regards raps, one must remember that as early as 1851 it was shown that these could be and were produced by voluntarily dislocating the knee-joint. Holding the knees of one of the original Fox sisters was sufficient to prevent the appearance of the raps. It will be impossible to detail the many devices to prevent fraud of which Mrs. Sidgwick availed herself; but the reading of these extends one's appreciation of the conjuring art. Perhaps the most ingenious device was that of placing the medium in a hammock connected with a spring-balance which recorded the weight of the hammock and its contents. If the medium herself personated the 'materializations,' her stepping out of the hammock would be recorded. "The seances were nearly unsuccessful until the last." In the apparently successful ones an associate was in the cabinet for a time, and broke her promise by refusing to be searched when leaving it. In short, remembering that nearly every medium who pretends to any very remarkable manifestation, has been exposed at some time of his or her career; that the conditions which they prefer are those most available for trickery; that when the conditions are rigid and unexpected, success is rare (if it ever occurs); that the kind of feats by which the spiritualists choose to prove their theories are exactly the kind which a conjurer chooses, — in view of all this, the aversion of scientific men to investigate such phenomena is largely justified. The most (perhaps the only) valuable result of this research is, as was said above, the light it throws on the psychology of belief, and, from a natural-history point of view, the willingness of a certain class of humanity to be deceived and to long and search for the philosopher's stone.

Mr. C. C. Massey contributes a paper on the possibilities of mal-observation in the evidences of spiritualism, in which he maintains that these possibilities have been greatly exaggerated, and that, if we simply take the precaution of recording one simple observation at a time, human testimony is reliable enough. Mr. Massey (who is the translator of Zöllner's 'Transcendental physics') then attempts to show, by recounting seances with notorious mediums, that reliable evidence for the existence of obscure forces exists in abundance. The former president, Mr. Sidgwick, very properly adds a note that the policy of a psychic research society, far from encouraging this not over-moral trade, should distinctly be averse to having more to do with it than is necessary.

Two papers by Mr. Frederic W. H. Myers deserve some notice. The first treats of "Human personality in the light of hypnotic suggestion," and is a very exaggerated estimate of the evidence which this condition can furnish with regard to the nature of the eye. The main idea is, that the subject almost always resists the notion that anything but his own free choice determined the suggested action, and will invent the most fanciful explanations to make an absurd action appear rational. In other words, one may even have the feeling of acting as a free agent, and yet be constrained by a foreign agent, — a fact, by the way, well known to Spinoza. The object of the second paper is to suggest that telepathy may be operative hypnotism; that a subject may be put into this condition by the will of the operator himself a quarter of a mile or more away. The evidence produced is far from satisfactory, owing, in part, to the fact that the observers who were sent to find out whether the sleep followed would themselves unconsciously furnish the suggestion. Mr. Myers then proposes a serial classification of the methods of 'hypnogeny,' beginning with such massive disturbances as cause cataplexy in animals, and gradually leading up to this new 'telepathic' hypnotism. The scheme is in part suggestive, but is premature, and adopts as proved, facts extremely uncertain and improbable. The theoretical portion of the paper is extremely disheartening; such a sentence as "that perhaps when I *attend* to a thing, or *will* a thing, I am directing upon my own nervous system actually that same force which, when I direct it on another man's nervous system, is the 'vital influence' of mesmerists, or the 'telepathic impact' of which Mr. Gurney and I have said so much," certainly smacks of anything but a scientific spirit.

Mr. Myers, Mr. Gurney, and Mr. Podmore will very shortly give a detailed statement of their psychical researches, in a two-volume book, 'Phantasms of the living,' and to this work Mr. Myers refers readers for further information.

The present writer can not refrain from asking, if all the brains, the labor, the money, and the time devoted to these investigations by our English cousins have yielded such meagre results, and have led the way to so much useless and markedly perverted thinking, whether, as long as the world has so many important questions waiting for a decision, so much good cogitative energy should be allowed to go waste.

RECENT WORKS ON TOPOGRAPHICAL SURVEYING.

THE field work of the topographer consists of two parts, which are entirely distinct in character. These are, first, the work of location, which may be done entirely by angulation, or by angulation and distance measurements. It is geometrical

work. This work of location serves only to correct the map; it forms no part of the map itself. The matter of the map is obtained by the second part of the topographer's work, that of sketching. This is artistic work. Here we come to a definition of a map from the constructive point of view. It is a sketch, corrected by locations. The more locations per square inch of the map, other things being equal, the better the map; but however numerous the locations may be, the map itself is none the less a sketch.

Locations are effected in two ways, as noted above. First, by angular measurement, starting from a carefully measured base. These measurements may be made with the theodolite or plane-table. Second, by direction and distance measurements; the former by compass, theodolite, or plane-table, the latter by chain, steel tape, odometer, or stadia. These two methods are frequently used in combination, as in the ordinary work of the U. S. coast and geodetic survey, where the plane-table stations and many unoccupied points are located by angular work, while other points are fixed in position by direction and distance, from the stations, using the plane-table and stadia for this purpose.

Among topographers of wide experience in the use of instruments and methods of work, there is no question, where the conditions are favorable, as to the advisability of using the method of location by angulation, rather than that by direction and distance measurements. It is without doubt the most rapid and the most accurate method of controlling the sketches for a topographic map. Its employment requires, however, that the country shall present some relief, that it contain an adequate number of points, natural or artificial, suitable for being 'cut in,' and that it be not too generally covered with forests, in order that a sufficient number of cleared summits, well distributed for stations, may be obtained. The primary advantage in the use of the plane-table with this method, as with all other methods, is, that the work is plotted directly upon the station, and the sketch is then made upon a correct framework, — in other words, the map is made upon the station, with the country in view. The principal disadvantage, if it be a disadvantage, is that the angles, being recorded graphically, cannot be used subsequently for a map upon a larger scale. Objections to this instrument on account of its weight and cumbrousness have no force, as the plane-table may be made very light and simple without reducing its accuracy.

The theodolite may be used, the angles recorded, and the map plotted upon the station. This combines the advantages of the plane-table and the theodolite. It requires, however, more men, more instruments, and more time devoted to work upon the station, where time is of especial value. Another method of combining the advantages of both instruments is in extensive use in the western work of the U. S. geological survey. Here a light and simple plane-table is used, in conjunction with a theodolite. The map is made upon the former instrument, while with the latter, angles for location are read upon all important points. These are subsequently plotted in the office, and the plane-table sheets corrected accordingly.

The methods of continuous location by direction and distance measurements are known generally as traverse or meander methods. They are primarily applicable to the survey of lines and not of areas. The essential feature of these methods is, that one station is located from another in continuous series. There is necessarily an accumulation of error in such a series, which may be corrected by connecting the line with points in a triangulation. All these methods are imperfect in several respects. First, they are inaccurate, because of the liability to an accumulation of error. Second, they are ill adapted to the survey of areas, inasmuch as while the line (usually a road) and its immediate neighborhood are surveyed in the greatest detail, the areas between lines of survey are, in practice, comparatively poorly surveyed, and the resulting map is unequal in quality in different parts. Third, the traverse is necessarily made upon a much larger scale than is required by the scale of the map, and so the work is more expensive than it need be. The more hilly the country, the more force there is in the second of these objections, as the lines of survey, following the roads and trails, necessarily pass through the lowest parts of the country, and, therefore, the topographer, instead of being free to select the best points for overlooking his area, is obliged to content himself with the poorest outlooks. The result is seen in meaningless hill-forms, which were evidently sketched from below in the valleys. By experienced topographers, traverse methods are avoided whenever practicable, but in flat or timbered regions it often becomes necessary to adopt them.

Of the instruments used, the plane-table is ill adapted to this work, being difficult to manipulate quickly. The chain and tape are generally discarded in the survey of areas, as being more accurate than the requirements, and proportionately slower. The odometer attached to a revolving wheel measures distances with ample accuracy for almost any scale, and, in connection with the compass, allows the most rapid work of any of these methods. Measurements of height, how-

ever, must be made by a separate instrument, — by the barometer, if great accuracy is not required, or by spirit-level, if the barometer does not meet the requirements. The stadia instrument measures distance, direction, and relative height. In this combination lies its superiority to other instruments for traverse surveying. It is not, however, as rapid, as cheap, or as accurate in its measurements as the odometer. The method is new to many surveyors, and is attractive from its novelty. Extraordinary claims are made for it in regard to accuracy, which are scarcely to be realized in practice.

Until recent years, the vertical element of topography has received little attention. If recognized at all, it has been represented qualitatively only, by means of shading, either by hachures, crayon, or brush work. The U. S. coast and geodetic survey, however, from its inception, has mapped the relief quantitatively, by means of contours, but, strange to say, has in nearly all its published maps failed to reproduce this material, but has represented relief by hachures. At present the importance of showing the relief quantitatively is becoming recognized, and most modern maps have a vertical as well as a horizontal scale, the relief being represented by contours. Although this reform is now well advanced, and although the methods of surveying the vertical element are well matured, there is still much misconception among engineers in regard to these methods. Many engineers can imagine no other way of mapping the contours of an area except that of taking up each contour and tracing it in all its convolutions. That contours can be sketched with sensible accuracy over a wide area, providing the sketch be corrected by the measurement of the heights of a dozen or more key points, they are slow to believe, and the fact that the U. S. coast and geodetic survey uses this means of locating contours, only lessens their faith in the infallibility of that organization.

Among all the treatises and text-books upon topographic surveying recently published there is not one which treats the subject in a comprehensive manner. These books, in so far as they relate to field work, discuss little besides the geometrical part of the topographer's work, — the simplest and in many respects the least important, and always the most easily learned part of his profession. The artistic part of the field work is either ignored entirely or is treated as of very little importance. This is perhaps due to the difficulty of describing the almost infinite variety of the work, as it changes with each day and with every square mile. Moreover, it is a subject which can be treated with much greater facility by means of object lessons in the field than by books. The aphorism that 'topographers are born but not made,' may have something to do with this lack of facilities for making them. Another general criticism upon these books is, that, of the various methods of location, they treat only of location by traverse, and the impression constantly conveyed to the student is, that topographic work is universally done by means of traverses. A misconception regarding the use of the plane-table appears to exist in the minds of most engineers who have written upon topographic surveying. They appear to regard the plane-table solely as a stadia instrument, and criticise it from that point of view alone. There is no method of surveying to which this instrument is not applicable, and, for most kinds of work, it is the simplest, most convenient, and most accurate instrument in use. Again, these books are very unsatisfactory regarding the construction of the vertical element of maps. The impression conveyed by the treatment of this subject is, that contours should be traced upon the ground, a method never employed upon geographical surveys, as stated above.

Another generic feature of these books which is worthy of attention is, the great number and complexity of the conventional signs which they describe. In general topographic maps it is desirable to keep the number of such symbols down to the smallest possible, consistent with the amount of information which the map should contain: first, in order that the maps may be easily read; and second, that they may be easily kept up to date. Another notable omission is, the want of consideration of the scale of maps as affecting the character of the work, — a matter which involves the degree of accuracy and of detail necessary to be obtained in the survey, and, consequently, the cost of the work. It appears to be assumed that *a survey is a survey*, which may be plotted upon a larger or a smaller scale, without any regard to the quality of the material obtained. In point of fact, there is no more important question in the economics of map-making than that of scale, and the right proportionment of the work to the adopted scale. It is in this direction, more than any other, that improvement is to be expected in the conduct of work.

Professor Haupt's 'The topographer'[1] is the most comprehensive and satisfactory of the recent manuals on topographic surveying. Still, while treating with great fulness of traverse surveying, it ignores other methods of location. It makes an attempt to treat of sketching, but without much success. The chapter upon relief, drainage systems,

[1] *The topographer, his instruments and methods.* By LEWIS M. HAUPT, A.M., C.E., Philadelphia, *Stoddart*, 1886. 8°.

etc., contains numerous erroneous statements regarding geographical laws. The book is fully illustrated with cuts and maps. Most of the latter are fairly good specimens of work, but a better example of hachure work might have been selected than the map of the Yellowstone national park, while that of the Neversink mountains near Reading, Pa., is by no means a good specimen of contour work.

Mr. Carpenter's little book[1] is essentially a description of the methods of work in use upon the U. S. geographical surveys west of the 100th meridian, in which organization his experience was obtained. It is almost unnecessary to say that it deals almost entirely with traverse methods of location.

A number of text-books have been written upon stadia surveying, and many tables for the reduction of stadia measurements have been made, most of which are theoretically faulty, but all good enough for the material to be treated. Among these are Winslow's 'Stadia surveying'[2] and Johnson's 'Topographical surveying.'[3] The former contains only the theory of the instrument, with tables for its use. It is a convenient little volume. The latter goes into the subject more fully, giving the theory, describing the instruments in ordinary use, and the routine of field and office work, together with the applications of the method to railroad, canal, ditch, and pipe-line surveys, surveys of drainage basins, and city and town sites, etc. In discussing the cost per square mile by this method it will be noticed that no reference is made to scale, a fact which necessarily makes the figures of no value. Mr. Johnson discusses the relative advantages of the use of the plane-table and the stadia instrument at some length, to the disadvantage of the former, but it will be seen that he assumes that the plane-table is used simply as a stadia instrument. His concluding objection to the plane-table, viz., that it is a very difficult instrument to learn, suggests a want of familiarity with it.

Lieutenant Reed's 'Topographical drawing and sketching'[4] relates principally to the office work upon maps. A few pages are, however, devoted to field sketching and the use of instruments, but these treat of that ruder class of surveying known as reconnoissance. A chapter is devoted to the use of photography as an aid to topographic work, an idea which is very popular with amateur topographers. That portion of the work which treats of the office preparation of maps is very full, and is excellent. The book is beautifully illustrated with plates of conventional signs and examples of existing maps.

[1] *Geographical surveying.* F. DEY. CARPENTER. New York, *Van Nostrand*, 1878. 12°.

[2] *Stadia surveying.* By ARTHUR WINSLOW. New York, *Van Nostrand*, 1884. 12°.

[3] *A manual of the theory and practice of topographical surveying by means of the transit and stadia.* By J. B. JOHNSON, C.E. New York, *Wiley*, 1885. 8°.

[4] *Topographical drawing and sketching, including applications of photography.* By Lieut. HENRY A. REED, U.S.A. New York, *Wiley*, 1886. 4°.

M. VULPIAN recently communicated to the French academy the interesting results of an experiment on brain-mutilation in a fish. The cerebral lobes were removed from a carp on March 18 last, and the fish was under daily observation up to the 29th of September, when it died from causes believed by the author to be wholly unconnected with the brain injury. During all this time its movements and respirations were normal, not differing from those of its uninjured fellows. In fact, two months after the operation, M. Vulpian could not perceive any difference in its movements and behavior from those of healthy fishes. Its sight was in no wise impaired. It saw and avoided obstacles, and readily recognized the yellow and white fragments of boiled egg on the bottom of the aquarium. It struggled actively with its fellows to obtain the small particles of food thrown into the water, seeing them from a distance, and following them as they fell. At the approach of the one feeding the fishes, it would swim from the opposite side of the aquarium, manifesting no impairment of intelligence. Its sense of taste was preserved, as shown by its rejecting non-alimentary substances accidentally taken into its mouth. The sense of smell only, was destroyed, owing to the section of the olfactory processes; otherwise it seemed to retain all the senses, and the intellectual and instinctive faculties of the normal healthy fish. Upon examination, the cerebral lobes and pineal gland were found to be entirely wanting, but the rest of the brain was intact. Although nearly six months had elapsed since the operation, there was no indication of the regeneration of the lobes. The opening in the cranium closed up in about two months, and, had the fish lived a month or two longer, the author was certain that the walls would have been wholly ossified. The experiment shows that the instinct and the will — faculties which in all higher animals seem to be located in the cerebrum — are capable of their full manifestation in the fish after its complete ablation.

— Dr. Beaulieu, in the *Economiste français*, gives the following as the quantity of tobacco consumed by each 1,000 people in Europe; in Spain, 110 pounds; Italy, 128; Great Britain, 138; Prussia, 182; Hungary, 207; France, 210; Denmark, 284; Norway, 229; Austria, 273; Germany, 336; Holland, 448; Belgium, 560.