the inference that all parts of the surface are not alike susceptible of the same vibration, and this we shall presently see more fully illustrated in the drum head. The fact also indicates that a certain change in the tension of the *membrana*

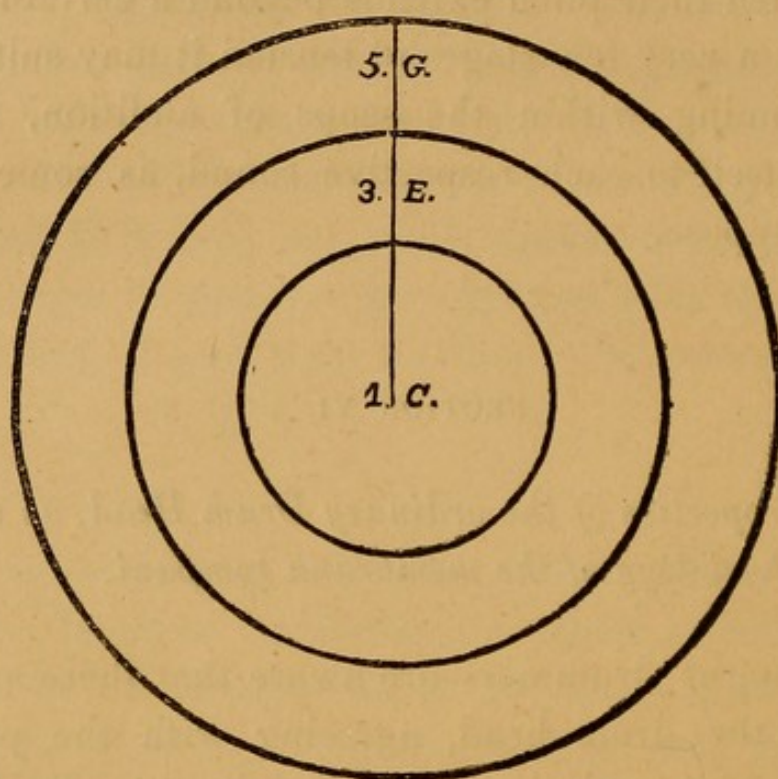
tympani is necessary for the more efficient reception of sounds when their pitch extends beyond a certain range, so that by a very few stages of tension it may suit all the sounds coming within the scope of audition, without adapting itself to each respective sound, as some physiologists suppose.

SECTION VI.

Acoustic properties of the ordinary Drum Head, as supplied to the physiology of the membrana tympani.

Well taught drummers are aware that there are three notes on the drum head, agreeing with the principal harmonics of a musical string. See diagram XVI. One note is limited to the centre, a second to the circumference, and a third to the intermediate portion. The central point gives the tonic or key note of the instrument, say C; that of the circumference being a fifth or five notes higher than the central, is equivalent to G; while the note between these, which is a third above the key note, corresponds to E; thus the constituents of the perfect chord or triad of C may be produced by striking those several parts successively. Here also we perceive that the laws of vibrating chords are extended to membranous surfaces, harmonic vibrations being developed in both. Thus, a string sounding C may have secondary or harmonic vibrations excited in several of its parts, making up the elements of the perfect chord, and this is also well exemplified in the drum head.

DIAGRAM XVI.



The consideration of the qualities of the drum head (above referred to) accounts for the extension of the handle of the malleus to the apex or centre of the membrana tympani, (as indicated by the perpendicular in the diagram) in order that it might convey to the seat of impression, the segmental vibrations, whether harmonically or sympathetically excited.

The high notes affecting the circumference of the membrane take but a short course along the handle of the malleus, agreeably with their pitch and intensity, while the vibrations of the centre, being of a grave and penetrating character, take the tragit of the entire manubrium; thus all inequality is compensated, and an

important physiological end answered. Hence, it may be inferred, that the handle of the malleus, in correcting the unequal effects that would necessarily result from the diversity of the pitch and power of musical intervals, takes an analogous office to that fulfilled by the refracting media of the eye, whereby the contending refrangibilities of different colours are reconciled, and all are brought as nearly as possible to impinge upon the retina in the same plane.

It is an interesting fact that in order to establish any note as a new key, a correct conception of its fifth is necessary, as any other interval will not determine it. This constitutes the difficulty in following abrupt modulations or sudden changes of key, without notes of transition; just as the educated eye feels hurt when discordant colorific intervals are ignorantly associated, for the impression of one colour must be artfully neutralized by the juxtaposition of others having a sympathy with it. Now the three vibrating segments of the membrana tympani respecting to a key note, its third, and fifth, embrace all the requisites for determining the key; and this natural or physical division of the membranous surface producing the perfect chord above mentioned, explains the necessity of every musical composition both commencing and ending with this combination of sounds. Moreover, on applying the laws of musical harmony to the association of colours, we shall find it necessary to establish some one colour as a key note in pictures, and upon this we may construct a colorific chord. Again,

on the principle of harmonic vibration, if we suppose the note C alone to impinge on the *membrana tympani*, the notes E and G will be harmonically excited. Thus, the physical change affecting the membrane being communicated to the auditory nerve, induces the mental conception of the natural agreements; and this we may conclude is the mode of instruction which the mind undergoes in the formation of what is called "the musical ear," a faculty enjoyed by some favoured individuals, independently of any musical education.

The laws of the complementary colours have a similar bearing on the visual faculty, thus: the impression of red (equivalent to C) on the retina induces the perception of green, composed of yellow and blue, (third and fifth), answerable to E and G respectively, to the complementaries of which (purple and orange) the same principle will apply. The *membrana tympani* and the *malleus* accurately represent the sound board and steel rod of the experiment previously alluded to, and we may fairly infer that while the *membrana* communicates its vibrations to the ossicles, it also causes the *malleus* to percuss the face of the *incus*, responsively to the rapid and varied impressions made upon it. The accentuations, *piano*, *forte*, &c., in musical pieces will be marked with extreme accuracy, and should the parts of the music be deranged by a defect in time, an uneasy jog will be produced upon the auditory apparatus. Hence the antipathy of the mind to any erratic deviation in this respect. It is very remarkable that the *malleus* and *incus* (the hammer and anvil),

should correspond, not only in figure, but also in function, to the objects from which their respective names are derived, for as we have already seen, the uses of the hammer and anvil as employed in mechanics are literally fulfilled by the malleus and incus, answering very important ends in the faculty of audition. By the action of one upon the other, sounds are not only correctly transmitted to the auditory nerve, but an accurate register of time is effected in the manner above explained. Thus, the mind is impressed with a faithful transcript of the harmony, style and general effect of musical pieces.

SECTION VII.

Laws of Rhythm and Time in relation to organic structure.

With regard to rhythm, it is in music what symmetry is in the arts, for as the lateral parts of symmetrical bodies or their pictorial representations must be similar, in order to maintain their special character, so the parts of a melody, although consisting of a series of intervals impinging successively on the ear, must be equal in duration as though symmetrically disposed, on the one hand preceding, and on the other following, a centre of time, for equal breadth in visual impressions is analogous to equal continuance in those of audition, space having the same relation to the organ of vision that time has to the organ of hearing. In this point of light the difficulty of philosophers in explaining the nature of rhythm appears

to be in some measure cleared away, for it is no more wonderful to conceive the idea of equal portions of time, as presented to the ear in the several parts of a melody than that of similar portions of space, either as occupied by natural objects or their outlines in pictures.

It is well understood that the most difficult thing to be attained in the study of music is the correct appreciation of the value of the notes composing the bars and parts of musical pieces as regulated by a determinate time. And it is not unreasonable to presume, that the physical impulses of the malleus, whereby it percusses the incus in accordance with the measure of the music, are the very means employed by nature in thus instructing the mind to appreciate musical symmetry in rhythm.

CHAPTER IV.

PRACTICAL APPLICATION OF THE FOREGOING PRINCIPLES,
HAVING SPECIAL REFERENCE TO THE WORKS OF THE
GREAT MASTERS IN THE FINE ARTS.

SECTION I.

A kindredness observable in the arts of Music & Painting

It is remarkable that the great masters should have so uniformly expressed their pictorial ideas in strict accordance with the laws of harmony; but we must note the fact, that what is termed "gusto" in colouring is intuitive to the painter of genius, just as a musical taste is a

natural gift to the born musician, who may compose and harmonize pleasingly, though ignorant of all rules.

Many of the great masters were practical musicians as well as painters, and profitted accordingly. In this connection the following short notices may not be uninteresting :—

Sebastian del Piombo enjoyed great reputation as a musician. Bassano and his son Leandro were admired for their attainments in music, as well as their skill in Painting. Tintoretto and his daughter Tintoretta made both music and painting their beloved studies. Bordone, a disciple of Titian, Antonio Tempesta, (patronized by Pope Greg. XIII) and Augustine Carracci were skilled in music. Carl Antonio and his son Ercole were devoted to music and painting, and distinguished for their appreciation of harmony in both arts. Bamboccio Georgione and Andrea Verocchio were eminent as painters and musical performers. Salvator Rosa was a painter, a poet and a musician. Dominichino was a scholar in the theory of music; his talent lay principally in the correctness of his style and his power of expressing the passions and affections of the mind. Guido Reni was a profound musician, and his taste in the harmony of colours has probably never been surpassed. His works were said to have been made by "hands divine." Parmigiano, whose pencil was the most graceful and elegant of his day, delighted and excelled in music; he was patronized by the Emperor Charles V. Rosso, a celebrated Florentine

painter, and a favourite of Francis I, of France, was well skilled in music; he exercised great judgment in the mixture of his colours, and in chiaro oscuro, by the artful distribution of his lights and shadows. Julio Romano, said to be the most excellent of Raphael's disciples, was cherished by the muses; and Leonardo da Vinci was esteemed both a skilful musician and an able poet. Finally, Peter van Laer excelled in music, and was a painter in every line of the art. It would be easy to add other important names to those already quoted, but these will suffice to show the close relationship of musical and artistic taste. We shall by and by refer to the chef d'œuvres of Rubens, Titian, Guido, Veronese, Da Vinci and others, with the view of discovering how far they proceeded intuitively, in accordance with musical rule, as applicable to painting.

SECTION II.

Ordinary Vision and Hearing.

The fine arts and music enter more into the philosophy of vision and hearing than people are commonly aware of, including the perspective of visible things and sounds, as well as the special adaptations required for the perception of detail by the eye and the ear.

In surveying objects presenting an extensive surface, the eye is engaged with vigilant activity, passing from centre to circumference, and traversing the most interest-

ing points, obedient to the will. Thus, we are enabled to appreciate the merits and beauties of artistic performances; but although the general effect may be perceived at a glance, yet only one small point can be distinctly seen at any particular moment. Standing before an architectural edifice, if we inspect the figures on the pediment we have a confused idea of the cornice and mouldings; if we direct our attention to the architrave and frieze we almost lose sight of the columns; in counting the number of niches our perception of all other accessaries is in abeyance, and it is not until we have carefully inspected the several parts in relation to the whole and committed them to memory, that we can obtain an adequate idea of the object. The auditory process in acquiring the air of a song or other musical composition is of exactly the same nature. A performer may play a piece in our hearing, but such cannot become thoroughly known to ordinary capacities until they have committed it to memory bar after bar, a work of time and careful study. Isolated sounds and simple objects (as a cube, a cone, or a sphere) may be perceived immediately, and there can be little difficulty in retaining them in the mind, but as they become more complicated and abstract, our powers of profitably hearing the former and seeing the latter require more practice. This analogy holds strictly good in most particulars, for we see and hear in detail, and the aid of memory is called in, to confirm and deepen the impressions made in both cases.

The central point of the retina is the seat of particular vision, and passing away from this point in every direc-

tion, objects in the general field become more and more obscure or ill defined. Hence it is that vignette pictures are so attractive, being somewhat circular, and fading off towards the circumference, while the central parts are carefully handled. Just as the convex mirror reflects the rays by "crescendo" with more fulness and strength towards the middle, the figures should stand out from the musical subject in bold and brilliant passages, as in pictorial representations, from the canvas or back ground. Titian told Tintoretta that a bunch of grapes was his surest guide, of course, from its rotundity, softness, central projection in light, and gradual dissipation towards the extremities. Ample broad lights encompassed with friendly shadows and delicacy in the management of his colours, raised Corregio to eminence, together with his having acquired the grand secret of knowing when to make an end of finishing; for frequently without this, nothing would ultimately remain of one's first ideas, particularly in painting.

SECTION III.

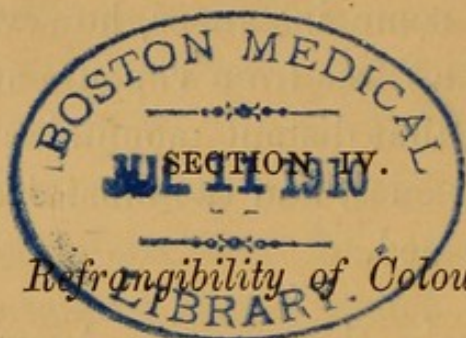
Perspective of Natural Objects and Sounds.

As the rays of light and sound proceed in straight lines from their respective sources, their intensity must diminish as the squares of the distance and the principles of common linear perspective are applicable to both. At the vanishing point of sight and hearing, impinging on the blendid auditory and visual horizons, both natural

objects and sounds cease to be discernible. Acute, medium, and deep sounds of appropriate strength and quality, may represent objects in perspective, which weaken in colour as they diminish in magnitude, receding from the eye. In some instances, however, the atmosphere is so clear, (*i.e.*) free from vapours and exhalations diffused through it, that distant mountains are nearly as well defined as near ones, and the most deceptive idea of distance may be formed.

This is particularly the case in Australian scenery, what is known as aerial perspective only occurring when the atmosphere is visibly dull. In such a case the slight opacity naturally existing, becomes more and more apparent as the distance increases, or as the mass of air intervening between the observer and distant objects becomes greater. In this way hill behind hill are the more delicately tinted as they pass off into mazy remoteness from the eye. A correct knowledge of the principles of aerial perspective, perhaps above all other things, enables the painter to show the imitative power of his art. Sunlight, though itself possessing no quality of opacity or shadow, often enhances the effect of aerial perspective by secondary radiation, thus: street views of considerable length, when sunny in the distance present a body of illuminated vapour, dense from bright reflection, while the more remote objects and buildings are, as it were allegorized en masse, and the detail is lost in soft and diffused light. A similar effect is also produced in vast interiors, as in lofty cathedrals, when oblique descending beams of sunshine enter the windows and gleam from

floating atoms in the air, shedding a luminous haze over the objects in their course. Sounds also grow softer by distance, and are in like manner less articulate as natural causes impede or arrest their progress.



Natural taste without demonstration has achieved great things in the graphic art, but when scientific rule can be established for its guidance, many persons not very highly favoured in that respect may take advantage of the principles, and develop results that they would little dream of otherwise. The study of the several degrees of refrangibility occurring in the prismatic scale will direct the painter in the grouping of his colours, and in carrying out numerous details in connection with his art, remembering that inversions of the chords of colour is quite as agreeable to the eye as those of the corresponding musical combinations are to the ear. In a general sense, however, colours of low refrangibility appear to the eye to possess an approximating equality, and belong more especially to the foreground, while others seem to recede from the eye, and according to their position appertain to middle or more remote distance.

We have seen that red is the least refrangible of the primitives, blue the most so, while yellow is intermediate,

both in this quality and in its position ; now if three lamps, one of each colour, be submitted to arrangement in different planes of distance, the effect will be pleasing or otherwise, as their natural order is preserved or violated. Contending refrangibilities producing a more jarring effect upon the retina by displacement. This would resemble a trio executed by musical performers at such unequal distances from the hearers, that the accompaniments may be considerably nearer than the subject, which is proportionably weakened by its remoteness from the ear. Indeed, we find that musicians as a rule congregate in one locality, and when this is impracticable their performance will give rise to a result often noticed in cathedrals where the choir is divided by the middle aisle, in which case the voices appear to oscillate from side to side, or from wall to wall, the organ also probably being at some considerable distance from the singers.

Red chalk drawings, or monochrome prints of the human figure, &c., are always sightly and pleasing, because any single colour is easily taken in by the eye, being of uniform refrangibility, and on a white ground, which is indifferent to every other colour ; for a like reason drawings in sepia and Indian ink are agreeable to the eye. Were pictures of this class bordered with bright positive colours, the effect would be fantastic and vulgar, inducing the eye to vibrate between the repose of the picture and the glaring colours surrounding them. To ordinary eyes such matters would appear to be trifles, but there are no trifles in the perfection of art.

An uneducated taste is most captivated with flaring effects, both in music and painting, preferring gaudy to subdued colouring, and the racket of fifes and drums to the harmony of the full military band.

The adaptive powers of the human eye are not only brought into exercise in passing from one prismatic colour to another, but also, as it would appear, in the appreciation of the numerous gradations between the extremes of light and shadow in each. The varieties of the red denomination, for instance, diversify its quality of tone, on the musical principle to be noticed hereafter. Moreover, colours like notes may be sharpened or flattened, forming passing notes, so called, which enhance the harmony without infringing grammatical rule. These accidents are of corresponding value in both cases. Colours of medium refrangibility call forth little or no exercise of the adaptive function; hence we find the overpowering influence of solar light on a bright summers day much neutralized, and pleasing relief experienced on surveying the green fields, from the sympathizing repose they afford to the eye.

In the natural landscape there would seem to be a localization of tints in accordance with their refrangibility, thus: mellow reds, yellow browns, madder, vandyke, &c., are usually foreground colours, having the approximating qualities of their trebles. The milder tints, subdued greens, blues, &c., occupy the more central parts in middle distance, while the back ground, mountains,

vapours, horizon, clouds and sky, are represented in the cool upper tints of the scale, and their compounds, comprehending every variety of gray to be found in works of a superior class, where landscape embellishes the subject, but particularly in the landscapes of Claude Lorraine. This great painter, who made nature his study, appears to have carried out the foregoing principles in his pictures. On the other hand, it may be necessary, in keeping with the circumstances of the case, to depart from the order here indicated, in illustration of which the picture of the marriage of Cana in Galilee, by Paul Veronese may be adduced. The Redeemer, who is here the principal figure, is carried somewhat back in the picture, and the painter, who could not properly distinguish him by mere lights and shadows, clothed him in red, the least refrangible and therefore the most approximating colour of the scale, so as effectually to conduct the eye to that figure. This is a striking instance of the musical and pictorial analogy, particularly in what is equivalent to an inversion of the common chord, which Paul Veronese seems to have accomplished with much musical perception.

In the perspective of colours the exercise of artistic skill is necessary, that every object may keep its own distance in the ground plane, thus: if one colour does not convene so soon as another, by approximating the one of least power, a compensation will be made, convening the less with the more refrangible colour at the same moment upon the retina. In this way blue in the foreground is equalized by red in the middle distance, which, with the

mediant yellow, or simple white, will give a pictorial example of the inversion of a harmonic triad.

SECTION V.

Determination of Key.

Any two notes taken together, with the exception of two semitones, will form an agreement, so that they may be referable to some key or other, as composing a part of a characteristic chord, but unless that particular key is indicated by some of its essential harmonies a discordant effect will ensue. Now the same principle is equally applicable to colours, so that there is an actual necessity for establishing a fixed key in painting, in order to suggest the employment of colours best suited for association and pictorial effect. In composing a musical piece the first object of the composer is to decide upon a key. Here the painter has a hint well worthy his attention, viz: to commence his colouring with a definite key note, red for example, and then arrange the proper according and dependent colours, which must be localized according to his own taste and judgment.

Red amongst colours is the equivalent of a musical tonic, which occurs so frequently, either expressed or felt in compositions that its impression is persistent upon the ear; and by analogy, taking the negative side of the

proposition, in such pictures as we find the tonic of colouring too sparingly employed, the key being defective, the corresponding impression will be lost to the eye. The key note must necessarily hold the most central and conspicuous position in the picture, so as to determine the arrangement of the chords of the dominant (blue) and sub-dominant, (green), should such be employed. The best colourists amongst the old masters inculcated this practice, as is exemplified in their works, and to illustrate this we would particularly refer to the celebrated picture—"the taking down from the cross," by Rubens. Here the central figure of the standing group is that of the disciple John, clothed, for the particular purpose in question, with red drapery. This figure was the key note of Rubens, and the colours in the immediate vicinity are in keeping with this idea, thus: to the left we find the other components of the perfect chord, and to the right the common chord of the sub-dominant, the first interval of which is given in the green drapery of a female figure kneeling. Such are some of the principal points occurring in the harmony of this sublime picture, which will be noticed more particularly in its proper place.

Change of key is effected by the introduction of certain notes characteristic of the modulation, thus: if it be desired to pass from C to F, the flat seventh, B flat being introduced entails the change. Modulation may also be effected in colours by adopting some similar expedient, but this of course would require more careful management.

SECTION VI.

Quality of Tone and Compass.

Musical instruments vary in their quality of tone, and even those of the same denomination manifest certain differences, apparent even to the uneducated ear. The great diversity occurring in this respect serves to enrich the harmony of a concert, and hence also arises the value of a solo on any particular instrument, all others being in subservience, by soft contrast giving prominence to its qualities. Colours vary as much in quality of tone or tint as the sounds of musical instruments, thus: there are many species of red, brick red, rose red, &c., varying considerably in hue though included under one denomination. In like manner, C on the violin and on the flute is still the same note, yet how different it is in character and effect in the two cases.

The great organ represents most instruments in imitation, with stops ranging from the 15th to the base trumpet and stop diapason; in all these we find a wonderful variety of tone; one is soft, another sweet, and a third harsh, as in stops of the reed class. Timbry and metallic sounds also tend to neutralize or enhance the effect of others of a different quality. As far as colours are concerned this subject is perhaps one of the most difficult in the whole enquiry, for whatever quality may be observed in a single red, crimson, scarlet, saturnine red, indian red, venetian red, light red, madder, cochineal, logwood, or

any other kind, a similar quality should pervade its own scale, and all the other colours should be akin to it, so as to bear comparison, each for each with the intervals of the musical scale of any single instrument, the peculiar quality of which is as apparent in one note as in another. The value of colours is much enhanced by texture, thus crimson cashmere is vastly exceeded by crimson Genoa velvet, the brightest stuffs are surpassed by silks and satins of the same colour, so that texture imparts a quality to colours equivalent in some way to peculiarity of tone in sounds. It is above all things necessary that artists should be acquainted with the principle here spoken of, that the colours they employ may be equalized in quality and strength just as all the pipes of each particular stop are voiced to prevent undue prominence of any over the rest. The incongruity of colours of different quality taking fortuitous parts in a pictorial theme may be compared to the single notes of a melody rendered by the interchange of the flute, cornet, sacbut, and all kinds of music. The blind man mentioned by Locke, as forming a notion of colour through the medium of sound, had conceptions and associations in his own mind making the comparison less absurd than readers generally imagine. This man heard of some colours, as green, being soft and soothing to the eyes of others, and he would naturally associate something soft in sound with such colours, and thus connect a visual with an auditory impression. Likewise hearing of the harshness of red on the sight of others, and such phrases as red as fire, understood by him from its effect in conflagration to be a fierce devouring element, together with red being a

military colour and associated with blood shed, the harsh trumpet, the prelude to the sanguinary charge, would afford the blind personage the best idea of the colour in question.

If we refer to the musical analogy we find that scarlet, equivalent to C, when contrasted with a sober blue, (G) the true fifth of the scale, will induce an unpleasant effect on the eye, supported by the fact that a grating discord would result from such an altered relation of the tonic to its dominant.

SECTION VII.

Grace and Style.

The drawing of a picture is equivalent to the theme, or subject of a musical piece, while the colouring represents the harmonious accompaniments of a composition in score. We have seen that the quality of sounds is answerable to the tones of colour, either may be sweet, mellow, rich, harsh, &c., and both positive and broken colours in association, have their analogues in triads, chords sprinkled &c., more or less forcibly expressed, while fugues represent skilful and effective repetition in the arts.

Elegance and richness of tone, cadences, crescendo diminuendo and all the graces of style have their representatives in painting, so that a mutual gratification is

administered to the senses of vision and hearing by a unity of expedients suited to affect the mind through two distinct organs. The lining of a garment is shewn with the same effect, when briefly indicated, as the appoggiatura used in music for graceful embellishment. The colouring of Titian and Guido exhibits much of what may be compared to expression in music. Thus, we find purity of intonation, fine quality of tone and the power of modifying it through all the numerous shades of piano and forte for contrast and variety. We observe also judicious attention to accent and emphasis, to the former in order to mark the natural flow of the rhythm, and to the latter for the purpose of giving such occasional relief to certain notes in each musical sentence, as may serve to mark their relative importance. There is also in music a practice of introducing passing notes, which is of equal importance to the painter in reference to colours, though such elements in either case form no intrinsic part of the harmony, but are in fact most discordant when inadvertently associated with it. Yet they are so transitory that they seem as embellishments to make concords still sweeter, and fill up vacant intervals ornamentally, without affecting the fundamental points of the musical or colorific agreements. We see then that passing colours are of great importance in the arts, and indeed are discernible, though to a limited extent, in the best paintings.

When the broad principles of accordances are attended to, it matters little what small portions of various colours may intervene between the grand chords, distinguishing

the prominent groups and masses of the picture. No such passing colours should be broad or they would become too prominent, and usurp the places of the legitimate harmonies. In music these harmonies are broad, and full, and in painting should be equally so. There is a variety in the touch or style of delivering the musical notes like what is known as handling in the arts, and implied by the terms legato, staccato, &c. Propriety and energy must be attended to in the performance of phrases, of melody, and sparkling brilliancy in those of mere execution so as to impart expression.

There is also in music and painting an identity in blending and softening, so that both may be included under one idea and expressed in the same language. The notes of the organ may be prolonged at pleasure, by holding down the keys, so that the performer is enabled to melt the tones of the instrument into each other; and in this he is especially assisted by the swell in the choir organ, which when judiciously used effects the feelings with tenderness, by its soft and fascinating impulses upon the ear. In a corresponding degree the painter avails himself of the means of softening peculiar to his art, blending his colours, while moist to attain a similar purpose.

Excess of this practice however, will neither apply in painting nor in music. The painter may be guided by the musician to use his privilege in moderation; for although it may be useful in certain cases, it cannot be admissible in all.

Mezzo-tinto engravings of the old school, were soft to mealiness, but to remedy this fault, etching has been very generally resorted to of late, to qualify the shadows and accessories. Grounding tools and roulettes cutting tissues of dotted lines are also now employed for a similar purpose. Mutes are used with wind instruments to enable the performers to imitate distant echos, and remote responses; to subdue certain musical phrases and cadences to a pianissimo point, and anon to give latitude to the qualities of sound, glazing in the arts is a mode of suppressing the obtrusiveness of colours, or toning them down, so as to mellow and refine them, mutes put sounds into perspective, and make them approach their vanishing points, and by judicious management in the hands of a clever artist a species of ventriloquism is produced, but with much more distant effect than mere vocal art can counterfeit.

Everything elegant and classic in art tends to make us appreciate the musical and pictorial analogy, for whatever delights the visual sense, finds sympathy in the auditory faculty, by judicious translation.

The accomplished lover of the arts sees much in pure classic architecture to feast his imagination, where perfect parts comprise a perfect whole. He observes the proportions of the pediment and the members composing it, and the shadows which they project with boldness and effect, upon the building itself, and should this be of some standard order, it will be sure to furnish a rich treat of light, middle-tint, shadow, and reflected light, duly

appreciated by the connoisseur in such matters. The chastely ornamented and trimmed parts enrich the simple beauty of the design; while the columns, from their cylindrical form, exhibit every beautiful gradation of light and shade, crowned by the capitals, which in themselves are contrived on the noblest principles for displaying relief and majestic boldness, associated with the charms of beauty and grace. Contrast with this a more glowing musical picture, from the "Musical Union,"—" *Le Desert de Felicien David.*"

"The performance of the ode symphonie (says the critic) will make a distinguished epoch in music, for David has sought his inspirations, not in the scores of past or contemporary writers, but he has gone forth in the freshness of his young genius, and gathered up the eloquent voices of nature in her might and loveliness; he has sought for kindred symbols therewith to interpret sounds.

The soft breathing of the eastern morning, the wild rushing of the withering simoom—the tramp of the caravan, with its heavy echo on the sandy ocean of the desert—the heaving of the patient dromedary, &c., expressed by sounds denoting the presence of things signified—the burst of devotional feeling, and the shrieks and groans of the tempest-tossed way farers, are vividly and poetically expressed.

Felicien David has quaffed deeply of the desert spring; he has positively imbued himself with the nomadic

feeling of the Arabs' life. Shall we then judge of this musical picture by the prosaic principle, measure its combinations with the carpenters' rule, or count its pulsations with a metronome? no! we may not measure the rainbow nor analyze the tints of a summer evening. David has conceived a glowing episode of eastern life, and has clothed it in all the hues of the palate. The outline is so perfect, and the dramatic feeling so intense, that we are fearless to assert that the execution is as perfect as the design is original and grand."

Thus, as explained in the above admirable critique, our ideas of a subject full of poetry, are carried out by music; visible objects are, as it were, suggested to the mind's eye through the medium of sounds artfully chosen, ("kindred symbols") interpreting the soft breathing of the eastern morn—the wild rushing of the withering simoom, by "sounds denoting the presence of things signified."

In the painters' palate, and the musicians' gamut, are the materials for sublime representations and intellectual works. The musical force of painting is no more difficult to comprehend, than the graphic power of music, nevertheless, both may be duly appreciated by some favoured individuals, whose art and natural genius are far in advance of their science, for neither the comprehension of such principles, nor their *modus operandi*, have yet been placed within the pale of prescribed rules.

In the hands of a skilful composer, the few elements of the musical scale may be made to produce effects of ex-

quisite refinement and feeling on the cultivated ear. At one time music may breathe the purest sentiments of affection, while at another, deep and melancholy thought may be depicted. So capable are sounds of developing pictures of benign fancy, or powerful imagination, by episodes, ingenious phrases, and impassioned strains, that the auditory may be dissolved in rapture, or overwhelmed with emotion. Thus, as a single illustration: the extraordinary effect of the semitone progression of the violincello, on the 4th string, ending with the "wild shriek" of a diminished 7th on the leading note of *la* melancholia, by Beethoven, defies description.

SECTION VIII.

Basis of Shadow in Colours.

It is remarkable that the notes of the musical scale are of proportionate strength as they become graver, and singers aware of this fact increase the power of their voice as they ascend the scale.

The distant effect of colours also appears to increase as they pass towards the least refrangible end of the series, though by experiment, the greatest amount of illumination occurs between the yellow and the green.

The first note in a concert that strikes the ear at a little distance, is that of the lowest bass. The other sounds seem to affect us by chromatic gradation.

Band masters inform us that the most audible sound in a distant military band, is that of the basoon, and this probably arises from the deep mellowness of tone produced by the rumbling vibrations of the double reed, requiring considerable force in their production.

Deep vibrating basses are of the same use in a musical sense, as the deep tones of colour are in supporting the lights and middle tints of pictures, so that in the pictorial, as well as in the musical art, a rich bass is a *sine qua non*. This shows the value of that great mellowness of shadow always characterising the works of the old masters, and distinguishing them from those of more modern schools of art.

The great masters, with intuitive taste for harmony in colouring, availed themselves of the better qualities of brown, in the general grounding, and middle tint shadows of their pictures. Black, as a rule, is intensely cold, unless tempered with the warmer parts of the scale; but the darkest recess of any daylight scene receives reflected lights from surrounding objects, to a greater extent than is generally perceived, so that the rejection of pure black as an ingredient of shadow in pictures is sanctioned by the rules of art. Dark brown, on the other hand, retains enough of the properties of black, to afford a good agreement with the more positive colours in general. They represent the shadows of projecting coloured objects, which could not be adequately expressed without them. Indeed, the want of light itself must have a representative in the arts, and the beauty of all objects in

the presence of light depends on the contrast of shadow, to enhance its value. The numerous species of humming birds are beautiful and pleasing to the eye, from the prismatic hues of their plumage, heightened by metallic lustre. To give due value to the golden and other tinting, the basses are intensely deep (dark). A volume of instructive references could be drawn from the plumage of tropical birds, and the feathered tribe generally. In the vast variety of this class, some description of black is found to constitute a considerable portion of their plumage, because as before mentioned, it accords in the way of contrast with all the prismatic colours. In particular, it adds the utmost value to the gem like parts, resembling ruby, amethyst, emerald, and tourquoise tints, with metallic reflections. The dark colours contrasting with the bright and metallic ones, go under the denomination of black, but on close inspection, they will be found in general to participate in a bluish purple, or yellowish cast, suitable for the purpose intended. In addition to the foregoing arguments, the practice of the great masters of the Roman, Venetian, and Flemish schools, confirm the principle advocated, to which may be added the approbation of the profoundest critics and connoisseurs, who are all in favour of brown, as a preparatory colour for grounding, half tinting, and shading all pictures, such as fruit, flowers, portraits, landscapes, marine views, and historical subjects; over this preparation are to be scumbled the local colouring and lights, on a drab ground, purposely preserved to receive them. Even in clouds, and the azure sky, the same preparatory grounding is required. This is particularly observable in the works

of the Dutch school, but, the process has been mistaken in modern art by several who conceive that when the azure and clouds have been painted in their own positive colours, they should be subsequently mellowed (*a la brun*) by mixing vandyke brown as an ingredient in varnish, to create an effect, more admired perhaps than understood. The result by the legitimate process is so mellow and effective as to give an indirect idea in the attempt to analyze it, and hence the misapprehension noticed.

The chef d'ouvres of our national collection are painted in the manner here advocated as simply a mechanical aid to approximate colouring, for the production of effects in the arts must be under the presiding taste of the painter, really such.

SECTION IX.

Black and White.

Black and white are of great importance in nature, defining outline by their contrast, and manifesting rotundity and depth, and may be considered as a matrix, in which colour is deposited in its more or less positive character. Black appears to be the result of the absorption of light, in a decomposed state, while the reflection of undecomposed light constitutes white. Neither may be called a proper colour; and this latter characteristic explains their power in supporting the true colours, and imparting to them varied degrees of intensity,

corresponding with piano and forte in music.

White light, compounded of the vibrations of all the colours, is in an achromatic state, in which the properties of its constituents are, as it were, latent. On this depends its accomodating quality, acting as a mediant, in almost every instance where a mediant is required, and relieving any chord with which it may be associated.

White is usually qualified by painters with a slight admixture of yellow, because a positive white is only employed for some very peculiar purposes; even in moonlight scenes, the resemblance of the luminary is tinted with yellow. Sunshine imparts a yellowish tint to white, imitated in the arts by white and yellow in combination; indeed, white without yellow is a cold unmanageable colour. White then may be considered as a general mediant, while yellow is a special one between Red and blue.

It is a question whether there is in nature any pigment or body of a pure black, (*i.e.*) without any of the ingredients of the scale contained in it, exhibiting themselves in some way or other. Some colours called black are merely intense specimens of the fifth and sixth intervals, or the presence of red or yellow may be slightly perceptible. Hence we recognize Brown, yellow, and blue black, as descriptive terms. So difficult is it to obtain an unexceptionable black, that Japanners and

other operatives neutralize the brown tint of the black paints of commerce, by finishing their work with a coating of blue; as varnish laid over black discloses its tendency to brown, however intense it may seem in a flat or opaque state. Even dyers cannot produce an approved black by one immersion, but finish with blue, to stand the test of a searching light. Were black to hold a position in the scale, it would probably be as an intense sixth, and white, as before mentioned, acts the part of a mediant, in common with yellow, between which and the green, we find the greatest amount of illumination in the spectrum.

Two dark colours lying in immediate proximity, require one of a lighter character to be interposed, that they may be the better distinguished from one another; and this is an important office of the mediant yellow, for while it reconciles the contending refrangibilities of red and blue, it admits of their separate discrimination, being lighter in tone than either. When white and yellow, or indeed any two light colours are brought together, a dark mediant may be required to separate them, if the *chiaro oscuro* of the picture be not thereby interfered with. This is the converse of the former principle, and may be instanced in the third position of the common chord of the sub-dominant, (E, green), in which the order is red, green, and indigo, the green serving as a mediant. In the same way, the second position of the dominant chord takes orange as a mediant, separating violet from blue, by a happy interposition. In matters of this kind, the colorific analogy may be of importance in music.

SECTION X.

Special Reference to Works of Excellence.

That the practice of the great masters is favourable to the principles advocated in this essay, will appear obvious by reference to the best pictures in the national gallery, and gems of art in other collections. In these works we have the painters' counsel and opinions handed down to us, and the best advice as to the choice of colours for harmonious effect. Although there is no evidence that the authors of those achievements consulted musical science, as being available in the pictorial art, still we find their selections in accordance with musical principles, simply arising out of an innate gusto for the harmony of colours.

In the picture of the Virgin and Child, painted by "the ornament of his profession," as Titian himself styled Paul Veronese, we find instructive illustrations of the perfect chord of the natural key of colours, in different positions.

Harmonious intervals are everywhere employed to the exclusion of all that are nonaccordant, so that a musical translation would be simple and pleasing to the ear.

In the admirable Bourgeois collection, there is a spirited picture by Vandyke,—*"The Descent from the Cross."* The harmony of this production is rich and glowing; the colours are positive, and the common chord

of the tonic is conspicuous in different positions, the according intervals being so localized as to produce the happiest effect; the shadows are broad, dark, and mellow, like a full, deep, and well sustained bass, admirably contrasting with the clear, well articulated harmony of the treble parts. Had Vandyke and Paul Veronese, in the paintings alluded to, chosen the colours expressed by the intervals 1, 2, 7, 8, good taste might disapprove of the selection, and inconclusive arguments might be advanced, both for and against it, but without the help of the musical analogy, its disagreeable effect would be for ever inexplicable. This test, however, shews us that the 2nd and 7th are irreconcilable dischords with the key note, and so the problem is solved. Such intervals are often heard in the creaking of a door on rusty hinges.

The musical analogy extends to every branch of the pictorial art. In "Canalettis View, or the Grand Canal," (No. 127, nat. gal.) the common chord of the tonic, and of the sub-dominant, alternate, and inverted, shew the skill of a contrapuntist. In this picture there is a multiplicity of according tones of colour, tinting the varied architectural masses. The sky supplies a dominant, to compensate for the want of it in the buildings, and is sufficiently near to complete the perfect chord; it contrasts also with the greenness of the water in the canal, which forms the sub-dominant, or 4th interval, according with qualities of the 6th and 8th, in the architectural part of the picture. The latter chord never fails to produce an agreeable effect, when it can be introduced with propriety.

Some of the richest specimens of pictorial harmony, occur in the works of Paolo Panini, representing ruins, and architectural beauties of ancient Greece, and Rome, with landscape. The observer is struck with the prismatic effect given in the tinting peculiar to lichen-grown and fractured pediments, architraves, and friezes, with all other accessories in time-worn and dilapidated edifices; but on closer inspection, inversions of musical chords expressed in broken colours, present themselves everywhere, and go hand in hand with the deliniation of the sculptured fragments.

In the Bourgeois collection, there is a remarkable flower painting, by Van Huysum, who flourished in Amsterdam, over a century ago,—(No. 140.) We particularly refer to this picture as illustrating the want of the mediant, or yellow interval. The group of flowers represented, is both cold and hard in colouring, and deliniation, and the absence of the mediant and its compounds must at once impress the beholder; the greens have a tendency to blue; no yellow green is to be found, nor is there a single flower in the mediant interval to enliven the picture. The drawing and handling are excellent, and the style is bold and masterly, but the defect mentioned leaves no perfect chord, and the 4th is a semitone nearer the 5th than the laws of musical harmony will sanction. Whenever a musical discord is apparent, the pictorial harmony is violated.

No. 121, in the Dulwich gallery, said to be by the

same master, is less carefully drawn and handled than the former, but being prismatic in its colouring, and the mediant prevailing, to sustain the perfect chord, and otherwise act as an auxiliary, the representation of the objects is more natural and lively. The 4th in the former picture is equivalent to F sharp, and therefore a discord throughout; but in No. 121, the 4th is natural, like its equivalent in the natural key of music. The eye of the connoisseur will perceive the difference, and he may account for it, (in the language of criticism), more technically, than explanatory of the cause, but the musical analogy points out at once the nature of the defect, and its remedy. Thus, from the study of painting, the musical value of the mediant is manifest, while music, *vice versa*, demonstrates its importance in painting.

We shall now refer to some of the works of Titian, the most universal genius of the Lombard school, and esteemed by M. Du Fresnoy, as the best colourist of all the great masters. In his celebrated picture of St. Peter, we find the garments coloured in the 3rd and 5th intervals, and to introduce the 1st, the artist ingeniously brings forward the red flag of St. George, (an attendant figure). The flag is in quantity, as to colour, an appropriate balance to the mediant and dominant associated with it, in the most central part of the picture. Another important advantage arising out of this expedient, is that special attention is attracted to the principal figure of the piece. Subordinate, though still striking characteristics pervade this picture, in all its accessories and details,

justified by the musical analogy.

The picture of Bacchus and Ariadne, reckoned a masterpiece of Titian's, when translated into music, affords full harmonies; but there is an undue force in the dominant, as compared with the other intervals of the perfect chord. An excess of this kind is of course, quite as possible in music as in painting. Were the notes 1 and 3 sounding smoothly together, and a 5th, of inordinate strength then introduced, the latter would naturally counterbalance the other notes, and obtrude itself painfully on the ear.

Musical rule would prescribe a reduction of the power of the 5th, to equalize the harmony; and the same principle should be recognized in painting, viz.:—to preserve equality in the breadth and strength of the components of all colorific chords. Trusting to the truth of the musical analogy, we are in no fear of incurring the charge of presumption, in thus noticing a single defect in a noble picture, so often and very justly quoted by critics as a standard of art in colouring. In the Bourgeois collection, there is a companion to this picture, by Titian,—“Jupiter and Europa,” painted exactly in the same key, in which the common chord is perfect, the dominant being kept within due limits, so that the harmony is complete.

Reverting to the “Taking Down from the Cross,” by Rubens, previously alluded to, in reference to a key note in painting, we notice the skilful distribution of the in-

gredients of the common chord of the tonic, as follows:—there are nine figures in the picture,—St. John occupies a central position, befitting the tonic, and is appropriately clothed in red. The draperies of the three Marys are in the intervals of 5 and 3, mixed, that of the Virgin being in 5. The dress of Joseph of Arimathea, (a conspicuous character in the story) consists of 1, 5, and 3, and that of a disciple, of 5 and 1, while two assistants wear clothing of 1, 5, and 3. The figure representing the key note, St. John, gives value to the attending parts of the chord, in different positions, and the utmost harmony prevails everywhere. In suitable places, passing colours of limited extent are judiciously introduced, and promote rather than impair the general harmony, like passing notes in music, which fill up, contrast with, and set off the agreements. Add to these the graces of composition, the theme, the quietly flowing melody in sustained tenderness, and whatever is soothing and enchanting in music, and it will all be found pictorially expressed in this fine production.

In Cuyps' admired picture,—“The Prince of Orange going out in the morning,” (alluded to by Burnet) we find an example of the common chord of the subdominant: the coat of the prince is red, 1st; that of his attendant, indigo, the 6th; and the dress of a groom in waiting is green, the 4th interval. The latter acts as a foil to the coat of the prince, enhancing its value, as purple and blue would respectively affect yellow and orange, their complementaries, or musically speaking, their 5ths.

Hogarth's portrait of himself is another example of a picture in which the dominant is excluded, and the chord of the sub-dominant, green, indigo, and red, commonly prevails. The coat being a brown red, has the value of a tonic, the quality of which is repeated. The curtains are in the 4th interval, while the accessories, in broken colours extend the harmony. These consist of a volume of Swift, indicative of wit and drollery; one of Shakespeare, for ideal beauty and sublimity; and on the palette, the "line of beauty and grace" is appropriately introduced. Out of the palette a piece appears to have been knawed, as if in allusion to the fierce opposition Hogarth experienced in defending his enlightened and admirable theory on that subject. The dog, with a countenance of poetic watchfulness, adds to the interest of the picture, contributing by the colour of his skin to extend the mediant, and to balance the other colours employed. In point of harmony, this interesting portrait is complete.

So perfect was the gusto of Hogarth in colouring, agreeably with the principles of musical harmony, that to extend the mediant, he would resort to the expedient of representing an open music book lying on a chair, the interval being essential to fill up the perfect chord, and the more so when the key note is frequently repeated for vigorous effect. On another occasion a fallen chair, upholstered in red, to increase the force of the tonic, which would be otherwise too weak. This effect of art occurs in the morning breakfast scene of the "Marriage a la mode." Hogarth was a man of consummate taste, for

the age in which he lived, when the fine arts were at a lower ebb than they were in the periods immediately preceeding and following. If we refer to the costume of his day, it was grotesque and slovenly, and either as it respected the attire of ladies or gentlemen, was anything but classical. The ladies were incommoded with tokens and hoops, giving the female form the travesty appearance of a Dutch doll; and the habiliments of the men were all made too large, that they might be sure to fit. Another difficulty Hogarth laboured under, was the want of preliminary education in a school of design; but in despite of all disadvantages, he acquired by the aid of natural genius, an admirable taste. He was a proficient in perspective, and showed great skill in his grouping, and the general expression of his subject. His attainments in colouring were of a high order, combined with a profound judgment of *chiaro oscuro*, and keeping. His style of painting has permanency, and is accordant in all points with musical harmony. In the "Contract of Marriage," anyone conversant with the analogy of music and colour, would be struck with his conceptions of the harmonious relationships of the pictorial intervals.

"Domestic Life after Marriage," (No. 114, nat. gal.,) affords a masterly management of the dominant, where blue pillars are employed, conducting the eye into a spacious inner apartment, in which numerous accessories recreate the imagination. The architecture and perspective display good judgment and taste, and a musical translation of the colours would be harmonious and pleasing. The toilet scene, "Marriage a la mode," is

excellent in colouring : the key note is full and repeated ; the mediant also is of considerable breadth, but the dominant is restricted in tone ; the common chord of the sub-dominant is most prevalent ; but taking it altogether, the counterpoint is without a single discord.

That the balance of musical tones to preserve graceful harmony, is a guide to the painter, in a comparative degree, will more fully appear on applying the musical test to "The Death of the Earl of Chatham in the House of Lords," that justly esteemed picture, by Copley, which is a credit to British taste and genius, and has a deserved place in the national collection. The key note, red, which is necessarily so predominant, is too overwhelming to be subdued by any device. The harmony is affected by the absence of the dominant and mediant, for which the refined ingenuity of the artist could scarcely find a place. Variety and contrast are shut out, or appearing in such small degrees, in respect of the tonic, as to leave but one broad impression of red upon the eye, equivalent to a loud and continuous key note in the accompaniment to a delightful strain, exhibited in the truthful grouping of the picture.

Francesco Francia, (179 and 180) appears to have had an instinct for the selection and classification of his colours, in accordance with the musical analogy. His groups are balanced with scrupulous precision ; from the peculiarity of his perceptions, as to rigid order and disposition, every figure and object being studiously arranged for inspection. His chords of colour are full, and ex-

hibit such changes as clothed figures are susceptible of; one colour harmonizing with another, by strict attention to colorific affinity and effect. In other respects, his views and style are rigid, as might be expected from the stiffness of the period in which he flourished.

In the portrait of Pope Julius II, by Raphael, (No. 27, nat. gal.) the sub-dominant supersedes the dominant, by necessity, though not perhaps by preference. The musical notation of the picture would be the key note and its fourth; the back ground being green, and the vestments of his Holiness, red; but as these are complementary colours, their combined effect is pleasing. The portrait, both in a pictorial and musical sense, is extremely simple. The key note is properly prominent, and repeated, while the 5th is utterly excluded, so that although containing no ingredient of discord, it exhibits but little richness of harmony; and the size of the picture, 2ft. 3in. by 3ft. 6in., would not admit of accessories to enrich it.

Murillo's fine picture of "St. John and the Lamb," (176, nat. gal.) illustrates the effect of broken colours, the positive ones being excluded. That this lovely picture should be a favourite with the British public, is a compliment to the discrimination of the committee of selection, even at a cost of £2000, the sum paid for it. Contrasting this picture with the flare up practice, we see everything in it to be admired, for chasteness, nature, expression, and general effect.

In the Bourgeois collection, the "Peasant Boys," also by Murillo, is in the same style of painting, which for truth and nature, cannot be surpassed. No. 248, in this collection, the "Spanish Flower Girl," has equal charms. The harmony of those paintings would require a very peculiar musical notation, and instrumental performance of a very high order, to be in keeping with it in all points. The tints are so chastened and subdued by refined taste, that delicacy and suppression would constitute the principal difficulty in imitation. In that grand picture and ornament of the national collection, the "Holy Family," by the same hand, the musical analogy is so fully carried out as to show the unity of the according intervals, in both the musical and colorific scales. The figure of the Virgin is clothed in the perfect chord; the tonic is judiciously full, and the force of the dominant is chastened by the mediant, a kercheif. The drapery of the Child is tonic, to which the garments of Joseph form a leading chord; and so far we are enabled to infer that the picture is painted with consummate cleverness and musical gusto. We pass on to the aerial and cloudy parts of the picture, which consist of partly broken and positive colours, repeating with delicacy and beauty the chords of the figures. We shall not allude to the forbidden representation of Deity, for any critical purpose further than to regret that this should have been attempted in any form, much more that of an old man, a conception one would suppose too gross to make an impression, even upon a Spaniard. The other works of Murillo, to which we have alluded, are executed in

broken colours ; but in this instance, in consequence of the magnitude of the work, and its original design, as the altar-piece of a Roman catholic place of worship, the style is rather after the colouring of Guido, but chastened with refined judgment, avoiding the more showy practice of the Roman school.

The picture of "St. John, preaching in the wilderness," (No. 331, Dulwich collection), ascribed to Guido, is identical in style, conception, and handling, with the other pictures of Murillo, in the same gallery. Murillo appears to have adopted the method and treatment of Guido, whom he survived about 43 years. Both occasionally adopted either the suppressed or the more positive styles. In the national collection, Guido's "Lot," and Murillo's "Holy Family," are quite prismatic, and widely different from the "Spanish peasant boys," and the "Flower Girl."

The British national gallery is rich in possessing perhaps the best picture that Rembrandt ever painted: "John VIII, 27." There are two subjects in this picture, and they make a primary and a secondary light. The brightest light is central, and managed with a brilliancy of effect in *chiaro oscuro*, unequalled in any other picture in the collection. Judicious contrast of light, with a bold extent of shadow, and ample breadth of middle tint, is effected by superimposing the colouring upon a transparent brown ground, after the method subsequently to be described. The shadows are remarkable for their mellowness, warmth, and intensity, like the deepest

musical basses, rendered with adequate richness of tone and judgment in performance.

The more brilliant focus consists of a flood of sunshine overspreading the group, when the story is told so plainly as to need no explanation.

The classification of the figures increases the charm, being executed neatly, and in the first style of art. The tenors are broad, full, and harmonious, and the basses sweet and clear in vibration, though profoundly deep; the treble articulations combine all the elements of pictorial harmony, like well executed instrumental performance in concert.

The secondary light comprehends a considerable focus, displaying the gorgeous alter of the temple, and a portion of the congregation assembled round an officiating priest. The colouring of this part of the picture is comparatively subdued, to set off the principal subject, just as a symphony would be employed in music, to give due effect to the theme.

Contrast in *chiaro oscuro*, peculiarly distinguishes the works of Rembrandt from those of the other great masters; and such contrasts in music, managed *a la Rembrandt*, by a skilful composer, would develop striking results. Here would be a model for producing an effective and brilliant subject, with a greater proportion of bass to treble, than musicians are in the habit of estimating as sufficient.

It is a maxim in the arts, that the lights should have a sufficient mass of shadow to support them; and such broad effects are called *reposes*, affording relief to the eye, which would be otherwise conducted from one bright object to another, so unceasingly as quickly to induce fatigue. Consistently with this principle, Rembrandt's "Adoration of the Shepherds," (No. 27), contains every variety of chord and modulation, sustained by rich basses, even suggesting the nature and quality of the instrumental parts best calculated to obtain an aural transcript of the visual impression. It is observable that the value of colours after Rembrandt's manner, is so enhanced that the slightest indication of a dulled prismatic hue tells for a clear positive one; and a constant artistic vigilance is required to suppress undue brilliancy; hence, the actual quantity of colour used by Rembrandt, was very small, compared with the extent of canvas covered.

The painter who works transparently in his grounding and shadows, only giving his high and subordinate lights due opacity, as was Rembrandt's practice, has acquired a secret worth knowing, as the best, and probably the only style leading to perfection in colouring. Transparency of colour in painting appears to be equivalent to clearness, or purity of tone in music.

An important peculiarity in this mode of colouring is the attainment of roundness or relief. Some of the portraits in the national collection, painted by men of genius, were undoubtedly, expressive likenesses, when first they came from the easel, but they have since be-

come dull and flat, having been painted on the opaque principle, in which permanent roundness is not attainable. Were such pictures placed near those painted in the style of the old masters, their flatness would be still more apparent. In the one case we are not for a moment deceived, but regard the representation as a mere painting; in the other, however, in an abstraction of thought, we may feel our senses cheated, by a head starting, as it were, from the canvas. Of this latter kind of painting, there is a noble specimen by Guido, in the Dulwich gallery, representing St. Sebastian, in which such relief is given to the figure, that it seems as though it would disengage itself from the background.

That modern paintings are absorbed into their canvases, and lose their colour after the lapse of a few years, is a calamity much to be deplored. In accounting for this evil, we would ascribe it to an erroneous principle in the mode of colouring, involving too many "processes." Again, the mixture and intermixture of tints cause mischievous effects, from the quantity thus supplied to promote chemical changes and their consequences. This would not occur, were the pictures painted on the transparent principle of the old masters, whose works after 150 or 200 years, are still, to all appearance, improving in mellowness, and beauty.

A man of talent will accomplish a portrait in a very few sittings, and, in all probability, it would not admit of many more, without deterioration. Simplicity is the grand desideratum in colouring, and the effect should be

such as we see in the portraits of Vandyke, Reubens, and Rigaud, combining excellence in style, with fidelity to nature.

The portraits by British painters in the Dulwich gallery, are much faded. The flesh tints have assumed a pale and sickly hue; the carnations are nearly gone, and the complexions are dying away. This is especially the case with Gainsborough's portraits. In those of Mrs. Tickle and Mrs. Sheridan, the flesh colours have altogether departed; and another picture: Mrs. Moody and her children, is so much faded, as to present the sad aspect of an unhealthy family.

In the paintings here alluded to, there is no such colour as the tonic, and the want of red, even in the faces and colour of the flesh, increases this effect, leaving to posterity but a sickly memorial of the persons represented. On the other hand, the paintings of Bassano, Vandyke, Maes, Vanderhelst, Hausman, &c., &c., stand the test of time, "in colours ever fresh and fair." As we go back to the time of Opie, the portraits grow flatter, and decay in clearness and strength of colouring, when they should improve with age, and hold their original colours in primitive value. Duration, and even improvement by time, are qualities attainable in art, by reformation in the grounding, and simplicity in the subsequent operations; for what men could do in the 15th and 16th centuries, (if we take the trouble to find out how they did it) may also be done in our own day.

It is very important to know whether the refined evanescent oils, now in general use, may not be at the bottom of the evil above alluded to. We have sufficient evidence from all that has been handed down to us, of the methods followed by the old masters, that pure linseed oil, both boiled and in the raw state, was the only vehicle for colour employed by them. There does not appear to be any proof that they ever mixed varnish of any kind with their paints, or used it in any such forced compound as maguelp.

When pigments in a finely levigated state, are mixed with oil, each molecule is, as it were, insulated by the vehicle, and thus preserved from the influence of extraneous agencies, and even from chemical changes, with the atoms of other pigments artistically commingled with them in tinting. It stands to reason that every absorbing surface, as in the bibulous grounding material of some kind of prepared canvas, added to the want of binding, and the evanescent nature of the vehicle itself, will sooner or later deprive the pigments of their protective matrix, exposing them to the action of new affinities, to the utter destruction of the pictorial effects they were intended to sustain. Soap and water would very soon undermine such colouring, whereas they may be fearlessly employed if necessary, in the superficial cleansing of pictures painted with linseed oil.

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