gether the designs belonging to the same natural class, we find, of circles, both plain and with inscribed figures, 287; of squares, both plain and with inscribed figures, 236; of triangles, equilateral and otherwise, 220; of four-sided figures, 245; the sum of which four classes is 988, or nearly one-fifth of all the drawings. In other words, if a person is about to draw the first ten designs that come to his mind, it is a pretty safe prediction that two of the ten will be either a circle, a square, a triangle, or a quadrilateral.

Tabulation upon another basis reveals the fact that 2,344 diagrams were drawn exclusively with straight lines, and 1,337 diagrams with less than six straight lines; that 681 diagrams were drawn exclusively with simple curved lines, and 603 diagrams with less than six such lines. One is more than three times as apt to draw a diagram composed of straight lines than one composed of curved lines. Among the non-geometrical designs, animals, plants, and manufactured objects include by far the most frequent drawings. Men are drawn 32 times; hands, 10 times; flowers, 46 times; leaves, 45 times; and trees follow with only 14 times; houses are drawn 56 times; and the next figure under this class is 15 for books.

Furthermore, without any express implication in the request, the respondents have taken it for granted that ten different designs were wanted, and very few repetitions of designs occur. If the number of persons drawing each kind of design be tabulated, it reenforces the conclusion suggested by the original tabulation as to the limitations of the mind when acting as it does in these tests. 40 per cent of the respondents have drawn circles; 34 per cent, squares; 31 per cent, equilateral triangles; 25 per cent, crosses; 16 per cent, diamonds, etc.; and there are very few designs drawn by only one person.

What this research especially impresses is the lack of individuality in our off-hand mental products. As Dr. Minot well puts it, "We too easily forget our similarity, and forget that it stretches over trifling habits as well as over the great and little modes of thought. We feel, and for the most part willingly acknowledge, the likeness of our natures, but our sentiments and ideas we are overinclined to consider original. Such tests as the drawing of the diagrams thrust home the conviction that even in trifles we differ very little. The images and notions which pass across the consciousness of each individual are almost all common property: they are comparable to coins, — every one is a separate entity, but yet the stamp is the same. Our thoughts are in a large measure owned by the community: we are in mental matters all pure communists."

There are other questions upon which these results shed interesting light. The first is the order in which one is apt to draw, and by inference to think of, the several designs. One would suppose that the designs occurring most frequently would also be the ones first thought of. The results, however, do not reveal as close an agreement as one would expect. They show that an equilateral triangle is more apt to be found among the first diagrams than any other figure. Then come squares, then right-angled triangles, then circles, then faces not in profile, then faces with profile to the right, then diamonds, then oblongs, and so on. It is possible that the order of frequency of diagrams occurring the very first of the ten would be more in agreement with the order of general frequency. Another interesting comparison is between the designs furnished by the men and by the women. Remembering that we have nearly twice as many records of the former as of the latter, we find that men have more than their share of circles, both plain and inscribed, of rhombi, of scrawls, of men, and of right-angled triangles, while women are fonder of squares, equilateral triangles, letters, diamonds, stars, faces, flowers, and so on. "That gentlemen preponderate with hearts, and ladies with hands, perhaps may seem to many a natural consequence of our social conditions;" and other of the preferences seem to have a natural basis. That many of them must be regarded as accidental is doubtless to be admitted. The general law, however, is that there is much more repetition, and thus much less variety, among women than among men.

A few residual points should be noted. Some of these designs are undoubtedly to be traced to the existence of a "form" in the mind towards which a person may persistently tend. The "number forms" so vividly described by Mr. Francis Galton may serve as a type of such habits. When toying with a pencil in one's hand, many persons will find themselves drawing over and over again a simple figure. This accounts for some of the very peculiar drawings furnished by some of the respondents, and testimony in favor of such "forms" could easily be gathered. The individual bent, the dominant interest, the "apperception," as the psychologist would term it, serves as another clew. "A painter recalls his palette; a naturalist, his butterfly; a physician, his skull; a college student, his bicycle; in a few cases the entire ten drawings seem to be taken from "professional" suggestions. Another class of drawings seem to have their origin in the surrounding objects, being really copies of objects seen at the time; but this is a small class, and most of the images are doubtless drawn from the resources of past experience. Finally, the drawings are almost all simple in character. We draw what is easiest. This is well shown in the prevalence of faces seen in profile to the left, of left-handed spirals, and so on: for these are easier to draw, and the corresponding designs inverted towards the right; that is, easier for right-handed persons. So that these predominances indicate at once the general right-handedness of mankind, and the tendency to draw what is easiest.

The practical application of these facts tells severely against the arguments supported by the English Society for Psychical Research in favor of thought-transferrence. Dr. Minot points out that in several series of experiments reported in their "Proceedings" the position has been assumed that one kind of card, of number, of simple figure, is as likely to be thought of as another, and has estimated the improbability of the recorded coincidences accordingly. All evidence in which such an assumption is used must be looked upon with suspicion; and only when the conditions of the experiments take full and complete account of this very universal tendency for minds to run in similar grooves when dealing with simple things, will it be time to consider the evidence in favor of any abnormal form of the communication of ideas.

COMMERCIAL GEOGRAPHY.

An Agricultural Map of North America.[1]

THE climatic conditions of North America are favorable to agriculture, except in the arid regions and in the extreme north. By the uncultivable region the agricultural land is divided into two parts of unequal extent, — the narrow Pacific coast strip, and the Atlantic region. East of the Rocky Mountains three zones of agriculture may be distinguished. The most southern one is that of subtropical cultures, reaching to the 37th degree of latitude; the central one is that of the culture of corn; and in the most northern zone wheat and oats are the principal products. On the Pacific coast there is no zone of subtropical cultures, but two zones only can be distinguished, — that of wheat, and that of oats. This fact shows that there is a marked difference between the Pacific and Atlantic regions. Two-thirds of the latter are used for the culture of subtropical plants, to which class corn belongs, while these are nowhere cultivated on the Pacific slope. This contrast is caused by the difference of climate, that of the wheat districts of California and Oregon being characterized by a uniform oceanic climate, with prevailing precipitations in winter, and dry summers; while the cotton and corn regions of the Atlantic side have a continental climate, with abundant precipitation during the warm seasons. Only the oats regions on the Pacific and Atlantic sides are analogous, the climate being characterized by a low temperature of summer and sufficient precipitation.

While the dampness and heat of the Atlantic summer favor the cultivation of subtropical plants more than in any other country, the sharp contrasts of summer and winter prevent the successful cultivation of plants of the southern temperate zones, especially that of the vine, oranges, and lemons, which require a spring with slowly rising temperature and moderate precipitation.

On the accompanying map the extent of each culture has been laid down according to the results of the tenth census, the percentage of area of land occupied by each culture being inserted in a large-scale map, of which the present sketch-map is a reduction.

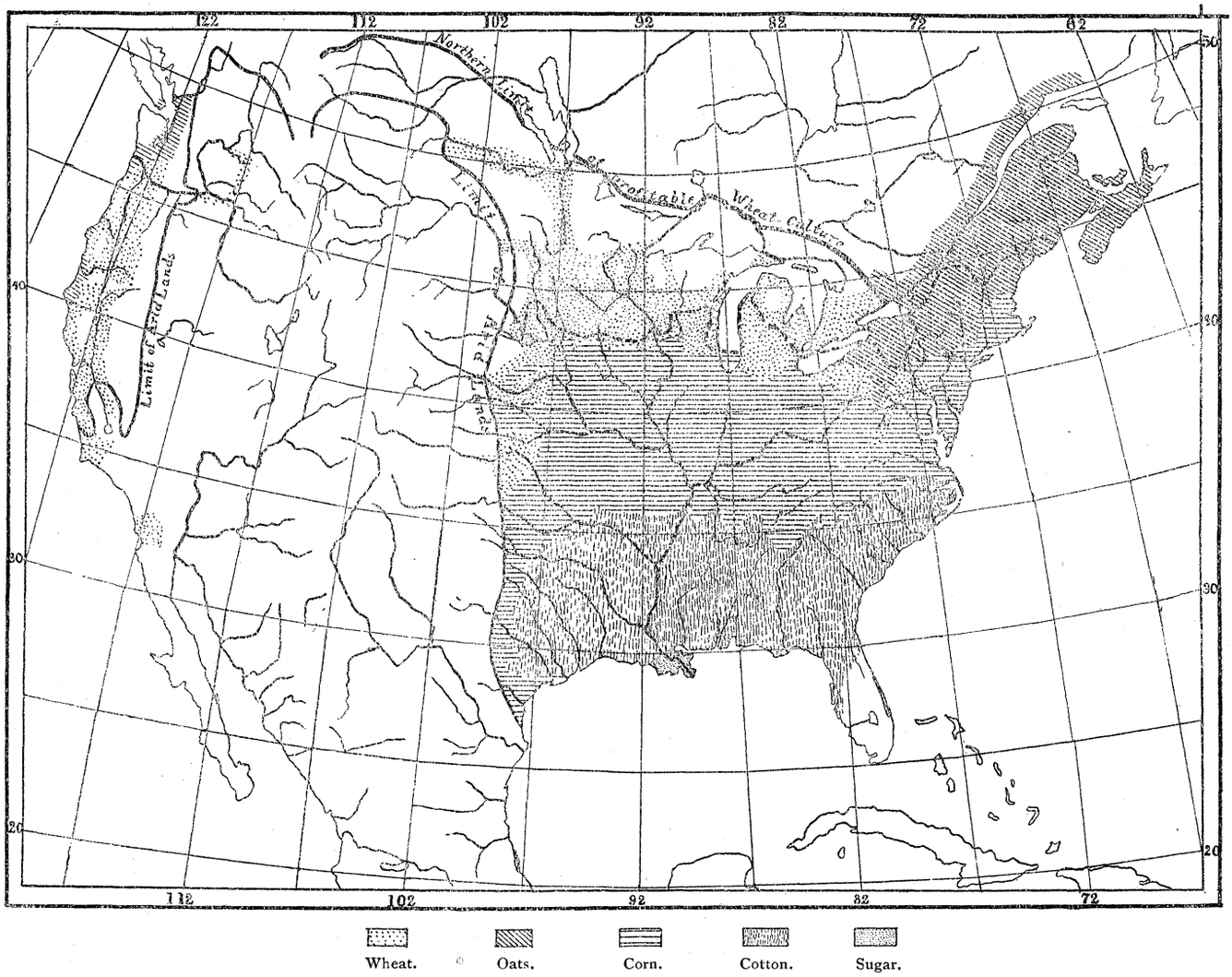
[1] According to Max Sering, Die landwirthschaftliche Konkurrenz Nordamerikas.

The area of cotton-culture has attained its present limits only after many attempts to introduce it still farther north, where early frosts prevent its being successfully carried on. At present the northern limit of cotton-culture approximately coincides with a mean January temperature of from 36° to 39° F. Even in the southern districts of cotton-cultivation, it is greatly influenced by the excessiveness of climate. While in the south of Spain the cotton-plant is a perennial, it is killed in the United States every winter by frost, and the plantations have to be renewed year by year. But the American plant exceeds, in amount and quality of its product, that of countries where the climate is more favorable to its growth. Besides cotton, corn is grown to a considerable extent; but everywhere the former is the central point of interest to the farmer, more money and labor being invested in cotton-plantations than in any other culture. It is a remarkable fact, that corn, although the climate is well adapted to its growth, does not give nearly as good and rich harvests as farther north, where the climate is not so well adapted to its growth. The same is true regarding wheat, which gives the greatest and best returns near the northern limit of its possible cultivation. In the cotton region, wheat, barley, and rye are cultivated only in dry districts, in the higher parts of the Alleghanies, and in the semi-arid region of western Texas.

Sugar-cane is not cultivated very extensively, as the cold of winter hurts the young plants. It is only in the delta of the Mississippi that it is the prevailing culture, and in the adjoining parts of Louisiana it reaches a considerable extent.

We turn to considering the second zone of the Atlantic region, that of corn. In North America corn-culture extends farther north than in any other part of the earth. In more than two-thirds of the eastern part of the United States it is the principal cereal product. Its growth is favored by the heat and the suddenness of precipitation in summer, the sky being generally clear, while rain comes down during brief thunder-storms. The northern and western limit of corn-culture is not determined by the decrease of summer temperature and of precipitation, but by the increasing frequency of early frosts in the fall, and late frosts in the spring. In the valley of the Mississippi, corn ceases to be the most important culture under the 43½ degree of latitude, where the mean temperature of July amounts to 72°.5 F. In eastern Ohio and Pennsylvania it hardly reaches the 40th degree of latitude, and in the mountains of Virginia it does not extend beyond the 37th degree of latitude; while on the coast, where there are no late frosts, it rises to the 44th degree of latitude. North of this line, early varieties of corn are still cultivated, their northern limit being indicated on our map by a broken line. North of this line oats take the place of corn. In the West the corn region does not extend nearly as far north as in the East, on account of the greater frequency of late frosts, which the young plant is unable to withstand. The irregularity of the western limit is not caused by climatic differences, but by the recent settlement of the districts.

In this region wheat is cultivated extensively, but it is everywhere second in importance to corn. In the humid, warm regions of Delaware, in Tennessee, Kentucky, Missouri, Illinois, about three-



AGRICULTURAL MAP OF THE UNITED STATES AND CANADA.

fifths of the whole region is used for corn-culture, while the northern and western limit covers those districts in which not more than one-half of the improved lands is used for this cereal. On the whole, the climate of the corn zone is not favorable to wheat, as the summers are too hot, and have too much rain. Notwithstanding this fact, the great centre of American wheat-production is situated in this region, south of the Great Lakes. It is remarkable, that, notwithstanding the great total amount of precipitation, excessive dryness in any part of the period of growth of the plant causes poor crops, long periods of clear weather being interrupted by sudden violent showers of rain. Besides this, the rapid increase of temperature in spring is not favorable to the development of wheat.

The northern zone is divided into two sections, — that of wheat, and that of oats. An important line in this region is the southern limit of summer wheat, as those countries in which only summer wheat can be grown have serious disadvantages as compared to others. As all the sowing has to be done in spring, the amount of work at this season is so great as to make the introduction of the most profitable methods of culture impossible. Owing to the severity of our winters, this line runs far more southerly than in Europe. Starting from Boston, it crosses Massachusetts, northern New York, and Ontario. It reaches the 45th parallel in Michigan, and in the prairie region descends to 38° and 39° north latitude. North of this line, only summer wheat can be grown. This region includes almost the whole arable prairie region, and the whole Dominion of Canada with the sole exception of southern Ontario. In the eastern portion this line coincides with a temperature in January of 18° F., while in the western part of the country it coincides with that of 30° F. This difference is principally founded on the difference of snowfall in those regions. While the Eastern States are covered with deep snow, the prairies have no such protection, and the dry, cold winds of winter kill the young plants.

One of the most remarkable features of the wheat area is its great extent northward in the central parts of our continent, where a clear summer favors its cultivation. The same climatic peculiarity accounts for the existence of the Genesee wheat region of central New York. Wherever the amount of precipitation in summer exceeds 50 centimetres, oats are cultivated in preference to wheat.

Finally we have to consider the Pacific coast strip. In the large valleys of California and Oregon the summers are warm, but not moist enough for the extensive cultivation of corn and cotton; while farther north the precipitation is sufficient, but the temperature too low. It is true that in a few districts of California, and also in Oregon and Washington Territory, corn is the third in importance among the cereal products; but, taken as a whole, only three per cent of the total area is applied to its cultivation. In southern California excellent crops of corn are obtained by means of irrigation.

In California and Oregon, and in that part of Washington Territory situated east of the Cascade Range, the culture of wheat is by far the most important. In California and Oregon seventy per cent of the cultivated area is used for growing wheat, a figure which is equalled only in Minnesota. The clear and dry summer favors wheat more than any other plant, a sufficient amount of humidity being retained in the ground after heavy winter rains. In southern California the cultivation of wheat requires irrigation. Second in importance is barley, which in California occupies twenty-three per cent of the cultivated area; farther north the rainfall increases, and oats take the place of barley; and still farther north barley-culture is more important than even that of wheat.

Taken as a whole, about one-half of the continent of North America is arable land, about thirty per cent belonging to the polar regions, while twenty per cent is arid land, or mountainous, rocky regions. The agricultural region includes one of the countries best adapted to the production of cotton and corn, while the climate of the same region excludes other cereals and the vine. The development of the wheat region, although very rapid, is hampered by numerous disadvantages, — severe winters, rapid increase of temperature in spring, sudden variations of temperature, late frosts in spring and early frosts in the fall, and frequent draughts impair its value, while the dryness of the early fall favors the culture. On the whole, the climate is not as favorable to the growth of wheat as that of Europe. If, notwithstanding this fact, the wheat-production of the North-west has reached the enormous importance it has actually attained, the reason must be looked for in economic more than in agricultural considerations. The rapid colonization of the prairie regions, their easy cultivation, and the great natural highways of our continent, have given it the importance it possesses at present. But it would be erroneous to believe that this development will continue, that the amount of wheat produced and exported will indefinitely increase. When the tillable land has been taken up, and no new areas of productive land are added to the old ones, the economic reasons which have made the North-west the great granary of the world will cease, and the development will take another course, yielding greater returns from the same area than are possibly attained by the present wheat-culture.

NOTES AND NEWS.

THE director of the United States Mint, in his annual report to Congress, says that the gold product of this country for the year 1888, was 1,644,927 ounces, of the value of $33,175,000. This is about the same as in 1887, being an excess of only $175,000. The silver product was 45,783,632 fine ounces, of the commercial value of about $43,000,000, and of the coining value of $59,195,000. This is an increase of 4,515,327 fine ounces over the product of 1887. In addition to the product of our own mines, some 10,000,000 ounces of silver were extracted in the United States from foreign ores and bullion, principally Mexican. The coinage of the mints during the year was as follows: gold, $31,380,808; silver dollars, $31,990,833; subsidiary silver, $1,034,773; minor, $912,201; total, $65,318,615. The import of gold bullion and coin was $11,031,941, and the export $34,619,667, a loss by export of $23,587,726. The import of silver was $21,592,062, and the export $29,895,222, a loss by export of $8,303,160. The metallic stock of the United States Jan. 1, 1889, including bullion in the mints awaiting coinage, is estimated to have been, gold, $705,061,975; silver, $403,516,756; total, $1,108,578,731.

— Dr. Chaillé, the well-known statistician, states that the average life of woman is longer than that of man, and in most parts of the United States woman's expectation of life is greater.

— A correspondent of the New Orleans *Medical and Surgical Reporter* says that petroleum-oil is almost universally used by the artisan and poorer classes in London as an illuminant, and the number of accidents which occur yearly with these lamps is very large. Mr. R. W. Brownhill has invented an ingenious prepayment gas-meter, based on the principle of the cigar, coffee, and other automatic supply-stands to be seen in every railway-station in London. It consists of a small attachment, which can be applied to any meter, and which will cause the gas to be delivered in definite quantities as paid for by pence dropped into a box. All that has to be done is to drop in a penny and pull a small handle, when sufficient gas for the supply of an ordinary burner for six hours will be delivered from the meter. Any number of pennies may be placed in the box, one at a time, up to 143, the handle being pulled after each penny, which would insure 858 hours' gas to one burner, or a shorter supply to several.

— Carl Zeiss, whose fame as a manufacturer of microscopes and microscopical lenses is world-wide, has just died at Jena, at the age of seventy-three.

— A flume fifty miles in length has just been completed at San Diego, Cal. It is intended for irrigation purposes and water-supply. The reservoir in the mountains, whence the water is supplied, is 4,500 feet above sea-level.

— Dr. O. J. Broch, at one time professor of mathematics at Christiania, and later minister of the Board of Trade in Norway, who more recently acted as director of the International Bureau of Weights and Measures at Paris, died at Sèvres, Feb. 5, at the age of seventy-one. It has been the especial duty of the bureau, over which Dr. Broch presided from its creation after the Metric Convention of 1875, to construct new standards of the metre and kilogram for the different countries which were parties to that convention. At the time of his death all these standards had been constructed, and were only awaiting final approval at Sèvres before their delivery this year to the several contracting States.