ance of "abnormal distributions." Well and good, if the S.P.R. have not under-estimated the importance of examining the actual distribution of cards cut and of cards guessed, they will have kept a record of each card cut and each card guessed, card for card. If they have not done so, then their experiment is scientifically of no value; if they have done so, then the analysis of the distributions of the cards cut and the cards guessed ought to have accompanied any publication of these experiments. It is an obvious, but by *no means sufficient*, condition for a proper experiment. If the Secretary of the S.P.R. will place in my hands the actual analyses of the cards cut and the cards guessed made by a competent mathematician, *before* the publication in their *Proceedings* of the card guesses, and proving that they did at that time fully consider the point, and take this obvious precaution against deception, my estimation of the "scientific acumen" of the S.P.R. will at any rate on this point be modified.

I, of course, do not refer to my friend Prof. Edgeworth's investigations, which do not touch the question of the distributions of cards cut and cards guessed. KARL PEARSON.

MAY I call attention to Prof. Lodge's method of "silencing" me in your issue of January 10. It bears very closely upon this question of the effect of psychical research upon the investigator's reasoning. He quotes the preface of Mr. Podmore's book to show that that gentleman is not a "bigoted upholder of the certainty of telepathy," and the casual reader would scarcely guess that, in truth, I never asserted that he was. I complained of the very air of open-mindedness in that preface to which Prof. Lodge's quotation witnesses, and showed by an instance, that in the body of the book question-begging occurred which was all the more dangerous on account of the liberal tone of the opening portion. I made no objection to the individual prosecution of psychical research—only to its public recognition before it has produced more definite results than it has done so far. So much for the "silencing." It shows either that Prof. Lodge has not read my review, or that he has misunderstood it; and in either case it enforces my contention that these investigators are over-hasty. The phrase "irresponsible detractor," points in the same direction. H. G. WELLS.

The Suspended Animation of Snakes.

IN NATURE of December 6, p. 128, Mr. G. E. Hadow asks whether the snakes feign death for protective purposes, with intent to deceive, or whether the strange action is the result of a general nervous inhibition, produced reflexly by the action of fright, which would render it more or less analogous to a fainting fit. He and others of your readers will be interested in an additional observation that, in a measure, answers his question. The snake, a "hognose," "spreading adder," or "blowing viper," *Heterodon platyrhinus*, upon which Dr. L. C. Jones based his note in NATURE, November 29, p. 107, the origin of the discussion, was presented to me about five months ago. While in my possession it has repeatedly verified Dr. Jones's statements; and, besides, it has proved that it does not depend upon the feint alone. The latter is preceded by another action that apparently has not been published hitherto. After being teased a little, the animal, vigorously bending from side to side, the tail abruptly raised and the vent slightly protruded, begins to smear itself over the back with urine and excrement, the odour of which is so excessively nauseous that observers are quickly driven back, the better satisfied if they escape without a spatter in their faces. If the teasing stops with this, the victim glides away to hide; but if still more worried, it takes up the contortions that end in the trance-like condition, lasting ten minutes to half an hour, or until the creature feels that it may safely revive. The specimen still lives, and does not discard its filthy habit on prolonged acquaintance Much handling and familiarity with annoyance make little difference in behaviour, or in disposition to take advantage of the peculiar tactics. In the inception of the habits these actions most likely were due to terror; possibly the trance was a real faint; but, however their utility may have been discovered, it is evident at the present time that confidence in them as means of securing immunity from torment induces their practice on occasions when the existence of actual fright is hardly possible. At such times it would be difficult to convince witnesses that the snake is not intelligently employing what it knows to be its best methods of protection.

Cambridge, Mass., Dec. 27, 1894. S. GARMAN.

I DO not think that Mr. Vincent can be right in supposing that the suspended animation of grass snakes has nothing to do with simulation. I have never observed it in the case of a snake when unmolested in a glass case (as he has), though I have kept hundreds so, but noticed it first when catching snakes in the New Forest. After much struggling and the usual offensive methods of defence had proved vain, one has, in several instances, suddenly hung limp and apparently lifeless on my hand. It could hardly be a faint or anything but death-feigning, for as soon as I put it on the ground, or allowed it no longer to feel my hand, it recovered at once, and was off like a shot. I took particular pains to test this, as I was much surprised at the circumstance, which I did not remember having seen mentioned in any book. In all cases it was a *dernier ressort*, the ejection of food and the effusion of smell having preceded. W. KENNEDY.

"Finger-Print" Method.

IN my letter on the subject (NATURE, December 27, 1894, p. 199), I have introduced my assertion of the old Japanese usage of the "thumb-stamps" on legal papers, with a qualifying clause—"although at present I have no record to refer to." Continuing in my search, I have come across a passage which gives confirmation to the statement. It is in the *Fûzoku Gwahô*, No. 50, p. 6, Tôkyô, February 10, 1893, where the details of the bastinado inflicted on criminals during the *ancien régime* are given, and reads as follows:—"When the criminals' guilt was ascertained, and they signed with '*thumb-stamps*' on papers in the Court, they were sent to prison with the magistrate's words, 'Sentence shall follow,' which they used to understand as the signal of the approach of the day of punishment."

December 31, 1894. KUMAGUSU MINAKATA.

A White Rainbow.

THE white rainbow is so rare as to deserve noting. One was visible at Westnewton, Aspatria, for more than half an hour on Saturday, January 5. The band was much broader than in the ordinary bow, and the arc was formed in the upper intermediate cloud drift. This drift consisted of a light pallium of irregular cirro cumulus. It is important to observe that cumulus was forming, from above, at the time; *i.e.* the cirro cumulus was melting and descending into ordinary cumulus. A patch of this cumulus formed (under observation) and crossed beneath the bow. It then became coterminous with the western section of the arc, which blended with the cloud, and was of similar tint. Hard, dry frost continued and lasted till January 13. Barometer steady at time.

SAMUEL BARBER.

Westnewton, Aspatria, January 9.

P.S.—Connote with the above the condition of the weather on the Continent; also violent thunderstorms on following day in Cornwall; also snowstorms in Cumberland and Scotland within few days.—S. B.

AMERICAN TOPOGRAPHY.[1]

WE have it on the authority of Prof. Gannett that, at the present rate of progress, the series of topographical maps of the United States, which was commenced in 1882, will require no less than fifty years for completion, and that the cost of this great undertaking will not fall far short of twenty million dollars. The map is primarily intended to meet the needs of the geologists of the Survey; but it has been thought economical to make such arrangements that the resulting map may be adequate to serve all purposes for which general topographic maps are used. Its scope is limited to the representation of the larger natural features, and the artificial features which are of general or public interest, to the exclusion of those which are purely of a private character, and therefore liable to rapid changes.

In the vast area covered by the United States, there is a great diversity both of natural and cultural features, and the extent of the survey and the scales of the maps

[1] "United States Geological Survey. A Manual of Topographic Methods." By Henry Gannett, Chief Topographer. (Washington: Government Printing Office, 1893.)

are varied accordingly. The scales adopted at the commencement of the work were 1 : 62,500, 1 : 125,000, and 1 : 250,000 ; or very nearly 1, 2, and 4 miles to the inch respectively. With the progress of industrial development, the maps came to be in great demand in connection with all sorts of enterprises in which the nature of the ground required consideration, as in the projection of railways, water-works, drainages, and the like. Maps on a larger scale, and showing more detail, have in many instances become necessary, so that it has been determined to altogether discontinue the four miles to the inch map, but only to make new maps of the areas already represented on this scale in cases where they are specially required. It is believed that on the scales of one and two miles to the inch, it is possible to represent with faithfulness all necessary details.

The relief of the maps is represented by contours, or lines of equal elevation ; in the larger scale maps the intervals range from 5 to 50 feet, and in the smaller ones from 10 to 100 feet, according to the nature of the area mapped. For the now discarded scale the intervals are from 200 to 250 feet.

The methods adopted in the preparation of these maps form the subject of the twenty-second monograph of the United States Geological Survey, which constitutes an excellent manual of topography. It is not intended as an elementary treatise on surveying, nor as a general treatise on topographic work, "although it may, to a certain extent, supply the existing need of such a work." It is primarily intended for the information of the men actually engaged upon the survey ; but we believe that it will have a much larger field of usefulness.

We may look upon this manual as consisting of two essential parts : first, that dealing with the methods employed in the surveys ; second, that giving a brief account of the origin of the various topographical features. The latter part we hope to refer to on another occasion, and for the present it is sufficient to say that its object is to act as a guide to correct delineation in filling in the details of the sketching.

A map, whatever its character, is defined as a sketch, corrected by locations. "The work of making locations is geometric, while that of sketching is artistic, and however numerous the locations may be, they form no part of the map itself, but serve only to correct the sketch, while the sketch supplies all the material for the map." Hence, the education of the topographer, as Prof. Gannett tells us, should consist of two parts, the mathematical and the artistic. "The first may be acquired from books, and this book knowledge must be supplemented by practice in the field. The second, if not inherited, can be acquired only by long experience in the field, and by many can be acquired only imperfectly. In fact, the sketching makes the map, and therefore, the sketching upon the Geological Survey is executed by the best topographer in the party, usually its chief, whenever practicable to do so."

In making a map, four principal operations are involved. (1) Astronomical observations for locating the map upon the earth's surface ; (2) the horizontal location of points ; (3) the measurement of heights ; (4) the sketching of the map.

With regard to the methods now employed, "it is to be understood that they are not fixed, but are subject to change and development, and that this manual describes the stage of development reached at present." Five principal instruments have been employed in the Survey : theodolites of a powerful and compact form, for use in the primary triangulation ; plane tables of the best type with telescopic alidades, for secondary triangulation and height measurements ; plane tables of simple form with sighted alidades, used for traversing and minor triangulations ; "odometers," for measuring distances ; aneroids, for the measurement of details of heights.

All these instruments are described with sufficient fulness, while other instruments, such as transits, chains, tapes, and telemeters, which are commonly figured and described in all works on surveying, receive no special attention.

A single instrument of a very convenient form suffices for the astronomical determinations of position. This is a combined transit and zenith telescope, and consists of an ordinary transit instrument provided with a zenith micrometer eye-piece, and resting on a graduated circular base in such a way that the whole instrument can be made to revolve when using it as a zenith telescope. The telescope has an aperture of two and a half inches, and a focal length of twenty-seven inches. We are not acquainted with any other instrument so convenient for the double purpose of finding latitudes and longitudes with accuracy. Examples of the observations made with the instrument are given, and these, with the various steps in the reductions, form an admirable guide to the astronomical work.

Triangulation is employed in preference to primary traversing wherever the country presents sufficient relief for the purpose, as it is more accurate and cheaper. The initial step in this process is, of course, the measurement of a base line, and in our British survey this was accomplished by Colby's compensation bars. This method of measurement was also employed in the United States up to 1887, when it was decided to adopt a system of measurement by steel tapes. The tape in use has a length of 300 feet, and it is claimed that it is easy to obtain the required degree of accuracy in a far shorter time and at much less expense. A special apparatus for using this tape has been devised, and full instructions for its use and reduction to standard are given.

The description of the base-line measurement is naturally followed by hints as to the selection of stations and the erection of signals for triangulation. A very convenient form of observing tower, or combined instrument support and signal, for use when surrounding objects have to be overlooked, is figured and described. We learn that vernier theodolites have now been discarded in favour of others in which the circles are read by micrometer microscopes, although the circles are only 8 inches in diameter. An excellent and concise account is given of the various errors to which angular measurements are liable, and of the methods of eliminating them from the final results. Some of these errors are instrumental, others personal ; and in this connection, Prof. Gannett remarks that, "after learning how to make good observations, the observer should place the utmost confidence in them, and never yield to the temptation of changing them because they disagree with some preceding observations. Such discrepancies are in general an indication of good, rather than poor, work."

In some districts it is almost impossible to carry on a triangulation, and in such cases primary traverse lines are resorted to, these simply differing from ordinary traverse lines in being more elaborately and carefully executed. These traverse lines, it may be said, consist of a series of measurements of distance and directions, and when they are intended to replace the triangulation, they are made with the steel tape, to which reference has already been made, and theodolites.

The account of the secondary triangulation is remarkable chiefly for the great prominence given to the plane table. Speaking of this, Prof. Gannett says that "much misapprehension exists, especially in this country [the United States], regarding the character and application of this instrument. This arises, apparently, from the fact that it is little known. For making a map the plane table is a universal instrument. It is applicable to all kinds of country, to all methods of work, and to all scales. For making a map it is the most simple, direct, and economic instrument ; its use renders possible the making of the

map directly from the country as copy, and renders unnecessary the making of elaborate notes, sketches, photographs, &c., which is not only more expensive, but produces inferior results." As the instrument is perhaps not widely known in our own country, we may say that it consists of a drawing-board mounted on a tripod in such a way that it can be levelled, turned in azimuth, and clamped in any position. At the centre of the board is pivoted the alidade, consisting of a ruler with a graduated bevelled edge, to which is attached a pair of sights for rough work, or a telescope for work of a higher class. A small graduated arc is provided in the better-class instrument for the measurement of vertical angles, but the horizontal directions are plotted directly, by means of the alidade, on a sheet of paper stretched on the board. The edge of the board is set in the same direction when the instrument is in use at different points in the area being mapped, and horizontal locations are thus readily determined by intersections.

The simple form of plane table is now exclusively used by the Survey for the ordinary traverse work. Distance measurements in this class of work are made in the usual way by counting the revolutions of a wheel, an "odometer" being used for this purpose.

The manual abounds in practical hints on the various points connected with surveying, and concludes with a brief account of the office work which is so important a supplement to work in the field.

The numerous appendices consist of tables to be used in the various computations, and are complete enough to include even a table of logarithms.

It is not too much to say that Prof. Gannett has produced a manual which will be of interest to many not actually engaged in surveying, while at the same time it forms a very valuable supplement to the ordinary works on the subject. A. FOWLER.

LIFE AT THE ZOO.[1]

A SIGN of the increasing interest shown by the outside world in all questions concerning life, and more especially animal life, is evidenced by the far greater number of books published every year on popular natural history.

The past year witnessed the commencement of several large works, such as the "Royal Natural History," edited by Mr. Lydekker; the republication of "Jardine's Naturalists' Library," edited by Dr. R. B. Sharpe; and the "Cambridge Natural History," of which, so far, only one volume has appeared. Besides these there have been issued a number of smaller works not extending over so wide a ground.

The present volume consists of a number of short articles on various natural history topics more or less directly connected with the Zoological Society's Gardens, illustrated with reproductions of some of Gambier Bolton's successful photographs of the animals found there. A considerable number of these sketches have already appeared before in the pages of the *Spectator*, but many chapters have been added, and the whole forms a very agreeable *repertoire* of gossip, with, in some cases, pretensions to higher things in the shape of accounts of experiments on the æsthetics of the animal world.

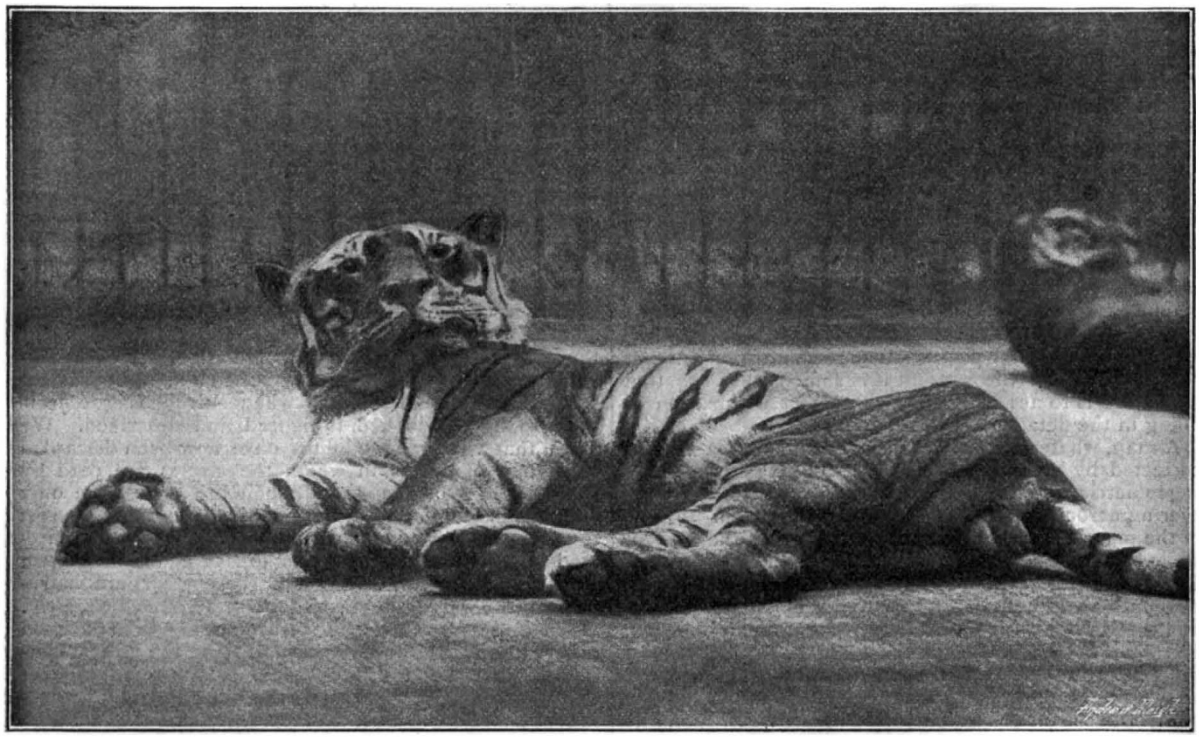

FIG. 1.—The Tiger listening to soft music.

One of the most interesting of the articles directly connected with the Zoo is that on "Elephant Life in England." The number of elephants now in Europe, chiefly in circuses and menageries, is considerable. Mr. Cornish gives it at about 120, of which England possesses about thirty-four. With some half-dozen exceptions, all these elephants belong to the Indian species, and are mostly imported from Burma, where they are bred in a half-wild state. The African elephant, according to our

[1] "Life at the Zoo. Notes and Traditions of the Regent's Park Gardens." By C. J. Cornish. 8vo. (London: Seeley and Co., 1895.)