religion, society, language and art, can be applied to music. Moreover, if Mr. Fillmore's presentation is correct it is hard to avoid the conclusion that the Omahas, though unconscious of it, are at the same stage of musical culture as he was; for he was just able to account for every peculiarity of their music, but only by bringing in "pretty much the whole ground of modern harmonic structure," including "the use of the third and sixth relationships in harmony, one of the most notable peculiarities of the Modern Romantic school" (p. 62). One cannot resist the suspicion that the writer has portrayed a cloud-land, not real hills lying as distant from his point of view as savagery is from civilization,—a suspicion strengthened by a multitude of facts, that there is no space here even to hint at.

But lest this criticism be misunderstood let us remind ourselves that in reporting music, as in writing history or producing a picture, there are two distinct ways of working; one aims either at a photographic, literal, scientific, analytical presentation, or at an artistic one; rarely at both. If the worker's aim be not regarded his most successful portraiture may be considered false; the artist disregards details, aiming rather at the impression of the whole; the scientific worker must first have the details. Miss Fletcher presented her "collection of Omaha Indian songs feeling confident that therein is truthfully set forth in a manner intelligible to members of my own race the Indian's mode of expressing emotion in musical forms" (p. 7): so her aim was artistic; she deliberately disregarded the material she had collected along the lines of physical or scientific presentation. She does not pretend to give the Indian music accurately as to pitch or quality, but in a translation, as it were, or perhaps rather a paraphrase. Many persons can deny that she gives Indian music; probably she is the most competent witness on the question whether her melodies with Mr. Fillmore's harmonies express to white musicians the emotions of the Omahas. No one doubts that for Miss Fletcher's purpose the modern musician's standpoint is the necessary one: is there any more doubt that for Mr. Fillmore's philosophical and scientific purpose it is absolutely unfit, and that views from it are obscure and misleading?

V.

While all such faithful, sympathetic attempts to paraphrase foreign music are cordially welcomed, we must not forget that an even harder work remains to be done:—to find out the elements of every strange musical language, and the rules by which they have been combined, and so to come to some real understanding of the thoughts and moods that lie back of the musical expression. In spite of the brilliant successes of the present generation in making vivid before us the life and thoughts of past generations, the story of the world's music has not yet been told; and the thousands of unsatisfying pages that attempt to do it still leave the subject in the condition of Egyptian history before the hieroglyphs were deciphered. The strong light thrown by the books under review on the position of modern European musicians shows that they are even farther removed from musicians of all other lands and times, than any one realized a few years ago. So before an author can write an adequate universal history of music, he must find, and occupy at least for a time, some other standpoint than that occupied by the writers of these books.

CHARLES K. WEAD.

THE EFFECT OF THE MEXICAN EARTHQUAKE OF JANUARY 19, AT MOUNT HAMILTON, CALIFORNIA.

THE detection of the occurrence of a distant earthquake shock, by means of a Meridian Circle, appears to be sufficiently

novel to be worthy of record. The effect was noticed here, upon setting the telescope for the Nadir observation, on the night of Friday, January 19th, the date of the earthquake, most seriously felt at Colima, Mexico.

The reflected images of the threads were at once seen to be swinging across the field of vision, with a regular oscillation, much like the swing of a pendulum. The period was about seven seconds for the full amplitude of the swing. The extent of the arc could be exactly estimated, in the east and west direction, by the fixed transit threads, and appeared to be of the same amount in the north and south direction. The reflection from the surface of mercury doubles the actual angle of inclination, which was very closely 15″, for the full arc of vibration, at the maximum seen.

This corresponds to a total displacement of the eye end of the telescope of $\frac{1}{200}$ of an inch. A movement of twice this amount in the surface of the earth, when produced suddenly, will ordinarily be detected as a slight earthquake shock, and will be recorded by delicate seismographs. It would fall at II. of the Rossi-Forel scale, and is about as slight a vibration as can usually be detected. The delicacy of this test is shown by the fact of the oscillations being still easily perceptible when they had fallen to less than one-tenth of the above maximum.

It is probable that vibrations in the earth's crust of much larger extent would still be entirely imperceptible to the senses when taking place as slowly as in the present case. They are believed to extend to great distances from the active center of the disturbance, at least in special cases; and may perhaps precede the sensible shock by a considerable interval. In the additional instance, recorded below, there is little doubt that the early vibration was the forerunner of an earthquake shock, which was local only, as far as known.

In the present case, if the same vibrations extended to the summit of our large dome, they would amount to but the twentieth of an inch in actual displacement; and being of so slow a period, no injury would be anticipated. We have records here of displacements of the earth's crust during earthquake shocks of twenty times that of January 19th, coming as sharp and continued vibrations.

The oscillations were first noted at 10h. 50m. Pacific standard time, eight hours slow of Greenwich. Local time would be six minutes less. They continued of the same amplitude, apparently, for five minutes at least, and at 11h. 5m. had diminished to about one-quarter of the maximum. At 11h. 15m. they were still easily perceptible, but appeared no longer as uniform; the reflected image would appear stationary for several seconds and then continue the swing.

At 11h. 30m. the vibration had so nearly ceased that the Nadir observation was made, in order to determine whether any change had taken place in the position of the instrument. The comparisons with preceding and following determinations indicate no change in any particular. The swing was nearly as regular as a pendulum at the beginning, and there was little variation in successive swings, except as they diminished in intensity, just as a pendulum comes to rest.

The night was at that time nearly calm; the wind, which had been earlier light from the northwest, having died out. It should be added that the Nadir observation is usually easily made here. There are no shocks to be anticipated of any character at night, and the wind, even at 40 miles an hour, does not interrupt the reflection of the images. When coming in strong gusts there is no vibration at the surface, either coming from direct pressure or carried down by the walls of the building. The

last will often quiver and rebound from the impact of the wind, as if it had been hurled against us in solid form. There is, of course, some difficulty in obtaining a steady illuminating flame during high winds, but no disturbance of the mercury surface.

The last previous observation of a star had been made upon a circumpolar at upper culmination, and nothing unusual was noticed up to the time of leaving the telescope. The last thread was taken nine minutes before the oscillation was detected at the Nadir, or at 10h. 41m. P. S. T. In the interval the circles and micrometer were read and the meteorological record taken for refraction. The barometer was again read, shortly following the cessation of the disturbance, and no change had taken place. The automatic recording instrument does not indicate any disturbance in the pressure during this interval.

The probable error of a telescope bisection is not greater than the hundredth part of the oscillation, at the maximum; so that it is clear that nothing of that nature was occurring at the time of observation. Nor could it fail to be detected in the transit record.

The circular reading, itself, might not indicate the beginning of the vibration; since it was of so slow and regular a character, that the telescope would probably have not been disturbed, in its position upon the pivots. An earthquake shock usually changes the position of the telescope in the wyes; in one case a change of 3″ was noted, as effect of a small, but perceptible tremor.

There is, thus, no way in which to fix the commencement of the oscillation, between the limits of 10 h. 41 m. and 10 h. 50 m. The duration is extraordinary, especially considering its minute amount. It was continuously observed for forty minutes. So impressive and startling was its character, when noted in an instrument of such stable form of mounting, that the observer had no hesitation in announcing the coming of an earthquake for this locality. Some previous experience served as the basis for such a prediction. On May 7, 1894, a similar oscillation, but far less pronounced in extent and duration, was detected by the same means. It was followed, after an interval of an hour and five minutes, by a slight earthquake, noted by three observers on Mt. Hamilton.*

In observing from two to three hundred nadirs a year, these two instances are the only ones noted of any vibration in the mountain. The indications were that this presaged a shock of a serious nature; and the chagrin, for an unfulfilled prophecy, is easily more than counterbalanced by the relief from the experience of a severe earthquake.

The connection with the Mexican earthquake is pretty clear, taking into account the slightly detailed accounts that have yet reached us. That was most severe at Colima, and Guadalajara, six or seven persons having been killed, many injured, and much damage to old and substantial buildings having been done. The first accounts of that disaster reached us on Monday, through the daily papers; and it appears that no further details are likely to be printed in that form. At Colima, the time was given at a quarter before twelve. At Guadalajara it was recorded at midnight. These cities are 18°, or a little more than an hour east of Mt. Hamilton: so that the first statement of the time would make the epoch near the beginning of the vibration noted here. Until more exact details of the times, recorded in Mexico, are known here, it will not be possible to check for closer agreement.

The cities where the worst of the shock

* Pub. Astr. Soc. Pac., 1894, Vol. VI., p. 184. Catalogue of Earthquakes, E. S. Holden: Smithsonian Miscell. Collec., No. 1087, p. 227.

was felt, are distant 1500 miles from this point. The shock would appear to have reached IX. of the R. F. scale, at the center. It will be interesting to learn how far this side the center, any sensations were noticed. The delicate indications of a fine telescope, poised over the mercury, will fill in the gap between the borders of the sensible shock, and the far extent of the real disturbance of the earth's crust.

R. H. TUCKER.

LICK OBSERVATORY, UNIVERSITY OF CALIFORNIA,
Jan. 24, 1900.

NOTE.—The thirty-six-inch and twelve-inch refractors and the Crossley reflector were in use while the oscillations of the earth, recorded by Professor Tucker, were taking place, but no unusual disturbances of these instruments were noticed. The observers were not, however, aware of the disturbance of the mercury under the meridian circle.

J. E. K.

THE CHICAGO SECTION OF THE AMERICAN MATHEMATICAL SOCIETY.

THE Section held its sixth semi-annual meeting at the University of Chicago on Thursday and Friday, December 28 and 29, 1899. Four sessions, two on each day, were fully occupied with the presentation and discussion of papers. Professor Moore, Vice-President of the Society, occupied the chair during the first session, after which Professor E. W. Davis presided.

The following papers were read:

(1) MR. R. E. MORITZ, University of Nebraska: 'A generalization of the process of differentiation.'

(2) PROFESSOR E. D. ROE, Elmira, N. Y.: 'On the transcendental form of the resultant.'

(3) DR. E. J. WILCZYNSKI, University of California: 'An application of Lie's theory to hydrodynamics.'

(4) DR. F. R. MOULTON, University of Chicago: (1) On the question of the stability of certain particular solutions of the problem of four bodies; (2) Particular solutions of the problem of n bodies of the Lagrangian type.

(5) PROFESSOR L. E. DICKSON, University of Texas: 'The canonical form of linear homogeneous substitutions in a general Galois field; (2) The cyclic sub-group of the simple group of linear fractional substitutions of determinant unity in two non-homogeneous variables with coefficients in an arbitrary Galois field.

(6) DR. J. V. WESTFALL, University of Iowa: 'On a category of transformation groups in space of four dimensions.'

(7) PROFESSOR O. BOLZA, University of Chicago: 'The elliptic sigma-functions considered as a special case of the hyperelliptic sigma-functions.

(8) PROFESSOR ALEXANDER PELL, University of South Dakota: Calculation of the integral

$$\int e^{-\left(px^2+\frac{q}{x^2}\right)} \begin{matrix}\sin\\ \cos\end{matrix} \left\{ rx^2+\frac{s}{x^2} \right\} dx.$$

(9) PROFESSOR JOHN A. MILLER, Indiana University: 'Concerning certain elliptic modular functions of square rank.'

(10) PROFESSOR ROBERT J. ALEY, Indiana University: 'A new collinear set of three points connected with the triangle.'

(11) PROFESSOR H. MASCHKE, University of Chicago: 'Note on the unilateral surface of Moebius.'

(12) PROFESSOR C. A. WALDO, Purdue University: 'On a family of warped surfaces connected by a simple functional relation.'

(13) PROFESSOR Henry S. WHITE, Northwestern University: 'Plane cubics and irrational covariant cubics.'

After the papers listed above had been read there followed a general discussion on the topic 'Limits of function of one or more variables' introduced by Professor Moore.

The program committee for the following year was elected at this meeting and will consist of the Secretary *ex-officio*, Professor H. B. Newson, University of Kansas, and Professor C. A. Waldo, Purdue University.

The next meeting of the Section will be held on Saturday, April 14, 1900, at Northwestern University, Evanston.

THOMAS F. HOLGATE,
Secretary of the Section.

EVANSTON, ILLINOIS.
Jan. 6, 1900.