work called "Sight and Touch," 1864, p. 57, collates the opinions of Heraclitus, Aristotle, and Cicero, who all assign to the moon's apparent diameter the length of a foot. He quotes, too, from Arthur Collier's *Clavis Universalis* the expression, "the moon which I see is a little figure of light, no bigger than a trencher." The old-fashioned trencher was about a foot in diameter. The late Sir William Rowan Hamilton pointed out to me this passage in Descartes' "Dioptricæ," cap. VI. § xx.:—"Abque hoc patet ex eo quod Luna et Sol, qui sunt e numero corporum remotissimorum, quæ contueamur, ... *pedales ut plurimum, vel ad summum bipedales* nobis videantur," &c. Bishop Berkeley, as Philonous, asks Hylas, "Since, according to you, men judge of the reality of things by their senses, how can a man be mistaken in thinking the moon a plain, lucid surface, about a foot in diameter?" Many more such cases could be cited from ancients and moderns, all concurring in assigning a foot, or something between one foot and two feet, to the apparent diameter of the moon. Let me now cite two recent cases. A law-clerk, whose lay notions certainly owed very little to books, told me that the moon always appeared to him of the size of a door-handle. This would give, at most, a diameter of three inches. An eminent astronomer tried his daughter with the question. She replied that the moon looked to her about *half a degree*. He said, "Come, you learned that from astronomy; but answer as a girl of common sense." She now replied, "A small saucer." That would be some four or five inches in diameter.

I suppose I was too early spoiled by trigonometry to enter into the merits of this style of estimate. Look at the moon as I may, I cannot compare her to anything definite, as a door-handle, a saucer, or a trencher. Judging by the distance at which we ordinarily see such things in the use of them, they all seem to me to be enormously too large. Looking at the moon through my window, sitting three or four yards from it, I should guess that a wafer stuck on it would eclipse her. My own conviction is that in the ordinary estimate (or rather comparison), there is no reference, the most covert or subconscious, to any standard of distance. True, thirty-six or thirty-seven yards would be the distance at which Arthur Collier's trencher would subtend the same angle as the moon. But who thinks of this in connection with a trencher, which is usually under a man's nose or on the kitchen rack or shelf, at a distance not exceeding four or five yards? In another letter I will, if you will allow me, call attention to some of the *veræ causæ* which are probably concomitant in these popular estimates; and this I shall do in respect to the apparently augmented size of the moon's disc on the horizon. Meanwhile, let me ask as a preliminary to that inquiry, is it a matter of fact that *to the naked eye* the moon does subtend the same angle at the horizon as at positions near the zenith? I am unable to perform the measurement myself, not merely for want of a proper instrument, but by reason of the fact that I always see in the moon a multitude of discs partially overlapping each other, five of which I can distinctly count. It would be awkward to find that one was attempting to solve an imaginary problem, like the Royal Society over King Charles's fish.

Ilford, March 24 C. M. INGLEBY

THE "lurking idea" of Mr. G. C. Thompson, that the moon looks about the size of a fourpenny piece, seems to me to show that those views of it have made most impression on him which he has taken when standing a few feet from the window, when it would cover some such space: while others, with the one foot or two feet idea, have been more wrought upon by unconscious measurement of it against trees in the garden, or house chimneys along the street. I do not think we can get beyond this, in regard to a "personal equation." As to the apparent difference between the moon near the horizon and the moon in mid-sky, your correspondents have not yet referred to the theory that the felt degree of convergence of the eyes is one help toward measuring distance; which, however, soon ceases as the object is more remote, and the convergence insensible: and that, in looking at the moon along the earth's surface, we feel that she lies beyond this limit by comparison with the objects which intervene, while in looking up through free air there is no such gradation to guide us; that, therefore, we assign, unconsciously, a greater distance to her, *i.e.*, a greater "lurking idea" of estimated magnitude for the same apparent surface, in the former case than in the latter. I write from a dim recollection of one of Sir Sidney Smith's lectures on Moral Philosophy, but I suppose the notion is trite to experts. Is there anything in it? J. R.

Concomitant Sounds and Colours.

THE investigation of the points of resemblance between two sciences, has its value and assists the development of both. Music gains by being thus raised from a mere sentimental recreation to the dignity of a science, but the science of colours may perhaps gain even more than music by the comparison, and this because the ear, in most persons, can distinguish with more precision a discord in sound, than the eye can in colour.

In the most ancient times it was well known that concomitant sounds produce a resultant whose vibrations are generated by the interference of the sonorous waves of the primaries. This physical fact was not only known but employed in the construction of Gregorian *Cantilenas*, whose succession of intervals shows a deep penetration of this truth.

The law of combination of the vibrations of concomitant sounds may be stated thus:—The resultant of two sounds has, as its number of vibrations, the difference between those of its primaries. Also any number of sounds combined two and two together, the 1st with the 2nd, the 2nd with the 3rd and so on, will form a series of resultants, which similarly combined two and two together form a second series of resultants; so that (continuing this process) we finally arrive at a single resultant which is that of the original combination. This law has been tested experimentally by Hallström and Scheibler. I considered that it might be useful to express this law by a general formula, so I will give it in this place.

If we have n sounds whose vibrations are $x_1, x_2, x_3, \ldots x_n$, all in ascending order as to *pitch*, then the resultant will be

$$R = (x - 1)_{n-2}\,(x_2 - x),$$

where the suffixes must be treated as indices, and $(x - 1)_{n-2}$ expanded according to the binomial theorem.

R is not, however, a resultant in the strict sense requiring the vanishing of the primary sounds; it might, perhaps, be better called the *Residuant* of the combination. It is thus the measure of the imperfection of the combination which is, more or less, a discord according as R is less or more nearly related to the primaries.

If we apply this formula we shall easily see that the tonic and subdominant generate a note two octaves below the subdominant: for example, C and F generate $\frac{F}{4}$. Also CEG, CGC^2, and CDE and all similar combinations in which the vibrations stand in arithmetical progression generate no residuant, hence, combinations of this class are perfectly consonant and are called by Boethius *equisonal concords*. (The combination CDE is discordant enough on a modern instrument, but I mean CDE tuned perfectly without temperament.)

Supposing then that an impression is made upon the retina by two or more colours in juxtaposition, analogous to that produced on the auditory nerve by two or more simultaneous sounds. We shall perceive that two complementary colours placed side by side ought to increase in intensity that one whose vibrations are the most rapid. Red and green, for instance, should give intensity to the green, since D and G generate $\frac{G}{4}$. Moreover, the colours corresponding to the *equisonal concords* ought to give us the most harmonious combinations; these are they:—

Violet	placed between	two	yellows,
Red	,,	,,	greens,
Orange	,,	,,	blues,
Yellow	,,	,,	indigo-blues,
Green	,,	,,	violets,
Blue	,,	,,	reds.

Yellow and indigo-violet ought always to be discordant, as they correspond with the discord F B or *tritone*. Again—

Violet, orange, green Yellow, blue, violet Indigo-blue, red, yellow Violet, red, orange Yellow, green, blue Indigo-blue, violet, red.	All correspond to equisonal concords and should form perfectly harmonious combinations.

It will be noticed that these tints must be precisely of the same shade as those in Newton's image; the slightest variation would destroy the harmony of colour. I have no doubt if pigments were made of tints identical with the ring-colours, the beauty of these combinations would be appreciated by all who used them.

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