differ not inconsiderably from those which belong to the musical scale and he is obliged, after all, to place blue and indigo together, taking their "mean rates" as corresponding with G. I do not know how far Newton's measurements are correct; but I find that Professor Zannotti, of Naples, gives for the diameters of the rings from red to red the cube-roots of the numbers 1, $\frac{8}{9}$, $\frac{5}{6}$, $\frac{3}{4}$, $\frac{2}{3}$, $\frac{3}{5}$, $\frac{9}{16}$, $\frac{1}{2}$. The intervals between these, taken successively, are $\frac{9}{8}$, $\frac{16}{15}$, $\frac{10}{9}$, $\frac{9}{8}$, $\frac{10}{9}$, $\frac{16}{15}$, $\frac{9}{8}$; that is—major-tone, semi-tone, minor-tone, major-tone, minor-tone, $\frac{1}{2}$-tone, major-tone. Calling the major-tone *M*, the minor tone *m*, and the semi-tone ×, for the sake of brevity. I will give the five different forms of which the musical scale is capable—expressed by the succession of intervals —and show that the above series of intervals is one of them :—

D, E, F, G, A, B, C, D

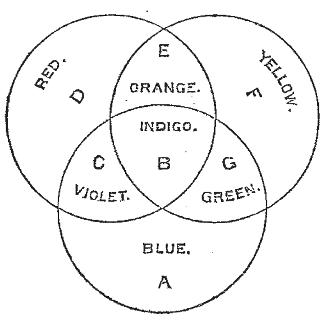
(1)	m	×	M	m	M	×	M, or Sintono.
(2)	M	×	m	M	m	×	M, or Newton's scale of colours.
(3)	M	×	M	m	M	×	m
(4)	m	×	M	M	m	×	M
(5)	M	×	m	M	M	×	m

Varieties depending upon the permutation of the quantities M, m, and ×. The 1st contains the imperfect fifth, DA; the 2nd two such fifths, EB and FC; the 3rd GD; the 4th A_2E_2; and the 5th the imperfect fifth, C_2G,—all of course with their corresponding augmented fourths.

Thus, Newton's scale of colour is one of a series of five scales of sound, all requiring modification by a *comma* of one, or at the most two-fifths; but all are found of perfect major and minor tones and major semitones. If the correlation between colour and sound exists, I think it will be found here. If this be admitted, the colours and notes corresponding are as follows :—

D, E, F, G, A, B, C, D

Red, Orange, Yellow, Green, Blue, Indigo, Violet, Red; or better according to the figure—



Thus the series of colours corresponds with the Gregorian Scale of the *first mode* and not with the modern scale of C. I may remark, by the way, that the ancient Greek *plain chant* is said sometimes to have a notation in which the notes are distinguished by different colours. It would be interesting to know whether such a notation has any scientific foundation.

In conclusion, I would say, that Newton's rings give a far more clear division of the colours that we get in the spectrum and the distinction between blue and indigo is too well defined to warrant them to be treated as Mr. Barrett has done. No doubt the neighbourhood of indigo is a difficult one and to make the correlation with sound complete, this colour itself ought to be divided into two; indigo-blue and indigo-violet corresponding to the notes B♭ and B♮, both of which are required to obtain the fourths and fifths all perfect. Allow me to inquire if there be any marked line in the red, dividing it into two reds separated by the interval $\frac{81}{80}$? I ask this question because the Sintono Scale (1) requires two D's differing by this interval, to complete its intervals of fourths and fifths. Also, would the correction of the fifths, &c., in the other four scales given above, by the introduction of one or two new notes, be such that these notes can be made to correspond to marked divisions in the spectrum or to like divisions in the series of colours determined by Newton's method? W. S. OKELY

THE supposed analogy between the spectrum and the musical scale is not strictly accurate, because in the former the colours blend into one another imperceptibly, while the notes of the latter are separated by distinct intervals.

Yet it is precisely on this blending of the colours that the pleasing effect of the spectrum depends. If we place red, orange, yellow, &c., in their order, in immediate juxtaposition, as distinctly defined bands, we obtain precisely that arrangement which is admittedly distasteful.

The chromatic scale, as its name implies, approaches more nearly to the spectrum than does the diatonic; but the spectrum would be still better represented by the sliding tones produced by running the finger up the sounding string of a violin.

But leaving this objection, which may be thought too critical, I would remark, that the analogy which Mr. Barrett points to is rather one of melody than of harmony.

In the case of a musical concord, the two notes fall simultaneously on the ear and are perceived as one compound sound, the effect of which is very different from that produced by sounding the notes in succession, however rapid; yet this last is what rather seems to correspond to the sensation produced by two colours placed in juxtaposition, the eye passing rapidly from the one to the other. To obtain the optical analogue of a musical concord, the colours ought to be received simultaneously on the retina—in other words, should be blended. Could not this be accomplished by producing two distinct spectra by means of two prisms and causing the so-called harmonious colours in either to overlap one another on the screen? Blending thus, for example, those rays of the two spectra whose vibrations are to one another in the ratio of 100 to 75, their resultant (a purple of some sort, I suppose) would give us the true analogue of the fifth in music.

Similar experiments, I am aware, have been made by causing patches of colours to rotate upon a disc so rapidly that they are in effect blended upon the retina; but some modification of the method above suggested would seem to have the immense advantage of enabling the experimenter to combine colours whose wave-lengths would be in any desired ratio.

I should be curious to know whether the result of such an experiment would be that the compound tint produced by the two rays would be more or less agreeable, the more or less nearly its component parts were in the exact musical ratio; also whether, when the two colours were slightly "out of tune," we should have the phenomena of "interference" presenting themselves analogous to the "beats" in music.

A curious speculation here suggests itself. It is well known that what are called complementary colours—red and green, for instance—produce, if combined in due proportions, white.

Proceeding by the above method, then, should we find that the particular tints of red and green necessary to produce white. are those whose ratio is exactly that of the musical fourth? If so, white is as much entitled to a place in our catalogue of colours as purple or any other harmonised compound.

If white is not the optical representative of the musical fourth, where shall we look for its analogue in the latter science? Can any of your readers suggest a method of producing a *white sound?* "White," we know, is the resultant of the blending of the whole rays of the spectrum—*i. e.*, of the same part of the retina simultaneously receiving rays whose wave-lengths pass imperceptibly through every conceivable shade of difference.

If it were possible for a violinist to slide his finger up the string of his instrument in such a way that, instead of producing a sound varying in pitch, every part of the string passed over should continue to sound simultaneously with every other part; or, if we can suppose some millions of violinists each sounding a note inappreciably higher than his neighbour, but comprehending among them every conceivable shade of pitch within the octave, we might possibly obtain the purest and most ætherial of tones, a "White Sound!"

Edinburgh, Jan. 24 FRANCIS DEAS

Government Aid to Science

WILL you allow me, with the utmost respect, to remind your able correspondent, that *every individual* in the state pays taxes for ignorance and inefficiency; while so interwoven are the interests of man with man—so often does inquiry after the most abstract principles lead to valuable practical results, that it is impossible to predict in which department of Science discoveries may be made that shall materially lighten these unsatisfactory imposts. Hence the field of research should be open to all and