THE GRAPHIC METHOD OF REPRESENTING MUSICAL INTERVALS *

THE object of the paper was to explain a method of representing musical intervals, which was very useful in giving a clear idea to the mind of relations often complex and obscure.

The author pointed out that there was a natural tendency to refer the positions of musical notes to positions in space. It was by no means clear that there was any real physical or physiological relation between the two things, but somehow or other the idea had become so firmly rooted in the mind that it had developed itself in expressions of every-day use. For example, it was customary to call a note with rapid vibrations a *high* note, and one with slow vibrations a *low* note. Few people considered whether there was any natural justification for these terms; probably there was none, but they had existed almost ever since music had taken a definite form, and had given rise to the form of notation employed to express the positions of musical sounds.

It followed from this that the musical idea of distance between two notes, which was technically called a musical interval, might be considered as having an analogy between the high and low positions of the two notes respectively, a greater interval being represented by a greater space, and *vice versâ*; and carrying this idea out to its full extent it became possible to represent musical intervals to the eye in such a way as to convey ideas of comparative magnitude precisely analogous to the impressions which these intervals would make on the ear. This the author called the *graphic* method of representing intervals.

The idea of such a method had been embodied from early times in the word *scale*, which was derived from the Latin *scala*, a ladder, thereby clearly implying an analogy between the spaces of the steps and the intervals of the notes. Mr. Hullah, in some of his elementary books, had actually made use of a diagram of a ladder for this purpose, and he had introduced the improvement of representing the intervals between the third and fourth and between the seventh and eighth steps (of the diatonic major scale) as only half the length of the other degrees, thereby embodying, in a graphic mode, the distinction in magnitude between the whole tones and the semitones. What the author proposed to do in this paper was merely to establish this mode on definite principles, and to give it more capability and more accuracy.

It was well known that the scientific definition of a musical interval was expressed by the ratio which the vibration-number of the higher sound bore to that of the lower one, and it had been shown that the idea of the magnitude of the interval in a musical sense might be expressed by the logarithm of this ratio. Hence, by plotting down this logarithm with a scale of equal parts, and drawing a line of that length, such a line would be a correct graphic representation of the magnitude of the interval.

The author explained the mode of doing this in a simple practical way, which might be put in practice by anyone, with the aid of a small table of logarithms, as easily as working a simple sum in arithmetic; and he calculated and laid down several examples in the presence of the audience. It would be, he said, sufficiently accurate to express the distances in three places of figures, as, for example:—

The interval of an octave would be expressed by a line whose length was—

= log. 2 ... ... = 301
That of a major—
Sixth = log. $\frac{5}{3}$ ... ... = 222
That of a minor—
Sixth = log. $\frac{8}{5}$ ... ... = 204
That of a fifth—
= log. $\frac{3}{2}$ ... ... = 176
That of a fourth—
= log. $\frac{4}{3}$ ... ... = 125
That of a major—
Third = log. $\frac{5}{4}$ ... ... = 97
That of a minor—
Third = log. $\frac{6}{5}$ ... ... = 79

And so on for any others.

It would be seen how truly these numbers corresponded to the ideas of the intervals existing in musical practice, for, according to the usual musical rules—

Fifth + Fourth ... ... = Octave.
Major Sixth + Minor Third ... ... = Octave.
Minor Sixth + Major Third ... ... = Octave.
Major Third + Minor Third ... ... = Fifth.
Fourth + Minor Third ... ... = Minor Sixth.

And so on.

The author then, as a more extended illustration of the principle, showed the process of determination of the exact positions of the various notes of the modern musical scale, including all the accidental sharps and flats necessary for chromatic purposes and for modulation; and he proceeded to draw the same on a large diagram, making the octave 3 feet long. This enabled the audience to appreciate clearly many delicate points of intonation, which were difficult to be conveyed to the mind by any process of verbal description, and which the author explained and commented on in their theoretical and practical bearings. He also drew a corresponding scale on the plan of equal temperament, and pointed out the more important differences between this and the true scale, concluding with some remarks on the subject of intonation generally.

* Abstract of a paper read by W. Pole, F.R.S., Mus. Doc., Oxon., at the second meeting of the Musical Association for the Advancement of the Art and Science of Music on Dec. 6, at the Beethoven Rooms, Harley Street, Mr. Bosanquet in the chair.

THE SWEDISH ARCTIC EXPEDITION

THE following extracts are taken from a letter addressed to Mr. Oscar Dickson, of Gothenburg by Dr. F. R. Kjellman, who (and not his brother Dr. Theél Kjellman, as was stated by mistake in NATURE, vol. xiii. p. 75) was in command of the *Pröven*, the vessel of the Swedish Arctic Expedition during the return voyage from the mouth of the Jenesei to Norway. The *Pröven* left the mouth of the Jenesei on the 19th August, fell in with ice on the 23rd in 75° 22′ N. lat. and 66° 30′ E. long. from Greenwich; sailed along the edge of the ice until, a little south of Cape Middendorff, it was found to connect itself with the land so as to bar all passage northwards. The *Pröven* then turned south and was carried by a current twelve miles south of Matotschkin Scharr.

"Before going farther I may perhaps be permitted to make some remarks on the higher vertebrate animals which we found to inhabit or visit the Kara Sea. The walrus occurs here plentifully, and has of late years been the object of exterminating pursuit on the part of the Norwegians. At many places on the Samoyede peninsula and White Island we saw great herds of these beautiful animals. The Kara Sea has three species of seals, *Phoca barbata*, *hispida*, and *Grœnlandica*. The last-named was that which we saw most frequently and in greatest numbers. Off Obi and Jenesei white fish (? dolphins) were very common, and on the east coast of Novaya Zemlya we saw a large fin-whale (*fenhval*). If I add that one day, as we lay becalmed between Udde Bay and Matotschkin Scharr, an ice-bear quite unexpectedly came swimming out to our vessel, where he, of course, soon met his death, I have named all the mammalia we saw during our navigation of the Kara Sea. The bird world was exceedingly poor. I may almost say that it was a great rarity to see a tern or a mew. The alka (*Uria Brünnichii*), which occurs in such immense numbers on the west coast of Novaya Zemlya, is believed to be absent on the east coast. We saw here only one, and it appeared to have gone astray. Only some few species of fish were observed."

The *Pröven* passed through Matotschkin Scharr on the 10th and 11th September, arriving at Hammerfest on the 26th of the same month, and at Tromsö on the 3rd October. Dr. Kjellman sums up the scientific results of the expedition as follows:—

"We botanists have endeavoured not only to ascertain what species of plants Novaya Zemlya possesses, but also to get an insight into the varying distribution of the different species, the nature of the vegetation at different localities, in different latitudes, at varying heights above the sea, at varying distances from the seashore, &c. We have made a great number of such observations, and thereby will, I believe, be in a position to give such an account of the vegetation of Novaya Zemlya as will satisfy the requirements of science. Of flowering plants we have rich collections from Matotschkin Scharr, from many places on the west coast of Southern Novaya Zemlya, from Waigats Island and the mainland lying opposite to it, from the Samoyede peninsula and the region lying round Dickson's Harbour, and these collections contain a considerable number of species new to those localities. The phanerogamic egetation of Novaya Zemlya has a strong resemblance to that of Spitzbergen, but at the same time, as might be expected from