to 'pull' air particles apart. On p. 52 we are told that the motions of particles of a water wave "are always at right angles to the direction of the wave itself." On p. 68 the author corrects this statement, but in doing so, takes occasion to speak of a plane "in," instead of 'passing through' the line of progression. On p. 380 he describes harmonic partial-tones as "modifying the quality of their fundamental," though he obviously means the quality of the compound sound due to the fundamental and other partial-tones combined. On p. 387 it is said that the "ratios of frequencies" which characterize particular sounds "are called intervals," and that by dividing one note by another we obtain the intervals between them. Language of this kind is, indeed, hardly misleading, but it is certainly very slipshod.

Before passing from the more generally acoustical, to the more specially musical portion of Prof. Zahm's volume, it is proper to point out one important respect in which it has the advantage over most, or possibly all, the manuals on the same subject which have preceded it. This merit consists in giving a somewhat full account of elaborate experimental researches on beats, combination-tones and quality conducted by Dr. Koenig, the results of which are to a considerable extent at variance with conclusions previously announced by Prof. Helmholtz. In the opinion of our author, Dr. Koenig is "one who, not excepting even the eminent German philosopher just mentioned (Helmholtz), has contributed more than any other person to the advancement of the science of acoustics" (p. 17). A more balanced judgment, while placing great reliance on Dr. Koenig's experimental skill and on the superlative excellence of the apparatus constructed by him, would probably attribute to Helmholtz's opinion a preponderant weight in interpreting and correlating the results of experiment. Be that, however, as it may, Prof. Zahm has done excellent service by popularizing the work so laboriously performed, and so modestly placed on record, by the eminent instrument-maker to whom no one who has put his hand to acoustical work can fail to be under considerable practical obligations.

The specifically musical are decidedly the least meritorious parts of our author's performance. The looseness of phraseology already complained of is here at its worst. On p. 166 we are told that a 'comma,' ($\frac{1}{512}$) is "the smallest interval used in music." A beginner might easily take this to mean that notes differing by only that interval were actually heard consecutively in a musical phrase—of course an absurd supposition. Very misleading, again, is the statement on p. 388 that tones, like major and minor tones, that differ from each other only by a comma "are considered in music to have the same value." The only rational meaning to be got out of it seems to be that *in the equally tempered scale* the distinction between major and minor tones is obliterated. On p. 389 the notes of the diatonic scale, and their relations, in respect to rapidity of vibration "to one another," are set out, and it is added that all but the second and the seventh of the intervals thus indicated are consonant. The essential piece of information, that it is not the intervals formed by these notes with "one another," but with the *tonic*, that are in question, is with-

held, and so the reader is left free to suppose *e.g.* that the tritone, F—B, is a consonance. On p. 390 the 'inversion' of intervals is mentioned without any explanation of its meaning.

Attention may well be called to a process of reasoning which occurs on pp. 388-390. Prof. Zahm abruptly introduces (p. 388) calculation by "frequency-ratios"; assumes, without attempt at proof, that addition of two semitones is performed by squaring the ratio $\frac{1}{2}$, and then remarks (p. 390) "From the foregoing we observe that the sum of two intervals is obtained by multiplying, not by adding their ratios together." An *assumption* in a *particular case* is thus made to do duty as a *general demonstration*.

On p. 396 we read that "so perfectly does the interval of the fifth answer the requirements of the ear that even unpractised singers find it quite natural to take a fifth to a chorus that does not quite suit the pitch of their voice." If, as this passage appears to suggest, practised singers in America find it still more natural to accompany melodies in consecutive fifths, wonderful effects may surely be expected from the choruses to be heard at the Chicago exhibition.

On p. 429 our author describes a diagram by Helmholtz as concerned with the transposition of an interval by an octave, whereas what it really deals with is the enlargement of the interval in question by the addition to it of an octave. On p. 430 he writes down, as *constituents of the chromatic scale of C*, the notes E $\sharp$, F $\sharp$, B $\sharp$ and C $\sharp$.

On p. 441, he tells us that in listening to such violin players as Joachim, Wilhelmj, and others "one can always hear distinctly the *Tartini*, or beat-tones, that add such richness and volume to violin music."

To gauge the amount of truth contained in this remark it suffices to bear in mind that in the case of most major, and of all minor consonant chords, Tartini's tones cause a *decided dissonance*. Players who made them 'always distinctly audible' would soon be reduced to permanent inaudibility themselves.

Prof. Zahm's volume is creditably free from misprints: the following have, however, been noted:

- P. 23, l. 16 'period' for 'periods.'
- P. 68, l. 21 'amplitude' for 'amplitudes.'
- P. 90, l. 8 'Ajugari' for 'Agujari.'
- P. 142, in diagram, B $\sharp$ for B $\flat$.
- P. 152, in diagram I, B $\sharp$ for B.
- P. 388, ll. 11 and 12, G for F.

GERLAND'S ETHNOLOGICAL ATLAS.

Atlas der Völkerkunde. (Berghaus' Physikalischer Atlas, Abth. vii.). Bearbeitet von Dr. Georg Gerland, Professor a.d. Universität in Strassburg. (Gotha: Perthes, 1892.)

ANTHROPOLOGY owes much to Prof. Gerland, whose completion of the two last volumes of the late Prof. Waitz's "Anthropologie der Naturvölker" is a monument of that co-ordinated knowledge of fact which is the source of sound principle. His new "Atlas of Ethnology," while forming part of the great Physical Atlas of Berghaus, may be obtained and used as a separate work by anthro-

pologists, to whom it will be of great service in methodizing the vast and growing information with which they have to deal. This application of graphical method, it is true, has difficulties which even the greatest skill cannot altogether overcome, but Prof. Gerland may well be content with his success in making evident at a glance the characteristics of mankind, seen from many points of view. Their distribution over the earth, as thus made evident, may often lead straight on into theories of origin. The fifteen plates contain nearly fifty maps, each suggesting a principle, or showing where there is room for one.

Plate I. represents on two planiglobes the classification of human races as to skin and hair. Prof. Gerland does not even combine these two characteristics, and points out in his introductory remarks that any attempt to map out man into defined physical races is impossible, for such division does not exist in nature. Anthropologists of course know this, but care is not always taken to make it clear that race-types are not so much complete realities as statistical abstractions from partial realities, the various measurable characters of skull, limbs, complexion, hair-form, &c., combining and blending too intricately for absolute definition. I was struck by meeting lately in a popular book with a confident mention of the four distinct Aryan race-types, and it occurred to me that it would bring the statement down to its bearings to put one of Prof. Gerland's planiglobes before the author, desiring him to define and map out these varieties of mankind. Even in Gerland's broad general distinctions of complexion and hair, an anthropologist not thoroughly special on the anatomical side may find novelty and difficulty. The opinion that all native Americans are similar as to race is here strongly and probably with reason modified by the native Brazilians being separated on the complexion-map from other peoples of North and South America, and placed to match the Tartars and Chinese. What amount of evidence there is for placing the Berbers of North Africa under the same map-colour seems not so clear, but it is to be noticed that the same tint includes several more or less distinct grades in Broca's scale. An attempt is even made to separate the friz-haired negroids into classes according to the arrangement of their corkscrew-tufts of hair on the skin. Plate III., in two maps, classifies man according to his religious beliefs and customs, and here the prevalence of special rites offers instructive generalizations. Thus the American line which limits the smoking of tobacco as a religious ceremony, indicates the spread of this peculiar rite from some religious centre over an enormous area. No doubt it is rooted in nature, from the fact that its narcotic ecstasy brought the priest into direct visionary contact with the spirit-world. But none the less, it proves the religions of savage tribes, separated by great distances on the map, to be bound together by historical connexion. Not less remarkable is the compactness of the districts of Eastern Asia and the opposite Continent of America, where masks are used, apparently originally with religious significance. Here again it is evident that we have to do not merely with independent growth from the human mind, but in some way with historical transmission. It must be remembered in using these maps, that they bind their author only to fact, and not to theoretical interpretation.

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This same plate maps out the immense districts whose natives have a myth of a deluge, the upheaving of the earth, &c., but it cannot distinguish in North and South America, for instance, between regions where deluge-myths are old, and those where they were introduced by the Jesuits a few generations ago. Plate IV., mapping out regions liable to special diseases, as malarious fevers, pestilence, cholera, yaws, &c., contains in a condensed form a vast collection of knowledge, bearing on anthropological arguments as to the relation of race to physical constitution, and thus opening into one of the great problems of the history of man. Plate V. classes out the varieties of human food, clothing, dwellings and occupations. Plate VI. and onward map out the distribution of nations and tribes at different periods as known to history, Plate XIV. being devoted to the distribution of languages over the world.

Anthropologists who keep this atlas at hand as a help in their work will by practice find out its merits and defects. The representation of the geographical distribution of arts and customs has long been a feature of the Pitt-Rivers Museum, where so far as possible each series, illustrating development and transmission of culture, is accompanied by a small world-map coloured to show the parts of the world it occupies. It is of course impossible to Prof. Gerland to work in such detail, involving as it would do hundreds of separate charts. He has to indicate his distributions on a moderate number of plates and mostly uses planiglobes, a projection which, after being neglected for generations, will, in its improved modern arrangement, certainly come into more general favour. On these, by ingenious devices of tinted patches and streaks, combined with lines and dots, he succeeds in giving a more general survey of man and civilization than our students have ever had in their hands before.

EDWARD B. TYLOR.

OUR BOOK SHELF.

Castorologia; or, The History and Traditions of the Canadian Beaver. By Horace Martin, F.Z.S. (London: Stanford, 1892.)

"BEAVER" was once the most important fur in the world. In former days the pelt of this Rodent was the standard by which all barter in the Dominion of Canada was regulated, and "beaver" passed as current coin throughout the whole of North America. Even now the quantity of beaver skins brought to England is considerable. Mr. Poland, in his "Fur-bearing Animals," tells us that upwards of 63,000 beaver skins were sold by the Hudson's Bay Company in 1891. But "beaver-hats" formerly required a much larger supply than this, and in 1743 it is said that 127,000 beaver-skins were imported into La Rochelle alone. Our "top" hats are now made of silk, and beaver has become a fur of second-rate importance.

Besides the fur of the beaver many other points of interest attached to this animal will be found discussed more or less completely in Mr. Martin's volume. Long before its fur was required for hats *castoreum* or *castorin*—a substance found in two large glands, situated near the base of the beaver's tail—was a much-valued specific in medicine, as spoken of by Hippocrates and Pliny. Even at the present time its use is by no means abandoned, and the "crude article" is "still sold at our drug-stores" at prices varying "from eight to ten dollars a