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SIGNS AND SYMBOLS.*

BY DR. ERNST SCHROEDER.

THE mathematician who is called upon to address a public assembly on a subject within his own province, is confronted with difficulties of quite a special character.

His peculiar researches move almost exclusively in domains, to penetrate in which a skillful mastery of a definite symbolic language is absolutely indispensable. Not only, therefore, does such a province always remain unintelligible to the ordinary lay person, but not infrequently it is also inaccessible, without laborious preparatory work, to many of his professional associates, who, in the present state of a wide division of labor, do not always move in related directions of research. It would, therefore, be too great a misuse of the patience of my hearers, should I select a theme from any such special province of research as is for instance that of quaternions, or ultra-elliptic functions.

There consequently remains, if any regard is to be had for the intelligibility of my dissertation, only the choice between: (1) A theme of an historical character, and (2) A theme of an elementary, or popularly philosophical character.

I have chosen for my present subject a theme of the latter kind, and one that is the most general of its class. I shall speak of the Sign. In the considerations which I here advance, I may mention that I shall have frequent occasion to introduce the expositions of the philosopher Trendelenburg.†

* A Memorial Address held in November, 1890, on the occasion of the change of the directorship of the Grand Ducal Badensian Technical High School.

† The sources of the present subject are given more in detail in the author's *Vorlesungen über die Algebra der Logik: Exakte Logik* (Leipzig, 1890-91). It was not without hesitation, that I decided to have the present dissertation printed and translated, and my reason has been, that the expositions of Trendelenburg, though, as they appeared in the work of mine just mentioned, took up by the side of the author's own researches comparatively little space, yet here in an address intended to be popularly intelligible, occupy a much greater proportion of space. The latter consideration also brought it about that I have dwelt much more at length here on the statement of the problem in question than on the advances which have been made in its solution, the explanation and further development of which is undertaken in my two-volume work. To the expositions mentioned are to be reckoned first all the historical references to Descartes and Leibnitz, then many remarks of a very general nature, especially the statements on this and the two succeeding pages and other isolated statements in the text, which generally I was unable to give prominence to by marks of citation, and which as they did

It was with the appearance of the designative or symbolising activity of the human mind that the human race first rose above the absolute zero point of civilisation, and lifted itself above the level of the animal; and it is not probable that the human mind owes to any one material thing as many advances as it does to the signs of things.

The sign, which in gesture and in sound speaks to the emotions, to the vital dispositions of the body, speaks in the word and in the sentence to the intellect, and possesses the power, in virtue of the laws of the association of ideas, to produce, in the persons who perceive or employ it, determinate pictures and images, and to arrange them in proper succession.

Intermingling, making itself identical with the image, it reacts upon thought. "We are in need of signs," says Leibnitz, "not only that we may be able to communicate our ideas to others, but also that we may be of help to ourselves in our own thinking."

By the sign, the images that would otherwise merge into one another and ultimately melt totally away, are clearly separated, and, as isolated elements, rendered a permanent acquisition to us, over which the thinking mind forever afterwards can exercise control. By means of the sign, distinctions are made, distinctions are fixed, and the distinctions fixed rendered fit for combination into new and peculiar forms. The sign is a handle by which we take hold of the things of thought. In and through the sign ideas are first dissolved from their connection with sense-impressions, to which they otherwise would cling, and enabled to lift themselves to the plane of general significance. Thought, thus, on the one hand, is made free by the sign, on the other is defined and limited by it.

This general thought, limited by the verbal symbol, and thus suppositive of a language, it is, principally, that distinguishes the human reason from the understanding of the animal. That reason and language go hand in hand in their development, and mutually con-

not literally fit in with the text, I was often obliged to change, though usually only slightly, to suit my purposes or my taste. These utterances of the great-minded philosopher appeared to me, however, as golden words, which did not deserve the fate of being buried in libraries in the third volume of a four-volume work (*Historische Beiträge zur Philosophie*), but deserve the broadest circulation.

dition each other, is a point on which the best thinkers at the present day are at one. And not improperly, has our famous countryman, Max Müller, of Oxford, so long asserted the thesis, "No language without reason—no reason without language," and made this thought the central idea of two of the largest and most popular of his great works, his "Lectures on the Science of Language," and "The Science of Thought."

Many and various are the activities and fields of skill by which man, in the efforts which have lifted him to the present stage of civilisation, has established the enormous chasm that yawns between him and the world of animals.

Though in a certain degree he possesses in common with many species of animals the architectural art, the art of constructing dwellings, though the spider spins its web, the bee constructs its honey-comb, the birds build their nests, and the beaver erects his cities, yet man alone manufactures for himself tools, instruments, and works of art. As a characteristic feature of distinction between him and animals, the art of cooking might well be cited: no animal cooks its food.

But that which goes deepest, and that which is fraught with the most far-reaching consequences, is, beyond all this, unquestionably that province of human activity which reaches its culmination in the creation of a system of *signs* for things—that is to say, in the creation of a language—and which finds its further exercise in the use and development of the same.

Not until very recent times has biology begun to devote due attention to the sensory and mental life of animals. And the first result of its doing so was the general fact that heretofore we have been too much inclined to underrate the intellect of animals. What a wonderful thing, for instance, is the ability of carrier-pigeons, to find their way back to their destinations. How it surprises us to hear that an insect is much farther advanced in the art of counting than many a Papuan negro; for a species of saw-fly, among whom the females are considerably larger than the males, regularly assign to the egg from which the larva of a male is to emerge, only five little wounded caterpillars for the nourishment of the larva, while they assign to the egg which conceals a female animal, ten such caterpillars!

Have not Darwin's careful studies with the earth-worm informed us that this low form of animal life, furnished, it is true, with a brain in the shape of a nervous ganglion, yet headless and lacking utterly any specific organ of sense, a creature whose nervous system as a whole appears to possess special sensitiveness to shocks only, nevertheless possesses geometrical judgment enough always to drag the triangular or polygonal fragments of leaves into its tube-shaped sub-

terranean passages with the end which has the smallest angle *first*,—that end presenting the least resistance,—and that it never attempts the operation unsuccessfully!

But it is particularly in the case of the colony-forming animals, like bees and ants, that we observe activities requiring so much union of effort as to make it difficult to believe that some means of mutual understanding based on a common system of signs are not present.

In some species of ants, scientists are now studying architecture, agriculture (ants eradicate grass seeds they do not like), cattle raising (they harbor plant-lice as domestic animals, and at times even build them pens), their conduct of war, and their institution of slavery.

As this last mentioned species of slavery, though not yet extinct in many civilised countries, may not be very generally known, I shall stop a moment to speak of it. In Alsace there live a species of reddish-yellow ants. These sally out at times in multitudinous hordes from their nests or ant-piles and attack the piles of some not far distant black species. Great slaughter then takes place, and when the black enemy has been dispersed, their puppæ, or young—popularly but wrongly called ant-eggs—are carried home as booty. The black ants which subsequently emerge from these puppæ are then born-slaves. They know naught else from their youth upward but that they have to serve their red masters, and they are educated and trained to minister food unto them. Imagine what is not necessary to such a task. So great, in consequence of this custom, do the ease and leisure of these slave-barons become, that they ultimately lose that most powerful of all animal instincts, the instinct of self-nourishment; as we know from the fact that they will starve to death by the very side of their favorite food unless one of their servants are present to minister it to them.

The busily swarming ants, as they pass one another by, actually seem to communicate with each other. They possess a kind of deaf and dumb language which they speak by tapping one another about the head with their feelers. "If a state," says W. Marshall, in his charming Zoölogical Essays, "exist, its citizens must have some means of understanding each other. And this holds good of ants as well as of men." It is an established fact with regard to some other species of insects, that they make known to one another their presence by means of highly pitched, buzzing sounds, which as a general rule are not perceptible to the human ear.

So much, at least, is undeniably established, that even animals have some sense for signs, and are not without intelligence.

At any rate, in and by the symbol alone, by means of which the same thought, the same purpose, one will and one soul are made possible in many, does that community of human powers exist on which the life of human beings, as a life of individuals in the midst of a great race, their culture and civilisation are founded.

This power of the spoken sign is immensely augmented in writing.

The audible sign, ephemeral as the moment, (at least it was so up to Edison's invention of the phonograph which we all still remember,) is made visible and permanent by the written word, and thus becomes the medium that unites the ideas of those who are separated by space and that makes possible the intercourse, limited it is true, of the present with nations that have long since perished and with those that are still to come.

So far as the life of man is an historical life, a life in a spiritual substance handed down and elaborated by history, in so far as the written word the organ of this constantly continued and constantly extended life and activity. The historical spirit of humanity takes its form and propagates itself in the written word.

For these reasons men have felt since its first invention the importance of writing for human life, and laws have interdicted its forgery.

For half a thousand years almost, the written sign, through the printing-press, has much increased its power of extended communication, and inventors are constantly at work at the problem of so placing written signs on small spaces in the shortest possible time and with the greatest means of multiplication as to be recognisable and distinguishable by the eye. Finally, we may mention with pride that the signs that unite humanity are now transmitted as invisible electricity from country to country, and from continent to continent, embracing in their dominion the entire earth.

The sign in speech and in writing thus has for man a significance unequalled by anything else. Inventions and discoveries, all the material acquisitions which the human mind has acquired control of, are based almost without exception upon the assumption of an intelligible and logically employed system of signs, which is the condition at the same time of the silent soliloquy of thought with itself, and of the intellectual intercourse of humanity generally; and the more we turn our glance from life generally to the provinces of intellectual activity, the more prominent a rôle do we observe the sign to assume: and its most important one in the sciences, particularly in the exact sciences.

Humanity, it is true, will always regard its present industrial and technical excellence as based almost exclusively upon coal and upon iron. From the energy of the solar rays of past millions of years, stored up by kind nature in overflowing store-houses, we derive since

more than a hundred years the blessings and innumerable benefits which the steam engine has bestowed upon us, and we now stand upon the point of passing out of the age of steam into that of electricity. Appropriate, though, as these appellations may be, it is perhaps more correct to say that our entire epoch is an age of paper—on account of its enormous production of the material that is the vehicle of the sign which subserves the purposes of thought.

It is certainly worth one's while to bestow profound reflection upon an object which has proved itself in so extensive a degree a blessing to humanity. The ancients were aware of this, as for instance the writing of the Epicurean Philodemus bears witness by its title *Περὶ σημείων καὶ σημειωσέων* (On signs and on things to be supplied with signs). (Compare Bahnsch, Lyck, 1879.) The same point of view also repeatedly appears in the writings of later thinkers, as in Von Holland's treatise on mathematics, "The Universal Art of Symbols and the Different Characters of the Rules of Computation," as in Lambert's "New Organon, or Ideas Concerning the Investigation and Designation of the Truth," etc. According to the celebrated utterance of Gustav Kirchhoff, the extension of which from mechanics as the science of motion, to other sciences is immediate, it is the business of that branch of inquiry "to describe the motions that take place in nature exhaustively and in the simplest possible manner"; in which statement there is a direct and implied reference to the fact that it is of prime and essential importance to acquire a symbolic language which shall render such *simplest* "description" possible.

As a general rule, however, we must say, that even, in the sciences it is customary to devote rather too little conscious attention to the element of *designation* as such, to the tool, the instrument and means of our description of reality and of our representation of the truth; and what is more, that as a general thing the care that is justly its due can scarcely ever be fully given to it.

As I pass on now to devote to the sign as such some more profound considerations, the necessity presents itself, in view of the shortness of the time at my disposal, of restricting this somewhat too widely extended task, and I beg, therefore, to be permitted hastily to touch upon a few things which I must exclude from consideration.

It is not my intention here to enter upon the history of the numeral signs or of the literal characters of the many hundreds of languages which the earth knows, or upon the phonic and verbal symbols of the East Asiatic tongues, upon the successful deciphering of the hieroglyphics, or upon the runes which in dim prehistoric times our Germanic forefathers cut into the bark of trees. Nor shall the language of the deaf

and dumb occupy us, nor the signs in which the congenitally deaf, dumb, and blind have been taught to read the Bible, nor the signs of telegraphy, nor international codes of signals; nor the marks of money, the stamps of the mercantile postal intercourse and general traffic of the world, nor the insignia of apparel, nor the emblems of heraldry and numismatics.

Still less is it my intention to study the sign in its effects upon the human emotions and imagination. The sign as "symbol" or allegory, as metaphor, simile, or myth, as the object of worship or of religious cult, belongs to æsthetics. The famous æsthetician who wrote the "Third Part" of Goethe's *Faust* under the pseudonym—characteristic of the general bent and view of this production—of "Deutobold, Symbolizetti, Allegoriowitsch, Mystifizinski," Vischer, supplied us, shortly before his death, with an ingenious study of this theme. The multiplicity of the forms in which human superstition has associated itself with the sign, with the amulets, with the exorcisms and charms of medieval magic, would alone form an inexhaustible theme, would alone fill a tremendous chapter in the pathology of the human intellect, and in the history, by no means yet concluded, of the illusions and hallucinations of the human mind.

I shall limit my task to the consideration of the sign in so far only as it is designed to serve exclusively intellectual purposes, in so far only as it appears to be fitted to promote human aims of knowledge—but shall not do this for any one special sign, but generally.

In this, however, we shall follow the sign from the most elementary duties which fell to its lot to the very highest functions which it has ever performed.

(TO BE CONTINUED.)

CURRENT TOPICS.

In a late number of *The Open Court*, I spoke in hopeful praise about the Parliament of all Religions appointed to meet next year in the city of Chicago under the direction of "The World's Congress Auxiliary of The World's Columbian Exposition," a solemn and imposing attachment compelling reverence by the size and sound of its name. I am sorry to say that my hopes are blighted, for the Parliament of all Religions promises to be a failure. This being "Dedication" week, the pulpit theme last Sunday in most of the Chicago churches was Columbus, and the contradictory sects pelted one another with him in a combative spirit that forebodes disaster to the Parliament of all Religions. An event purely natural and human was conjured into a theological miracle, and it was made religiously evident that Columbus came over in a supernatural ship. On this point the vote was unanimous, but there was an acrimonious dispute about the sectarian character of the cargo, some asserting that it was Catholic, and others vehemently declaring that it was Protestant; an idle controversy, frivolous as a claim that the grass is Presbyterian, and the breezes Methodist. "The discovery was purely a Catholic idea," said Father Dore, "nurtured and carried out by Catholics." This was poetically, but not historically contradicted by Bishop Fallows when he reminded the Catholics that "although Columbus found America, Protestants created this new continent." It seems like

an act of presumption for an Israelite to thrust himself into the debate, as if it were a free for all fight, but Dr. Hirsch did it, and ideally perceiving in the cabin with Columbus the future civilisation of America, he triumphantly proclaimed that "The constitution of the United States embodies the principles sounded from the housetops by the ancient Hebrews," a boast that I fear will never be allowed a hearing in the Parliament of all Religions.

* * *

Although the theology of Dr. Hirsch contained all the orthodox mistakes that ought to be required of any man, he and his people were thrust out and denied any religious part or share in the domain discovered by Columbus. Although with dogmatic fervor he declared that "Columbus was the direct agent of God," and that "the 12th of October, 1492, was a providential turning in the life of man," he was rudely answered that the Jew was not within the providential plan. "It was one of God's plans," declared the Rev. Mr. Gunsaulus, "that America should be discovered only by him on whose banner was the great emblem of Christianity"; and Bishop Cheney of the Episcopal church, proclaimed *ex cathedra* that "There would be in the coming Exposition only what had been born of Christianity, nourished by Christianity, and pushed to its development by Christianity," shutting out of the World's Fair, and out of the Parliament of all Religions, with one imperious decree, Confucius, Buddha, Mahomet, Moses, and the prophets. This was the speech of nearly every Protestant pulpit in Chicago, but it was all reduced to vulgar fractions and worldly mathematics by the Rev. Father Cashman who gave this very business-like explanation of the enterprise. "It was because of his intense Catholic faith that he set forth on his mission of discovery. He had heard of India and the great wealth of that country. He was fired with the idea of driving the Turks out of the holy land. This task needed money for its accomplishment, and Columbus set forth to get it with the pure heart and heroic determination of a crusader." The mission here confessed by Father Cashman is almost piracy, and yet there is more truth in what he says than in any of the hysterical rhapsodies of men who pretend to see in the exploit of Columbus the band of God revealing a new continent, a land literally flowing with milk and honey, for the use of Christians only.

* * *

Several months ago I wrote, "Wise is the man who reads but one side"; and yet, with a full knowledge of the consequences, I persist in the folly of reading both sides, as I did this morning, and here is the deplorable result. Describing the conduct of the police at the dedication parade yesterday, the *Herald* said that "Its distinguishing feature was a brutality such as never before was witnessed in Chicago. Women, men, and even children were unmercifully clubbed; and in almost every case the action of the police was accompanied by a torrent of shocking abuse and obscenity." A column or so of detail follows, and we are informed that "the work of breaking heads began early in the day and continued until the great pageant had passed into history." Some parts of the story are too shocking to describe, but the *Herald* is quite circumstantial enough to be contradicted if they are not true. According to that paper the cruel assaults made by the police on women provoked the Vice-president of the United States to say to Mr. Secretary Foster, "That is shameful." If the story is true we must allow a heavy discount on the greatness of Chicago; but how am I to believe it when I read in the *News-Record* that the police of Chicago "nobly and faithfully rose to the emergency," and that "from all quarters comes praise of the work done by the police in handling the hundreds of thousands of people who were massed along the line of march." Then come tributes to their "tactical force," their "careful energy," and their "unruffled temper." The *News-Record* then "congratulates the police force on the honors it won yesterday." Thus, again, by reading both sides I am left in a state of painful uncertainty as to the truth of either

The Duke of Wellington said on one occasion that there was hardly a general in the British army who knew enough or had nerve enough to get a corps of twenty-five thousand men out of Hyde Park, London. He meant, of course, without confusion, according to tactics, and in a military way. Major General Miles appears to have had misgivings about his own ability to get twenty-five thousand soldiers out of Hyde Park, Chicago, or even into it, in any military style, so he prudently determined not to try. He therefore allowed the troops to get into the park and out of it in their own way. This was not military style, but it was the safest plan for him. It was characteristic of the Fuss and Feathers Department of the Government to send several thousand soldiers to Chicago to take part in the great Columbian parade, and then keep them out of it altogether. Major General Miles was most appropriately appointed by the Circumlocution office to show the World's Fair management "how not to do it." Men who have seen armies of a hundred thousand, or two-hundred thousand men marching through Berlin, Paris, or even through the crooked narrow streets of London will laugh at American generals who dare not march one simple army corps through the wide and rectangular streets of Chicago. What will the old veterans who tramped across a continent carrying musket, knapsack, haversack, blanket, canteen, and forty rounds, say of the American soldiers of to-day who cannot march a few miles on the level pavements of a city without "fatigue"? If the intention was to show the incongruity of soldiers in a civic parade celebrating the achievements of industry and the promise of international peace, then the general did well in keeping the professional warriors altogether away from a procession of the people.

* * *

Not long ago the London *Times* in a rather patronising way contrasted our brick and mortar greatness with our intellectual poverty, regretting in a plaintive wail that Chicago had not yet given to the world "even one conspicuous man of letters." The reproach was washed away last night by the flood of poetry and eloquence contributed by Chicago genius to the banquet of the Fellowship club, at whose tables, in the Chicagonese dialect of the reporter, was assembled "the greatest gathering of distinguished men which ever sat around a single banquet board." Chicago genius had an inspiring theatre of display; the Vice-president of the United States was there, and an ex-president, cabinet ministers, generals, the Chief Justice of the United States, and several of the judges, a cardinal and several bishops, senators, ambassadors from foreign courts, and no less than twenty-five governors, or "chief executives," as the barbarous phrase is. Before that goodly company literary Chicago appeared at its best, excelling ordinary talent as the terra cotta "banner with a strange device" excels in taste and splendor the star spangled banner of the nation. The poet laureate of the city contributed a song that thrilled the company with enthusiasm. There were three verses in it, and every verse melted gracefully into this melodious chorus:

Hurrah! Hurrah! The button has been pressed,
Hurrah! Hurrah! Chicago'll do the rest;
She's modest, she's retiring, but she'll do her level best
While we are honoring Columbus

The historian of the banquet calls that inspiring lyric a "gem," which it certainly is. In order to give a classic tone to the banquet, although it really made it look more like a barbecue, a roasted deer was carried round the hall by four men, "while a chorus lilted the hunting song from 'As you like it'; a very good song in its way, but Shakespeare's effort was as dull as a bit of wood when compared with our own Chicago "gem."

* * *

The oratory was equal to the poetry, sparkling as Amontillado, genial as Fellowship punch, and fragrant with the aroma of Mumm's Extra Dry. It is wonderful that anything by the name

of Mumm can stimulate a man to eloquence, but that was the effect of it upon the Mayor of Chicago. The liquid inspiration was so delicious and so exciting that he could speak of nothing else. Gazing fondly on the wine bubbles in his glass, with eloquent praise he said, "We look into its cloudless depths and forget its dregs of yesterday. We salute it with our lips, and the to-morrows become brighter for that kiss." This beautiful tribute to the nectar warmed the company up to an ecstasy that lasted until the headache in the morning. Prone to moralise, as we all are after the third or fourth bottle, the Mayor said: "We, too, are gathered from many bill-boards; the press, which has removed and cast aside the dregs and passions of our daily lives, is fellowship, friendship, love." Melted into philanthropy, he figuratively embraced the whole human race, and gave a certificate of good character to every man at the banquet, saying, "I am sure that we are all bettered for this night, and shall go away feeling that humanity is not entirely bad." The admission that humanity is not "entirely" bad was a great condescension in the Mayor of Chicago, but after looking over the bill of fare as it was printed in the papers, I cannot see how any man could have the run of that for a whole night, wines included, and then think that humanity could ever be bad at all. Then, unable still to get away from the wine, he compared humanity to "the grape whose shell and pulp and seeds contain a pure and sparkling essence." At last, fearful that the tippable would go to waste, of which there was no danger, he said "Let us drink this wine, for it reflects our better selves; let us drink this wine to that fellowship that shares our triumphs without one envious pang. Let us drink this wine to a mutual fellowship, which shall continue until we know the great unknown." What will the London *Times* think of us now?

M. M. TRUMBULL.

CHRISTOPHER COLUMBUS.

General Trumbull's remarks concerning the claims of the different confessions on Columbus, suggest to us the idea of publishing an impartial statement of the historical facts of the life of the great discoverer. Columbus was undoubtedly a deeply religious man, and it is more than probable that in many respects he shared with his contemporaries the narrowness of the religious views of his time. But one thing is certain, and that is that he stood high above the average minds of his century in his never-failing trust in science. This trust in the soul of a man of iron energy and unflinching courage made the discovery of the new world possible.

We here extract from the "Encyclopædia Britannica" the events of his life up to the moment he achieved his great success:

"Christopher Columbus (1436-1506) was the eldest son of Dominico Colombo and Suzanna Fontanarossa, and was born at Genoa in 1435 or 1436, the exact date being uncertain. His father was a wool-comber, of some small means, who was yet living two years after the discovery of the West Indies, and who removed his business from Genoa to Savona in 1469. His eldest boy was sent to the university of Pavia, where he devoted himself to the mathematical and natural sciences, and where he probably received instruction in nautical astronomy from Antonio da Terzagio and Stefano di Faenza. On his removal from the university it appears that he worked for some months at his father's trade; but on reaching his fifteenth year he made his choice of life, and became a sailor.

"Of his apprenticeship, and the first years of his career, no records exist. The whole of his earlier life, indeed, is dubious and conjectural, founded as it is on the half dozen dark and evasive chapters devoted by Fernando, his son and biographer, to the first half century of his father's times. It seems certain, however, that these unknown years were stormy, laborious, and eventful; 'wherever ship has sailed,' he writes, 'there have I journeyed.' He is known, among other places, to have visited England, 'Ultima Thule' (Iceland), the Guinea coast, and the Greek Isles; and he appears to have been some time in the service of René of Provence, the

for whom he is recorded to have intercepted and seized a Venetian galley with great bravery and audacity. According to his son, too, he sailed with Colombo el Mozo, a bold sea captain and privateer; and a sea fight under this commander was the means of bringing him ashore in Portugal. Meanwhile, however, he was preparing himself for greater achievements by reading and meditating on the works of Ptolemy and Marinus, of Nearchus and Pliny, the 'Cosmographia' of Cardinal Aliaco, the travels of Marco Polo and Mandeville. He mastered all the sciences essential to his calling, learned to draw charts and construct spheres, and thus fitted himself to become a consummate practical seaman and navigator.

"In 1470 he arrived at Lisbon, after being wrecked in a sea fight that began off Cape St. Vincent, and escaping to land on a plank. In Portugal he married Felipa Munnis Perestrello, daughter of a captain in the service of Prince Henry, called the Navigator, one of the early colonists and the first governor of Porto Santo, an island off Madeira. Columbus visited the island, and employed his time in making maps and charts for a livelihood, while he pored over the logs and papers of his deceased father-in-law, and talked with old seamen of their voyages, and of the mystery of the western seas. About this time, too, he seems to have arrived at the conclusion that much of the world remained undiscovered, and step by step to have conceived that design of reaching Asia by sailing west which was to result in the discovery of America. In 1474 we find him expounding his views to Paolo Toscanelli, the Florentine physician and cosmographer, and receiving the heartiest encouragement.

"These views he supported with three different arguments, derived from natural reasons, from the theories of geographers, and from the reports and traditions of mariners. 'He believed the world to be a sphere,' says Helps; 'he under-estimated its size; he over-estimated the size of the Asiatic continent. The farther that continent extended to the east, the nearer it came round towards Spain.' And he had but to turn from the marvellous propositions of Mandeville and Aliaco to become the recipient of confidences more marvellous still. The air was full of rumors, and the weird imaginings of many generations of mediæval navigators had taken shape and substance, and appeared bodily to men's eyes. Martín Vicente, a Portuguese pilot, had found, 400 leagues to the westward of Cape St. Vincent, and after a westerly gale of many days' duration, a piece of strange wood, wrought, but not with iron; Pedro Correa, his own brother-in-law, had seen another such waif at Porto Santo, with great canes capable of holding four quarts of wine between joint and joint, and had heard of two men being washed up at Flores, 'very broad-faced, and differing in aspect from Christians.' West of the Azores now and then there hove in sight the mysterious islands of St. Brandam; and 200 leagues west of the Canaries lay somewhere the lost island of the Seven Cities, that two valiant Genoese had vainly endeavored to discover. In his northern journey, too, some vague and formless traditions may have reached his ear, of the voyages of Biorn and Leif, and of the pleasant coasts of Helleland and Vinland that lay towards the setting sun. All were hints and rumors to bid the bold mariner sail westward, and this he at length determined to do.

"The concurrence of some state or sovereign, however, was necessary for the success of this design. The Senate of Genoa had the honor to receive the first offer, and the responsibility of refusing it. Rejected by his native city, the projector turned next to John II. of Portugal. This king had already an open field for discovery and enterprise along the African coast; but he listened to the Genoese, and referred him to a Committee of Council for Geographical Affairs. The council's report was altogether adverse; but the king, who was yet inclined to favor the theory of Columbus, assented to the suggestion of the bishop of Ceuta that the plan should be carried out in secret and without Columbus's knowledge by means of a caravel or light frigate. The caravel was dispatched, but it re-

turned after a brief absence, the sailors having lost heart, and having refused to venture farther. Upon discovering this dishonorable transaction Columbus felt so outraged and indignant that he sent off his brother Bartholomew to England with letters for Henry VII., to whom he had communicated his ideas. He himself left Lisbon for Spain (1484), taking with him his son Diego, the only issue of his marriage with Felipa Munnis, who was by this time dead. He departed secretly,—according to some writers, to give the slip to King John, according to others, to escape his creditors. Three years after (20th March 1488) a letter was sent by the king to 'Christopher Colon, our especial friend,' inviting him to return, and assuring him against arrest and proceedings of any kind; but it was then too late.

"Columbus next betook himself to the south of Spain, and seems to have proposed his plan first to the duke of Medina Sidonia (who was at first attracted by it, but finally threw it up as visionary and impracticable), and next to the duke of Medina Celi. The latter gave him great encouragement, entertained him for two years, and even determined to furnish him with the three or four caravels. Finally, however, being deterred by the consideration that the enterprise was too vast for a subject, he turned his guest from the determination he had come to of making instant application at the court of France, by writing on his behalf to queen Isabella; and Columbus repaired to the court at Cordova at her bidding.

"It was an ill moment for the navigator's fortune. Castile and Leon were in the thick of that struggle which resulted in the final defeat of the Moors; and neither Ferdinand nor Isabella had time to listen. The adventurer was indeed kindly received; he was handed over to the care of Alonso de Quintanilla, whom he speedily converted into an enthusiastic supporter of his theory. He made many other friends, and here met with Beatriz Enriquez, the mother of his second son Fernando.

"From Cordova Columbus followed the court to Salamanca, where he was introduced to the notice of the grand cardinal, Pedro Gonzalez de Mendoza, 'the third king of Spain.' The cardinal, while approving the project, thought that it savored strongly of heterodoxy; but an interview with the projector brought him over, and through his influence Columbus at last got audience of the king. The matter was finally referred, however, to Fernando de Talavera, who in 1487 summoned a junta of astronomers and cosmographers to confer with Columbus, and examine his design and the arguments by which he supported it. The Dominicans of San Estebán in Salamanca entertained Columbus during the conference. The jurors, who were most of them ecclesiastics, were by no means unprejudiced, nor were they disposed to abandon their pretensions to knowledge without a struggle. Columbus argued his point, but was overwhelmed with Biblical texts, with quotations from the great divines, with theological objections; and in a short time the junta was adjourned. In 1489 Columbus, who had been following the court from place to place (billeted in towns as an officer of the king's, and gratified from time to time with sums of money toward his expenses), was present at the siege of Malaga. In 1490 the junta decided that his project was vain and impracticable, and that it did not become their highnesses to have anything to do with it; and this was confirmed, with some reservation, by their highnesses themselves, at Seville.

Columbus was now in despair. He at once betook himself to Huelva, where his brother-in-law resided, with the intention of taking ship for France. He halted, however, at Palos, a little maritime town in Andalusia. At the monastery of La Rabida he knocked and asked for bread and water for his boy Diego, and presently got into conversation with Juan Perez de Marchena, the guardian, who invited him to take up his quarters in the monastery, and introduced him to Garcí Fernandez, a physician and an ardent student of geography. To these good men did Columbus propound his theory and explain his plan. Juan Perez had been the queen's confessor;

he wrote to her, and was summoned to her presence; and money was sent to Columbus, to bring him once more to court. He reached Granada in time to witness the surrender of the city; and negotiations were resumed. Columbus believed in his mission, and stood out for high terms; he asked the rank of Admiral at once, the viceroyalty of all he should discover, and a tenth of all the gain, by conquest or by trade. These conditions were rejected, and the negotiations were again interrupted. An interview with Mendoza appears to have followed; but nothing came of it, and in January 1492 Columbus actually set out for France. At length, however, on the entreaty of Luis de Santangel, receiver of the ecclesiastical revenues of the crown of Aragon, Isabella was induced to determine on the expedition. A messenger was sent after Columbus, and overtook him at the Bridge of Pines, about two leagues from Granada. He returned to the camp of Santa Fé; and on 17th April 1492, the agreement between him and their Catholic majesties was signed and sealed.

"His aims were nothing less than the discovery of the marvellous province of Cipango and the conversion to Christianity of the Grand Khan, to whom he received a royal letter of introduction. The town of Palos was ordered to find him two ships, and these were soon placed at his disposal. But no crews could be got together, in spite of the indemnity offered to all criminals and broken men who would serve on the expedition; and had not Juan Perez succeeded in interesting Martin Alonso Pinzon and Vicente Yanez Pinzon in the cause, Columbus's departure had been long delayed. At last, however, men, ships, and stores were ready. The expedition consisted of the 'Santa Maria,' a decked ship, with a crew of 50 men, commanded by the Admiral in person; and of two caravels, the 'Pinta,' with 30 men, under Martin Pinzon, and the 'Nina,' with 24 men, under his brother Vicente Yanez, afterwards (1499) the first to cross the line in the American Atlantic. The adventurers numbered 120 souls; and on Friday, 3d August, 1492, at eight in the morning, the little fleet weighed anchor, and stood out for the Canary Islands.

"An abstract of the Admiral's diary made by the Bishop, Las Casas is yet extant; and from it many particulars may be gleaned concerning this first voyage. Three days after the ships had set sail the 'Pinta' lost her rudder; the Admiral was in some alarm, but comforted himself with the reflection that Martin Pinzon was energetic and ready-witted; they had, however, to put in (August 9) at Tenerife, to refit the caravel. On 6th September they weighed anchor once more with all haste, Columbus having been informed that three Portuguese caravels were on the look-out for him. On 13th September the variations of the magnetic needle were for the first time observed; on the 15th a wonderful meteor fell into the sea at four or five leagues distance. On the 16th they arrived at those vast plains of seaweed called the Sargasso Sea; and thenceforward, writes the Admiral, they had most temperate breezes, the sweetness of the mornings being most delightful, the weather like an Andalusian April, and only the song of the nightingale wanting. On the 17th the men began to murmur; they were frightened by the strange phenomena of the variations of the compass, but the explanation Columbus gave restored their tranquillity. On the 18th they saw many birds, and a great ridge of low-lying cloud; and they expected to see land. On the 20th they saw two pelicans, and were sure the land must be near. In this, however, they were disappointed, and the men began to be afraid and discontented; and thenceforth Columbus, who was keeping all the while a double reckoning, one for the crew and one for himself, had great difficulty in restraining the men from the excesses which they meditated. On the 25th Alonso Pinzon raised the cry of land, but it proved a false alarm; as did the rumor to the same effect of the 7th October, when the 'Nina' hoisted a flag and fired a gun. On the 11th the 'Pinta' fished up a cane, a log of wood, a stick wrought with iron, and a board, and the 'Nina' sighted a stake covered with dog-

roses; and with these signs all of them breathed, and were glad. At ten o'clock on that night Columbus perceived and pointed out a light ahead; and at two in the morning of Friday, the 12th of October, 1492, Rodrigo de Triana, a sailor aboard the 'Nina,' announced the appearance of what proved to be the New World. The land sighted was an island, called by the Indians Guanahani, and named by Columbus San Salvador.

"The same morning Columbus landed, richly clad, and bearing the royal banner of Spain. He was accompanied by the brothers Pinzon, bearing banners of the Green Cross, a device of his own, and by great part of the crew. When they all had 'given thanks to God, kneeling upon the shore, and kissed the ground with tears of joy, for the great mercy received,' the Admiral named the island, and took solemn possession of it for their Catholic majesties of Castile and Leon. At the same time such of the crews as had shown themselves doubtful and mutinous sought his pardon weeping, and prostrated themselves at his feet."

Concerning Columbus's personality we read further on:

"In person Columbus was tall and shapely, long-faced and aquiline, white-eyed and auburn-haired, and beautifully complexioned. At thirty his hair was quite grey. He was temperate in eating, drinking, and dress; and 'so strict in religious matters, that for fasting and saying all the divine office, he might be thought professed in some religious order.' His piety, as his son has noted, was earnest and unwavering; it entered into and colored alike his action and his speech; he tries his pen in a Latin distich of prayer; his signature is a mystical pietistic device. He was pre-eminently fitted for the task he created for himself. Through deceit and opprobrium and disdain he pushed on towards the consummation of his desire; and when the hour for action came the man was not found wanting."

The advice of the Bishop of Ceuta was undoubtedly a contemptible act, but the failure of the Portuguese sailors who had been dispatched to steal the ideas of Columbus and to cheat him out of the fruits of his project, show the courageous discoverer to the greater advantage.

Faith in science is a moral quality. Hirelings have no idea of the religious holiness of science. How can we expect of them the courage to carry out a great work, the success of which rested almost exclusively upon the trustworthiness of inferences that could only be drawn from positively observed facts according to strictly scientific methods.

Columbus, whatever were his views concerning the saints of the Church and the magic powers of ecclesiastical ceremonies; was a man who had unbounded trust in science, and to this trust we owe the discovery of the new world that ought to bear his name.

CORRESPONDENCE.

THE CRITIC OF ARGUMENTS.

To the Editor of The Open Court:

UNDER the above heading, in your issue of October 13, '92, Mr. Charles S. Peirce unfairly scores a work entitled "Astronomy Without Mathematics." He styles the work "a melancholy book," and disparages it in strong language, beginning with the title which he stigmatises as the "initial lie." His assumption of authority is probably based on the acknowledged evidence that in advanced astronomy, mathematics is emphatically indispensable. However it does not follow that the writer of "Astronomy Without Mathematics," has not written an interesting as well as valuable treatise on the subject, and one calculated to meet a long felt want. It is not expected that a work with this title will equal the requirements of first class astronomers, but is rather adapted for elementary students, or, better still, for that fortunately growing class in all modernised countries; a class, which, aside from daily duties,

has a tendency towards the accumulation of a fund of general information. To these souls (and I am one of them), a work filled with the intricacies relating from figures, is not only incomprehensible but often abso. ly oppressive and distasteful.

A map of the heavens, or as it has been improperly called, geography of the heavens, if studied and compared, becomes a promoter of pleasure even when unaccompanied by remarks. It is far more instructive and useful to the average citizen, than a book of incomprehensible figures, the vastness of which stupefies us. Computations of eclipses by college students, and which they forget after graduation, in ninety-nine cases in each hundred, cannot afford the pleasure to our later life that the lasting knowledge does that we are familiar with the pole star, dog star, and Orion, which were pointed out to us in our childhood by our parents. It is well for all to know that Mars is outside and Venus within the earth's orbit, while it is obviously unnecessary for those not specially devoted to the science, to burden the brain with stupendous figures of distances between the planets; figures too, which it is safe to say, are not exact.

As I comprehend it, the word "critic," in the above heading, means *an art, like logic*, and is devoted to methods of reasoning. If this is so, then it is but fair to admit, even in criticising, that a work or person qualified to instruct those minds not capable of understanding higher flights, is amply worthy of respect, and in thus meeting these requirements, really fills a distinct niche in our onward educational march.

It is essential that a thorough physicist should know the exact proportion, both as to volume and weight of the components of atmospheric air; still it is pleasing to learn that a simple child can name the elements of the air we breathe. The day has passed when the initiatory learning of a vast list of scientific names with an accompanying prosy classification, constitutes a naturalist. The observant youth with preliminary scientific training, may learn many facts in zoölogy or other branches of natural history, unknown to the so-called closet naturalist or self-satisfied pedagogue. This is emphatically an age of research and study, and the same motive which inspires it, also agreeably fosters the popularising of the sciences with the masses.

It may seem that I am interested in the book "Astronomy Without Mathematics," but this interest is evident only as far as a respect for the title goes, as I assure the readers that I have never seen the work. It occurs to me, as it must appear to others, that the author, a Fellow of the Royal Astronomical Society, could not descend from his elevated plane to a greater advantage and in a better cause, than in simplifying the noble science of Astronomy that we might profit. To simplify the subject and bring it within the range of the masses is grand. To create a thirst for study of the heavens is most commendable, for the deepest feelings of reverence cannot fail to be called forth. We are all astronomers then to a certain extent, when interested in the stars, and surely, deep-seated devotion is the result. Young truthfully says:

"An undevout astronomer is mad."

The Open Court, as a very sensible heading, has these words: "Devoted to the Work of Conciliating Religion with Science." I would ask if there is a simpler way of reaching your aim, than by securing to the masses comprehensive works on our leading sciences.

MORRIS GIBBS.

NOTES.

The *Century* Magazine will take up the Bible and Science controversy. In the November *Century*, Professor Charles W. Shields, of Princeton, answers the question "Does the Bible contain Scientific Errors?" with an emphatic *no*. He says: "Literary and textual obscurities there may be upon the surface of Holy Writ, like spots upon the sun, or rather like motes in the eye; but scien-

tific error in its divine purport would be the sun itself extinguished at noon. Such a Bible could not live in this epoch."

Professor Shields's article will be followed by one in the December *Century* on "The Effect of Scientific Study upon Religious Beliefs."

The three-page poem by John G. Whittier, which will appear in the November *St. Nicholas* Magazine, commemorates the visit of a party of young girls to the poet's home. It contains the following lines, which have a peculiar significance now that the good Quaker poet has passed away:

"I would not if I could repeat
A life which still is good and sweet;
I keep in age, as in my prime,
A not uncheerful step with time,
And, grateful for all blessings sent,
I go the common way, content
To make no new experiment.
On easy terms with law and fate,
For what must be I calmly wait,
And trust the path I cannot see,—
That God is good sufficeth me.
And when at last upon life's play
The curtain falls, I only pray
That hope may lose itself in truth,
And age in Heaven's immortal youth,
And all our loves and longing prove
The foretaste of diviner love!"

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