

THE PROPENSITY TOWARD THE MAR- VELLOUS.¹

BY PROF. ERNST MACH.

ALL incitation to inquiry is born of the novel, the uncommon, and the imperfectly understood. Ordinary events, to which we are accustomed, take place almost unnoticed; novel events alone catch the eye and solicit the attention. It happens thus that the propensity toward the marvellous, which is a universal attribute of mankind, is of immense import also for the development of science. It is the *striking* forms and colors of plants and animals, the *startling* chemical and physical phenomena, that arrest our notice in youth. Afterwards the craving for *enlightenment* is gradually aroused, as we compare these unwonted events with the events of familiar and daily occurrence.

The beginnings of all physical science were intimately associated with magic. Hero of Alexandria makes use of his knowledge of the expansion of air by heat to perform conjuring tricks; Porta describes his beautiful optical discoveries in a work entitled *Natural Magic*; Athanasius Kircher turns his physical knowledge to account in the construction of a *magic lantern*; and in the *Mathematical Recreations* of the day and in such works as Enslin's *Thaumaturgus*, the sole purpose for which the more phenomenal facts of physics were employed was that of dazzling the uninitiated. With the fascination intrinsically exerted by phenomenal events was naturally associated in the case of the person first discovering them the temptation *to acquire greater prestige by keeping them secret*, to produce extraordinary effects by their assistance, to derive profit from their practice, to gain increased power, or at least the semblance of the same. Some slight successful venture of this kind may then have kindled the imagination and awakened hopes of at-

¹ Translated from the *Wärmelehre* by T. J. McCormack.

taining some altogether extraordinary goal, resulting in the deception not only of others but perhaps also of the person himself. In this manner, for example, from the observation of some astonishing and inexplicable transformation of matter, may have originated alchemy, with its desire to transmute metals into gold, to discover a panacea, etc. The felicitous solution of some innocent geometrical problem is the probable foundation of the geomancy of the *Arabian Nights*, which divines futurity by means of numbers, as it was probably also of astrology, etc. That *Malefici* and *Mathematici* were once mentioned in the same breath by a Roman law, is also intelligible on this theory.¹ Even in the dark days of mediæval demonology and witchcraft, natural inquiry was not extinguished; on the contrary, it appears to have been invested then with a distinct charm of mystery and wondrousness, and to have become imbued with new life.

The mere happening of an extraordinary event is in itself not marvellous; the marvel is to be sought, not in the event, but in the person observing the event. A phenomenon appears marvellous when one's entire mode of thought is disturbed by it and forced out of its customary and familiar channels. The astonished spectator does not believe for a moment that *no* connexion exists between the new event and other phenomena; but, not being able to discern a connexion, and being invariably accustomed to such, he is led, in the nature of the case, to adopt extraordinary conjectures, which are usually fallacious. The character of these conjectures may be infinitely varied, but inasmuch as the psychical organisation of mankind, conformably to the universal conditions of life, is everywhere pretty much the same, and since young individuals and races, whose psychical organisation is of the simplest type, are most frequently thrown into situations productive of surprise, almost the same psychological phenomena are repeated the world over.

Auguste Comte² first touched upon the phenomena here referred to, and Tylor³ subsequently made a very thorough study of them, utilising the vast material which the ethnology of the savage races afforded. The most phenomenal constant occurrences in the natural environment of the savage, are those of which he himself or his fellow-creatures are the authors. He is conscious of

¹ Hankel, *Geschichte der Mathematik*. Leipsic, 1874. Page 301.

² Comte, *Philosophie positive*, Paris, 1852.

³ Tylor, *Primitive Cultur*, two volumes, London and New York.

will power and muscular force in his own person, and is tempted thus to interpret every unusual phenomenon as the creation of the will of some creature like himself. His limited capacity to distinguish sharply his thoughts, moods, and even his dreams, from his perceptions, leads him to regard the images of absent or deceased companions appearing in his dreams, or even those of lost or ruined objects, as real phantom entities, as *souls*. Out of the worship of the dead which here took its being has sprung the worship of demons, of national deities, etc. The conception of sacrifice, which is utterly unintelligible in modern religion, finds its explanation here as the logical evolutionary outgrowth of the funeral sacrifice. Savages are wont to bury with the dead the objects which their phantoms have most desired in their dreams, that the shades of the one may take pleasure in the company of the shades of the other. This disposition to consider all things as like ourselves, as animated and ensouled, is in the same manner transferred to useful or injurious objects generally and leads to *fetishism*. There is a strain of fetishism even in the theories of physics. So long as we consider heat, electricity, and magnetism as mysterious and impalpable entities residing in bodies and imparting to them their known wonderful properties, we still stand on the level of fetishism. True, we invest these entities with a more stable character and do not attribute to them the capricious behavior which we deem possible in the case of living beings; but the point of view indicated is not entirely discarded until exact investigation by means of metrical concepts has taken the place of the fetishistic views.

The failure to distinguish sharply between one's thoughts and feelings and the perceptions of sense, which is noticeable even in scientific theories to-day, plays a predominant rôle in the philosophy of youthful individuals and nations. Things that appear alike in the least respect are taken to be kindred in character and to be closely allied also in *physical efficacy*. Plants that exhibit the slightest similarity with any part of the human body are held to be remedies for corresponding local disorders. The heart of the lion is supposed to augment courage, the phallus of the ass to be a cure for impotence, etc. Ample corroboration of these facts is afforded by the old Egyptian medical papyruses, the prescriptions of which are found in Pliny and even as late as Paulinus. Things that are desirable but difficult to obtain are sought after by the most fantastic possible combinations of ingredients, as is amply demonstrated by the recipes of the alchemists. One need but recall one's

childhood to appreciate from personal experience this manner of thinking.

The intellectual deportment of the savage is similar throughout to that of the child. The one strikes the fetish that has deluded him, the other strikes the table that has hurt him; both talk to trees as they would to persons; both believe it possible to climb to heaven by high trees. The phantom world of fairy tales and the world of reality are not sharply distinguished for them. We know this condition from childhood. If we will but reflect that the children of all ages are invariably disposed to harbor thoughts of this character, that a goodly portion even of highly civilised peoples possesses no genuine intellectual culture but only the outward semblance of the same, that furthermore there always exist men who derive profit from fostering the lingering relics of the views of primitive mankind, and that entire sciences of deception even have been created for their preservation, we shall clearly understand why these habits of thought have not yet died out. We may read, indeed, in Petronius's *Symposium of Trimalchio* and in Lucian's *Liars' Friend* the same blood-curdling stories that are told to-day; and the belief in witchcraft now prevalent in Central Africa is not a whit different from that which pestered our forefathers. The same ideas, slightly modified, are also found in modern spiritualism.

From manifestations of life in every respect similar to those of which we ourselves are the authors, the stupendous, significant, and wonderfully *adaptive* inference of an *alter ego* analogous to our own ego is drawn. But as is the case with all thoroughly adaptive habits, this inference is likewise drawn where the premises do not justify it. True, the phenomena of the inorganic world do in a measure run parallel with the phenomena of the organic world; yet, owing to their simpler conditions, they are subject to laws of a far more elementary character. Something similar to will is doubtless existent there also, but the train of reasoning which invests trees and stones with all the attributes of human personality appears at our stage of civilisation unfounded. Even the critically trained intellect infers the agency of an *alter ego* in spiritualistic séances, but it is the ego of the performing mountebank and not that of a spirit.

Darwin¹ has abundantly shown that habits which were originally adaptive continue to exist even where they are useless and indifferent. And there can be no doubt that they also continue to exist where they are even injurious, provided they do not bring

¹ *The Expression of the Emotions.*

about the extinction of the species. The habits of thought above discussed are all based, in their elements, upon adaptive psychical functions, however monstrous they may have become in their subsequent development. Yet no one would think of saying that the human species has been preserved or even bettered by the human sacrifices of Dahomey or by the rival persecutions of witches and heretics inaugurated by the Church. It has simply not perished through these maleficent practices.

Should any one be prone to think that the foregoing discussions are supererogatory for a scientific public, he is mistaken; for science is never severed from the life of the every-day world. It is the blossom of the latter, and is permeated with its ideas. When a chemist who has achieved fame by his beautiful discoveries in his science espouses spiritualism; when a noted physicist does the same; when a renowned inquirer in the domain of biology, after expounding to us in cogent manner the grandeur of the Darwinian theory, closes with the statement that the doctrines he has set forth are applicable only to the organic world but not to the spiritual; when this same inquirer openly professes spiritualism; when prominent psychiatrists show themselves disposed upon the slightest pretext to attribute extraordinary nerve-power to every female mountebank;—it is certain that the intellectual malady of which I have here been speaking is very deeply seated, and that not alone in the minds of the non-scientific public. The malady appears in the majority of cases to spring from a biassed intellectual culture and from a lack of philosophical training. In this event it may be eradicated by a study of the works of Tylor, which exhibit the psychological origin of the views under consideration in a very lucid manner, and so render them susceptible of critical scrutiny. But the situation is not infrequently different. An inquirer elevates his view of the fitful play of the atoms, which serves good purposes in limited domains, to the rank of a world conception. Is it to be wondered at then that his conception seems to him so barren, insipid, and inadequate as to render it possible for spiritualism to satisfy his intellectual, or rather sentimental, cravings?

A few personal observations, which are instructive enough to make public, will show how great the demand for marvels is with some scientists.

I was once in the university town of X, when several distinguished inquirers, whom we shall call A, B, and C, were seized with the spiritualistic craze. The event was to me a psychological problem solely, and I resolved to take a nearer look at the situa-

tion. At the head of the group stood A, whom I had known for a long time. He received me kindly and showed me the wonderful results of his communion with the spirits, expatiating also enthusiastically and picturesquely on the happenings in the séances. In reply to my question as to whether he had really examined closely into all the things described, he answered: "Well, the fact is that I did not myself look into everything so closely, but you must remember that careful observers like C and D," etc. C in his turn said: "I should not have been so much convinced by what I saw myself, but you must remember that accurate observers like A and D were present, who subjected the performances to the most searching scrutiny," etc., etc. I believe we are justified in drawing no other inference from this vicious circle than that any kind of miracle could have counted upon a sympathetic reception from the members of this circle.

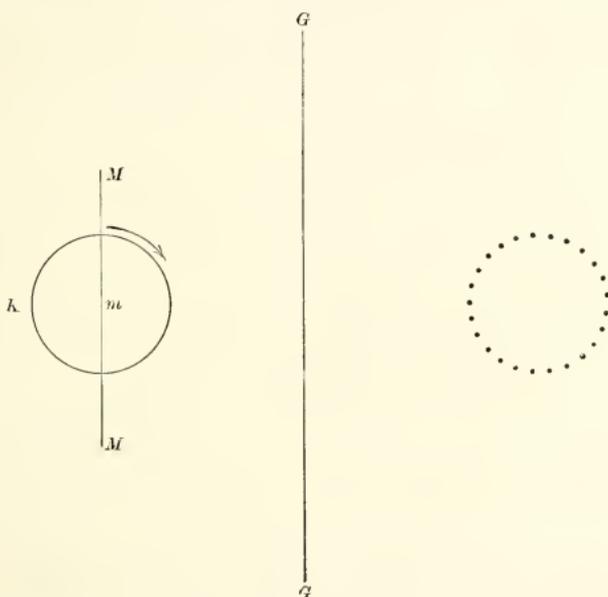
The chief curiosity which A showed me was an ivory ring which could be slipped upon the leg of a round center-table by a conjuring trick only; provided of course the top of the table were not removable. That the top of this table could be easily removed I surmised from its appearance, and imparted my suspicion to another acquaintance of mine in the same town, remarking that with his pronounced predilection for the marvellous A had undoubtedly never once thought of investigating whether such was really the case. Years later, after A's death, I met a friend of his; the subject accidentally came up in our conversation, and I was informed that while the celebrated table was being removed after A's death the leg fell off and the top remained in the hands of the movers.

Let the circle K of the annexed figure be pictured as performing a revolution in space about the axis GG , situated in the same plane with it, and conceive the ring thus described to be composed of vulcanised rubber. Then imagine a knife, MM , thrust through the ring, and conceive a point m of the blade to be carried in a circle round GG as axis, whilst at the same time the blade performs a complete rotation about m , say in the direction of the arrow. In this way, the ring will be cut into two component rings, locked within each other. Simony¹ describes this beautiful geometric and substantially topologic fact along with numerous others of kindred character. I once showed it to an acquaintance of mine, a professor of mechanics, who perceived at once that the two rings could not be separated without tearing them asunder. Now, I am a me-

¹ Simony, *In ein ringförmiges, geschlossenes Band einen Knoten zu machen*, Vienna, Gerold third edition, 1881.

dium, I said, and concealing the two rings for a moment behind my back, I placed them separate and intact upon the table. I shall never forget my friend's amazement. All I had done was boldly and undisguisedly to exchange the locked rings for a pair of detached rings which I had in my pocket. The latter are readily obtained from the operation indicated above by first turning the blade of the knife one-half a revolution about m in one direction and then one-half a revolution in the opposite direction. The two pairs of rings are sufficiently alike to be easily confounded.

I wanted to show my friend how easy it was to be deceived, but his *penchant* for mysticism was not to be eradicated by my



efforts. As a devotee of homeopathy he found a corroboration of his views in the discovery that the merest vestiges of sulphuric acid were sufficient for effecting the electrolysis of water, whereas pure water did not permit of electrolysis. He claimed to have been cured once of a serious affection of the lungs by *natrium muriaticum* (table salt) in minute doses, diluted in the ratio of 1 to 100,000. The remark that the accidental variations in the saline constituents of the food which he ate must have been many thousand times greater than the doses of his physician, could not shake his opinion, which he doubtless carried with him to the grave.

There was once on exhibition in a certain city a girl who had been struck by lightning, and who in consequence of the stroke

ever afterwards gave forth electric sparks. She was not confined to one spot, but was free to move about at will. An old gentleman, Mr. S., an able professional man, was disposed to take the matter seriously, to the undisguised gratification of the proprietor of the show, who must have chuckled gleefully to himself, and inwardly repeated the adage, *difficile est satyram non scribere*. Mr. S. persuaded me to go and see the curiosity. I recognised the sparks as those of a small Ruhmkorff coil, but was unable to discover the connexions, despite the fact that I had brought along with me a cane covered with a strip of tinfoil. My machinist, however, who was a versatile conjurer, lighted upon the secret of the device after a brief autopsy, and an hour later exhibited to the old gentleman his own son similarly affected. The old gentleman was delighted, but when shown the simple contrivance by which the trick had been effected, he cried out: "No, that was not the way it was done!" and disappeared.

Of the common run of spiritualistic séances I will say nothing here. They afford abundant opportunity for observing the ingenuousness of the so-called "educated" public with its insatiable thirst for miracles, as well as the artfulness, sagacity, and knowledge of human nature displayed by the mountebanks. I, for my part, have always felt on such occasions as if I had been transported among savages, in the very heart of Europe.

The tricks of the spiritualists have been repeatedly imitated by prestidigitateurs and sceptics; and the methods have been revealed by which they can be performed. Many mediums have been exposed and have been found guilty of resorting to the tricks of the prestidigitateur. The psychological principles by which the prestidigitateur proceeds¹ are very simple. The psychological habit of regarding things which are at all alike as identical is turned to frequent account here, as in the rapid interchange of similar objects, or where the conjurer assuming an expression of deepest sincerity, *appears* to perform movements which he does not perform, but which are believed to have been performed. A second method is that of concentrating the attention upon a time or place where apparently the event of greatest importance is taking place, whilst in reality that event is being enacted at a different time and a different place. An excellent example of the effectiveness of this method is afforded by the well-known question: "Which is correct, 7 and 9 are 15, or 7 and 9 is 15?" The person addressed, having his at-

¹ See Max Dessoir, *The Psychology of Legerdemain*, in *The Open Court*, Nos. 291-295, 1893.

tention diverted to the grammatical form of the sentence, seldom notices the arithmetical error, at first impulse.

But explanations of this character have no weight with devotees. The tricks which conjurers perform by natural methods are performed for them by spirits, by supernatural methods. Newton's rules of admitting only true causes for the explanation of phenomena, of not assuming more causes than are necessary for explanation, of explaining like phenomena everywhere by like causes, appear to be unknown to these people. On the other hand, many persons to whom spiritualism is instinctively repulsive or who stand in fear of its practical consequences, do not always assume the correct attitude. They frequently characterise spiritualism as a "superstitious belief" and recommend as a preventive against it "the true belief." But who is to decide which belief really is true? If such a decision were possible, it would be wrong to speak of *belief*; we should then rather have to speak of *knowledge*. History arouses our apprehensions here. For as compared with the atrocities with which the extravagant outbreaks of the various "true beliefs" have in times past beatified us, the consequences of spiritualism are, by virtue of their private character, the merest pleasantries. It would be inadvisable accordingly to drive out the Devil by the hand of Beelzebub. The preferable course would seem to be to regard that alone as true and acceptable from a scientific point of view which admits of demonstrative proof, and to entertain in practical life and in science only such suppositions as may lay claim to a high degree of probability from the point of view of sound and sober criticism.

The fallacy of that wide-spread movement of modern thought which fosters spiritualism along with many other intellectual aberrations does not consist of the undue attention which it devotes to *extraordinary phenomena per se*, for these the natural inquirer, even more than any other, may not neglect. Indeed, it is almost invariably extraordinary phenomena like the attraction of light particles by rubbed amber, the adherence of iron filings to certain ores, that lead in their subsequent development to results of greatest significance. The fallacy is also not to be looked for in the belief that our knowledge of nature is not exhaustive and definitive. No natural inquirer will imagine for a moment that new discoveries of great import are impossible, that new and undreamed-of relations between the facts of nature may not still be revealed. The error of these people lies rather in their *reckless and uncritical pursuit of miracles as such*, and in the childish and unthinking delight which

they take in contemplating them and which is productive invariably of chronic insensibility to what is genuinely marvellous and worthy of investigation.

Do not far greater marvels encompass us in reality than the pseudo-miracles that the spiritualists offer? They can lift themselves upon a chair in the dark, but we are able, in broad daylight, before the eyes of all, and by means known to all, to raise ourselves thousands of yards into the air. We can speak with a friend many miles distant the same as we can with a person at our side, and this by the aid of a spirit who does not capriciously conceal himself or act the miser with his powers, but who has freely revealed to us those powers and placed them at our disposal. A three-cornered piece of glass enables us to determine the composition of objects millions of miles away. By means of a few magic formulæ, which are concealed from no man, our engineers discover how a waterfall can be compelled to illuminate our town, by what means steam can be made to draw our burdens, how mountains can be tunneled and valleys bridged. A talisman of heavy metal in my pocket, which every man can acquire by labor, gains for me, by a phenomenal understanding on the part of spirits, everywhere in the world a kindly reception. Even when alone in my own study, I am still not alone. Spirits still stand ready at my beck. A problem perplexes me; I reach out now for this and now for that volume, and suddenly I observe that I have taken counsel of the dead. Galileo, Newton, and Euler have aided me. I too can call up the spirits of the dead. And when I rouse to life again in my own person some great thought of Newton, or develop that thought to remoter consequences, then I have called up the spirits of the dead in a far different fashion from the spiritualists, who can extract from their ghosts the expression of nonsensical commonplaces only.

Are not these far more stupendous miracles—miracles which have actually transformed the world? But they have their drawbacks. Their working is fraught with far more toil than is the making of one's hair stand on end in a darkened room; and it is certainly far less alluring, since, by the common belief, anyone has a chance of becoming a medium.

But the mere taking note of what is extraordinary is not the sole factor by which our knowledge of nature is advanced. There is requisite, in addition, the resolution of the extraordinary into the ordinary, the elimination of the miraculous. The two operations, however, need not be combined in any one person or in any

one period. The alchemists, while proceeding altogether uncritically, made some remarkable observations, which subsequently were put to good use. And the possibility is also not excluded that the modern inquirers into miracle-working may unearth some valuable results. Attention has again been called by this movement of thought to the almost forgotten arts of hypnosis and suggestion; why should not something more of that character and perhaps of greater moment be brought to light?

Of real observations and results there can of course be no question, so long as this domain, which requires the nicest critical discernment for its exploration, remains the *rendezvous* of credulous and uncritical minds. One is confronted every day with the results that are forthcoming when people are determined to see only what is remarkable, and care naught for criticism. I once visited while a student Baron von Reichenbach, the famous investigator of od. According to his frank confession he himself saw absolutely nothing of the wonderful phenomena which he so minutely described, but obtained his information altogether from the persons upon whom he was experimenting. One of these persons, Frau Ruf, confessed to Fechner after Reichenbach's death that the statements of her experiences had been wheedled from her by cross-examination. I gained an ineradicable impression of Reichenbach's method from the following experiment: Passing a ray of light through a piece of Iceland spar, he split it into two parts, each of which was directed into a glass of water; the water of one of these glasses became in this manner od-positive and that of the other od-negative; but it seems never to have occurred to him that the od-positive water would have been changed into od-negative by simple rotation through 90° .

We will not be disposed to condemn the "method" of the spiritualists too severely, if we compare it with the method employed by many psycho-pathologists and neuro-pathologists. When we are told by a physician that a person has been made by suggestion to see an elephant upon a piece of blank paper, we believe it; but when we are told that the same person picked out the same piece of paper from a packet of similar empty sheets, and saw the elephant upon this sheet only, and saw it inverted when the sheet was accidentally inverted, saw it magnified through an opera glass, and reduced in size when the opera glass was inverted,—then this scientific statement taxes rather too severely our credulity. Why not rather say everything is possible, and give up all further investigation as unnecessary?

Constant appeals to our ignorance and to the incompleteness of our knowledge, which is denied by no genuine inquirer, are indeed characteristic of the methods of the professional miracle-seekers or occultists. But the conjectures which may be built upon our ignorance are infinitely numerous, while those which are built upon our knowledge are as a rule but few. The latter are accordingly alone qualified to serve as starting-points for further investigation. Whereas the miracle-seekers see in the incompleteness of our knowledge the possibility and necessity of an extraordinary and phenomenal extension of the same, the obscurantists both within and without science base upon this incompleteness their claims for casting doubt upon the actual results which have been already obtained. How often have we been obliged to hear that the Darwinian theory is still nothing more than a hypothesis, to the demonstration of which much is still lacking, and this from people who would fill up the gaps of science with the relics of mysticism which they have carried with them from their childhood days and which for them it would seem is no hypothesis. The result of this procedure is in both cases the same, the substitution of chimerical illusions for sound, productive knowledge.

The *observation* of singularities in nature does not alone constitute science; the elimination of them is also a factor in its composition. So long as a person sees a miracle in the saving of power accomplished by the lever, so long as he regards it as an exception, and deceiving both himself and others sets to work to construct a perpetual-motion machine on its principles,—that person still stands upon the level of the alchemist. Not until he has perceived with Stevinus that the “marvel is no marvel” has he made a real scientific advance. In the place of intellectual intoxication now comes the delight which springs from logical order and from the intellectual resolution of what is apparently heterogeneous and manifold. The propensity to mysticism appears frequently with unmistakable distinctness even in the exact sciences. Many a bizarre theory owes its origin to this propensity. Even the principle of energy is not without a mystical coloring in some of its conceptions. And, to take a commoner instance, with what satisfaction are not people often heard to remark upon the marvels which we can accomplish with electricity, without ever knowing what electricity really is? What else, pray, can electricity be than the totality of the facts in question, all of which we know and of which, as Popper¹ has aptly said, we hope to know still more? This state of affairs may afford some apology for our having placed the propensity to mysticism in so drastic a light here.

¹ *Die Grundsätze der elektrischen Kraftübertragung.* Vienna, Hartleben.