

PUBLISHED
MONTHLY

SULLY (yes)
SUBSCRIPTION PRICE
\$1.75 PER YEAR

No. 56.

PRICE 15 CENTS

JUNE 1884

THE HUMBOLDT LIBRARY OF SCIENCE

ILLUSIONS A PSYCHOLOGICAL STUDY

BY

JAMES SULLY

PART I

NEW YORK
THE HUMBOLDT PUBLISHING COMPANY
19 ASTOR PLACE

*The Greatest Book of the Century. Thousands of Copies
ordered every Week.*

EVERY ONE SHOULD READ
LOOKING BACKWARD.

By EDWARD BELLAMY.

In paper covers, 50 cents; in cloth covers, \$1.

"Bellamy's wonderful book."—EDWARD EVERETT HALE.

"It is a revelation and an evangel."—FRANCES E. WILLARD.

"A romance of surpassing merit and noble purpose."—EDGAR FAWCETT.

"The vital, inspiring, convincing power of this book."—*Literary World*.

"Intensely interesting, and more than interesting."—*Golden Rule, Boston*.

"That remarkable and fascinating novel which so many are now reading."—E. C. STEDMAN, in
The Critic.

"A marvelous story, combined with social philosophy and a forecast of the millennium."—*Portland
Transcript*.

"That astonishing book, 'Looking Backward,' how it haunts one, like a grown-up 'Alice in Wonderland.' The mind follows entranced."—*Gazette, Boston*.

"It has made a deeper and more lasting impression than any other book of the year, not even excepting the two great theological novels."—*Boston Herald*.

"'Looking Backward' is the 'Uncle Tom's Cabin' of the industrial slavery of to-day—a noble dream admirably wrought out."—JAMES JEFFREY ROCHE.

"The extraordinary effect which Mr. Bellamy's romance has had with the public; . . . one cannot deny the charms of the author's art; . . . his alluring allegory."—W. D. HOWELLS.

"The most wonderful book of the nineteenth century. This is the best of the many good ones written to make the people think. But 'Looking Backward' inspires hope as well as thought."—*The Examiner*.

"Its satire, and its intense feeling for the wronged and suffering of the present day, make the reader think seriously. The appeal is always made to a man's reason, and to his noblest sentiments—never to his selfishness."—*Boston Post*.

"It is a thought-breeding book, and all who are studying the problems of the age, all who believe in progress, all who are free to receive new light upon the capacities and possibilities of the race, will find in Mr. Bellamy's exceedingly clever book satisfaction and inspiration."—*New York Tribune*.

"'Looking Backward' is a well-made book, but it is more—a glowing prophecy and a gospel of peace. He who reads it expecting merely to be entertained, must, we should think, find himself unexpectedly haunted by visions of a golden age wherein all the world unites to do the world's work like members of one family, where labor and living are provided for each man, where toil and leisure alternate in happy proportions, where want and therefore greed and jealousy are unknown, where the pleasures of this world are free to all, to cheer but not enslave."—*The Nation, New York*.

We will mail this book to any Post Office address in the WORLD at above prices.

Address:

THE HUMBOLDT PUBLISHING CO.

LIBRARY
SURGEON GENERAL'S OFFICE

OCT -7 1899

ILLUSIONS:

A PSYCHOLOGICAL STUDY.

By JAMES SULLY,

AUTHOR OF "SENSATION AND INTUITION," "PESSIMISM," ETC.

IN TWO PARTS.—PART FIRST.

PREFACE.

THE present volume takes a wide survey of the field of error, embracing in its view not only the illusions of sense dealt with in treatises on physiological optics, etc., but also other errors familiarly known as illusions, and resembling the former in their structure and mode of origin. I have throughout endeavored to keep to a strictly scientific treatment, that is to say, the description and classification of acknowledged errors, and the explanation of these by a reference to their psychical and physical conditions. At the same time, I was not able, at the close of my exposition, to avoid pointing out how the psychology leads on to the philosophy of the subject. Some of the chapters were first roughly sketched out in articles published in magazines and reviews; but these have been not only greatly enlarged, but, to a considerable extent, rewritten.

Hampstead, April, 1881.

J. S.

CHAPTER I.

THE STUDY OF ILLUSION.

COMMON sense, knowing nothing of fine distinctions, is wont to draw a sharp line between the region of illusion and that of sane intelligence. To be the victim of an illusion is, in the popular judgment, to be excluded from the category of rational men. The term at once calls up images of stunted figures with ill-developed brains, half-witted

creatures, hardly distinguishable from the admittedly insane. And this way of thinking of illusion and its subjects is strengthened by one of the characteristic sentiments of our age. The nineteenth century intelligence plumes itself on having got at the bottom of mediæval visions and church miracles, and it is wont to commiserate the feeble minds that are still subject to these self-deceptions.

According to this view, illusion is something essentially abnormal and allied to insanity. And it would seem to follow that its nature and origin can be best studied by those whose speciality it is to observe the phenomena of abnormal life. Scientific procedure has in the main conformed to this distinction of common sense. The phenomena of illusion have ordinarily been investigated by alienists, that is to say, physicians who are brought face to face with their most striking forms in the mentally deranged.

While there are very good reasons for this treatment of illusion as a branch of mental pathology, it is by no means certain it can be a complete and exhaustive one. Notwithstanding the flattering supposition of common sense, that illusion is essentially an incident in abnormal life, the careful observer knows well enough that the case is far otherwise.

There is, indeed, a view of our race diametrically opposed to the flattering opinion referred to above, namely, the humiliating judgment that all men habitually err, or that illusion is to be regarded as the natural condition of mortals. This idea has found expression, not only in the cynical exclamation of the misanthropist that most men are fools, but also in the cry of despair that sometimes

breaks from the weary searcher after absolute truth, and from the poet when impressed with the unreality of his early ideals.

Without adopting this very disparaging opinion of the intellectual condition of mankind, we must recognize the fact that most men are sometimes liable to illusion. Hardly anybody is always consistently sober and rational in his perceptions and beliefs. A momentary fatigue of the nerves, a little mental excitement, a relaxation of the effort of attention by which we continually take our bearings with respect to the real world about us, will produce just the same kind of confusion of reality and phantasm which we observe in the insane. To give but an example: the play of fancy which leads to a detection of animal and other forms in clouds, is known to be an occupation of the insane, and is rightly made use of by Shakespeare as a mark of incipient mental aberration in Hamlet; and yet this very same occupation is quite natural to children, and to imaginative adults when they choose to throw the reins on the neck of their phantasy. Our luminous circle of rational perception is surrounded by a misty penumbra of illusion. Common sense itself may be said to admit this, since the greatest stickler for the enlightenment of our age will be found in practice to accuse most of his acquaintance at some time or another of falling into illusion.

If illusion thus has its roots in ordinary mental life, the study of it would seem to belong to the physiology as much as to the pathology of mind. We may even go further, and say that in the analysis and explanation of illusion the psychologist may be expected to do more than the physician. If, on the one hand, the latter has the great privilege of observing the phenomena in their highest intensity, on the other hand, the former has the advantage of being familiar with the normal intellectual process which all illusion simulates or caricatures. To this it must be added that the physician is naturally disposed to look at illusion mainly, if not exclusively, on its practical side, that is, as a concomitant and symptom of cerebral disease, which it is needful to be able to recognize. The psychologist has a different interest in the subject, being especially concerned to understand the mental antecedents of illusion and its relation to accurate perception and belief. It is pretty evident, indeed, that the phenomena of illusion form a region common to the psychologist and the mental pathologist, and that the complete elucidation of the subject will need the co-operation of the two classes of investigator.

In the present volume an attempt will be made to work out the psychological side of the subject; that is to say, illusions will be viewed in their relation to the process of just and accurate perception. In the carrying out of this plan our principal attention will be given to the manifestations of the illusory impulse in normal life. At the same time,

though no special acquaintance with the pathology of the subject will be laid claim to, frequent references will be made to the illusions of the insane. Indeed, it will be found that the two groups of phenomena—the illusions of the normal and of the abnormal condition—are so similar, and pass into one another by such insensible gradations, that it is impossible to discuss the one apart from the other. The view of illusion which will be adopted in this work is that it constitutes a kind of borderland between perfectly sane and vigorous mental life and dementia.

And here at once there forces itself on our attention the question, What exactly is to be understood by the term "illusion"? In scientific works treating of the pathology of the subject, the word is confined to what are specially known as *illusions of the senses*, that is to say, to false or illusory perceptions. And there is very good reason for this limitation, since such illusions of the senses are the most palpable and striking symptoms of mental disease. In addition to this, it must be allowed that, to the ordinary reader, the term first of all calls up this same idea of a deception of the senses.

At the same time, popular usage has long since extended the term so as to include under it errors which do not counterfeit actual perceptions. We commonly speak of a man being under an illusion respecting himself when he has a ridiculously exaggerated view of his own importance, and in a similar way of a person being in a state of illusion with respect to the past when, through frailty of memory, he pictures it quite otherwise than it is certainly known to have been.

It will be found, I think, that there is a very good reason for this popular extension of the term. The errors just alluded to have this in common with illusions of sense, that they simulate the form of immediate or self-evident cognition. An idea held respecting ourselves or respecting our past history does not depend on any other piece of knowledge; in other words, is not adopted as the result of a process of reasoning. What I believe with reference to my past history, so far as I can myself recall it, I believe instantaneously and immediately, without the intervention of any premise or reason. Similarly, our notions of ourselves are, for the most part, obtained apart from any process of inference. The view which a man takes of his own character or claims on society he is popularly supposed to receive intuitively by a mere act of internal observation. Such beliefs may not, indeed, have all the overpowering force which belongs to illusory perceptions, for the intuition of something by the senses is commonly looked on as the most immediate and irresistible kind of knowledge. Still, they must be said to come very near illusions of sense in the degree of their self-evident certainty.

Taking this view of illusion, we may provisionally define it as any species of error which counterfeits the form of immediate,

self-evident, or intuitive knowledge, whether as sense-perception or otherwise. Whenever a thing is believed on its own evidence and not as a conclusion from something else, and the thing then believed is demonstrably wrong, there is an illusion. The term would thus appear to cover all varieties of error which are not recognized as fallacies or false inferences. If for the present we roughly divide all our knowledge into the two regions of primary or intuitive, and secondary or inferential knowledge, we see that illusion is false or spurious knowledge of the first kind, fallacy false or spurious knowledge of the second kind. At the same time, it is to be remembered that this division is only a very rough one. As will appear in the course of our investigation, the same error may be called either a fallacy or an illusion, according as we are thinking of its original mode of production or of the form which it finally assumes; and a thorough-going psychological analysis of error may discover that these two classes are at bottom very similar.

As we proceed, we shall, I think, find an ample justification for our definition. We shall see that such illusions as those respecting ourselves or the past arise by very much the same mental processes as those which are discoverable in the production of illusory perceptions; and thus a complete psychology of the one class will, at the same time, contain the explanation of the other classes.

The reader is doubtless aware that philosophers have still further extended the idea of illusion by seeking to bring under it beliefs which the common sense of mankind has always adopted and never begun to suspect. Thus, according to the idealist, the popular notion (the existence of which Berkeley, however, denied) of an external world, existing in itself and in no wise dependent on our perceptions of it, resolves itself into a grand illusion of sense.

At the close of our study of illusions we shall return to this point. We shall there inquire into the connection between those illusions which are popularly recognized as such, and those which first come into view or appear to do so (for we must not yet assume that there are such) after a certain kind of philosophic reflection. And some attempt will be made to determine roughly how far the process of dissolving these substantial beliefs of mankind into airy phantasms may venture to go.

For the present, however, these so-called illusions in philosophy will be ignored. It is plain that illusion exists only in antithesis to real knowledge. This last must be assumed as something above all question. And a rough and provisional, though for our purpose sufficiently accurate, demarcation of the regions of the real and illusory seems to coincide with the line which common sense draws between what all normal men agree in holding and what the individual holds, whether temporarily or permanently, in contradiction to this. For our present purpose

the real is that which is true for all. Thus, though physical science may tell us that there is nothing corresponding to our sensations of color in the world of matter and motion which it conceives as surrounding us; yet, inasmuch as to all men endowed with the normal color-sense the same material objects appear to have the same color, we may speak of any such perception as practically true, marking it off from those plainly illusory perceptions which are due to some subjective cause, as, for example, fatigue of the retina.

To sum up: in treating of illusions we shall assume, what science as distinguished from philosophy is bound to assume, namely, that human experience is consistent; that men's perceptions and beliefs fall into a consensus. From this point of view illusion is seen to arise through some exceptional feature in the situation or condition of the individual, which, for the time, breaks the chain of intellectual solidarity which under ordinary circumstances binds the single member to the collective body. Whether the common experience which men thus obtain is rightly interpreted is a question which does not concern us here. For our present purpose, which is the determination and explanation of illusion as popularly understood, it is sufficient that there is this general consensus of belief, and this may provisionally be regarded as at least practically true.

CHAPTER II.

THE CLASSIFICATION OF ILLUSIONS.

If illusion is the simulation of immediate knowledge, the most obvious mode of classifying illusions would appear to be according to the variety of the knowledge which they simulate.

Now, the popular psychology that floats about in the ordinary forms of language has long since distinguished certain kinds of unreasoned or uninferred knowledge. Of these the two best known are perception and memory. When I see an object before me, or when I recall an event in my past experience, I am supposed to grasp a piece of knowledge directly, to know something immediately, and not through the medium of something else. Yet I know differently in the two cases. In the first I know by what is called a presentative process, namely, that of sense-perception; in the second I know by a representative process, namely, that of reproduction, or on the evidence of memory. In the one case the object of cognition is present to my perceptive faculties; in the other it is recalled by the power of memory.

Scientific psychology tends, no doubt, to break down some of these popular distinctions. Just as the zoologist sometimes groups together varieties of animals which the unscientific eye would never think of connecting, so the psychologist may analyze mental

operations which appear widely dissimilar to the popular mind, and reduce them to one fundamental process. Thus recent psychology draws no sharp distinction between perception and recollection. It finds in both very much the same elements, though combined in a different way. Strictly speaking, indeed, perception must be defined as a presentative-representative operation. To the psychologist it comes to very much the same thing whether, for example, on a visit to Switzerland, our minds are occupied in *perceiving* the distance of a mountain or in *remembering* some pleasant excursion which we made to it on a former visit. In both cases there is a reinstatement of the past, a reproduction of earlier experience, a process of adding to a present impression a product of imagination—taking this word in its widest sense. In both cases the same laws of reproduction or association are illustrated.

Just as a deep and exhaustive analysis of the intellectual operations thus tends to identify their various forms as they are distinguished by the popular mind, so a thorough investigation of the flaws in these operations, that is to say, the counterfeits of knowledge, will probably lead to an identification of the essential mental process which underlies them. It is apparent, for example, that, whether a man *projects* some figment of his imagination into the external world, giving it present material reality, or whether (if I may be allowed the term) he *retrojects* it into the dim region of the past, and takes it for a reality that has been, he is committing substantially the same blunder. The source of the illusion in both cases is one and the same.

It might seem to follow from this that a scientific discussion of the subject would overlook the obvious distinction between illusions of perception and those of memory; that it would attend simply to differences in the mode of origination of the illusion, whatever its external form. Our next step, then, would appear to be to determine these differences in the mode of production.

That there are differences in the origin and source of illusion is a fact which has been fully recognized by those writers who have made a special study of sense-illusions. By these the term illusion is commonly employed in a narrow, technical sense, and opposed to hallucination. An illusion, it is said, must always have its starting-point in some actual impression, whereas a hallucination has no such basis. Thus it is an illusion when a man, under the action of terror, takes a stump of a tree, whitened by the moon's rays, for a ghost. It is a hallucination when an imaginative person so vividly pictures to himself the form of some absent friend that, for the moment, he fancies himself actually beholding him. Illusion is thus a partial displacement of external fact by a fiction of the imagination, while hallucination is a total displacement.

This distinction, which has been adopted

by the majority of recent alienists,* is a valuable one, and must not be lost sight of here. It would seem, from a psychological point of view, to be an important circumstance in the genesis of a false perception whether the intellectual process sets out from within or from without. And it will be found, moreover, that this distinction may be applied to all the varieties of error which I propose to consider. Thus, for example, it will be seen further on that a false recollection may set out either from the idea of some actual past occurrence or from a present product of the imagination.

It is to be observed, however, that the line of separation between illusion and hallucination, as thus defined, is a very narrow one. In by far the largest number of hallucinations it is impossible to prove that there is no modicum of external agency co-operating in the production of the effect. It is presumable, indeed, that many, if not all, hallucinations have such a basis of fact. Thus, the madman who projects his internal thoughts outward in the shape of external voices may, for aught we know, be prompted to do so in part by faint impressions coming from the ear, the result of those slight stimulations to which the organ is always exposed, even in profound silence, and which in his case assume an exaggerated intensity. And ever if it is clearly made out that there are hallucinations in the strict sense, that is to say, false perceptions which are wholly due to internal causes, it must be conceded that illusion shades off into hallucination by steps which it is impossible for science to mark. In many cases it must be left an open question whether the error is to be classed as an illusion or as a hallucination.†

For these reasons, I think it best not to make the distinction between illusion and hallucination the leading principle of my classification. However important psychologically, it does not lend itself to this purpose. The distinction must be kept in view and illustrated as far as possible. Accordingly, while in general following popular usage and employing the term illusion as the generic name, I shall, when convenient, recognize the narrow and technical sense of the term as answering to a species co-ordinate with hallucination.

Departing, then, from what might seem the ideally best order of exposition, I propose after all to set out with the simple popular scheme of faculties already referred to. Even

* A history of the distinction is given by Brierre de Boismont, in his work *On Illusions* (translated by R. T. Hulme, 1859). He says that Arnold (1806) first defined hallucination, and distinguished it from illusion. Esquiver, in his work, *Des Maladies Mentales* (1838), may be said to have fixed the distinction. (See Hunt's translation, 1845, p. 111.)

† This fact has been fully recognized by writers on the pathology of the subject; for example, Griesinger, *Mental Pathology and Therapeutics* (London, 1867), p. 84; Baillarger, article, "Des Hallucinations," in the *Mémoires de l'Académie Royale de Médecine*, tom. xii. p. 273, etc.; Wundt, *Physiologische Psychologie*, p. 653.

if they are, psychologically considered, identical operations, perception and memory are in general sufficiently marked off by a speciality in the form of the operation. Thus, while memory is the reproduction of something with a special reference of consciousness to its past existence, perception is the reproduction of something with a special reference to its present existence as a part of the presented object. In other words, though largely *representative* when viewed as to its origin, perception is *presentative* in relation to the object which is supposed to be immediately present to the mind at the moment.* Hence the convenience of recognizing the popular classification, and of making it our starting-point in the present case.

All knowledge which has any appearance of being directly reached, immediate, or self-evident, that is to say, of not being inferred from other knowledge, may be divided into four principal varieties: Internal Perception or Introspection of the mind's own feelings; External Perception; Memory; and Belief, in so far as it simulates the form of direct knowledge. The first is illustrated in a man's consciousness of a present feeling of pain or pleasure. The second and the third kinds have already been spoken of, and are too familiar to require illustration. It is only needful to remark here that, under perception, or rather in close conjunction with it, I purpose dealing with the knowledge of others' feelings, in so far as this assumes the aspect of immediate knowledge. The term belief is here used to include expectations and any other kinds of conviction that do not fall under one of the other heads. An instance of a seemingly immediate belief would be a prophetic prevision of a coming disaster, or a man's unreasoned persuasion as to his own powers of performing a difficult task.

It is, indeed, said by many thinkers that there are no legitimate immediate beliefs; that all our expectations and other convictions about things, in so far as they are sound, must repose on other genuinely immediate knowledge, more particularly sense-perception and memory. This difficult question need not be discussed here. It is allowed by all that there is a multitude of beliefs which we hold tenaciously and on which we are ready to act, which, to the mature mind, wear the appearance of intuitive truths, owing their cogency to nothing beyond themselves. A man's belief in his own merits, however it may have been first obtained, is as immediately assured to him as his recognition of a real object in the act of sense-perception. It may be added that many of our every-day working beliefs about the world in which we live, though presumably derived from memory and perception, tend to lose all traces of their origin and to simulate the aspect of intuitions. Thus the proposition that logicians are in the habit

of pressing on our attention, that "Men are mortal," seems, on the face of it, to common sense to be something very like a self-evident truth, not depending on any particular facts of experience.

In calling these four forms of cognition immediate, I must not, however, be supposed to be placing them on the same logical level. It is plain, indeed, to a reflective mind that, though each may be called immediate in this superficial sense, there are perceptible differences in the degree of their immediacy. Thus it is manifest, after a moment's reflection, that expectation, so far as it is just, is not primarily immediate in the sense in which purely presentative knowledge is so, since it can be shown to follow from something else. So a general proposition, though through familiarity and innumerable illustrations it has acquired a self-evident character, is seen with a very little inspection to be less fundamentally and essentially so than the proposition, "I am now feeling pain;" and it will be found that even with respect to memory, when the remembered event is at all remote, the process of cognition approximates to a mediate operation, namely, one of inference. What the relative values of these different kinds of immediate knowledge are is a point which will have to be touched on at the end of our study. Here it must suffice to warn the reader against the supposition that this value is assumed to be identical.

It might seem at a first glance to follow from this four-fold scheme of immediate or quasi-immediate knowledge that there are four varieties of illusion. And this is true in the sense that these four heads cover all the main varieties of illusion. If there are only four varieties of knowledge which can lay any claim to be considered immediate, it must be that every illusion will simulate the form of one of these varieties, and so be referable to the corresponding division.

But though there are conceivably these four species of illusion, it does not follow that there are any actual instances of each class forthcoming. This we cannot determine till we have investigated the nature and origin of illusory error. For example, it might be found that introspection, or the immediate inspection of our own feelings or mental states, does not supply the conditions necessary to the production of such error. And indeed, it is probable that most persons, antecedently to inquiry, would be disposed to say that to fall into error in the observation of what is actually going on in our own minds is impossible.

With the exception of this first division, however, this scheme may easily be seen to answer to actual phenomena. That there are illusions of perception is obvious, since it is to the errors of sense that the term illusion has most frequently been confined. It is hardly less evident that there are illusions of memory. The peculiar difficulty of distinguishing between a past real event and a mere phantom of the imagination, illustrated

* I here touch on the distinction between the psychological and the philosophical view of perception, to be brought out more fully by and by.

in the exclamation, "I either saw it or dreamt it," sufficiently shows that memory is liable to be imposed on. Finally, it is agreed by all that the beliefs we are wont to regard as self-evident are sometimes erroneous. When, for example, an imaginative woman says she knows, by mere intuition, that something interesting is going to happen, say the arrival of a favorite friend, she is plainly running the risk of being self-deluded. So, too, a man's estimate of himself, however valid for him, may turn out to be flagrantly false.

In the following discussion of the subject I shall depart from the above order in so far as to set out with illusions of sense-perception. These are well ascertained, forming, indeed, the best-marked variety. And the explanation of these has been carried much further than that of the others. Hence, according to the rule to proceed from the known to the unknown, there will be an obvious convenience in examining these first of all. After having done this, we shall be in a position to inquire whether there is anything analogous in the region of introspection or internal perception. Our study of the errors of sense-perception will, moreover, prove the best preparation for an inquiry into the nature and mode of production of the remaining two varieties.*

I would add that, in close connection with the first division, illusions of perception, I shall treat the subtle and complicated phenomena of dreams. Although containing elements which ought, according to strictness, to be brought under one of the other heads, they are, as their common appellation, "visions," shows, largely simulations of external and more especially visual, perception.

Dreams are no doubt sharply marked off from illusions of sense-perception by a number of special circumstances. Indeed, it may be thought that they cannot be adequately treated in a work that aims primarily at investigating the illusions of normal life, and should rather be left to those who make the pathological side of the subject their special study. Yet it may, perhaps, be said that in a wide sense dreams are a feature of normal life. And, however this be, they have quite enough in common with other illusions of perception to justify us in dealing with them in close connection with these.

CHAPTER III.

ILLUSIONS OF PERCEPTION: GENERAL.

THE errors with which we shall be concerned in this chapter are those which are commonly denoted by the term illusion, that

is to say, those of sense. They are sometimes called deceptions of the senses; but this is a somewhat loose expression, suggesting that we can be deceived as to sensation itself, though, as we shall see later on, this is only true in a very restricted meaning of the phrase. To speak correctly, sense-illusions must be said to arise by a simulation of the form of just and accurate perceptions. Accordingly, we shall most frequently speak of them as illusions of perception.

In order to investigate the nature of any kind of error, it is needful to understand the kind of knowledge it imitates, and so we must begin our inquiry into the nature of illusions of sense by a brief account of the psychology of perception; and, in doing this, we shall proceed best by regarding this operation in its most complete form, namely, that of visual perception.

I may observe that in this analysis of perception I shall endeavor to keep to known facts, namely, the psychical phenomena or events which can be seen by the methods of scientific psychology to enter into the mental content called the percept. I do not now inquire whether such an analysis can help us to understand all that is meant by perception. This point will have to be touched later on. Here it is enough to say that, whatever our philosophy of perception may be, we must accept the psychological fact that the concrete mental state in the act of perception is built up out of elements, the history of which can be traced by the methods of mental science.

Psychology of Perception.—Confining ourselves for the present to the mental, as distinguished from the physical, side of the operation, we soon find that perception is not so simple a matter as it might at first seem to be. When a man on a hot day looks at a running stream and "sees" the delicious coolness, it is not difficult to show that he is really performing an act of mental synthesis or imaginative construction. To the sense-impression* which his eye now gives him, he adds something which past experience has bequeathed to his mind. In perception, the material of sensation is acted on by the mind, which embodies in its present attitude all the results of its past growth. Let us look at this process of synthesis a little more closely.

When a sensation arises in the mind, it may, under certain circumstances, go unattended to. In that case there is no perception. The sensation floats in the dim outer regions of consciousness as a vague feeling, the real nature and history of which are unknown. This remark applies not only to the undefined bodily sensations that are always oscillating about the threshold of

* It might even be urged that the order here adopted is scientifically the best, since sense-perception is the earliest form of knowledge, introspected facts being known only in relation to perceived facts. But if the mind's knowledge of its own states is thus later in time, it is earlier in the logical order, that is to say, it is the most strictly presentative form of knowledge.

* Here and elsewhere I use the word "impression" for the whole complex of sensation which is present at the moment. It may, perhaps, not be unnecessary to add that, in employing this term, I am making no assumption about the independent existence of external objects.

obscure consciousness, but to the higher sensations connected with the special organs of perception. The student in optics soon makes the startling discovery that his field of vision has all through his life been haunted with weird shapes which have never troubled the serenity of his mind just because they have never been distinctly attended to.

The immediate result of this process of directing the keen glance of attention to a sensation is to give it greater force and distinctness. By attending to it we discriminate it from other feelings present and past, and classify it with like sensations previously received. Thus, if I receive a visual impression of the color orange, the first consequence of attending to it is to mark it off from other color-impressions, including those of red and yellow. And in recognizing the peculiar quality of the impression by applying to it the term orange, I obviously connect it with other similar sensations called by the same name. If a sensation is perfectly new, there cannot, of course, be this process of classifying, and in this case the closely related operation of discriminating it from other sensations is less exactly performed. But it is hardly necessary to remark that, in the mind of the adult, under ordinary circumstances, no perfectly new sensation ever occurs.

When the sensation, or complex sensation, is thus defined and recognized, there follows the process of interpretation, by which I mean the taking up of the impression as an element into the complex mental state known as a percept. Without going into the philosophical question of what this process of synthesis exactly means, I may observe that, by common consent, it takes place to a large extent by help of a reproduction of sensations of various kinds experienced in the past. That is to say, the details in this act of combination are drawn from the store of mental recollections to which the growing mind is ever adding. In other words, the percept arises through a fusion of an actual sensation with mental representations or "images" of sensation.* Every element of the object that we thus take up in the act of perception, or put into the percept, as its actual size, distance, and so on, will be found to make itself known to us through mental images or revivals of past experiences, such as those we have in handling the object, moving to and from it, etc. It follows that if this is an essential ingredient in the act of

perception, the process closely resembles an act of inference; and, indeed, Helmholtz distinctly calls the perception of distance an unconscious inference or a mechanically performed act of judgment.

I have hinted that these recovered sensations include the feelings we experience in connection with muscular activity, as in moving our limbs, resisting or lifting heavy bodies, and walking to a distant object. Modern psychology refers the eye's instantaneous recognition of the most important elements of an object (its essential or "primary" qualities) to a reinstatement of such simple experiences as these. It is, indeed, these reproductions which are supposed to constitute the substantial background of our perceptions.

Another thing worth noting with respect to this process of filling up a sense-impression is that it draws on past sensations of the eye itself. Thus, when I look at the figure of an acquaintance from behind, my reproductive visual imagination supplies a representation of the impressions I am wont to receive when the more interesting aspect of the object, the front view, is present to my visual sense.*

We may distinguish between different steps in the full act of visual recognition. First of all comes the construction of a material object of a particular figure and size, and at a particular distance; that is to say, the recognition of a tangible thing having certain simple space-properties, and holding a certain relation to other objects, and more especially our own body, in space. This is the bare perception of an object, which always takes place even in the case of perfectly new objects, provided they are seen with any degree of distinctness. It is to be added that the reference of a sensation of light or color to such an object involves the inclusion of a quality answering to the sensation, as brightness, or blue color, in the thing thus intuited.

This part of the process of filling in, which is the most instantaneous, automatic, and unconscious, may be supposed to answer to the most constant and therefore the most deeply organized connections of experience; for, speaking generally, we never have an impression of color, except when there are circumstances present which are fitted to yield us those simple muscular and tactual experiences through which the ideas of a particular form, size, etc., are pretty certainly obtained.

The second step in this process of presentative construction is the recognition of an object as one of a class of things, for example, oranges, having certain special qualities, as a particular taste. In this step the

* Psychological usage has now pretty well substituted the term "image" for "idea," in order to indicate an individual (as distinguished from a general) representation of a sensation or percept. It might, perhaps, be desirable to go further in this process of differentiating language, and to distinguish between a sensational image, e.g. the representation of a color, and a perceptual image, as the representation of a colored object. It may be well to add that, in speaking of a fusion of an image and a sensation, I do not mean that the former exists apart for a single instant. The term "fusion" is used figuratively to describe the union of the two sides or aspects of a complete sensation.

* This impulse to fill in visual elements not actually present is strikingly illustrated in people's difficulty in recognizing the gap in the field of vision answering to the insensitive "blind" spot on the retina. (See Helmholtz, *Physiologische Optik*, p. 173, et seq.)

connections of experience are less deeply organized, and so we are able to some extent, by reflection, to recognize it as a kind of intellectual working up of the materials supplied us by the past. It is to be noted that this process of recognition involves a compound operation of classifying impressions as distinguished from that simple operation by which a single impression, such as a particular color, is known. Thus the recognition of such an object as an orange takes place by a rapid classing of a multitude of passive sensations of color, light, and shade, and those active or muscular sensations which are supposed to enter into the visual perception of form.

A still less automatic step in the process of visual recognition is that of identifying individual objects, as Westminster Abbey, or a friend, John Smith. The amount of experience that is here reproduced may be very large, as in the case of recognizing a person with whom we have had a long and intimate acquaintance.

If the recognition of an object as one of a class, for example, an orange, involves a compound process of classing impressions, that of an individual object involves a still more complicated process. The identification of a friend, simple as this operation may at first appear, really takes place by a rapid classing of all the salient characteristic features which serve as the visible marks of that particular person.

It is to be noted that each kind of recognition, specific and individual, takes place by a consciousness of likeness and unlikeness. It is obvious that a new individual object has characters not shared in by other objects previously inspected. Thus, we at once class a man with a dark-brown skin, wearing a particular garb, as a Hindoo, though he may differ in a host of particulars from the other Hindoos that we have observed. In thus instantly recognizing him as a Hindoo, we must, it is plain, attend to the points of similarity, and overlook for the instant the points of dissimilarity. In the case of individual identification, the same thing happens. Strictly speaking, no object ever appears exactly the same to us on two occasions. Apart from changes in the object itself, especially in the case of living beings, there are varying effects of illumination, of position in relation to the eye, of distance, and so on, which very distinctly affect the visual impression at different times. Yet the fact of our instantly recognizing a familiar object in spite of these fluctuations of appearance, proves that we are able to overlook a very considerable amount of diversity when a certain amount of likeness is present.

It is further to be observed that in these last stages of perception we approach the boundary line between perception and inference. To recognize an object as one of a class is often a matter of conscious reflection and judgment, even when the class is constituted by obvious material qualities which

the senses may be supposed to apprehend immediately. Still more clearly does perception pass into inference when the class is constituted by less obvious qualities, which require a careful and prolonged process of recollection, discrimination, and comparison, for their recognition. Thus, to recognize a man by certain marks of gesture and manner as a military man or a Frenchman, though popularly called a perception, is much more of an unfolded process of conscious inference. And what applies to specific recognition applies still more forcibly to individual recognition, which is often a matter of very delicate conscious comparison and judgment. To say where the line should be drawn here between perception and observation on the one hand, and inference on the other, is clearly impossible. Our whole study of the illusions of perception will serve to show that the one shades off into the other too gradually to allow of our drawing a hard and fast line between them.

Finally, it is to be noted that these last stages of perception bring us near the boundary line which separates objective experience as common and universal, and subjective or variable experience as confined to one or to a few. In the bringing of the object under a certain class of objects there is clearly room for greater variety of individual perception. For example, the ability to recognize a man as a Frenchman turns on a special kind of previous experience. And this transition from the common or universal to the individual experience is seen yet more plainly in the case of individual recognition. To identify an object, say a particular person, commonly presupposes some previous experience or knowledge of this object, and the existence in the past of some special relation of the recognizer to the recognized, if only that of an observer. In fact, it is evident that in this mode of recognition we have the transition from common perception to individual recollection.*

While we may thus distinguish different steps in the process of visual recognition, we may make a further distinction, marking off a passive and an active stage in the process. The one may be called the stage of preperception, the other that of perception proper.† In the first the mind holds itself in a passive attitude, except in so far as the energies of external attention are involved. The impression here awakens the mental images which answer to past experiences according to the well-known laws of association. The interpretative image which is to transform the impression into a percept is now being formed by a mere process of suggestion.

When the image is thus formed, the mind

* This relation will be more fully discussed under the head of "Memory."

† I adopt this distinction from Dr. J. Hughlings Jackson. See his articles, "On Affections of Speech from Diseases of the Brain," in *Brain*, Nos. iii. and vii. The second stage might conveniently be named *apperception*, but for the special philosophical associations of the term.

may be said to enter upon a more active stage, in which it now views the impression through the image, or applies this as a kind of mold or framework to the impression. This appears to involve an intensification of the mental image, transforming it from a representative to a presentative mental state, making it approximate somewhat to the full intensity of the sensation. In many of our instantaneous perceptions these two stages are indistinguishable to consciousness. Thus, in most cases, the recognition of size, distance, etc., takes place so rapidly that it is impossible to detect the two phases here separated. But in the classification of an object, or the identification of an individual thing, there is often an appreciable interval between the first reception of the impression and the final stage of complete recognition. And here it is easy to distinguish the two stages of preperception and perception. The interpretative image is slowly built up by the operation of suggestion, at the close of which the impression is suddenly illumined as by a flash of light, and takes a definite, precise shape.

Now, it is to be noted that the process of preperception will be greatly aided by any circumstance that facilitates the construction of the particular interpretative image required. Thus, the more frequently a similar process of perception has been performed in the past, the more ready will the mind be to fall into the particular way of interpreting the impression. As G. H. Lewes well remarks, "The artist sees details where to other eyes there is a vague or confused mass; the naturalist sees an animal where the ordinary eye only sees a form."* This is but one illustration of the seemingly universal mental law, that what is repeatedly done will be done more and more easily.

The process of preperception may be shortened, not only by means of a *permanent* disposition to frame the required interpretative scheme, the residuum of past like processes, but also by means of any *temporary* disposition pointing in the same direction. If, for example, the mind of a naturalist has just been occupied about a certain class of bird, that is to say, if he has been dwelling on the *mental image* of this bird, he will recognize one at a distance more quickly than he would otherwise have done. Such a simple mental operation as the recognition of one of the less common flowers, say a particular orchid, will vary in duration according as we have or have not been recently forming an image of this flower. The obvious explanation of this is that the mental image of an object bears a very close resemblance to the corresponding percept, differing from it, indeed, in degree only, that is to say, through the fact that it involves no actual sensation. Here again we see illustrated a general psychological law, namely, that what the mind has recently

done, it tends (within certain limits) to go on doing.

It is to be noticed, further, that the perception of a single object or event is rarely an isolated act of the mind. We recognize and understand the things that surround us through their relations one to another. Sometimes the adjacent circumstances and events suggest a definite expectation of the new impression. Thus, for example, the sound of a gun heard during a walk in the country is instantly interpreted by help of suggestions due to the previous appearance of the sportsman, and the act of raising the gun to his shoulder. It may be added that the verbal suggestions of others act very much like the suggestions of external circumstances. If I am told that a gun is going to be fired, my mind is prepared for it just as though I saw the sportsman.*

More frequently the effect of such surrounding circumstances is to give an air of familiarity to the new impression, to shorten the interval in which the required interpretative image is forthcoming. Thus, when traveling in Italy, the visual impression answering to a ruined temple or a bareheaded friar is construed much more rapidly than it would be elsewhere, because of the attitude of mind due to the surrounding circumstances. In all such cases the process of preperception connected with a given impression is effected more or less completely by the suggestions of other and related impressions.

It follows from all that has been just said that our minds are never in exactly the same state of readiness with respect to a particular process of perceptual interpretation. Sometimes the meaning of an impression flashes on us at once, and the stage of preperception becomes evanescent. At other times the same impression will fail for an appreciable interval to divulge its meaning. These differences are, no doubt, due in part to variations in the state of attention at the moment; but they depend as well on fluctuations in the degree of the mind's readiness to look at the impression in the required way.

In order to complete this slight analysis of perception, we must look for a moment at its physical side, that is to say, at the nervous actions which are known or supposed with some degree of probability to accompany it.

The production of the sensation is known to depend on a certain external process, namely, the action of some stimulus, as light, on the sense-organ, which stimulus has its point of departure in the object, such as it is conceived by physical science. The sensation arises when the nervous process is transmitted through the nerves to the conscious center, often spoken of as the sensorium, the exact seat of which is still a matter of some debate.

The intensification of the sensation by the

* *Problems of Life and Mind*, third series, p. 107. This writer employs the word "preperception" to denote this effect of previous perception.

* Such verbal suggestion, moreover, acting through a sense-impression, has something of that vividness of effect which belongs to all excitation of mental images by external stimuli.

reaction of attention is supposed to depend on some re-enforcement of the nervous excitation in the sensory center proceeding from the motor regions, which are hypothetically regarded as the center of attention.* The classification of the impression, again, is pretty certainly correlated with the physical fact that the central excitation calls into activity elements which have already been excited in the same way.

The nervous counterpart of the final stage of perception, the synthesis of the sensation and the mental representation, is not clearly ascertained. A sensation clearly resembles a mental image in quality. It is most obviously marked off from the image by its greater vividness or intensity. Agreeably to this view, it is now held by a number of eminent physiologists and psychologists that the nervous process underlying a sensation occupies the same central region as that which underlies the corresponding image. According to this theory, the two processes differ in their degree of energy only, this difference being connected with the fact that the former involves, while the latter does not involve, the peripheral region of the nervous system. Accepting this view as on the whole well founded, I shall speak of an ideational, or rather an imaginative, and a sensational nervous process, and not of an ideational and a sensational center.†

The special force that belongs to the representative element in a percept, as compared with that of a pure "perceptual" image,‡ is probably connected with the fact that, in the case of actual perception, the nervous process underlying the act of imaginative construction is organically united to the initial sensational process, of which indeed it may be regarded as a continuation.

For the physical counterpart of the two stages in the interpretative part of perception, distinguished as the passive stage of preperception, and the active stage of perception proper, we may, in the absence of certain knowledge, fall back on the hypothesis put forward by Dr. J. Hughlings Jackson, in the articles in *Brain* already referred to, namely, that the former answers to an action of the right hemisphere of the brain, the latter to a subsequent action of the left hemisphere. The expediting of the process of preperception in those cases where it has frequently been performed before, is clearly an illustration of the organic law that every function is improved by exercise. And the temporary disposition to perform the process due to recent imaginative activity, is explained at once

on the physical side by the supposition that an actual perception and a perceptual image involve the activity of the same nervous tracts. For, assuming this to be the case, it follows, from a well-known organic law, that a recent excitation would leave a temporary disposition in these particular structures to resume that particular mode of activity.

What has here been said about visual perception will apply, *mutatis mutandis*, to other kinds. Although the eye is the organ of perception *par excellence*, our other senses are also avenues by which we intuit and recognize objects. Thus touch, especially when it is finely developed as it is in the blind, gives an immediate knowledge of objects—a more immediate knowledge, indeed, of their fundamental properties than sight. What makes the eye so vastly superior to the organ of touch as an instrument of perception, is first of all the range of its action, taking in simultaneously a large number of impressions from objects at a distance as well as near; and secondly, though this may seem paradoxical, the fact that it gives us so much indirectly, that is, by way of association and suggestion. This is the interesting side of visual perception, that, owing to the vast complex of distinguishable sensations of light and color of various qualities and intensities, together with the muscular sensations attending the varying positions of the organ, the eye is able to recognize at any instant a whole external world with its fundamental properties and relations. The ear comes next to the eye in this respect, but only after a long interval, since its sensations (even in the case of musical combinations) do not simultaneously order themselves in an indefinitely large group of distinguishable elements, and since even the comparatively few sensations which it is capable of simultaneously receiving, being altogether passive—that is to say, having no muscular accompaniments—impart but little and vague information respecting the external order. It is plain, then, that in the study of illusion, where the indirectly known elements are the thing to be considered, the eye, and after this the ear, will mostly engage our attention.*

* Touch gives much by way of interpretation only when an individual object, for example a man's hat, is recognized by aid of this sense alone, in which case the perception distinctly involves the reproduction of a complete visual percept. I may add that the organ of smell comes next to that of hearing, with respect both to the range and definiteness of its simultaneous sensations, and to the amount of information furnished by these. A rough sense of distance as well as of direction is clearly obtainable by means of this organ. There seems to me no reason why an animal endowed with fine olfactory sensibility, and capable of an analytic separation of sense-elements, should not gain a rough perception of an external order much more complete than our auditory perception, which is necessarily so fragmentary. This supposition appears, indeed, to be the necessary complement to the idea first broached, so far as I am aware, by Professor Croom Robertson, that to such animals, visual perception consists in a reference to a system of muscular feelings defined and bounded by strong olfactory sensations, rather than by actual sensations as in our case.

* See Wundt, *Physiologische Psychologie*, p. 723.

† For a confirmation of the view adopted in the text, see Professor Bain, *The Senses and the Intellect*, Part II. ch. i. sec. 8; Herbert Spencer, *Principles of Psychology*, vol. i. p. 234, et passim; Dr. Ferrier, *The Functions of the Brain*, p. 258, et seq.; Professor Wundt, *op. cit.*, pp. 644, 645; G. H. Lewes, *Problems of Life and Mind*, vol. v. p. 445, et seq. For an opposite view, see Dr. Carpenter, *Mental Physiology*, fourth edit., p. 220, etc.; Dr. Maudsley, *The Physiology of Mind*, ch. v. p. 259, etc.

‡ See note, p. 7.

So much it seemed needful to say about the mechanism of perception, in order to understand the slight disturbances of this mechanism that manifest themselves in sense-illusion. It may be added that our study of these illusions will help still further to elucidate the exact nature of perception. Normal mental life, as a whole, at once illustrates, and is illustrated by, abnormal. And while we need a rough provisional theory of accurate perception in order to explain illusory perception at all, the investigation of this latter cannot fail to verify and even render more complete the theory which it thus temporarily adopts.

Illusions of Perception.—With this brief psychological analysis of perception to help us, let us now pass to the consideration of the errors incident to the process, with a view to classify them according to their psychological nature and origin.

And here there naturally arises the question, How shall we define an illusion of perception? When trying to fix the definition of illusion in general, I practically disposed of this question. Nevertheless, as the point appears to me to be of some importance, I shall reproduce and expand one or two of the considerations then brought forward.

It is said by certain philosophers that perception, as a whole, is an illusion, inasmuch as it involves the fiction of a real thing independent of mind, yet somehow present to it in the act of sense-perception. But this is a question for philosophy, not for science. Science, including psychology, assumes that in perception there is something real, without inquiring what it may consist of, or what its meaning may be. And though in the foregoing analysis of perception, viewed as a complex mental phenomenon or psychical process, I have argued that a percept gets its concrete filling up out of elements of conscious experience or sensations, I have been careful not to contend that the particular elements of feeling thus represented are the *object* of perception or the thing perceived. It may be that what we mean by a single object with its assemblage of qualities is much more than any number of such sensations; and it must be confessed that, on the face of it, it seems to be much more. And however this be, the question, What is meant by object; and is the common persuasion of the existence of such an entity in the act of perception accurate or illusory? must be handed over to philosophy.

While in the following examination of sense-illusions we put out of sight what certain philosophers say about the illusoriness of perception as a whole, we shall also do well to leave out of account what physical science is sometimes supposed to tell us respecting a constant element of illusion in perception. The physicist, by reducing all external changes to "modes of motion," appears to leave no room in his world-mechanism for the secondary qualities of bodies, such as light and heat, as popularly con-

ceived. Yet, while allowing this, I think we may still regard the attribution of qualities like color to objects as in the main correct and answering to a real fact. When a person says an object is red, he is understood by everybody as affirming something which is true or false, something therefore which either involves an external fact or is illusory. It would involve an external fact whenever the particular sensation which he receives is the result of a physical action (ether vibrations of a certain order), which would produce a like sensation in anybody else in the same situation and endowed with the normal retinal sensibility. On the other hand, an illusory attribution of color would imply that there is no corresponding physical agency at work in the case, but that the sensation is connected with exceptional individual conditions, as, for example, altered retinal sensibility.

We are now, perhaps, in a position to frame a rough definition of an illusion of perception as popularly understood. A large number of such phenomena may be described as consisting in the formation of percepts or quasi-percepts in the minds of individuals under external circumstances which would not give rise to similar percepts in the case of other people.

A little consideration, however, will show that this is not an adequate definition of what is ordinarily understood by an illusion of sense. There are special circumstances which are fitted to excite a momentary illusion in all minds. The optical illusions due to the reflection and refraction of light are not peculiar to the individual, but arise in all minds under precisely similar external conditions.

It is plain that the illusoriness of a perception is in these cases determined in relation to the sense-impressions of other moments and situations, or to what are presumably better percepts than the present one. Sometimes this involves an appeal from one sense to another. Thus, there is the process of verification of sight by touch, for example, in the case of optical images, a mode of perception which, as we have seen, gives a more direct cognition of external quality. Conversely, there may occasionally be a reference from touch to sight, when it is a question of discriminating two points lying very close to one another. Finally, the same sense may correct itself, as when the illusion of the stereoscope is corrected by afterward looking at the two separate pictures.

We may thus roughly define an illusion of perception as consisting in the formation of a quasi-percept which is peculiar to an individual, or which is contradicted by another and presumably more accurate percept. Or, if we take the meaning of the word common to include both the universal as contrasted with the individual experience, and the permanent, constant, or average, as distinguished from the momentary and variable percept, we may still briefly describe an illusion of

perception as a deviation from the common or collective experience.

Sources of Sense-Illusion.—Understanding sense-illusion in this way, let us glance back at the process of perception in its several stages or aspects, with the object of discovering what room occurs for illusion.

It appears at first as if the preliminary stages—the reception, discrimination, and classification of an impression—would not offer the slightest opening for error. This part of the mechanism of perception seems to work so regularly and so smoothly that one can hardly conceive a fault in the process. Nevertheless, a little consideration will show that even here all does not go on with unerring precision.

Let us suppose that the very first step is wanting—distinct attention to an impression. It is easy to see that this will favor illusion by leading to a confusion of the impression. Thus the timid man will more readily fall into the illusion of ghost-seeing than a cool-headed observant man, because he is less attentive to the actual impression of the moment. This inattention to the sense-impression will be found to be a great co-operating factor in the production of illusions.

But if the sensation is properly attended to, can there be error through a misapprehension of what is actually in the mind at the moment? To say that there can may sound paradoxical, and yet in a sense this is demonstrable. I do not mean that there is an observant mind behind and distinct from the sensation, and failing to observe it accurately through a kind of mental short-sightedness. What I mean is that the usual psychical effect of the incoming nervous process may to some extent be counteracted by a powerful reaction of the centers. In the course of our study of illusions, we shall learn that it is possible for the quality of an impression, as, for example, of a sensation of color, to be appreciably modified when there is a strong tendency to regard it in one particular way.

Postponing the consideration of these, we may say that certain illusions appear clearly to take their start from an error in the process of classifying or identifying a present impression. On the physical side, we may say that the first stages of the nervous process, the due excitation of the sensory center in accordance with the form of the incoming stimulation and the central reaction involved in the recognition of the sensation, are incomplete. These are so limited and comparatively unimportant a class, that it will be well to dispose of them at once.

Confusion of the Sense-Impression.—The most interesting case of such an error is where the impression is unfamiliar and novel in character. I have already remarked that in the mental life of the adult perfectly new sensations never occur. At the same time, comparatively novel impressions sometimes arise. Parts of the sensitive surface of the body which rarely undergo stimulation are sometimes acted on, and at other times they

receive partially new modes of stimulation. In such cases it is plain that the process of classing the sensation or recognizing it is not completed. It is found that whenever this happens there is a tendency to exaggerate the intensity of the sensation. The very fact of unfamiliarity seems to give to the sensation a certain exciting character. As something new and strange, it for the instant slightly agitates and discomposes the mind. Being unable to classify it with its like, we naturally magnify its intensity, and so tend to ascribe it to a disproportionately large cause.

For instance, a light bandage worn about the body at a part usually free from pressure is liable to be conceived as a weighty mass. The odd sense of a big cavity in the mouth, which we experience just after the loss of a tooth, is probably another illustration of this principle. And a third example may also be supplied from the recollection of the dentist's patient, namely, the absurd imagination which he tends to form as to what is actually going on in his mouth when a tooth is being bored by a modern rotating drill. It may be found that the same principle helps to account for the exaggerated importance which we attach to the impressions of our dreams.

It is evident that all indistinct impressions are liable to be wrongly classed. Sensations answering to a given color or form, are, when faint, easily confused with other sensations, and so an opening occurs for illusion. Thus, the impressions received from distant objects are frequently misinterpreted, and, as we shall see by and by, it is in this region of hazy impression that imagination is wont to play its most startling pranks.

It is to be observed that the illusions arising from wrong classification will be more frequent in the case of those senses where discrimination is low. Thus, it is much easier in a general way to confuse two sensations of smell than two sensations of color. Hence the great source of such errors is to be found in that mass of obscure sensation which is connected with the organic processes, as digestion, respiration, etc., together with those varying tactual and motor feelings which result from what is called the subjective stimulation of the tactual nerves, and from changes in the position and condition of the muscles. Lying commonly in what is known as the sub-conscious region of mind, undiscriminated, vague, and ill-defined, these sensations, when they come to be specially attended to, readily get misapprehended, and so lead to illusion, both in waking life and in sleep. I shall have occasion to illustrate this later on.

With these sensations, the result of stimulations coming from remote parts of the organism, may be classed the ocular impressions which we receive in indirect vision. When the eye is not fixed on an object, the impression, involving the activity of some peripheral region of the retina, is compara-

tively indistinct. This will be much more the case when the object lies at a distance for which the eye is not at the time accommodated. And in these circumstances, when we happen to turn our attention to the impression, we easily misapprehend it, and so fall into illusion. Thus, it has been remarked by Sir David Brewster, in his *Letters on Natural Magic* (letter vii.), that when looking through a window at some object beyond, we easily suppose a fly on the window-pane to be a larger object, as a bird, at a greater distance.*

While these cases of a confusion or a wrong classification of the sensation are pretty well made out, there are other illusions or quasi-illusions respecting which it is doubtful whether they should be brought under this head. For example, it was found by Weber, that when the legs of a pair of compasses are at a certain small distance apart they will be felt as two by some parts of the tactual surface of the body, but only as one by other parts. How are we to regard this discrepancy? Must we say that in the latter case there are two sensations, only that, being so similar, they are confused one with another? There seems some reason for so doing, in the fact that, by a repeated exercise of attention to the experiment, they may afterwards be recognized as two.

We here come on the puzzling question, How much in the character of the sensation must be regarded as the necessary result of the particular mode of nervous stimulation at the moment, together with the laws of sensibility, and how much must be put down to the reaction of the mind in the shape of attention and discrimination? For our present purpose we may say that, whenever a deliberate effort of attention does not suffice to alter the character of a sensation, this may be pretty safely regarded as a net result of the nervous process, and any error arising may be referred to the later stages of the process of perception. Thus, for example, the taking of the two points of a pair of compasses for one, where the closest attention does not discover the error, is best regarded as arising, not from a confusion of the sense-impression, but from a wrong interpretation of a sensation, occasioned by an overlooking of the limits of local discriminative sensibility.

Misinterpretation of the Sense-Impression.—Enough has been said, perhaps, about those errors of perception which have their root in the initial process of sensation. We may now pass to the far more important class of illusions which are related to the later stages

* It may be said, perhaps, that the exceptional direction of attention, by giving an unusual intensity to the impression, causes us to exaggerate it just as in the case of a novel sensation. An effort of attention directed to any of our vague bodily sensations easily leads us to magnify its cause. A similar confusion may arise even in direct vision, when the objects are looked at in a dim light, through a want of proper accommodation. (See Sir D. Brewster, *op. cit.*, letter i.)

of perception, that is to say, the process of interpreting the sense-impression. Speaking generally, one may describe an illusion of perception as a misinterpretation. The wrong kind of interpretative mental image gets combined with the impression, or, if with Helmholtz we regard perception as a process of "unconscious inference," we may say that these illusions involve an unconscious fallacious conclusion. Or, looking at the physical side of the operation, it may be said that the central course taken by the nervous process does not correspond to the external relations of the moment.

As soon as we inspect these illusions of interpretation, we see that they fall into two divisions, according as they are connected with the process of *suggestion*, that is to say, the formation of the interpretative image so far as determined by links of association with the actual impression, or with an independent process of *preperception* as explained above. Thus, for example, we fall into the illusion of hearing two voices when our shout is echoed back, just because the second auditory impression irresistibly calls up the image of a second shouter. On the other hand, a man experiences the illusion of seeing specters of familiar objects just after exciting his imagination over a ghost-story, because the mind is strongly predisposed to frame this kind of percept. The first class of illusions arises from without, the sense-impression being the starting-point, and the process of preperception being controlled by this. The second class arises rather from within, from an independent or spontaneous activity of the imagination. In the one case the mind is comparatively passive; in the other it is active, energetically reacting on the impression, and impatiently anticipating the result of the normal process of preperception. Hence I shall, for brevity's sake, commonly speak of them as *Passive* and *Active Illusions*.*

I may, perhaps, illustrate these two classes of illusion by the simile of an interpreter poring over an old manuscript. The first would be due to some peculiarity in the document misleading his judgment, the second to some caprice or preconceived notion in the interpreter's mind.

It is not difficult to define conjecturally the physiological conditions of these two large classes of illusion. On the physical side, an illusion of sense, like a just perception, is the result of a fusion of the nervous process answering to a sensation with a nervous process answering to a mental image. In the case of passive illusions, this fusion may be said to take place in consequence of some point of connection between the two. The existence of such a connection appears to be involved in the very fact of suggestion, and may be said to be the organic result of frequent conjunctions of the two parts of the

* They might also be distinguished as *objective* and *subjective illusions*, or as *illusions a posteriori* and *illusions a priori*.

nervous operation in our past history. In the case of active illusions, however, which spring rather from the independent energy of a particular mode of the imagination, this point of organic connection is not the only or even the main thing. In many cases, as we shall see, there is only a faint shade of resemblance between the present impression and the mental image with which it is overlaid. The illusions dependent on vivid expectation thus answer much less to an objective conjunction of past experiences than to a capricious subjective conjunction of mental images. Here, then, the fusion of nervous processes must have another cause. And it is not difficult to assign such a cause. The antecedent activity of imagination doubtless involves as its organic result a powerful temporary disposition in the nervous structures concerned to go on acting. In other words, they remain in a state of sub-excitation, which can be raised to full excitation by a slight additional force. The more powerful this disposition in the centers involved in the act of imagination, the less the additional force of external stimulus required to excite them to full activity.

Considering the first division, passive illusions, a little further, we shall see that they may be broken up into two sub-classes, according to the causes of the errors. In a general way we assume that the impression always answers to some quality of the object which is perceived, and varies with this; that, for example, our sensation of color invariably represents the quality of external color which we attribute to the object. Or, to express it physically, we assume that the external force acting on the sense-organ invariably produces the same effect, and that the effect always varies with the external cause. But this assumption, though true in the main, is not perfectly correct. It supposes that the organic conditions are constant and that the organic process faithfully reflects the external operation. Neither of these suppositions is strictly true. Although in general we may abstract from the organism and view the relation between the external fact and the mental impression as direct, we cannot always do so.

This being so, it is possible for errors of perception to arise through peculiarities of the nervous organization itself. Thus, as I have just observed, sensibility has its limits, and these limits are the starting-point in a certain class of widely shared or *common* illusions. An example of this variety is the taking of the two points of a pair of compasses for one by the hand, already referred to. Again, the condition of the nervous structures varies indefinitely, so that one and the same stimulus may, in the case of two individuals or of the same individual at different times, produce widely unlike modes of sensation. Such variations are clearly fitted to lead to *gross individual errors* as to the external cause of the sensation. Of this sort is the illusory sense of temperature which we often

experience through a special state of the organ employed.

While there are these errors of interpretation due to some peculiarity of the organization, there are others which involve no such peculiarity, but arise through the special character or exceptional conformation of the environment at the moment. Of this order are the illusions connected with the reflection of light and sound. We may, perhaps, distinguish the first sub-class as organically conditioned illusions, and the second as extra-organically determined illusions. It may be added that the latter are roughly describable as common illusions. They thus answer in a measure to the first variety of organically conditioned illusions, namely, those connected with the limits of sensibility. On the other hand, the active illusions, being essentially individual or subjective, may be said to correspond to the other variety of this class—those connected with variations of sensibility.

Our scheme of sense-illusions is now complete. First of all, we shall take up the passive illusions, beginning with those which are conditioned by special circumstances in the organism. After that we shall illustrate those which depend on peculiar circumstances in the environment. And finally, we shall separately consider what I have called the active illusions of sense.

It is to be observed that these illusions of perception properly so called, namely, the errors arising from a wrong interpretation of an impression, and, not from a confusion of one impression with another, are chiefly illustrated in the region of the two higher senses, sight and hearing. For it is here, as we have seen, that the interpretative imagination has most work to do in evolving complete perceptions of material, tangible objects, having certain relations in space, out of a limited and homogeneous class of sensations, namely, those of light and color, and of sound. As I have before observed, tactual perception, in so far as it is the recognition of an object of a certain size, hardness, and distance from our body, involves the least degree of interpretation, and so offers little room for error; it is only when tactual perception amounts to the *recognition* of an individual object, clothed with secondary as well as primary qualities, that an opening for palpable error occurs.

With respect, however, to the first sub-class of these illusions, namely, those arising from organic peculiarities which give a twist, so to speak, to the sensation, no very marked contrast between the different senses presents itself. So that in illustrating this group we shall be pretty equally concerned with the various modes of perception connected with the different senses.

It may be said once for all that in thus marking off from one another certain groups of illusion, I am not unmindful of the fact that these divisions answer to no very sharp natural distinctions. In fact, it will be found that one class gradually passes into the other, and that the different characteristics

here separated often combine in a most perplexing way. All that is claimed for this classification is that it is a convenient mode of mapping out the subject.

CHAPTER IV.

ILLUSIONS OF PERCEPTION—continued.

A. Passive Illusions (a) as determined by the Organism.—In dealing with the illusions which are related to certain peculiarities in the nervous organism and the laws of sensibility, I shall commence with those which are connected with certain limits of sensibility.

Limits of Sensibility.—To begin with, it is known that the sensation does not always answer to the external stimulus in its degree or intensity. Thus, a certain amount of stimulation is necessary before any sensation arises. And this will, of course, be greater when there is little or no attention directed to the impression, that is to say, no co-operating central reaction. Thus it happens that slight stimuli go overlooked, and here illusion may have its starting-point. The most familiar example of such slight errors is that of movement. When we are looking at objects, our ocular muscles are apt to execute very slight movements which escape our notice. Hence we tend, under certain circumstances, to carry over the retinal result of the movement, that is to say, the impression produced by a shifting of the parts of the retinal image to new nervous elements, to the object itself, and so to transform a "subjective" into an "objective" movement. In a very interesting work on apparent or illusory movements, Professor Hoppe has fully investigated the facts of such slight movements, and endeavored to specify their causes.*

Again, even when the stimulus is sufficient to produce a conscious impression, the degree of the feeling may not represent the degree of the stimulus. To take a very inconspicuous case, it is found by Fechner that a given increase of force in the stimulus produces a less amount of difference in the resulting sensations when the original stimulus is a powerful one than when it is a feeble one. It follows from this, that differences in the degree of our sensations do not exactly cor-

respond to objective differences. For example, we tend to magnify the differences of light among objects, all of which are feebly illuminated, that is to say, to see them much more removed from one another in point of brightness than when they are more strongly illuminated. Helmholtz relates that, owing to this tendency, he has occasionally caught himself, on a dark night, entertaining the illusion that the comparatively bright objects visible in twilight were self-luminous.*

Again, there are limits to the conscious separation of sensations which are received together, and this fact gives rise to illusion. In general, the number of distinguishable sensations answers to the number of external causes; but this is not always the case, and here we naturally fall into the error of mistaking the number of the stimuli. Reference has already been made to this fact in connection with the question whether consciousness can be mistaken as to the character of a present feeling.

The case of confusing two impressions when the sensory fibers involved are very near one another, has already been alluded to. Both in touch and in sight we always take two or more points for one when they are only separated by an interval that falls below the limits of local discrimination. It seems to follow from this that our perception of the world as a continuum, made up of points perfectly continuous one with another, may, for what we know, be illusory. Supposing the universe to consist of atoms separated by very fine intervals, then it is demonstrable that it would appear to our sensibility as a continuum, just as it does now.†

Two or more simultaneous sensations are indistinguishable from one another, not only when they have nearly the same local origin, but under other circumstances. The blending of partial sensations of tone in a *klangeinsens*, and the coalescence in certain cases of the impressions received by way of the two retinas, are examples of this. It is not quite certain what determines this fusion of two simultaneous feelings. It may be said generally that it is favored by similarity between the sensations;‡ by a comparative feebleness of one of the feelings; by the fact of habitual concomitance, the two sensations occurring rarely, if ever, in isolation; and by the presence of a mental disposition to view them as answering to one external object. These considerations help us to explain the coalescence of the retinal impressions and

* *Die Schein-Bewegungen*, von Professor Dr. J. I. Hoppe (1879); cf. an ingenious article on "Optical Illusions of Motion," by Professor Silvanus P. Thompson, in *Brain*, October, 1880. These illusions frequently involve the co-operation of some preconception or expectation. For example, the apparent movement of a train when we are watching it and expecting it to move, involves both an element of sense-impression and of imagination. It is possible that the illusion of table-turning rests on the same basis, the table-turner being unaware of the fact of exerting a certain amount of muscular force, and vividly expecting a movement of the object.

* *Physiologische Optik*, p. 316.

† It is plain that this supposed error could only be brought under our definition of illusion by extending the latter, so as to include sense-perceptions which are contradicted by reason employing idealized elements of sense-impression, which, as Lewes has shown (*Problems of Life and Mind*, i. p. 260), make up the "extra-sensible world" of science.

‡ An ingenious writer, M. Binet, has tried to prove that the fusion of homogeneous sensations, having little difference of local color, is an illustration of this principle. (See the *Revue Philosophique*, September, 1880.)

its limits, the fusion of partial tones, and so on.*

It is plain that this fusion of sensations, whatever its exact conditions may be, gives rise to error or wrong interpretation of the sense-impression. Thus, to take the points of two legs of a pair of compasses for one point is clearly an illusion of perception. Here is another and less familiar example. Very cold and smooth surfaces, as those of metal, often appear to be wet. I never feel sure, after wiping the blades of my skates, that they are perfectly dry, since they always seem more or less damp to my hand. What is the reason of this? Helmholtz explains the phenomenon by saying that the feeling we call by the name of wetness is a compound sensation consisting of one of temperature and one of touch proper. These sensations occurring together so frequently, blend into one, and so we infer, according to the general instinctive tendency already noticed, that there is one specific quality answering to the feeling. And since the feeling is nearly always produced by surfaces moistened by cold liquid, we refer it to this circumstance, and speak of it as a feeling of wetness. Hence, when the particular conjunction of sensations arises apart from this external circumstance, we erroneously infer its presence.†

The most interesting case of illusion connected with the fusion of simultaneous sensations is that of single vision, or the deeply organized habit of combining the sensations of what are called the corresponding points of the two retinas. This coalescence of two sensations is so far erroneous since it makes us overlook the existence of two distinct external agencies acting on different parts of the sensitive surface of the body. And this is the more striking in the case of looking at solid objects, since here it is demonstrable that the forces acting on the two retinas are not perfectly similar. Nevertheless, such a coalescence plainly answers to the fact that these external agencies usually arise in one and the same object, and this unity of the object is, of course, the all-important thing to be sure of.

This habit may, however, beget palpable illusion in another way. In certain exceptional cases the coalescence does not take place, as when I look at a distant object and

hold a pencil just before my eyes.* And in this case the organized tendency to take one visual impression for one object asserts its force, and I tend to fall into the illusion of seeing two separate pencils. If I do not wholly lapse into the error, it is because my experience has made me vaguely aware that double images under these circumstances answer to one object, and that if there were really two pencils present I should have four visual impressions.

Once more, it is a law of sensory stimulation that an impression persists for an appreciable time after the cessation of the action of the stimulus. This "after sensation" will clearly lead to illusion, in so far as we tend to think of the stimulus as still at work. It forms, indeed, as will be seen by and by, the simplest and lowest stage of hallucination. Sometimes this becomes the first stage of a palpable error. After listening to a child crying for some time the ear easily deceives itself into supposing that the noise is continued when it has actually ceased. Again, after taking a bandage from a finger, the tingling and other sensations due to the pressure sometimes persist for a good time, in which case they easily give rise to an illusion that the finger is still bound.

It follows from this fact of the reverberation of the nervous structures after the removal of a stimulus, that whenever two discontinuous stimulations follow one another rapidly enough, they will appear continuous. This fact is a fruitful source of optical illusion. The appearance of a blending of the stripes of colors on a rotating disk or top, of the formation of a ring of light by swinging round a piece of burning wood, and the illusion of the toy known as the thaumatrope, or wheel of life, all depend on this persistence of retinal impression. Many of the startling effects of sleight of hand are undoubtedly due in part to this principle. If two successive actions or sets of circumstances to which the attention of the spectator is specially directed follow one another by a very narrow interval of time, they easily appear continuous, so that there seems absolutely no time for the introduction of an intermediate step.†

There is another limit to sensibility which is in a manner the opposite to the one just named. It is a law of nervous stimulation that a continued activity of any structure results in less and less psychic result, and

* Even the fusion of elementary sensations of color, on the hypothesis of Young and Helmholtz, in a seemingly simple sensation may be explained to some extent by these circumstances, more especially the identity of local interpretation.

† The perception of luster as a single quality seems to illustrate a like error. There is good reason to suppose that this impression arises through a difference of brightness in the two retinal images due to the regularly reflected light. And so when this inequality of retinal impression is imitated, as it may easily be by combining a black and a white surface in a stereoscope, we imagine that we are looking at one lustrous surface. (See Helmholtz, *Physiologische Optik*, p. 782, etc., and *Populäre wissenschaftliche Vorträge*, 2tes Heft, p. 80.)

* The conditions of the production of these double images have been accurately determined by Helmholtz, who shows that the coalescence of impressions takes place whenever the object is so situated in the field of vision as to make it practically necessary that it should be recognized as one.

† These illusions are, of course, due in part to inattention, since close critical scrutiny is often sufficient to dispel them. They are also largely promoted by a preconception that the event is going to happen in a particular way. But of this more further on. I may add that the late Professor Clifford has argued ingeniously against the idea of the world being a continuum, by extending this idea of the wheel of life. (See *Lectures and Essays*, i. p. 112, et seq.)

that when a stimulus is always at work it ceases in time to have any appreciable effect. The common illustration of this law is drawn from the region of sound. A constant noise, as of a mill, ceases to produce any conscious sensation. This fact, it is plain, may easily become the commencement of an illusion. Not only may we mistake a measure of noise for perfect silence,* we may misconceive the real nature of external circumstances by overlooking some continuous impression.

Curious illustrations of this effect are found in optical illusions, namely, the errors we make respecting the movement of stationary objects after continued movement of the eyes. When, for example, in a railway carriage we have for some time been following the (apparent) movement of objects, as trees, etc., and turn our eyes to an apparently stationary object, as the carpet of the compartment, this seems to move in the contrary direction to that of the trees. Helmholtz's explanation of this illusion is that when we suppose that we are fixing our eye on the carpet we are really continuing to move it over the surface by reason of the organic tendency, already spoken of, to go on doing anything that has been done. But since we are unaware of this prolonged series of ocular movements, the muscular feelings having become faint, we take the impression produced by the sliding of the picture over the retina to be the result of a movement of the object.†

Another limit to our sensibility, which needs to be just touched on here, is known by the name of the specific energy of the nerves. One and the same nerve-fiber always reacts in a precisely similar way, whatever the nature of the stimulus. Thus, when the optic nerve is stimulated in any manner, whether by light, mechanical pressure, or an electric current, the same effect, a sensation of light, follows.‡ In a usual way, a given class of nerve-fiber is only stimulated by one kind of stimulus. Thus, the retina, in ordinary circumstances, is stimulated by light. Owing to this fact, there has arisen a deeply organized habit of translating the impression in one particular way. Thus, I instinctively

regard a sensation received by means of the optic nerve as one caused by light.

Accordingly, whenever circumstances arise in which a like sensation is produced by another kind of stimulus, we fall into illusion. The phosphenes, or circles of light which are seen when the hinder part of the eye-ball is pressed, may be said to be illusory in so far as we speak of them as perceptions of light, thus referring them to the external physical agency which usually causes them. The same remark applies to those "subjective sensations," as they are called, which are known to have as their physical cause subjective stimuli, consisting, in the case of sight, in varying conditions of the peripheral organ, as increased blood-pressure. Strictly speaking, such simple feelings as these appear to be, involve an ingredient of false perception: in saying that we perceive light at all, we go beyond the pure sensation, interpreting this wrongly.

Very closely connected with this limitation of our sensibility is another which refers to the consciousness of the local seat, or origin of the impression. This has so far its basis in the sensation itself as it is well known that (within the limits of local discrimination, referred to above) sensations have a particular "local" color, which varies in the case of each of the nervous fibers by the stimulation of which they arise.* But though this much is known through a difference in the sensibility, nothing more is known. Nothing can certainly be ascertained by a mere inspection of the sensation as to the distance the nervous process has traveled, whether from the peripheral termination of the fiber or from some intermediate point.

In a general way, we refer our sensations to the peripheral endings of the nerves concerned, according to what physiologists have called "the law of eccentricity." Thus I am said to feel the pain caused by a bruise in the foot in the member itself. This applies also to some of the sensations of the special senses. Thus, impressions of taste are clearly localized in the corresponding peripheral terminations.

With respect to the sense of smell, and still more to those of hearing and sight, where the impression is usually caused by an object at a distance from the peripheral organ, our attention to this external cause leads us to overlook in part the "bodily seat" of the sensation. Yet even here we are dimly aware that the sensation is received by way of a particular part of the sensitive surface, that is to say, by a particular sense-organ. Thus, though referring an odor to a distant flower, we perceive that the sensation of odor has its bodily origin in the nose. And even in the case of hearing and sight, we vaguely refer the impressions, as such, to the appro-

* It is supposed that in the case of every sense-organ there is always some minimum forces of stimulus at work, the effect of which on our consciousness is nil.

† See Helmholtz, *Physiologische Optik*, p. 603. Helmholtz's explanation is criticised by Dr. Hoppe, in the work already referred to (sec. vii.), though I cannot see that his own theory of these movements is essentially different. The apparent movement of objects in vertigo, or giddiness, is probably due to the loss, through a physical cause, of the impressions made by the pressure of the fluid contents of the ear on the auditory fibers, by which the sense of equilibrium and of rotation is usually received. (See Ferrier, *Functions of the Brain*, pp. 60, 61.)

‡ I do not need here to go into the question whether, as Johannes Müller assumed, this is an original attribute of nerve-structure, or whether, as Wundt suggests, it is due simply to the fact that certain kinds of nervous fiber have, in the course of evolution, been slowly adapted to one kind of stimulus.

* I here refer to what is commonly supposed to be the vague innate difference of sensation according to the local origin, before this is rendered precise, and added to by experience and association.

prate sense-organ. There is, indeed, in these cases a double local reference, a faint one to the peripheral organ which is acted on, and a more distinct one to the object or the force in the environment which acts on this.

Now, it may be said that the act of localization is in itself distinctly illusory, since it is known that the sensation first arises in connection with the excitation of the sensory center, and not of the peripheral fiber.* Yet it must at least be allowed that this localization of sensation answers to the important fact that, under usual circumstances, the agency producing the sensation is applied at this particular point of the organism, the knowledge of which point is supposed by modern psychologists to have been very slowly learnt by the individual and the race, through countless experiments with the moving organ of touch, assisted by the eye.

Similarly, the reference of the impression, in the case of hearing and sight, to an object in the environment, though, as we have seen, from one point of view illusory, clearly answers to a fact of our habitual experience; for in an immense preponderance of cases at least a visual or auditory impression does arise through the action on the sense-organ of a force (ether or air waves) proceeding from a distant object.

In some circumstances, however, even this element of practical truth disappears, and the localization of the impression, both within and without the organism, becomes altogether illusory. This result is involved in the illusions, already spoken of, which arise from the instinctive tendency to refer sensations to the ordinary kind of stimulus. Thus, when a feeling resulting from a disturbance in the optic nerve is interpreted as one of external light vaguely felt to be acting on the eye, or one resulting from some action set up in the auditory fiber as a sensation of external sound vaguely felt to be entering the ear, we see that the error of localization is a consequence of the other error already characterized.

As I have already observed, an excitation of a nerve at any other point than the peripheral termination, occurs but rarely in normal life. One familiar instance is the stimulation of the nerve running to the hand and fingers, by a sharp blow on the elbow over which it passes. As everybody knows, this gives rise to a sense of pain at the *extremities* of the nerve. The most common illustration of such errors of localization is found in subjective sensations, such as the impression we sometimes have of something creeping over

the skin, of a disagreeable taste in the mouth, of luminous spots floating across the field of vision, and so on. The exact physiological seat of these is often a matter of conjecture only; yet it may safely be said that in many instances the nervous excitation originates at some point considerably short of its peripheral extremity: in which case there occurs the illusion of referring the impressions to the peripheral sense-organ, and to an external force acting on this.

The most striking instances of these errors of localization are found in abnormal circumstances. It is well known that a man who has lost a leg refers all sensations arising from a stimulation of the truncated fibers to his lost foot, and in some cases has even to convince himself of the non-existence of his lost member by sight or touch. Patients often describe these experiences in very odd language. "If," says one of Dr. Weir Mitchell's patients, "I should say I am more sure of the leg which ain't than the one which air, I guess I should be about correct."*

There is good reason for supposing that this source of error plays a prominent part in the illusions of the insane. Diseased centers may be accompanied by disordered peripheral structures, and so subjective sensation may frequently be the starting-point of the wildest illusions. Thus, a patient's horror of poison may have its first origin in some subjective gustatory sensation. Similarly, subjective tactual sensations may give rise to gross illusions, as when a patient "feels" his body attacked by foul and destructive creatures.

It may be well to remark that this mistaken interpretation of the seat or origin of subjective sensation is closely related to hallucination. In so far as the error involves the ascription of the sensation to a force external to the sense-organ, this part of the mental process must, when there is no such force present, be viewed as hallucinatory. Thus, the feeling of something creeping over the skin is an hallucination in the sense that it implies the idea of an object external to the skin. Similarly, the projection of an ocular impression due to retinal disturbance into the external field of vision, may rightly be named an hallucination. But the case is not always so clear as this. Thus, for example, when a gustatory sensation is the result of an altered condition of the saliva, it may be said that the error is as much an illusion as an hallucination.†

In a wide sense, again, all errors connected with those subjective sensations which arise from a stimulation of the peripheral regions

* The illusory character of this simple mode of perception is seen best, perhaps, in the curious habit into which we fall of referring a sensation of contact or discomfort to the edge of the teeth, the hair, and the other insentient structures, and even to anything customarily attached to the sentient surface, as dress, a pen, graving tool, etc. On these curious illusions, see Lotze, *Mikrokosmos*, third edit., vol. ii. p. 202, etc.; Taine, *De l'Intelligence*, tom. ii. p. 83, et seq.

* Quoted by G. H. Lewes, *Problems of Life and Mind*, third series, p. 335. These illusions are supposed to involve an excitation of the nerve-fibers (whether sensory or motor) which run to the muscles and yield the so-called muscular sensations.

† It is brought out by Griesinger (*loc. cit.*) and the other writers on the pathology of illusion already quoted, that in the case of subjective sensations of touch, taste, and smell, no sharp line can be drawn between illusion and hallucination.

of the nerve may be called illusions rather than hallucinations. Or, if they must be called hallucinations, they may be distinguished as "peripheral" from those "central" hallucinations which arise through an internal automatic excitation of the sensory center. It is plain from this that the region of subjective sensation is an ambiguous region, where illusion and hallucination mix and become confused. To this point I shall have occasion to return by and by.

I have now probably said enough respecting the illusions that arise through the fact of there being fixed limits to our sensibility. The rationale of these illusions is that whenever the limit is reached, we tend to ignore it and to interpret the impression in the customary way.

Variations of Sensibility.—We will now pass to a number of illusions which depend on something variable in the condition of our sensibility, or some more or less exceptional organic circumstance. These variations may be momentary and transient or comparatively permanent. The illusion arises in each case from our ignoring the variation, and treating a given sensation under all circumstances as answering to one objective cause.

First of all, the variation of organic state may effect our mental representation of the strength of the stimulus or external cause. Here the fluctuation may be a temporary or a permanent one. The first case is illustrated in the familiar example of taking a room to be brighter than it is when emerging from a dark one. Another striking example is that of our sense of the temperature of objects, which is known to be strictly relative to a previous sensation, or more correctly to the momentary condition of the organ. Yet, though every intelligent person knows this, the deeply rooted habit of making sensation the measure of objective quality asserts its sway, and frequently leads us into illusion. The well-known experiment of first plunging one hand in cold water, the other in hot, and then dipping them both in tepid, is a startling example of this organized tendency. For here we are strongly disposed to accept the palpable contradiction that the same water is at once warm and cool.

Far more important than these temporary fluctuations of sensibility are the permanent alterations. Excessive fatigue, want of proper nutrition, and certain poisons are well known to be causes of such changes. They appear most commonly under two forms, exalted sensibility, or hyperæsthesia, and depressed sensibility, or anæsthesia. In these conditions flagrant errors are made as to the real magnitude of the causes of the sensations. These variations may occur in normal life to some extent. In fairly good health we experience at times strange exaltations of actual sensibility, so that a very slight stimulus, such as the contact of the bed-clothes, becomes greatly exaggerated.

In diseased states of the nervous system

these variations of sensibility become much more striking. The patient who has hyperæsthesia fears to touch a perfectly smooth surface, or he takes a knock at the door to be a clap of thunder. The hypochondriac may, through an increase of organic sensibility, translate organic sensations as the effect of some living creature gnawing at his vitals. Again, states of anæsthesia lead to odd illusions among the insane. The common supposition that the body is dead, or made of wood or of glass, is clearly referable in part to lowered sensibility of the organism.*

It is worth adding, perhaps, that these variations in sensibility give rise not only to sensory but also to motor illusions. To take a homely instance, the last miles of a long walk seem much longer than the first, not only because the sense of fatigue leading us to dwell on the transition of time tends to magnify the apparent duration, but because the fatigued muscles and connected nerves yield a new set of sensations which constitute an exaggerated standard of measurement. A number of optical illusions illustrate the same thing. Our visual sense of direction is determined in part by the feelings accompanying the action of the ocular muscles, and so is closely connected with the perception of movement, which has already been touched on. If an ocular muscle is partially paralyzed it takes a much greater "effort" to effect a given extent of movement than when the muscle is sound. Hence any movement performed by the eye seems exaggerated. Hence, too, in this condition objects are seen in a wrong direction; for the patient reasons that they are where they would seem to be if he had executed a wider movement than he really has. This may easily be proved by asking him to try to seize the object with his hand. The effect is exaggerated when complete paralysis sets in, and no actual movement occurs in obedience to the impulse from within.†

Variations in the condition of the nerve affect not only the degree, but also the quality of the sensation, and this fact gives rise to a new kind of illusion. The curious phenomena of color-contrast illustrate momentary alterations of sensibility. When, after looking at a green color for a time, I turn my eye to a gray surface and see this of the complementary rose-red hue, the effect is supposed to be due to a temporary fatigue of the retina in relation to those ingredients of the total light in the second case which answer to

* For a fuller account of these pathological disturbances of sensibility, see Griesinger; also Dr. A. Mayer, *Die Sinnesstörungen*.

† Helmholtz, *op. cit.*, p. 600, *et seq.* These facts seem to point to the conclusion that at least some of the feelings by which we know that we are expending muscular energy are connected with the initial stage of the outgoing nervous process in the motor centers. In other pathological conditions the sense of weight by the muscles of the arms is similarly confused.

the partial light in the first (the green rays).*

These momentary modifications of sensibility are of no practical significance, being almost instantly corrected. Other modifications are more permanent. It was found by Himly that when the retina is over-excitable every stimulus is raised in the spectrum scale of colors. Thus, violet becomes red. An exactly opposite effect is observed when the retina is torpid.† Certain poisons are known to affect the quality of the color-impression. Thus, santalin, when taken in any quantity, makes all colorless objects look yellow. Severe pathological disturbances are known to involve, in addition to hyperæsthesia and anaesthesia, what has been called paræsthesia, that is to say, that condition in which the quality of sensation is greatly changed. Thus, for example, to one in this state all food appears to have a metallic taste, and so on.

If we now glance back at the various groups of illusions just illustrated, we find that they all have this feature in common: they depend on the general mental law that when we have to do with the unfrequent, the unimportant, and therefore unattended to, and the exceptional, we employ the ordinary, the familiar, and the well-known as our standard. Thus, whether we are dealing with sensations that fall below the ordinary limits of our mental experience, or with those which arise in some exceptional state of the organism, we carry the habits formed in the much wider region of average every-day perception with us. In a word, illusion in these cases always arises through what may, figuratively at least, be described as the application of a rule, valid for the majority of cases, to an exceptional case.

In the varieties of illusion just considered, the circumstance that gives the peculiarity to the case thus wrongly interpreted has been referred to the organism. In the illusions to which we now pass, it will be referred to the environment. At the same time, it is plain that there is no very sharp distinction between the two classes. Thus, the visual illusion produced by pressing the eyeball might be regarded not only as the result of the organic law of the "specific energy" of the nerves, but, with almost

equal appropriateness, as the consequence of an exceptional state of things in the environment, namely, the pressure of a body on the retina. As I have already observed, the classification here adopted is to be viewed simply as a rough expedient for securing something like a systematic review of the phenomena.

CHAPTER V.

ILLUSIONS OF PERCEPTION—continued.

A. *Passive Illusions (b) as determined by the Environment.*—In the following groups of illusion we may look away from nervous processes and organic disturbances, regarding the effect of any external stimulus as characteristic, that is, as clearly marked off from the effects of other stimuli, and as constant for the same stimulus. The source of the illusion will be looked for in something exceptional in the external circumstances, whereby one object or condition of an object imitates the effect of another object or condition, to which, owing to a large preponderance of experience, we at once refer it.

Exceptional Relation of Stimulus to Organ.—A transition from the preceding to the following class of illusions is to be met with in those errors which arise from a very exceptional relation between the stimulus and the organ of sense. Such a state of things is naturally interpreted by help of more common and familiar relations, and so error arises.

For example, we may grossly misinterpret the intensity of a stimulus under certain circumstances. Thus, when a man crunches a biscuit, he has an uncomfortable feeling that the noise as of all the structures of his head being violently smashed is the same to other ears, and he may even act on his illusory perception, by keeping at a respectful distance from all observers. And even though he be a physiologist, and knows that the force of sensation in this case is due to the propagation of vibrations to the auditory center by other channels than the usual one of the ear, the deeply organized impulse to measure the strength of an external stimulus by the intensity of the sensation asserts its force.

Again, if we turn to the process of perceptual construction properly so called, the reference of the sensation to a material object lying in a certain direction, etc., we find a similar transitional form of illusion. The most interesting case of this in visual perception is that of a disturbance or displacement of the organ by external force. For example, an illusory sense of direction arises by the simple action of closing one eye, say the left, and pressing the other eyeball with one of the fingers a little outwards, that is to the right. The result of this movement is, of course, to transfer the retinal picture to new nervous elements rather to

* Wundt (*Physiologische Psychologie*, p. 653) would exclude from illusions all those errors of sense-perception which have their foundation in the normal structure and function of the organs of sense. Thus, he would exclude the effects of color-contrast, e.g., the apparent modification of two colors in juxtaposition toward their common boundary, which probably arises (according to E. Hering) from some mutual influence of the temporary state of activity of adjacent retinal elements. To me, however, these appear to be illusions, since they may be brought under the head of wrong interpretations of sense-impressions. When we see a gray patch as rose-red, as though it were so independently of the action of the complementary light previously or simultaneously, that is to say, as though it would appear rose-red to an eye independently of this action, we surely misinterpret.

† Quoted by G. H. Lewes, *loc. cit.*, p. 257.

the right. And since, in this instance, the displacement is not produced in the ordinary way by the activity of the ocular muscle making itself known by certain feelings of movement, it is disregarded altogether, and the direction of the objects is judged as though the eye were stationary.

A somewhat similar illusion as to direction occurs in auditory perception. The sense of direction by the ear is known to be due in part to the action of the auricle, or projecting part of the ear. This collects the air-waves, and so adds to the intensity of the sounds, especially those coming from in front, and thus assists in the estimation of direction. This being so, if an artificial auricle is placed in front of the ears; if, for example, the two hands are each bent into a sort of auricle, and placed in front of the ears, the back of the hand being in front, the sense of direction (as well as of distance) is confused. Thus, sounds really traveling from a point in front of the head will appear to come from behind it.

Again, the perception of the unity of an object is liable to be falsified by the introduction of exceptional circumstances into the sense-organ. This is illustrated in the well-known experiment of crossing two fingers, say the third and fourth, and placing a marble or other small round object between them. Under ordinary circumstances, the two lateral surfaces (that is, the outer surfaces of the two fingers) now pressed by the marble, can only be acted on simultaneously by two objects having convex surfaces. Consequently, we cannot help feeling the presence of two objects in this exceptional instance. The illusion is analogous to that of the stereoscope, to be spoken of presently.

Exceptional External Arrangements.—Passing now to those cases where the exceptional circumstance is altogether exterior to the organ, we find a familiar example in the illusions connected with the action of well-known physical forces, as the refraction of light, and the reflection of light and sound. A stick half-immersed in water always looks broken, however well we may know that the appearance is due to the bending of the rays of light. Similarly, an echo always sounds as though it came from some object in the direction in which the air-waves finally travel to the ear, though we are perfectly sure that these undulations have taken a circuitous course. It is hardly necessary to remind the reader that the deeply organized tendency to mistake the direction of the visible or audible object in these cases has from remote ages been made use of as a means of popular delusion. Thus, we are told by Sir D. Brewster, in his entertaining *Letters on Natural Magic* (letter iv.), that the concave mirror was probably used as the instrument for bringing the gods before the people. The throwing of the images formed by such mirrors upon smoke or against fire, so as to make them more distinct, seems to have

been a favorite device in the ancient art of necromancy.

Closely connected with these illusions of direction with respect to resting objects, are those into which we are apt to fall respecting the movements of objects. What looks like the movement of something across the field of vision is made known to us either by the feeling of the ocular muscles, if the eye follows the object, or through the sequence of locally distinct retinal impressions, if the eye is stationary. Now, either of these effects may result, not only from the actual movement of the object in a particular direction, but from our own movement in an opposite direction; or, again, from our both moving in the first direction, the object more rapidly than ourselves; or, finally, from our both moving in an opposite direction to this, ourselves more rapidly than the object. There is thus always a variety of conceivable explanations, and the action of past experience and association shows itself very plainly in the determination of the direction of interpretation. Thus, it is our instinctive tendency to take apparent movement, for real movement, except when the fact of our own movement is clearly present to consciousness, as when we are walking, or when we are sitting behind a horse whose movement we see. And so when the sense of our own movement becomes indistinct, as in a railway carriage, we naturally drift into the illusion that objects, such as trees, telegraph posts, and so on, are moving, when they are perfectly still. Under the same circumstances, we are apt to suppose that a train which is just shooting ahead of us is moving slowly.

Similar uncertainties arise with respect to the relative movement of two objects, the eye being supposed to be fixed in space. When two objects seem to pass one another, it may be that they are both moving in contrary directions, or that one only is moving, or finally, that both are moving in the same direction, the one faster than the other. Experience and habit here again suggest the interpretation which is most easy, and not unfrequently produce illusion. Thus, when we watch clouds scudding over the face of the moon, the latter seems moving rather than the former, and the illusion only disappears when we fix the eye on the moon and recognize that it is really stationary. The probable reason of this is, as Wundt suggests, that experience has made it far easier for us to think of small objects like the moon moving rapidly, than of large masses like the clouds.*

The perception of distance, still more than that of direction, is liable to be illusory. Indeed, the visual recognition of distance, together with that of solidity, has been the great region for the study of "the deceptions

* The subject of the perception of movement is too intricate to be dealt with fully here. I have only touched on it so far as necessary to illustrate our general principle. For a fuller treatment of the subject, see the work of Dr. Hoppe, already referred to.

of the senses." Without treating the subject fully here, I shall try to describe briefly the nature and source of these illusions.*

Confining ourselves first of all to near objects, we know that the smaller differences of distance in these cases are, if the eyes are at rest, perceived by means of the dissimilar pictures projected on the two retinas; or if they move, by this means, together with the muscular feelings that accompany different degrees of convergence of the two eyes. This was demonstrated by the famous experiments of Wheatstone. Thus, by means of the now familiar stereoscope, he was able to produce a perfect illusion of relief. The stereoscope may be said to introduce an exceptional state of things into the spectator's environment. It imitates, by means of two flat drawings, the dissimilar retinal pictures projected by a single solid receding object, and the lenses through which the eyes look are so constructed as to compel them to converge as though looking on a single object. And so powerful is the tendency to interpret this impression as one of solidity, that even though we are aware of the presence of the stereoscopic apparatus, we cannot help seeing the two drawings as a single solid object.

In the case of more remote objects, there is no dissimilarity of the retinal pictures or feelings of convergence to assist the eye in determining distance. Here its judgment, which now becomes more of a process of *conscious* inference, is determined by a number of circumstances which, through experience and association, have become the signs of differences of depth in space. Among these are the degree of indistinctness of the impression, the apparent or retinal magnitude (if the object is a familiar one), the relations of linear perspective, as the interruption of the outline of far objects by that of near objects, and so on. In a process so complicated there is clearly ample room for error, and wrong estimates of distance whenever unusual circumstances are present are familiar to all. Thus the inexperienced English tourist, when in the clear atmosphere of Switzerland, where the impressions from distant objects are more distinct than at home, naturally falls into the illusion that the mountains are much nearer than they are, and so fails to realize their true altitude.

Illusions of Art.—The imitation of solidity and depth by art is a curious and interesting illustration of the mode of production of illusion. Here we are not, of course, concerned with the question how far illusion is desirable in art, but only with its capabilities of illusory

presentment; which capabilities, it may be added, have been fully illustrated in the history of art. The full treatment of this subject would form a chapter in itself; here I can only touch on its main features.

Pictorial art working on a flat surface cannot, it is plain, imitate the stereoscope, and produce a perfect sense of solidity. Yet it manages to produce a pretty strong illusion. It illustrates in a striking manner the ease with which the eye conceives relations of depth or relief and solidity. If, for example, on a carpet, wall-paper, or dress, bright lines are laid on a dark color as ground, we easily imagine that they are advancing. The reason of this seems to be that in our daily experience advancing surfaces catch and reflect the light, whereas retreating surfaces are in shadow.*

The same principle is illustrated in one of the means used by the artist to produce a strong sense of relief, namely, the cast shadow. A circle drawn with chalk with a powerful cast shadow on one side will, without any shading or modeling of the form, appear to stand out from the paper, thus:



FIG. 1.

The reason is that the presence of such a shadow so forcibly suggests to the mind that the object is a prominent one intervening between the light and the shaded surface.†

Even without differences of light and shade, by a mere arrangement of lines, we may produce a powerful sense of relief or solidity. A striking example of this is the way in which two intersecting lines sometimes appear to recede from the eye, as the lines *a a'*, *b b'*, in the next drawing, which seem to belong to a regular pattern on the ground, at which the eye is looking from above and obliquely.

Again, the correct delineation of the projection of a regular geometrical figure, as a cube, suffices to give the eye a sense of relief.

* The perception of magnitude is closely connected with that of distance, and is similarly apt to take an illusory form. I need only refer to the well-known simple optical contrivances for increasing the apparent magnitude of objects. I ought, perhaps, to add that I do not profess to give a complete account of optical illusions here, but only to select a few prominent varieties, with a view to illustrate general principles of illusion. For a fuller account of the various mechanical arrangements for producing optical illusion, I must refer the reader to the writings of Sir D. Brewster and Helmholtz.

* Painters are well aware that the colors at the red end of the spectrum are apt to appear as advancing, while those of the violet end are known as retreating. The appearance of relief given by a gilded pattern on a dark blue as ground, is in part referable to the principle just referred to. In addition, it appears to involve a difference in the action of the muscles of accommodation in the successive adaptations of the eye to the most refrangible and the least refrangible rays. (See Brücke, *Die Physiologie der Farber*, sec. 17.)

† Helmholtz tells us (*Populäre wissenschaftliche Vorlesungen*, 3tes Heft, p. 64) that even in a stereoscopic arrangement the presence of a wrong cast shadow sufficed to disturb the illusion.

This effect is found to be the more striking in proportion to the familiarity of the form.

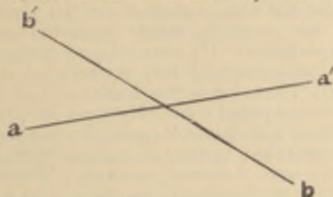


FIG. 2.

The following drawing of a long box-shaped solid at once seems to stand out to the eye.

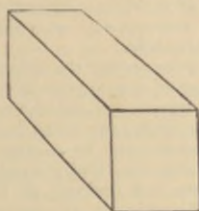


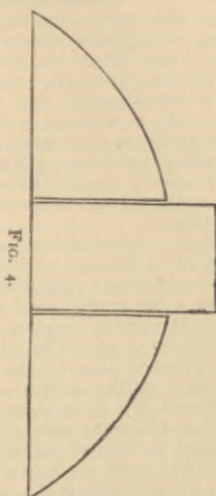
FIG. 3.

This habitual interpretation of the flat in art as answering to objects in relief, or having depth, can only be understood when it is remembered that our daily experience gives us myriads of instances in which the effect of such flat representations answers to solid receding forms. That is to say, in the case of all distant objects, in the perception of which the dissimilarity of the retinal pictures and the feeling of convergence take no part, we have to interpret solidity and relations of nearer and further by such signs as linear perspective and cast shadow. On the other hand, it is only in the artificial life of indoors, on our picture-covered walls, that we experience such effects without discovering corresponding realities. Hence a deeply organized habit of taking these impressions as answering to the solid and not to the flat. If our experience had been quite different; if, for example, we had been brought up in an empty room, amid painted walls, and had been excluded from the sight of the world of receding objects outside, we might easily have formed an exactly opposite habit of taking the actual mountains, trees, etc., of the distant scene to be pictures laid on a flat surface.

It follows from this that, with respect to the distant parts of a scene, pictorial art possesses the means of perfect imitation; and here we see that a complete illusory effect is obtainable. I need but to refer to the well-known devices of linear and aerial perspective, by which this result is secured.*

* Among the means of giving a vivid sense of depth to a picture, emphasized by Helmholtz, is diminishing magnitude. It is obvious that the perceptions of real magnitude and distance are mutually involved. When, for example, a picture represents a receding series of objects, as animals, trees, or buildings, the sense of the third dimension is rendered much more clear.

The value of these means of producing illusion at the command of the painter, may be illustrated by the following fact, which I borrow from Helmholtz. If you place two pieces of cardboard which correspond to portions of one form at the sides and in



front of a third piece, in the way represented above, so as just to allow the eye to follow the contour of this last, and then look at this arrangement from a point at some little distance with one eye, you easily suppose that it stands in front of the side pieces. The explanation of the illusion is that this particular arrangement powerfully suggests that the outline of the whole figure, of which the two side pieces are parts, is broken by an intervening object. Owing to the force of these and other suggestions, it is easy for the spectator, when attending to the background of a landscape painting, to give himself up for a moment to the pleasant delusion that he is looking at an actual receding scene.

In connection with pictorial delusion, I may refer to the well-known fact, that the eye in a portrait seems to follow the spectator, or that a gun, with its muzzle pointing straight outwards, appears to turn as the spectator moves.* These tricks of art have puzzled many people, yet their effect is easily understood, and has been very clearly explained by Sir D. Brewster, in the work already referred to (letter v.). They depend on the fact that a painting, being a flat projection only and not a solid, continues to present the front view of an object which it represents wherever the spectator happens to stand. Were the eye in the portrait a real eye, a side movement of the spectator would, it is evident, cause him to see less of the pupil and more of the side of the eyeball,

* A striking example of this was given in a painting, by Andsell, of a sportsman in the act of shooting, exhibited in the Royal Academy in 1879.

and he would only continue to see the full pupil when the eye followed him. We regard the eye in the picture as a real eye having relief, and judge accordingly.

We may fall into similar illusions respecting distance in auditory perception. A change of wind, an unusual stillness in the air, is quite sufficient to produce the sense that sounding objects are nearer than they actually are. The art of the ventriloquist manifestly aims at producing this kind of illusion. By imitating the dull effect of a distant voice, he is able to excite in the minds of his audience a powerful conviction that the sounds proceed from a distant point. There is little doubt that ventriloquism has played a conspicuous part in the arts of divination and magic.

Misconception of Local Arrangement.—Let us now pass to a class of illusions closely related to those having to do with distance, but involving some special kind of circumstance which powerfully suggests a particular arrangement in space. One of the most striking examples of these is the erroneous localization of a quality in space, that is to say, the reference of it to an object nearer or further off than the right one. Thus, when we look through a piece of yellow glass at a dull, wintry landscape, we are disposed to imagine that we are looking at a sunny scene of preternatural warmth. A moment's reflection would tell us that the yellow tint with which the objects appear to be suffused, comes from the presence of the glass; yet, in spite of this, the illusion persists with a curious force. The explanation is, of course, that the circumstances are exceptional, that in a vast majority of cases the impression of color belongs to the object and not to an intervening medium,* and that consequently we tend to ignore the glass, and to refer the color to the objects themselves.

When, however, the fact of the existence of a colored medium is distinctly present to the mind, we easily learn to allow for this, and to recognize one colored surface correctly through a recognized medium. Thus, we appear to ourselves to see the reflected images of the wall, etc., of a room, in a bright mahogany table, not suffused with a reddish yellow tint, as they actually are—and may be seen to be by the simple device of looking at a small bit of the image through a tube, but in their ordinary color. We may be said to fall into illusion here in so far as we overlook the exact quality of the impression actually made on the eye. This point will be touched on presently. Here I am concerned to show that this habit of allowing for the colored medium may, in its turn, occasionally lead to plain and palpable illusion.

The most striking example of this error is to be met with among the curious phenomena of color-contrast already referred to. In many of these cases the appearance of the contrasting color is, as I have observed, due

to a temporary modification of the nervous substance. Yet it is found that this organic factor does not wholly account for the phenomena. For example, Meyer made the following experiment. He covered a piece of green paper by a sheet of thin transparent white paper. The color of this double surface was, of course, a pale green. He then introduced a scrap of gray paper between the two sheets, and found that, instead of looking whitish as it really was, it looked rose-red. Whatever the color of the under sheet the gray scrap took the complementary hue. If, however, the piece of gray paper is put outside the thin sheet, it looks gray; and what is most remarkable is that when a second piece is put outside, the scrap inside no longer wears the complementary hue.

There is here evidently something more than a change of organic conditions; there is an action of experience and suggestion. The reason of our seeing the scrap rose-red in one case and neutral gray in another, is that in the first instance we vividly represent to ourselves that we are looking at it through a greenish veil (which is, of course, a part of the illusion); for rose-red seen through a greenish medium would, as a matter of fact, be light gray, as this scrap is. Even if we allow that there always exists after an impression of color a temporary organic disposition to see the complementary hue, this does not suffice as an explanation of these cases; we have to conclude further that imagination, led by the usual run of our experience, is here a co-operant factor, and helps to determine whether the complementary tint shall be seen or not.

Misinterpretation of Form.—More complex and circumscribed associations take part in those errors which we occasionally commit respecting the particular form of objects. This has already been touched on in dealing with artistic illusion. The disposition of the eye to attribute solidity to a flat drawing is the more powerful in proportion to the familiarity of the form. Thus, an outline drawing of a building is apt to stand out with special force.

Another curious illustration of this is the phenomenon known as the conversion of the concave mold or matrix of a medal into the corresponding convex relief. If, says Helmholtz, the mold of a medal be illuminated by a light falling obliquely so as to produce strong shadows, and if we regard this with one eye, we easily fall into the illusion that it is the original raised design, illuminated from the opposite side. As a matter of fact, the visual impression produced by a concave form with the light falling on one side, very closely resembles that produced by a corresponding convex form with the light falling on the other side. At the same time, it is found that the opposite mode of conversion, that is to say, the transformation of the raised into the depressed form, though occurring occasionally, is much less frequent. Now, it may be asked, why should we tend to transform the

* This is at least true of all near objects.

concave into the convex, rather than the convex into the concave? The reader may easily anticipate the answer from what has been said about the deeply fixed tendency of the eye to solidify a plane surface. We are rendered much more familiar, both by nature and by art, with raised (*caméo*) design than with depressed design (*intaglio*), and we instinctively interpret the less familiar form by the more familiar. This explanation appears to be borne out by the fact emphasized by Schroeder that the illusion is much more powerful if the design is that of some well-known object, as the human head or figure, or an animal form, or leaves.*

Another illustration of this kind of illusion recently occurred in my own experience. Nearly opposite to my window came a narrow space between two detached houses. This was, of course, darker than the front of the houses, and the receding parallel lines of the bricks appeared to cross this narrow vertical shaft obliquely. I could never look at this without seeing it as a convex column, round which the parallel lines wound obliquely. Others saw it as I did, though not always with the same overpowering effect. I can only account for this illusion by help of the general tendency of the eye to solidify impressions drawn from the flat, together with the effect of special types of experience, more particularly the perception of cylindrical forms in trees, columns, etc.

It may be added that a somewhat similar illustration of the action of special types of experience on the perception of individual form may be found in the region of hearing. The powerful disposition to take the finely graduated cadences of sound produced by the wind for the utterances of a human voice, is due to the fact that this particular form and arrangement of sound has deeply impressed itself on our minds in connection with numberless utterances of human feeling.

Illusions of Recognition.—As a last illustration of comparatively passive illusions, I may refer to the errors which we occasionally commit in recognizing objects. As I have already observed, the process of full and clear recognition, specific and individual, involves a classing of a number of distinct aspects of the object, such as color, form, etc. Accordingly, when in a perfectly calm state of mind we fall into illusion with respect to any object plainly visible, it must be through some accidental resemblance between the object and the other object or class of objects with which we identify it. In the case of individual identification such illusions are, of course, comparatively rare, since here there are involved so many characteristic differences. On the other hand, in the case of specific recognition there is ample room for error,

especially in those kinds of more subtle recognition to which I have already referred. To "recognize" a person as a Frenchman or a military man, for example, is often an erroneous process. Logicians have included this kind of error under what they call "fallacies of observation."

Errors of recognition, both specific and individual, are, of course, more easy in the case of distant objects or objects otherwise indistinctly seen. It is noticeable in these cases that, even when perfectly cool and free from emotional excitement, we tend to interpret such indistinct impressions according to certain favorite types of experience, as the human face and figure. Our interpretative imagination easily sees traces of the human form in cloud, rock, or tree-stump.

Again, even when there is no error of recognition, in the sense of confusing one object with other objects, there may be partial illusion. I have remarked that the process of recognizing an object commonly involves an overlooking of points of diversity in the object, or aspect of the object, now present. And sometimes this inattention to what is actually present includes an error as to the actual visual sensation of the moment. Thus, for example, when I look at a sheet of white paper in a feebly lit room, I seem to see its whiteness. If, however, I bring it near the window, and let the sun fall on a part of it, I at once recognize that what I have been seeing is not white, but a decided gray. Similarly, when I look at a brick viaduct a mile or two off, I appear to myself to recognize its redness. In fact, however, the impression of color which I receive from the object is not that of brick-red at all, but a much less decided tint; which I may easily prove by bending my head downwards and letting the scene image itself on the retina in an unusual way, in which case the recognition of the object as a viaduct being less distinct, I am better able to attend to the exact shade of the color.

Nowhere is this inattention to the sensation of the moment exhibited in so striking a manner as in pictorial art. A picture of Meissonier may give the eye a representation of a scene in which the objects, as the human figures and horses, have a distinctness that belongs to near objects, but an apparent magnitude that belongs to distant objects. So again, it is found that the degree of luminosity or brightness of a pictorial representation differs in general enormously from that of the actual objects. Thus, according to the calculations of Helmholtz,* a picture representing a Bedouin's white raiment in blinding sunshine, will, when seen in a fairly lit gallery, have a degree of luminosity reaching only to about one-thirtieth of that of the actual object. On the other hand, a painting representing marble ruins illuminated by moonlight, will, under the same conditions of illumination, have a luminosity amounting to as

* Helmholtz remarks (*op. cit.*, p. 628) that the difficulty of seeing the concave cast as convex is probably due to the presence of the cast shadow. This has, no doubt, some effect: yet the consideration urged in the text appears to me to be the most important one.

* *Populäre wissenschaftliche Vorträge*, 3tes Heft, pp. 71, 72.

much as from ten to twenty thousand times that of the object. Yet the spectator does not notice these stupendous discrepancies. The representation, in spite of its vast difference, at once carries the mind on to the actuality, and the spectator may even appear to himself, in moments of complete absorption, to be looking at the actual scene.

The truly startling part of these illusions is, that the direct result of sensory stimulation appears to be actually displaced by a mental image. Thus, in the case of Meyer's experiment, of looking at the distant viaduct, and of recognizing an artistic representation, imagination seems in a measure to take the place of sensation, or to blind the mind to what is actually before it.

The mystery of the process, however, greatly disappears when it is remembered that what we call a conscious "sensation" is really compounded of a result of sensory stimulation and a result of central reaction, of a purely passive impression and the mental activity involved in attending to this and classing it.* This being so, a sensation may be modified by anything exceptional in the mode of central reaction of the moment. Now, in all the cases just considered, we have one common feature, a powerful suggestion of the presence of a particular object or local arrangement. This suggestion, taking the form of a vivid mental image, dominates and overpowers the passive impression. Thus, in Meyer's experiment, the mind is possessed by the supposition that we are looking at the gray spot through a greenish medium. So in the case of the distant viaduct, we are under the mastery of the idea that what we see in the distance is a red brick structure. Once more, in the instance of looking at the picture, the spectator's imagination is enchaind by the vivid representation of the object for which the picture stands, as the marble ruins in the moonlight or the Bedouin in the desert.

It may be well to add that this mental uncertainty as to the exact nature of a present impression is necessitated by the very conditions of accurate perception. If, as I have said, all recognition takes place by overlooking points of diversity, the mind must, in course of time, acquire a habit of not attending to the exact quality of sense-impressions in all cases where the interpretation seems plain and obvious. Or, to use Helmholtz's words, our sensations are, in a general way, of interest to us only as signs of things, and if we are sure of the thing, we readily overlook the precise nature of the impression. In short, we get into the way of attending only to what is essential, constant, and characteristic in objects, and disregarding what is variable and accidental.† Thus, we attend,

in the first place, to the form of objects, the most constant and characteristic element of all, being comparatively inattentive to color, which varies with distance, atmospheric changes, and mode of illumination. So we attend to the relative magnitude of objects rather than to the absolute, and to the relative intensities of light and shade rather than to the absolute; for in so doing we are noting what is constant for all distances and modes of illumination, and overlooking what is variable. And the success of pictorial art depends on the observance of this law of perception.

These remarks at once point out the limits of these illusions. In normal circumstances, an act of imagination, however vivid, cannot create the semblance of a sensation which is altogether absent; it can only slightly modify the actual impression by interfering with that process of comparison and classification which enters into all definite determination of sensational quality.

Another great fact that has come to light in the investigation of these illusions is that oft-recurring and familiar types of experience leave permanent dispositions in the mind. As I said when describing the process of perception, what has been frequently perceived is perceived more and more readily. It follows from this that the mind will be habitually disposed to form the corresponding mental images, and to interpret impressions by help of these. The range of artistic suggestion depends on this. A clever draughtsman can indicate a face by a few rough touches, and this is due to the fact that the spectator's mind is so familiarized, through recurring experience and special interest, with the object, that it is ready to construct the requisite mental image at the slightest external suggestion. And hence the risk of hasty and illusory interpretation.

These observations naturally conduct us to the consideration of the second great group of sense-illusions, which I have marked off as active illusions, where the action of a pre-existing intellectual disposition becomes much more clearly marked, and assumes the form of a free imaginative transformation of reality.

CHAPTER VI.

ILLUSIONS OF PERCEPTION—continued.

B. Active Illusions.—When giving an account of the mechanism of perception, I spoke of an independent action of the imagination which tends to anticipate the process of suggestion from without. Thus, when expecting a particular friend, I recognize his

a small object which we are wont to handle, when it is placed far below the level of the eye. And hence the error people make in judging of the point in the wall or skirting which a hat will reach when placed on the ground.

* See, on this point, some excellent remarks by G. H. Lewes, *Problems of Life and Mind*, third series, vol. ii. p. 275.

† To some extent this applies to the changes of apparent magnitude due to altered position. Thus, we do not attend to the reduction of the height of

form much more readily than when my mind has not been preoccupied with his image.

A little consideration will show that this process must be highly favorable to illusion. To begin with, even if the preperception be correct, that is to say, if it answer to the perception, the mere fact of vivid expectation will affect the exact moment of the completed act of perception. And recent experiment shows that in certain cases such a previous activity of expectant attention may even lead to the illusory belief that the perception takes place before it actually does.*

A more palpable source of error resides in the risk of the formation of an inappropriate preperception. If a wrong mental image happens to have been formed and vividly entertained, and if the actual impression fits in to a certain extent with this independently formed preperception, we may have a fusion of the two which exactly simulates the form of a complete percept. Thus, for example, in the case just supposed, if another person, bearing some resemblance to our expected friend, chances to come into view, we may probably stumble into the error of taking one person for another.

On the physical side, we may, agreeably to the hypothesis mentioned above, express this result by saying that, owing to a partial identity in the nervous processes involved in the anticipatory image and the impression, the two tend to run one into the other, constituting one continuous process.

There are different ways in which this independent activity of the imagination may falsify our perceptions. Thus, we may voluntarily choose to entertain a certain image for a moment, and to look at the impression in a particular way, and within certain limits such capricious selection of an interpretation is effectual in giving a special significance to an impression. Or the process of independent preperception may go on apart from our volitions, and perhaps in spite of these, in which case the illusion has something of the irresistible necessity of a passive illusion. Let us consider separately each mode of production.

Voluntary Selection of Interpretation.—The action of a capricious exercise of the imagination in relation to an impression is illustrated in those cases where experience and suggestion offer to the interpreting mind an uncertain sound, that is to say, where the present sense-signs are ambiguous. Here we obviously have a choice of interpretation. And it is found that, in these cases, what we see depends very much on what we wish to see. The interpretation adopted is still, in a sense, the result of suggestion, but of one

particular suggestion which the fancy of the moment determines. Or, to put it another way, the caprice of the moment causes the attention to focus itself in a particular manner, to direct itself specially to certain aspects and relations of objects.

The eye's interpretation of movement, already referred to, obviously offers a wide field for this play of selective imagination. When looking out of the window of a railway carriage, I can at will picture to my mind the trees and telegraph posts as moving objects. Sometimes the true interpretation is so uncertain that the least inclination to view the phenomenon in one way determines the result. This is illustrated in a curious observation of Sinstedden. One evening, on approaching a windmill obliquely from one side, which under these circumstances he saw only as a dark silhouette against a bright sky, he noticed that the sails appeared to go, now in one direction, now in another, according as he imagined himself looking at the front or at the back of the windmill.*

In the interpretation of geometrical drawings, as those of crystals, there is, as I have observed, a general tendency to view the flat delineation as answering to a raised object, or a body in relief, according to the common run of our experience. Yet there are cases where experience is less decided, and where, consequently, we may regard any particular line as advancing or receding. And it is found that when we vividly imagine that the drawing is that of a convex or concave surface, we see it to be so, with all the force of a complete perception. The least disposition to see it in the other way will suffice to reverse the interpretation. Thus, in the following drawing, the reader can easily see at will

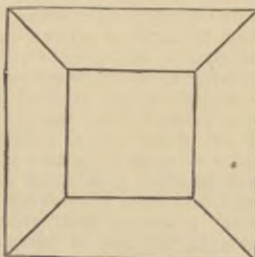


FIG. 5.

something answering to a truncated pyramid, or to the interior of a cooking vessel.

Similarly, in the accompanying figure of a transparent solid, I can at will select either of the two surfaces which approximately face the eye and regard it as the nearer, the other appearing as the hinder surface looked at through the body.

Again, in the next drawing, taken from Schroeder, one may, by an effort of will, see the diagonal step-like pattern, either as the

* I refer to the experiments made by Exner, Wundt, and others, in determining the time elapsing between the giving of a signal to a person and the execution of a movement in response. "It is found," says Wundt, "by these experiments that the exact moment at which a sense-impression is perceived depends on the amount of preparatory self-accommodation of attention." (See Wundt, *Physiologische Psychologie*, ch. xix., especially p. 735, et seq.)

* Quoted by Helmholtz, *op. cit.*, p. 626.

view from above of the edge of an advancing piece of wall at *a*, or as the view from below of the edge of an advancing (overhanging) piece of wall at *b*.

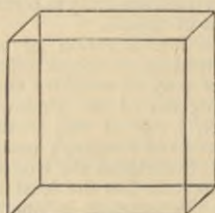


FIG. 6.

These last drawings are not in true perspective on either of the suppositions adopted, wherefore the choice is easier. But even when an outline form is in perspective, a strenuous effort of imagination may suffice to

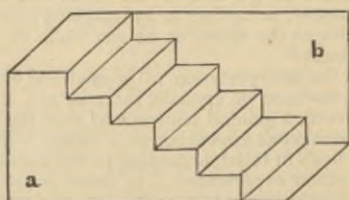


FIG. 7.

bring about a conversion of the appearance. Thus, if the reader will look at the drawing of the box-like solid (Fig. 3, p. 23), he will find that, after a trial or two, he succeeds in seeing it as a *concave* figure representing the cover and two sides of a box as looked at from within.*

Many of my readers, probably, share in my power of variously interpreting the relative position of bands or stripes on fabrics such as wall-papers, according to wish. I find that it is possible to view now this stripe or set of stripes as standing out in relief upon the others as a ground, now these others as advancing out of the first as a background. The difficulty of selecting either interpretation at will becomes greater, of course, in those cases where there is a powerful suggestion of some particular local arrangement, as, for example, the case of patterns much brighter than the ground, and especially of such as represent known objects, as flowers. Yet even here a strong effort of imagination will often suffice to bring about a conversion of the first appearance.

A somewhat similar choice of interpreta-

tion offers itself in looking at elaborate decorative patterns. When we strongly imagine any number of details to be elements of one figure, they seem to become so; and a given detail positively appears to alter in character according as it is viewed as an element of a more or less complex figure.

These examples show what force belongs to a vivid preconception, if this happens to fit only very roughly the impression of the moment, that is to say, if the interpretative image is one of the possible suggestions of the impression. The play of imagination takes a wider range in those cases where the impression is very indefinite in character, easily allowing of a considerable variety of imaginative interpretation.

I referred at the beginning of this account of sense-illusions to the readiness with which the mind deceives itself with respect to the nature and causes of the vague sensations which usually form the dim background of our mental life. A person of lively imagination, by trying to view these in a particular way, and by selectively attending to those aspects of the sensation which answer to the caprice of the moment, may give a variety of interpretations to one and the same set of sensations. For example, it is very easy to get confused with respect to those tactual and motor feelings which inform us of the position of our bodily members. And so, when lying in bed, and attending to the sensations connected with the legs, we may easily delude ourselves into supposing that these members are arranged in a most eccentric fashion. Similarly, by giving special heed to the sensations arising in connection with the condition of the skin at any part, we may amuse ourselves with the strangest fancies as to what is going on in these regions.

Again, when any object of visual perception is indistinct or indefinite in form, there is plainly an opening for this capricious play of fancy in transforming the actual. This is illustrated in the well-known pastime of discovering familiar forms, such as those of the human head and animals, in distant rocks and clouds, and of seeing pictures in the fire, and so on. The indistinct and indefinite shapes of the masses of rock, cloud, or glowing coal, offer an excellent field for creative fancy, and a person of lively imagination will discover endless forms in what, to an unimaginative eye, is a formless waste. Johannes Müller relates that, when a child, he used to spend hours in discovering the outlines of forms in the partly blackened and cracked stucco of the house that stood opposite to his own.* Here it is plain that, while experience and association are not wholly absent, but place certain wide limits on this process of castle-building, the spontaneous activity of the percipient mind is the great determining force.

So much as to the influence of a perfectly

*When the drawing, by its adherence to the laws of perspective, does not powerfully determine the eye to see it in one way rather than in the other (as in Figs. 5 to 7), the disposition to see the one form rather than the other points to differences in the frequency of the original forms in our daily experience. At the same time, it is to be observed that, after looking at the drawing for a time under each aspect, the suggestion now of the one and now of the other forces itself on the mind in a curious and unaccountable way.

* Ueber die phantastischen Gesichtsercheinungen, p. 45.

unfettered voluntary attention on the determination of the stage of preperception, and, through this, of the resulting interpretation. Let us now pass to cases in which this direction of preperception follows not the caprice of the moment, but the leading of some fixed predisposition in the interpreter's mind. In these cases attention is no longer free, but fettered, only it is now fettered rather from within than from without; that is to say, the dominating preperception is much more the result of an independent bent of the imagination than of some suggestion forced on the mind by the actual impression of the moment.

Involuntary Mental Preadjustment.—If we glance back at the examples of capricious selection just noticed, we shall see that they are really limited not only by the character of the impression of the time, but also by the mental habits of the spectator. That is to say, we find that his fancy runs in certain definite directions, and takes certain habitual forms. It has already been observed that the percipient mind has very different attitudes with respect to various kinds of impression. Toward some it holds itself at a distance, while toward others, it at once bears itself familiarly; the former are such as answer to its previous habit and bent of imagination, the latter such as do not so answer.

This bent of the interpretative imagination, assumes, as we have already seen, two forms, that of a comparatively permanent disposition, and that of a temporary state of expectation or mental preparedness. Illusion may arise in connection with either of these forms. Let us illustrate both varieties, beginning with those which are due to a lasting mental disposition.

It is impossible here to specify all the causes of illusion residing in organized tendencies of the mind. The whole past mental life, with its particular shade of experience, its ruling emotions, and its habitual direction of fancy, serves to give a particular color to new impressions, and so to favor illusion. There is a "personal equation" in perception as in belief—an amount of erroneous deviation from the common average view of external things, which is the outcome of individual temperament and habits of mind. Thus, a naturally timid man will be in general disposed to see ugly and fearful objects where a perfectly unbiased mind perceives nothing of the kind; and the forms which these objects of dread will assume are determined by the character of his past experience, and by the customary direction of his imagination.

In perfectly healthy states of mind this influence of temperament and mental habit on the perception of external objects is, of course, very limited; it shows itself more distinctly, as we shall see, in modifying the estimate of things in relation to the æsthetic and other feelings. This applies to the mythical poetical way of looking at nature—a part of our subject to which we shall have to return later on.

Passing now from the effect of such permanent dispositions, let us look at the more striking results of temporary expectancy of mind.

When touching on the influence of such a temporary mental attitude in the process of correct perception, I remarked that this readiness of mind might assume an indefinite or a definite form. We will examine the effect of each kind in the production of illusion.

Action of Sub-Expectation.—First of all, then, our minds may at the particular moment be disposed to entertain any one of a vaguely circumscribed group of images. Thus, to return to the example already referred to, when in Italy, we are in a state of readiness to frame any of the images that we have learnt to associate with this country. We may not be distinctly anticipating any one kind of object, but are nevertheless in a condition of *sub-expectation* with reference to a large number of objects. Accordingly, when an impression occurs which answers only very roughly to one of the associated images, there is a tendency to superimpose the image on the impression. In this way illusion arises. Thus, a man, when strolling in a cathedral, will be apt to take any kind of faint hollow sound for the soft tones of an organ.

The disposition to anticipate fact and reality in this way will be all the stronger if, as usually happens, the mental images thus lying ready for use have an emotional coloring. Emotion is the great disturber of all intellectual operations. It effects marvelous things, as we shall presently see, in the region of illusory belief, and its influence is very marked in the seemingly cooler region of external perception. The effect of any emotional excitement appears to be to give a preternatural vividness and persistence to the ideas answering to it, that is to say, the ideas which are its excitants, or which are otherwise associated with it. Owing to this circumstance, when the mind is under the temporary sway of any feeling, as, for example, fear, there will be a special readiness, to interpret objects by help of images congruent with the emotion. Thus, a man under the control of fear will be ready to see any kind of fear-inspiring object whenever there is any resemblance to such in the things actually present to his vision. The state of awe which the surrounding circumstances of a spiritualist *seance* inspires produces a general readiness of mind to perceive what is strange, mysterious, and apparently miraculous.

It is worth noting, perhaps, that those delightful half-illusions which imitative art seeks to produce are greatly favored by such a temporary attitude of the interpreting imagination. In the theater, for example, we are prepared for realizing the semblance of life that is to be unfolded before us. We come knowing that what is to be performed aims at representing a real action or actual series of events. We not improbably work ourselves into a slightly excited state in an-

ticipation of such a representation. More than this, as the play progresses, the realization of what has gone before produces a strong disposition to believe in the reality of what is to follow. And this effect is proportionate to the degree of coherence and continuity in the action. In this way, there is a cumulative effect on the mind. If the action is good, the illusion, as every play-goer knows, is most complete toward the end.

Were it not for all this mental preparation, the illusory character of the performance would be too patent to view, and our enjoyment would suffer. A man is often aware of this when coming into a theater during the progress of a piece before his mind accommodates itself to the meaning of the play. And the same thing is recognizable in the fact that the frequenter of the theater has his susceptibility to histrionic delusion increased by acquiring a habit of looking out for the meaning of the performance. Persons who first see a play, unless they be of exceptional imagination and have thought much about the theater—as Charlotte Brontë, for instance—hardly feel the illusion at all. At least, this is true of the opera, where the departure from reality is so striking that the impression can hardly fail to be a ludicrous one, till the habit of taking the performance for what it is intended to be is fully formed.*

A similar effect of intellectual preadjustment is observable in the fainter degrees of illusion produced by pictorial art. Here the undeceiving circumstances, the flat surface, the surroundings, and so on, would sometimes be quite sufficient to prevent the least degree of illusion, were it not that the spectator comes prepared to see a representation of some real object. This is our state of mind when we enter a picture gallery or approach what we recognize as a picture on the wall of a room. A savage would not "realize" a slight sketch as soon as one accustomed to pictorial representation, and ready to perform the required interpretative act.†

So much as to the effect of an indefinite state of sub-expectation in misleading our perceptions. Let us now glance at the results of definite pre-imagination, including what are generally known as expectations.

Effects of Vivid Expectation.—Such expectations may grow out of some present object—

* Another side of histrionic illusion, the reading of the imitated feelings into the actors' minds, will be dealt with in a later chapter.

† In a finished painting of any size this preparation is hardly necessary. In these cases, in spite of the great deviations from truth in pictorial representation already touched on, the amount of essential agreement is so large and so powerful in its effect that even an intelligent animal will experience an illusion. Mr. Romanes sends me an interesting account of a dog, that had never been accustomed to pictures, having been put into a state of great excitement by the introduction of a portrait into a room, on a level with his eye. It is not at all improbable that the lower animals, even when sane, are frequently the subjects of slight illusion. That animals dream is a fact which is observed as long ago as the age of Lucretius.

ive facts, which serve as signs of the expected event; or they may arise by way of verbal suggestion; or, finally, they may be due to internal spontaneous imagination.

In the first place, then, the expectations may grow out of previous perceptions, while, nevertheless, the direction of the expectation may be a wrong one. Here the interpreting imagination is, in a large sense, under the control of external suggestion, though, with respect to the particular impression that is misconstrued, it may be regarded as acting independently and spontaneously.

Illustrations of this effect in producing illusion will easily occur to the reader. If I happen to have heard that a particular person has been a soldier or clergyman, I tend to see the marks of the class in this person, and sometimes find that this process of recognition is altogether illusory. Again, let us suppose that a person is expecting a friend by a particular train. A passenger steps out of the train bearing a superficial resemblance to his friend; in consequence of which he falls into the error of false identification.

The delusions of the conjurer depend on a similar principle. The performer tells his audience that he is about to do a certain thing, for example, take a number of animals out of a small box which is incapable of holding them. The hearers, intent on what has been said, vividly represent to themselves the action described. And in this way their attention becomes bribed, so to speak, before hand, and fails to notice the inconspicuous movements, which would at once clear up the mystery. Similarly with respect to the illusions which overtake people at spiritualist séances. The intensity of the expectation of a particular kind of object excludes calm attention to what really happens, and the slightest impressions which answer to signs of the object anticipated are instantly seized by the mind and worked up into illusory perceptions.

It is to be noted that even when the impression cannot be made to tally exactly with the expectation, the force of the latter often effects a grotesque confusion of the perception. If, for example, a man goes into a familiar room in the dark in order to fetch something, and for a moment forgets the particular door by which he has entered, his definite expectation of finding things in a certain order may blend with the order of impressions experienced, producing for the moment a most comical illusion as to the actual state of things.

When the degree of expectation is unusually great, it may suffice to produce something like the counterfeit of a real sensation. This happens when the present circumstances are powerfully suggestive of an immediate event. The effect is all the more powerful, moreover, in those cases where the object or event expected is interesting or exciting, since here the mental image gains in vividness through the emotional excitement attending it. Thus, if I am watching a

train off and know from all the signs that it is just about to start, I easily delude myself into the conviction that it has begun to start, when it is really still.* An intense degree of expectation may, in such cases, produce something indistinguishable from an actual sensation. This effect is seen in such common experiences as that the sight of food makes the mouth of a hungry man water; that the appearance of a surgical instrument produces a nascent sensation of pain; and that a threatening movement, giving a vivid anticipation of tickling, begets a feeling which closely approximates to the result of actual tickling.

One or two very striking instances of such imagined sensations are given by Dr. Carpenter.† Here is one. An officer who superintended the exhuming of a coffin rendered necessary through a suspicion of crime, declared that he already experienced the odor of decomposition, though it was afterwards found that the coffin was empty.‡

It is, of course, often difficult to say, in such cases as these, how far elements of actual sensation co-operate in the production of the illusions. Thus, in the case just mentioned, the odor of the earth may have been the starting-point in the illusion. In many cases, however, an imaginative mind appears to be capable of transforming a vivid expectation into a nascent stage of sensation. Thus, a mother thinking of her sick child in an adjoining room, and keenly on the alert for its voice, will now and again fancy she really hears it when others hear nothing at all.

Transition to Hallucination.—It is plain that in these cases illusion approaches to hallucination. Imagination, instead of waiting on sensation, usurps its place and imitates its appearance. Such a "subjective" sensation produced by a powerful expectation might, perhaps, by a stretch of language, be regarded as an illusion, in the narrow sense, in so far as it depends on the suggestive force of a complete set of external circumstances; on the other hand, it is clearly an hallucination in so far as it is the production of the semblance of an external impression without any external agency corresponding to this.

In the class of illusory expectations just considered the immediately present environment still plays a part, though a much less direct part than that observable in the first

large group of illusions. We will now pass to a second mode of illusory expectation, where imagination is still more detached from the present surroundings.

A common instance of this kind of expectation is the so-called "intuition," or presentiment, that something is going to happen, which expectation has no basis in fact. It does not matter whether the expectation has arisen by way of another's words or by way of personal inclinations. A strong wish for a thing will, in an exalted state of mind, beget a vivid anticipation of it. This subject will be touched on again under the Illusions of Belief. Here I am concerned to point out that such presentiments are fertile sources of sense-illusion. The history of Church miracles, visions, and the like amply illustrates the effect of a vivid anticipation in falsifying the perceptions of external things.

In persons of a lively imagination any recent occupation of the mind with a certain kind of mental image may suffice to beget something equivalent to a powerful mode of expectation. For example, we are told by Dr. Tuke that on one occasion a lady, whose imagination had been dwelling on the subject of drinking-fountains, "thought she saw in a road a newly erected fountain, and even distinguished an inscription upon it, namely, 'If any man thirst, let him come unto Me, and drink.' She afterward found that what she had actually seen was only a few scattered stones."* In many cases there seems to be a temporary preternatural activity of the imagination in certain directions, of which no very obvious explanation is discoverable. Thus, we sometimes find our minds dwelling on some absent friend, without being able to give any reason for this mental preoccupation. And in this way arise strong temporary leanings to illusory perception. It may be said, indeed, that all unwonted activity of the imagination, however it arises, has as its immediate result a temporary mode of expectation, definite or indefinite, which easily confuses our perceptions of external things.

In proportion as this pre-existing imaginative impulse becomes more powerful, the amount of actual impression necessary to transform the mental image into an illusory perception becomes less; and, what is more important, this transformation of the internal image involves a larger and larger displacement of the actual impression of the moment. A man whose mind is at the time strongly possessed by one kind of image, will tend to project this outward with hardly any regard to the actual external circumstances.

This state of things is most completely illustrated in many of the grosser illusions of the insane. Thus, when a patient takes any small objects, as pebbles, for gold and silver, under the influence of the dominant idea of being a millionaire, it is obvious that external

* This kind of illusion is probably facilitated by the fact that the eye is often performing slight movements without any clear consciousness of them. See what was said about the limits of sensibility, p. 13.

† *Mental Physiology*, fourth edit., p. 138.

‡ In persons of very lively imagination the mere representation of an object or event may suffice to bring about such a semblance of sensation. Thus, M. Taine (*op. cit.*, vol. i. p. 94) vouches for the assertion that "one of the most exact and lucid of modern novelists," when working out in his imagination the poisoning of one of his fictitious characters, had so vivid a gustatory sensation of arsenic that he was attacked by a violent fit of indigestion.

* Mentioned by Dr. Carpenter (*Mental Physiology*, p. 207), where other curious examples are to be found.

suggestion has very little to do with the self-deception. The confusions into which the patient often falls with respect to the persons before him show the same state of mind; for in many cases there is no discoverable individual resemblance between the person actually present and the person for whom he is taken.

It is evident that when illusion reaches this stage, it is scarcely distinguishable from what is specially known as hallucination. As I have remarked in setting out, illusion and hallucination shade one into the other much too gradually for us to draw any sharp line of demarcation between them. And here we see that hallucination differs from illusion only in the proportion in which the causes are present. When the internal imaginative impulse reaches a certain strength, it becomes self-sufficient, or independent of any external impression.

This intimate relation between the extreme form of active illusion and hallucination may be seen, too, by examining the physical conditions of each. As I have already remarked, active illusion has for its physiological basis a state of sub-excitation, or an exceptional condition of irritability in the structures engaged in the act of interpretative imagination. The greater the degree of this irritability, the less will be the force of external stimulation needed to produce the effect of excitation, and the more energetic will be the degree of this excitation. Moreover, it is plain that this increase in the strength of the excitation will involve an extension of the area of excitation till, by and by, the peripheral regions of the nervous system may be involved just as in the case of external stimulation. This accounts for the gradual displacement of the impression of the moment by the mental image. It follows that when the irritability reaches a certain degree, the amount of external stimulus needed may become a vanishing quantity, or the state of sub-excitation may of itself develop into one of full activity.

Hallucinations.—I do not propose to go very fully into the description and explanation of hallucinations here, since they fall to a large extent under the category of distinctly pathological phenomena. Yet our study of illusions would not be complete without a glance at this part of the subject.

Hallucination, by which I mean the projection of a mental image outward when there is no external agency answering to it, assumes one of two fairly distinct forms; it may present itself either as a semblance of an external impression with the minimum amount of interpretation, or as a counterfeit of a completely developed percept. Thus, a visual hallucination may assume the aspect of a sensation of light or color which we vaguely refer to a certain region of the external world, or of a vision of some recognizable object. All of us frequently have incomplete visual and auditory hallucinations of the first order, whereas the complete hallucinations of the second order are comparatively rare. The

first I shall call rudimentary, the second developed, hallucinations.

Rudimentary hallucinations may have either a peripheral or a central origin. They may first of all have their starting-point in those subjective sensations which, as we have seen, are connected with certain processes set up in the peripheral regions of the nervous system. Or, secondly, they may originate in a certain preternatural activity of the sensory centers, or "sensorium," in what has been called by German physiologists an automatic excitation of the central structures, which activity may probably diffuse itself downward to the peripheral regions of the nerves. Baillarger would call hallucinations of the former class "psycho-sensorial," those of the latter class purely "psychical," hallucinations.*

It is often a matter of great difficulty to determine which part of the nervous system is originally concerned in these rudimentary hallucinations. It is probable that in normal life they are most frequently due to peripheral disturbance. And it seems reasonable to suppose that where the hallucination remains in this initial stage of a very incompletely interpreted visual or auditory impression, whether in normal or abnormal life, its real physiological source is the periphery. For the automatic excitation of the centers would pretty certainly issue in the semblance of some definite, familiar variety of sense-impression which, moreover, as a part of a complex state known as a percept, would instantly present itself as a completely formed quasi-percept. In truth, we may pretty safely argue that if it is the center which is directly thrown into a state of activity, it will be thrown into the usual complex, that is to say, *perceptual*, mode of activity.

Let us now turn to hallucinations properly so called, that is to say, completely developed quasi-percepts. These commonly assume the form of visual or auditory hallucinations. Like the incomplete hallucinations, they may have their starting-point either in some disturbance in the peripheral regions of the nervous system or in the automatic activity of the central structures: or, to use the language of Baillarger, we may say that they are either "psycho-sensorial" or purely "psychical." A subjective visual sensation, arising from certain conditions in the retina and connected portions of the optic nerve, may by chance resemble a familiar impression, and so be at once interpreted as an effect of a particular external object. More frequently, however, the automatic activity of the centers must be regarded, either in part or altogether, as the physiological cause of the phenomenon. This is clearly the case when, on the subjective side, the hallucination answers to a preceding energetic activity of the imagination, as in the case of the visionary and the monomaniac. Sometimes, however, as we have

* See *Annales Médico-Psychologiques*, tom. vi. p. 168, etc., tom. vii. p. 1, etc.

seen, the hallucinatory percept answers to previous prolonged acts of perception, leaving a kind of reverberation in the structures concerned; and in this case it is obviously impossible to say whether the peripheral or central regions (if either) have most to do with the hallucination.*

The classifications of the causes of hallucination to be met with in the works of pathologists, bear out the distinction just drawn. Griesinger tells us (*op. cit.*, pp. 94, 95) that the general causes of hallucination are: (1) Local disease of the organ of sense; (2) a state of deep exhaustion either of mind or of body; (3) morbid emotional states, such as fear; (4) outward calm and stillness between sleeping and waking; and (5) the action of certain poisons, as haschisch, opium, belladonna. The first cause points pretty distinctly to a peripheral origin, whereas the others appear to refer mainly, if not exclusively, to central derangements. Excessive fatigue appears to predispose the central structures to an abnormal kind of activity, and the same effect may be brought about by emotional agitation and by the action of poisons. The fourth case mentioned here, absence of external stimulation, would naturally raise the nervous structures to an exceptional pitch of excitability. Such a condition would, moreover, prove favorable to hallucination by blurring the distinction between mental image and actual impression.

Hallucinations of Normal Life.—In normal life, perfect hallucinations, in the strict sense as distinct from illusions, are comparatively rare. Fully developed persistent hallucinations, as those of Nicolai, the Berlin bookseller, and of Mrs. A—, the lady cited by Sir D. Brewster, in his *Letters on Natural Magic*, point to the presence of incipient nervous disorder. In healthy life, on the other hand, while everybody is familiar with subjective sensations such as flying spots, phosphenes, ringing in the ears, few fall into the error of seeing or hearing distinct recognizable objects in the absence of all external impressions. In the lives of eminent men we read of such phenomena as very occasional events. Malebranche, for example, is said to have heard the voice of God calling him. Descartes says that, after a long confinement, he was followed by an invisible person, calling him to pursue his search for truth. Dr. Johnson narrates that he once heard his absent mother calling him. Byron tells us that he was sometimes visited by specters. Goethe records that he once saw

an exact counterpart of himself coming toward him. Sir Walter Scott is said to have seen a phantom of the dead Byron. It is possible that all of us are liable to momentary hallucinations at times of exceptional nervous exhaustion, though they are too fugitive to excite our attention.

When not brought on by exhaustion or artificial means, the hallucinations of the sane have their origin in a preternatural power of imagination. It is well known that this power can be greatly improved by attention and cultivation. Goethe used to exercise himself in watching for ocular spectra, and could at will transform these subjective sensations into definite forms, such as flowers; and Johannes Müller found he had the same power.* Stories are told of portrait painters who could summon visual images of their sitters with a vividness equal to that of reality, and serving all the purposes of their art. Mr. Galton's interesting inquiries into the power of "visualizing" would appear to prove that many people can at will sport on the confines of the phantom world of hallucination. There is good reason to think that imaginative children tend to confuse mental images and percepts.†

The Hallucinations of Insanity.—The hallucinations of the insane are but a fuller manifestation of forces that we see at work in normal life. Their characteristic is that they simulate the form of distinctly present objects, the existence of which is not instantly contradicted by the actual surroundings of the moment.‡ The hallucinations have their origin partly in subjective sensations, which are probably connected with peripheral disturbances, partly and principally in central derangements.§ These include pro-

* That subjective sensation may become the starting-point in complete hallucination is shown in a curious instance given by Lazarus, and quoted by Taine, *op. cit.*, vol. i. p. 122, *et seq.* The German psychologist relates that, on one occasion in Switzerland, after gazing for some time on a chain of snow-peaks, he saw an apparition of an absent friend, looking like a corpse. He goes on to explain that this phantom was the product of an image of recollection which somehow managed to combine itself with the (positive) after-image left by the impression of the snow-surface.

† For an account of Mr. Galton's researches, see *Mind*, No. xix. Compare, however, Professor Bain's judicious observations on these results in the next number of *Mind*. The liability of children to take images for percepts, is illustrated by the experiences related in a curious little work, *Visions*, by E. H. Clarke, M.D. (Boston, U.S., 1878), pp. 17, 46, and 212.

‡ A common way of describing the relation of the hallucinatory to real objects, is to say that the former appear partly to cover and hide the latter.

§ Griesinger remarks that the forms of the hallucinations of the insane rarely depend on sense-disturbances alone. Though these are often the starting-point, it is the whole mental complexion of the time which gives the direction to the imagination. The common experience of seeing rats and mice running about during a fit of *delirium tremens* very well illustrates the co-operation of peripheral impressions not usually attended to, and possibly magnified by the morbid state of sensibility of the time (in this case flying spots, *Musca volitantes*), with emotional conditions. (See Griesinger, *loc. cit.*, p. 96.)

* I have already touched on the resonance of a sense-impression when the stimulus has ceased to act (see p. 16). The remarks in the text hold good of all such after-impressions, in so far as they take the form of fully developed percepts. A good example is the recurrence of the images of microscopic preparations, to which the anatomist is liable. (See Lewes, *Problems of Life and Mind*, third series, vol. ii. p. 299.) Since a complete hallucination is supposed to involve the peripheral regions of the nerve, the mere fact of shutting the eye would not, it is clear, serve as a test of the origin of the illusion.

found emotional changes, which affect the ruling mental tone, and exert a powerful influence on the course of the mental images. The hallucinations of insanity are due to a projection of mental images which have, owing to certain circumstances, gained a preternatural persistence and vividness. Sometimes it is the images that have been dwelt on with passionate longing before the disease, sometimes those which have grown most habitual through the mode of daily occupation,* and sometimes those connected with some incident at or near the time of the commencement of the disease.

In mental disease, auditory hallucinations play a part no less conspicuous than visual.† Patients frequently complain of having their thoughts spoken to them, and it is not uncommon for them to imagine that they are addressed by a number of voices at the same time.‡

These auditory hallucinations offer a good opportunity for studying the gradual growth of centrally originating hallucinations. In the early stages of the disease, the patient partly distinguishes his representative from his presentative sounds. Thus, he talks of sermons being composed to him in his head. He calls these "internal voices," or "voices of the soul." It is only when the disease gains ground and the central irritability increases that these audible thoughts become distinctly projected as external sounds into more or less definite regions of the environment. And it is exceedingly curious to notice the different directions which patients give to these sounds, referring them now to a quarter above the head, now to a region below the floor, and so on.§

Range of Sense-Illusions.—And now let us glance back to see the path we have traversed. We set out with an account of per-

fectly normal perception, and found, even here, in the projection of our sensations of color, sound, etc., into the environment or to the extremities of the organism, something which, from the point of view of physical science, easily wears the appearance of an ingredient of illusion.

Waiving this, however, and taking the word illusion as commonly understood, we find that it begins when the element of imagination no longer answers to a present reality or external fact in any sense of this expression. In its lowest stages illusion closely counterfeits correct perception in the balance of the direct factor, sensation, and the indirect factor, mental reproduction or imagination. The degree of illusion increases in proportion as the imaginative element gains in force relatively to the present impression; till, in the wild illusions of the insane, the amount of actual impression becomes evanescent. When this point is reached, the act of imagination shows itself as a purely creative process, or an hallucination.

While we may thus trace the progress of illusion toward hallucination by means of the gradual increase in force and extent of the imaginative, or indirect, as opposed to the sensuous, or direct, element in perception, we have found a second starting-point for this movement in the mechanism of sensation, involving, as it does, the occasional production of "subjective sensations." Such sensations constitute a border-land between the regions of illusion in the narrow sense, and hallucination. In their simplest and least developed form they may be regarded, at least in the case of hearing and sight, as partly hallucinatory; and they serve as a natural basis for the construction of complete hallucinations, or hallucinatory percepts.

In these different ways, then, the slight, scarcely noticeable illusions of normal life lead up to the most startling hallucinations of abnormal life. From the two poles of the higher centers of attention and imagination on the one side, and the lower regions of nervous action involved in sensation on the other side, issue forces which may, under certain circumstances, develop into full hallucinatory percepts. Thus closely is healthy attached to morbid mental life. There seems to be no sudden break between our most sober every-day recognitions of familiar objects and the wildest hallucinations of the demented. As we pass from the former to the latter, we find that there is never any abrupt transition, never any addition of perfectly new elements, but only that the old elements go on combining in ever new proportions.

The connection between the illusory side of our life and insanity may be seen in another way. All illusion has as its negative condition an interruption of the higher intellectual processes, the due control of our mental representations by reflection and reason. In the case of passive illusions, the error arises from our inability to subordinate the suggestion made by some feature of the present

* Wundt (*Physiologische Psychologie*, p. 652) tells us of an insane woodman who saw logs of wood on all hands in front of the real objects.

† It is stated by Baillarger (*Mémoires de l'Académie Royale de Médecine*, tom. xii. p. 273, etc.) that while visual hallucinations are more frequent than auditory in healthy life, the reverse relation holds in disease. At the same time, Griesinger remarks (*loc. cit.*, p. 98) that visual hallucinations are rather more common than auditory in disease also. This is what we should expect from the number of subjective sensations connected with the peripheral organ of vision. The greater relative frequency of auditory hallucinations in disease, if made out, would seem to depend on the close connection between articulate sounds and the higher centers of intelligence, which centers are naturally the first to be thrown out of working order. It is possible, moreover, that auditory hallucinations are quite as common as visual in states of comparative health, though more easily overlooked. Professor Huxley relates that he is liable to auditory though not to visual hallucinations. (See *Elementary Lessons in Physiology*, p. 267.)

‡ See Baillarger, *Mémoires de l'Académie Royale de Médecine*, tom. xii. p. 273, et seq.

§ See Baillarger, *Annales Médico-Psychologiques*, tom. vi. p. 168 et seq.; also tom. xii. p. 273, et seq. Compare Griesinger, *op. cit.* In a curious work entitled *Du Démon de Socrate* (Paris, 1856), M. Lélut seeks to prove that the philosopher's admonitory voice was an incipient auditory hallucination symptomatic of a nascent stage of mental alienation.

impression to the result of a fuller inspection of the object before us, or of a wider reflection on the past. In other words, our minds are dominated by the partial and the particular, to the exclusion of the total or the general. In active illusions, again, the powers of judgment and reflection, including those of calm perception itself, temporarily vacate their throne in favor of imagination. And this same suspension of the higher intellectual functions, the stupefaction of judgment and reflection made more complete and permanent, is just what characterizes insanity.

We may, perhaps, express this point of connection between the illusions of normal life and insanity by help of a physiological hypothesis. If the nervous system has been slowly built up, during the course of human history, into its present complex form, it follows that those nervous structures and connections which have to do with the higher intellectual processes, or which represent the larger and more general relations of our experience, have been most recently evolved. Consequently, they would be the least deeply organized, and so the least stable; that is to say, the most liable to be thrown *hors de combat*. This is what happens temporarily in the case of the sane, when the mind is held fast by an illusion. And, in states of insanity, we see the process of nervous dissolution beginning with the same nervous structures, and so taking the reverse order of the process of evolution.* And thus, we may say that throughout the mental life of the most sane of us, these higher and more delicately balanced structures are constantly in danger of being reduced to that state of inefficiency, which in its full manifestation is mental disease.

Does this way of putting the subject seem alarming? Is it an appalling thought that our normal mental life is thus intimately related to insanity, and graduates away into it by such fine transitions? A moment's reflection will show that the case is not so bad as it seems. It is well to remind ourselves that the brain is a delicately adjusted organ, which very easily gets disturbed, and that the best of us are liable to become the victims of absurd illusion if we habitually allow our imaginations to be overheated, whether by furious passion or by excessive indulgence in the pleasures of day-dreaming, or in the intoxicating mysteries of spiritualist séances. But if we take care to keep our heads cool and avoid unhealthy degrees of mental excitement, we need not be very anxious on the ground of our liability to this kind of error. As I have tried to show, our most frequent illusions are necessarily connected with something exceptional, either in the organism or in the environment. That is to say, it is of the nature of illusion in healthy conditions of body and mind to be

something very occasional and relatively unimportant. Our perceptions may be regarded as the reaction of the mind on the impressions borne in from the external world, or as a process of adjustment of internal mental relations to external physical relations. If this process is, in the main, a right one, we need not greatly trouble, because it is not invariably so. We should accept the occasional failure of the intellectual mechanism as an inseparable accompaniment of its general efficiency.

To this it must be added that many of the illusions described above can hardly be called cases of non-adaptation at all, since they have no relation to the practical needs of life, and consequently are, in a general way, unattended to. In other cases, again, namely, where the precise nature of a present sensation, being practically an unimportant matter, is usually unattended to, as in the instantaneous recognition of objects by the eye under changes of illumination, etc., the illusion is rather a part of the process of adaptation, since it is much more important to recognize the permanent object signified by the sensation than the precise nature of the present sensational "sign" itself.

Finally, it should never be forgotten that in normal states of mind there is always the possibility of rectifying an illusion. What distinguishes abnormal from normal mental life is the persistent occupation of the mind by certain ideas, so that there is no room for the salutary corrective effect of reflection on the actual impression of the moment, by which we are wont to "orientate," or take our bearings as to the position of things about us. In sleep, and in certain artificially produced states, much the same thing presents itself. Images become realities just because they are not instantly recognized as such by a reference to the actual surroundings of the moment. But in normal waking life this power of correction remains with us. We may not exercise it, it is true, and thus the illusion will tend to become more or less persistent and recurring; for the same law applies to true and to false perception: repetition makes the process easier. But if we only choose to exert ourselves, we can always keep our illusions in a nascent or imperfectly developed stage. This applies not only to those half-illusions into which we voluntarily fall, but also to the more irresistible passive illusions, and those arising from an over-excited imagination. Even persons subject to hallucinations, like Nicolai of Berlin, learn to recognize the unreal character of these phantasms. Sir W. Scott tells us, in his entertaining work *Demonology and Witchcraft*, that one of the greatest poets of his age, when asked if he believed in ghosts, answered, "No, madam, I have seen too many of them." However irresistible our sense-illusions may be, so long as we are under the sway of particular impressions or mental images, we can, when resolved to do so, undeceive ourselves by carefully attending to

*This is well brought out by Dr. J. Hughlings Jackson, in the papers in *Brain*, already referred to.

the actual state of things about us. And in many cases, when once the correction is made, the illusion seems an impossibility. By no effort of imagination are we able to throw ourselves back into the illusory mental condition. So long as this power of dispelling the illusion remains with us, we need not be alarmed at the number and variety of the momentary misapprehensions to which we are liable.

CHAPTER VII.

DREAMS.

THE phenomena of dreams may well seem at first sight to form a world of their own, having no discoverable links of connection with the other facts of human experience. First of all, there is the mystery of sleep, which quietly shuts all the avenues of sense, and so isolates the mind from contact with the world outside. To gaze at the motionless face of a sleeper temporarily rapt from the life of sight, sound, and movement—which, being common to all, binds us together in mutual recognition and social action—has always something awe-inspiring. This external inaction, this torpor of sense and muscle, how unlike to the familiar waking life, with its quick responsiveness and its overflowing energy! And then, if we look at dreams from the inside, we seem to find but the reverse face of the mystery. How inexpressibly strange does the late night-dream seem to a person on waking! He feels he has been seeing and hearing things no less real than those of waking life; but things which belong to an unfamiliar world, an order of sights and a sequence of events quite unlike those of waking experience; and he asks himself in his perplexity where that once visited region really lies, or by what magic power it was suddenly and for a moment created for his vision. In truth, the very name of dream suggests something remote and mysterious, and when we want to characterize some impression or scene which by its passing strangeness filled us with wonder, we naturally call it dream-like.

Theories of Dreams.—The earliest theories respecting dreams illustrate very clearly this perception of the remoteness of dream-life from waking experience. By the simple mind of primitive man this dream-world is regarded as similar in its nature or structure to our common world, only lying remote from this. The savage conceives that when he falls asleep, his second self leaves his familiar body and journeys forth to unfamiliar regions, where it meets the departed second selves of his dead ancestors, and so on. From this point of view, the experience of the night, though equal in reality to that of the day, is passed in a wholly disconnected region.*

A second and more thoughtful view of dreams, marking a higher grade of intellectual culture, is that these visions of the night are symbolic pictures unfolded to the inner eye of the soul by some supernatural being. The dream-experience is now, in a sense, less real than it was before, since the phantasms that wear the guise of objective realities are simply images spread out to the spirit's gaze, or the direct utterance of a divine message. Still, this mysterious contact of the mind with the supernatural is regarded as a fact, and so the dream assumes the appearance of a higher order of experience. Its one point of attachment to the experience of waking life lies in its symbolic function; for the common form which this supernatural view assumes is that the dream is a dim prevision of coming events. Artemidorus, the great authority on dream interpretation (*oneirocritics*) for the ancient world, actually defines a dream as "a motion or fiction of the soul in a diverse form signifying either good or evil to come;" and even a logician like Porphyry ascribes dreams to the influence of a good demon, who thereby warns us of the evils which another and bad demon is preparing for us. The same mode of viewing dreams is quite common to-day, and many who pride themselves on a certain intellectual culture, and who imagine themselves to be free from the weakness of superstition, are apt to talk of dreams as of something mysterious, if not distinctly ominous. Nor is it surprising that phenomena which at first sight look so wild and lawless, should still pass for miraculous interruptions of the natural order of events.*

Yet, in spite of this obvious and impressive element of the mysterious in dream-life, the scientific impulse to illuminate the less known by the better known has long since begun to play on this obscure subject. Even in the ancient world a writer might here and there be found, like Democritus or Aristotle, who was bold enough to put forward a natural and physical explanation of dreams. But it has been the work of modern science to provide something like an approximate solution of the problem. The careful study of mental life in its intimate union with bodily operations, and the comparison of dream-combinations with other products of the imagination, normal as well as morbid, have gradually helped to dissolve a good part of the mystery which once hung like an opaque mist about the subject. In this way, our dream-operations have been found to have a much closer connection with our waking experiences than could be supposed on a superficial view. The materials of our dreams are seen, when closely examined, to be drawn from our waking experience. Our waking consciousness acts in numberless ways on our dreams, and these again in unsuspected ways influence

* See E. B. Tylor, *Primitive Culture*, ch. xi.; cf. Herbert Spencer, *Principles of Sociology*, ch. x.

* For a fuller account of the different modes of dream-interpretation, see my article "Dream," in the ninth edition of the *Encyclopædia Britannica*.

our waking mental life.* Not only so, it is found that the quaint chaotic play of images in dreams illustrates mental processes and laws which are distinctly observable in waking thought. Thus, for example, the apparent objective reality of these visions has been accounted for, without the need of resorting to any supernatural agency, in the light of a vast assemblage of facts gathered from the by-ways, so to speak, of waking mental life. I need hardly add that I refer to the illusions of sense dealt with in the foregoing chapters.

Dreams are to a large extent the semblance of external perceptions. Other psychical phenomena, as self-reflection, emotional activity, and so on, appear in dream-life, but they do so in close connection with these quasi-perceptions. The name "vision," given by old writers to dreams, sufficiently points out this close affinity of the mental phenomena to sense-perception; and so far as science is concerned, they must be regarded as a peculiar variety of sense-illusion. Hence the appropriateness of studying them in close connection with the illusions of perception of the waking state. Though marked off by the presence of very exceptional physiological conditions, they are largely intelligible by help of these physiological and psychological principles which we have just been considering.

The State of Sleep.—The physiological explanation of dreams must, it is plain, set out with an account of the condition of the organism known as sleep. While there is here much that is uncertain, there are some things which are fairly well known. Recent physiological observation has gone to prove that during sleep all the activities of the organism are appreciably lowered. Thus, for example, according to Testa, the pulse falls by about one-fifth. This lowering of the organic functions appears, under ordinary circumstances, to increase toward midnight, after which there is a gradual rising.

The nervous system shares in this general depression of the vital activities. The circulation being slower, the process of reparation and nutrition of the nerves is retarded, and so their degree of excitability diminished. This is clearly seen in the condition of the peripheral regions of the nervous system, including the sense-organs, which appear to be but very slightly acted on by their customary stimuli.

The nervous centers must participate in this lethargy of the system. In other words, the activity of the central substance is lowered, and the result of this is plainly seen in what is usually thought of as the characteristic feature of sleep, namely, a transition from vigorous mental activity or intense and clear consciousness, to comparative inactivity or faint and obscure consciousness. The cause of this condition of the centers is supposed

to be the same as that of the torpidity of all the other organs in sleep, namely, the retardation of the circulation. But, though there is no doubt as to this, the question of the proximate physiological conditions of sleep is still far from being settled. Whether during sleep the blood-vessels of the brain are fuller or less full than during waking, is still a moot point. Also the qualitative condition of the blood in the cerebral vessels is still a matter of discussion.*

Since the effect of sleep is to lower central activity, the question naturally occurs whether the nervous centers are ever rendered inactive to such an extent as to interrupt the continuity of our conscious life. This question has been discussed from the point of view of the metaphysician, of the psychologist, and of the physiologist, and in no case is perfect unanimity to be found. The metaphysical question, whether the soul as a spiritual substance is capable of being wholly inactive, or whether it is not in what seem the moments of profoundest unconsciousness partially awake—the question so warmly discussed by the Cartesians, Leibnitz, etc.—need not detain us here.

Of more interest to us are the psychological and the physiological discussions. The former seeks to settle the question by help of introspection and memory. On the one side, it is urged against the theory of unbroken mental activity, that we remember so little of the lowered consciousness of sleep.† To this it is replied that our forgetfulness of the contents of dream-consciousness, even if this were unbroken, would be fully accounted for by the great dissimilarity between dreaming and waking mental life. It is urged, moreover, on this side that a sudden rousing of a man from sleep always discovers him in the act of dreaming, and that this goes to prove the uniform connection of dreaming and sleeping. This argument, again, may be met by the assertion that our sense of the duration of our dreams is found to be grossly erroneous; that, owing to the rapid succession of the images, the realization of which would involve a long duration, we enormously exaggerate the length of dreams in retrospection.‡ From this it is argued that the dream which is recalled on our being suddenly awakened may have had its whole course during the transition state of waking.

Again, the fact that a man may resolve, on going to sleep, to wake at a certain hour, has often been cited in proof of the persistence of a degree of mental activity even in perfectly sound sleep. The force of this consideration, however, has been explained away by saying that the anticipation of rising at an

* For a fuller account of the reactions of dreams on waking consciousness, see Paul Radestock, *Schlaf und Traum*. The subject is touched on later, under the Illusions of Memory.

* For an account of the latest physiological hypotheses as to the proximate cause of sleep, see Radestock, *op. cit.*, appendix.

† Plutarch, Locke, and others give instances of people who never dreamt. Lessing asserted of himself that he never knew what it was to dream.

‡ The error touched on here will be fully dealt with under Illusions of Memory.

unusual hour necessarily produces a slight amount of mental disquietude, which is quite sufficient to prevent sound sleep, and therefore to expose the sleeper to the rousing action of faint external stimuli.

While the purely psychological method is thus wholly inadequate to solve the question, physiological reasoning appears also to be not perfectly conclusive. Many physiologists, not unnaturally desirous of upsetting what they regard as a gratuitous metaphysical hypothesis, have pronounced in favor of an absolutely dreamless or unconscious sleep. From the physiological point of view, there is no mystery in a totally suspended mental activity. On the other hand, there is much to be said on the opposite side, and perhaps it may be contended that the purely physiological evidence rather points to the conclusion that central activity, however diminished during sleep, always retains a minimum degree of intensity. At least, one would be disposed to argue in this way from the analogy of the condition of the other functions of the organism during sleep. Possibly this modicum of positive evidence may more than outweigh any slight presumption against the doctrine of unbroken mental activity drawn from the negative circumstance that we remember so little of our dream-life.*

Such being the state of physiological knowledge respecting the immediate conditions of sleep, we cannot look for any certain information on the nature of that residual mode of cerebral activity which manifests itself subjectively in dreams. It is evident, indeed, that this question can only be fully answered when the condition of the brain as a whole during sleep is understood. Meanwhile we must be content with vague hypotheses.

It may be said, for one thing, that during sleep the nervous substance as a whole is less irritable than during waking hours. That is to say, a greater amount of stimulus is needed to produce any conscious result.† This appears plainly enough in the case of the peripheral sense-organs. Although these are not, as it is often supposed, wholly inactive during sleep, they certainly require a more potent external stimulus to rouse them to action. And what applies to the peripheral regions applies to the centers. In truth, it is clearly impossible to distinguish between the diminished irritability of the peripheral and that of the central structures.

At first sight it seems contradictory to the above to say that stimuli which have little effect on the centers of consciousness during waking life produce an appreciable result in sleep. Nevertheless, it will be found that this is the case. Thus organic processes which scarcely make themselves known to

the mind in a waking state, may be shown to be the originators of many of our dreams. This fact can only be explained on the physical side by saying that the special cerebral activities engaged in an act of attention are greatly liberated during sleep by the comparative quiescence of the external senses. These activities, by co-operating with the faint results of the stimuli coming from the internal organs, serve very materially to increase their effect.

Finally, it is to be observed that, while the centers thus respond with diminished energy to peripheral stimuli, external and internal, they undergo a direct, or "automatic," mode of excitation, being roused into activity independently of an incoming nervous impulse. This automatic stimulation has been plausibly referred to the action of the products of decomposition accumulating in the cerebral blood-vessels.* It is possible that there is something in the nature of this stimulation to account for the force and vividness of its conscious results, that is to say, of dreams.

The Dream State.—Let us now turn to the psychic side of these conditions, that is to say, to the general character of the mental states known as dreams. It is plain that the closing of the avenues of the external senses, which is the accompaniment of sleep, will make an immense difference in the mental events of the time. Instead of drawing its knowledge from without, noting its bearings in relation to the environment, the mind will now be given over to the play of internal imagination. The activity of fancy will, it is plain, be unrestricted by collision with external fact. The internal mental life will expand in free picturesque movement.

To say that in sleep the mind is given over to its own imaginings, is to say that the mental life in these circumstances will reflect the individual temperament and mental history. For the play of imagination at any time follows the lines of our past experience more closely than would at first appear, and being colored with emotion, will reflect the predominant emotional impulses of the individual mind. Hence the saying of Heraclitus, that, while in waking we all have a common world, in sleep we have each a world of our own.

This play of imagination in sleep is furthered by the peculiar attitude of attention. When asleep the voluntary guidance of attention ceases; its direction is to a large extent determined by the contents of the mind at the moment. Instead of holding the images and ideas, and combining them according to some rational end, the attention relaxes its energies and succumbs to the force of imagination. And thus, in sleep, just as in the condition of reverie or day-dreaming, there is an abandonment of the fancy to its own wild ways.

It follows that the dream-state will not

* For a very full, fair, and thoughtful discussion of this whole question, see Radestock, *op. cit.*, ch. iv.

† This may be technically expressed by saying that the liminal intensity (Schwelle) is raised during sleep.

* See Wundt, *Physiologische Psychologie*, pp. 188-191.

appear to the mind as one of fancy, but as one of actual perception, and of contact with present reality. Dreams are clearly illusory, and, unlike the illusions of waking life, are complete and persistent.* And the reason of this ought now to be clear. First of all, the mind during sleep wants what M. Taine calls the corrective of a present sensation. When awake under ordinary circumstances, any momentary illusion is at once set right by a new act of orientation. The superior vividness of the external impression cannot leave us in any doubt, when calm and self-possessed, whether our mental images answer to present realities or not. On the other hand, when asleep, this reference to a fixed objective standard is clearly impossible. Secondly, we may fairly argue that the mental images of sleep approximate in character to external impressions. This they do to some extent in point of intensity, for, in spite of the diminished excitability of the centers, the mode of stimulation which occurs in sleep may, as I have hinted, involve an energetic cerebral action. And, however this be, it is plain that the image will gain a preternatural force through the greatly narrowed range of attention. When the mind of the sleeper is wholly possessed by an image or group of images, and the attention kept tied down to these, there is a maximum re-enforcement of the images. But this is not all. When the attention is thus held captive by the image, it approximates in character to an external impression in another way. In our waking state, when our powers of volition are intact, the external impression is characterized by its fixity or its obdurate resistance to our wishes. On the other hand, the mental image is fluent, accommodating, and disappears and reappears according to the direction of our volitions. In sleep, through the suspension of the higher voluntary power of attention, the mental image seems to lord it over our minds just as the actual impression of waking life.

This much may suffice, perhaps, by way of a general description of the sleeping and dreaming state. Other points will make themselves known after we have studied the contents and structure of dreams in detail.

Dreams are commonly classified (*e.g.*, by Wundt) with hallucinations, and this rightly, since, as their common appellation of "vision" suggests, they are for the most part the semblance of percepts in the absence of external impressions. At the same time, recent research goes to show that in many dreams something answering to the "external impression" in waking perception is the starting-point. Consequently, in order to be as accurate as possible, I shall divide dreams into illusions (in the narrow sense) and hallucinations.

* There is, indeed, sometimes an undertone of critical reflection, which is sufficient to produce a feeling of uncertainty and bewilderment, and in very rare cases to amount to a vague consciousness that the mental experience is a dream.

Dream-Illusions.—By dream-illusions I mean those dreams which set out from some peripheral nervous stimulation, internal or external. That the organic processes of digestion, respiration, etc., act as stimuli to the centers in sleep is well known. Thus, David Hartley assigns as the second great source of dreams "states of the body."† But it is not so well known to what an extent our dreams may be influenced by stimuli acting on the exterior sense-organs. Let us first glance at the action of such external stimuli.

Action of External Stimuli.—During sleep the eyes are closed, and consequently the action of external light on the retina impeded. Yet it is found that even under these circumstances any very bright light suddenly introduced is capable of stimulating the optic fibers, and of affecting consciousness. The most common form of this is the effect of bright moonlight, and of the early sun's rays. Krauss tells a funny story of his having once, when twenty-six years old, caught himself, on waking, in the act of stretching out his arms toward what his dream-fancy had pictured as the image of his mistress. When fully awake, this image resolved itself into the full moon.‡ It is not improbable, as Radestock remarks, that the rays of the sun or moon are answerable for many of the dreams of celestial glory which persons of a highly religious temperament are said to experience.

External sounds, when not sufficient to rouse the sleeper, easily incorporate themselves into his dreams. The ticking of a watch, the stroke of a clock, the hum of an insect, the song of a bird, the patter of rain, was common stimuli to the dream-phantasy. M. Alf. Maury tells us, in his interesting account of the series of experiments to which he submitted himself in order to ascertain the result of external stimulation on the mind during sleep, that when a pair of tweezers was made to vibrate near his ear, he dreamt of bells, the tocsin, and the events of June, 1848.‡ Most of us, probably, have gone through the experience of impolitely falling asleep when some one was reading to us, and of having dream-images suggested by the sounds that were still indistinctly heard. Scherner gives an amusing case of a youth who was permitted to whisper his name into the ear of his obdurate mistress, the consequence of which was that the lady contracted a habit of dreaming about him, which led to a felicitous change of feeling on her part.§

The two lower senses, smell and taste, seem to play a less important part in the production of dream-illusions. Radestock says that the odor of flowers in a room easily leads to visual images of hot-houses, perfumery shops, and so on; and it is probable that the contents of the mouth may occasionally act as a stimulus to the organ of taste,

† *Observations on Man*, Part I. ch. iii. sec. 5.

‡ Quoted by Radestock, *op. cit.*, p. 110.

§ *Le Sommeil et les Rêves*, p. 132, et seq.

¶ *Das Leben des Traumer*, p. 369. Other instances are related by Beattie and Abercrombie.

and so give rise to corresponding dreams. As Radestock observes, these lower sensations do not commonly make known their quality to the sleeper's mind. They become transformed at once into visual, instead of into olfactory or gustatory percepts. That is to say, the dreamer does not imagine himself smelling or tasting, but seeing an object.

The contact of objects with the tactual organ is one of the best recognized causes of dreams. M. Maury found that when his lips were tickled, his dream-fancy interpreted the impression as of a pitch plaster being torn off his face. An unusual pressure on any part of the body, as, for example, from contact with a fellow-sleeper, is known to give rise to a well marked variety of dream. Our own limbs may even appear as foreign bodies to our dream-imagination, when through pressure they become partly paralyzed. Thus, on one occasion, I awoke from a miserable dream, in which I felt sure I was grasping somebody's hand in bed, and I was racked by terrifying conjectures as to who it might be. When fully awake, I discovered that I had been lying on my right side, and claspings the wrist of the right arm (which had been rendered insensible by the pressure of the body) with the left hand.

In close connection with these stimuli of pressure are those of muscular movement, whether unimpeded or impeded. We need not enter into the difficult question how far the "muscular sense" is connected with the activity of the motor nerves, and how far with sensory fibers attached to the muscular or the adjacent tissues. Suffice it to say that an actual movement, a resistance to an attempted movement, or a mere disposition to movement, whether consequent on a surplus of motor energy or on a sensation of discomfort or fatigue in the part to be moved, somehow or other makes itself known to our minds, even when we are deprived of the assistance of vision. And these feelings of movement, impeded or unimpeded, are common initial impulses in our dream-experiences. It is quite a mistake to suppose that dreams are built up out of the purely passive sensations of sight and hearing. A close observation will show that in nearly every dream we imagine ourselves either moving among the objects we perceive or striving to move when some weighty obstacle obstructs us. All of us are familiar with the common forms of nightmare, in which we strive hopelessly to flee from some menacing evil, and this dream-experience, it may be presumed, frequently comes from a feeling of strain in the muscles, due to an awkward disposition of the limbs during sleep. The common dream-illusion of falling down a vast abyss is plausibly referred by Wundt to an involuntary extension of the foot of the sleeper.

Action of Internal Stimuli.—Let us now pass from the action of stimuli lying outside the organism, to that of stimuli lying within the peripheral regions of the sense-organs. I have already spoken of the influence of

subjective sensations of sight, hearing, etc., on the illusions of waking life, and it is now to be added that these sensations play an important part in our dream-life. Johannes Müller lays great prominence on the part taken by ocular spectra in the production of dreams. As he observes, the apparent rays of light, light-patches, mists of light, and so on, due to changes of blood-pressure in the retina, only manifest themselves clearly when the eyes are closed and the more powerful effect of the external stimulus cut off. These subjective spectra come into prominence in the sleepy condition, giving rise to what M. Maury calls "hallucinations hypnagogiques," and which he regards (after Gruithuisen) as the chaos out of which the dream-cosmos is evolved.* They are pretty certainly the starting-point in those picturesque dreams in which figure a number of bright objects, such as beautiful birds, butterflies, flowers, or angels.

That the visual images of our sleep do often involve the peripheral regions of the organ of sight, seems to be proved by the singular fact that they sometimes persist after waking. Spinoza and Jean Paul Richter both experienced this survival of dream-images. Still more pertinent is the fact that the effects of retinal fatigue are producible by dream-images. The physiologist Gruithuisen had a dream, in which the principal feature was a violet flame, and which left behind it, *after waking*, for an appreciable duration, a complementary image of a yellow spot.†

Subjective auditory sensations appear to be much less frequent causes of dream-illusions than corresponding visual sensations. Yet the rushing, roaring sound caused by the circulation of the blood in the ear is, probably, a not uncommon starting-point in dreams. With respect to subjective sensations of smell and taste, there is little to be said. On the other hand, subjective sensations due to varying conditions in the skin are a very frequent exciting cause of dreams. Variations in the state of tension of the skin, brought about by alteration of position, changes in the character of the circulation, the irradiation of heat to the skin or the loss of the same, chemical changes—these are known to give rise to a number of familiar sensations, including those of tickling, itching, burning, creeping, and so on; and the effects of these sensations are distinctly traceable in our dreams. For example, the exposure of a part of the body through a loss of the bed-clothes is a frequent excitant of distressing dreams. A cold foot suggests that the sleeper is walking over snow or ice. On the other hand, if the cold foot happens to touch a warm part of the body, the dream-fancy

* *Le Sommeil et les Rêves*, p. 42, et seq.

† *Beiträge zur Physiognosie und Hautognosie*, p. 256. For other cases see H. Meyer, *Physiologie der Nervenfasern*, p. 309; and Strümpell, *Die Natur und Entstehung der Träume*, p. 125.

constructs images of walking on burning lava, and so on.

These sensations of the skin naturally conduct us to the organic sensations as a whole; that is to say, the feelings connected with the varying condition of the bodily organs. These include the feelings which arise in connection with the processes of digestion, respiration, and circulation, and the condition of various organs according to their state of nutrition, etc. During our waking life these organic feelings coalesce for the most part, forming as the "vital sense" an obscure background for our clear discriminative consciousness, and only come forward into this region when very exceptional in character, as when respiration or digestion is impeded, or when we make a special effort of attention to single them out.* When we are asleep, however, and the avenues of external perception are closed, they assume greater prominence and distinctness. The centers, no longer called upon to react on stimuli coming from without the organism, are free to react on stimuli coming from its hidden recesses. So important a part, indeed, do these organic feelings take in the dream-drama, that some writers are disposed to regard them as the great, if not the exclusive, cause of dreams. Thus, Schopenhauer held that the excitants of dreams are impressions received from the internal regions of the organism through the sympathetic nervous system.†

It is hardly necessary, perhaps, to give many illustrations of the effect of such organic sensations on our dreams. Among the most common provocatives of dreams are sensations connected with a difficulty in breathing, due to the closeness of the air or to the pressure of the bed-clothes on the mouth. J. Börner investigated the influence of these circumstances by covering with the bed-clothes the mouth and a part of the nostrils of persons who were sound asleep. This was followed by a protraction of the act of breathing, a reddening of the face, efforts to throw off the clothes, etc. On being roused, the sleeper testified that he had experienced a nightmare, in which a horrid animal seemed to be weighing him down.‡ Irregularity of the heart's action is also a frequent cause of dreams. It is not improbable that the familiar dream-experience of flying arises from disturbances of the respiratory and circulatory movements.

* A very clear and full account of these organic sensations, or common sensations, has recently appeared from the pen of A. Horwicz in the *Vierteiljahrsschrift für wissenschaftliche Philosophie*, iv. Jahrgang 3tes Heft.

† Schopenhauer uses this hypothesis in order to account for the apparent reality of dream-illusions. He thinks these internal sensations may be transformed by the "intuitive function" of the brain (by means of the "forms" of space, time, etc.) into quasi-realities, just as well as the subjective sensations of light, sound, etc., which arise in the organs of sense in the absence of external stimuli. (See *Versuch über das Geistesleben: Werke*, vol. v. p. 244, et seq.)

‡ Das Alpdrücken, pp. 8, 9, 27.

Again, the effects of indigestion, and more particularly stomachic derangement, on dreams are too well known to require illustration. It may be enough to allude to the famous dream which Hood traces to an excessive indulgence at supper. It is known that the varying condition of the organs of secretion influences our dream-fancy in a number of ways.

Finally, it is to be observed that an injury done to any part of the organism is apt to give rise to appropriate dream-images. In this way, very slight disturbances which would hardly affect waking consciousness may make themselves felt during sleep. Thus, for example, an incipient toothache has been known to suggest that the teeth are being extracted.*

It is worth observing that the interpretation of these various orders of sensations by the imagination of the dreamer takes very different forms according to the person's character, previous experience, ruling emotions, and so on. This is what is meant by saying that during sleep every man has a world of his own, whereas, when awake, he shares in the common world of perception.

Dream-Exaggeration.—It is to be noticed, further, that this interpretation of sensation during sleep is uniformly a process of exaggeration.† The exciting causes of the feelings of discomfort, for example, are always absurdly magnified. The reason of this seems to be that, owing to the condition of the mind during sleep, the nature of the sensation is not clearly recognizable. Even in the case of familiar external impressions, such as the sound of the striking of a clock, there appears to be wanting that simple process of reaction by which, in a waking condition of the attention, a sense-impression is instantly discriminated and classed. In sleep, as in the artificially induced hypnotic condition, the slighter differences of quality among sensations are not clearly recognized. The activity of the higher centers, which are concerned in the finer processes of discrimination and classification, being greatly reduced, the impression may be said to come before consciousness as something novel and unfamiliar. And just as we saw that in waking life novel sensations agitate the mind, and so lead to an exaggerated mode of interpretation, so here we see that what is unfamiliar disturbs the mind, rendering it incapable of calm attention and just interpretation.

This failure to recognize the real nature of an impression is seen most conspicuously in the case of the organic sensations. As I have remarked, these constitute for the most part, in waking life, an indiscriminated mass of obscure feeling, of which we are only conscious as the mental tone of the hour. And

* It is this fact which justifies writers in assigning a prognostic character to dreams.

† A part of the apparent exaggeration in our dream-experiences may be retrospective, and due to the effect of the impression of wonder which they leave behind them. (See Strümpell, *Die Natur und Entstehung der Träume*.)

in the few instances in which we do attend to them separately, whether through their exceptional intensity or in consequence of an extraordinary effort of discriminative attention, we can only be said to perceive them, that is, recognize their local origin, very vaguely. Hence, when asleep, these sensations get very oddly misinterpreted.

The localization of a bodily sensation in waking life means the combination of a tactual and a visual image with the sensation. Thus, my recognition of a twinge of toothache as coming from a certain tooth, involves representations of the active and passive sensations which touching and looking at the tooth would yield me. That is to say, the feeling instantly calls up a compound mental image exactly answering to a visual percept. This holds good in dream-interpretation too; the interpretation is effected by means of a visual image. But since the feeling is only very vaguely recognized, this visual image does not answer to the bodily part concerned. Instead of this, the fancy of the dreamer constructs some visual image which bears a vague resemblance to the proper one, and is generally, if not always, an exaggeration of this in point of extensive magnitude, etc. For example, a sensation arising from pressure on the bladder, being dimly connected with the presence of a fluid, calls up an image of a flood, and so on.

This mode of dream-interpretation has by some writers been erected into the typical mode, under the name of dream-symbolism. Thus Scherner, in his interesting though somewhat fanciful work, *Das Lebendes Traumtes*, contends that the various regions of the body regularly disclose themselves to the dream-fancy under the symbol of a building or group of buildings; a pain in the head calling up, for example, the image of spiders on the ceiling, intestinal sensations exciting an image of a narrow alley, and so on. Such theories are clearly an exaggeration of the fact that the localization of our bodily sensations during sleep is necessarily imperfect.*

In many cases the image called up bears on its objective side no discoverable resemblance to that of the bodily region or the exciting cause of the sensation. Here the explanation must be looked for in the subjective side of the sensation and mental image, that is to say, in their emotional quality, as pleasurable or painful, distressing, quieting, etc. It is to be observed, indeed, that in natural sleep, as in the condition known as hypnotism, while differences of specific quality in the sense-impressions are lost, the broad difference of the pleasurable and the painful is never lost. It is, in fact, the subjective emotional side of the sensation that uniformly forces itself into consciousness. This being so, it follows that, speaking generally, the sensations of sleep, both external and internal, or organic, will be interpreted by what G. H. Lewes has called "an analogy of feel-

ing;" that is to say, by means of a mental image having some kindred emotional character or coloring.

Now, the analogy between the higher emotional and the bodily states is a very close one. A sensation of obstruction in breathing has its exact analogue in a state of mental embarrassment, a sensation of itching its counterpart in mental impatience, and so on. And since these emotional experiences are deeper and fuller than the sensations, the tendency to exaggerate the nature and causes of these last would naturally lead to an interpretation of them by help of these experiences. In addition to this, the predominance of visual imagery in sleep would aid this transformation of a bodily sensation into an emotional experience, since visual perceptions have, as their accompaniments of pleasure and pain, not sensations, but emotions.*

Since in this vague interpretation of bodily sensation the actual impression is obscure, and not taken up as an integral part into the percept, it is evident that we cannot, strictly speaking, call the process an imitation of an act of perception, that is to say, an illusion. And since, moreover, the visual image by which the sensation is thus displaced appears as a present object, it would, of course, be allowable to speak of this as an hallucination. This substitution of a more or less analogous visual image for that appropriate to the sensation forms, indeed, a transition from dream-illusion, properly so called, to dream-hallucination.

Dream Hallucinations.—On the physical side, these hallucinations answer to cerebral excitations which are central or automatic, not depending on movements transmitted from the periphery of the nervous system. Of these stimulations some appear to be direct, and due to unknown influences exerted by the state of nutrition of the cerebral elements, or the action of the contents of the blood-vessels on these elements.

Effects of Direct Central Stimulation.—That such action does prompt a large number of dream-images may be regarded as fairly certain. First of all, it seems impossible to account for all the images of dream-fancy as secondary phenomena connected by links of association with the foregoing classes of sensation. However fine and invisible many of the threads which hold together our ideas may be, they will hardly explain the profusion and picturesque variety of dream-imagery. Secondly, we are able in certain cases to infer with a fair amount of certainty that a dream-image is due to such central stimulation. The common occurrence that we dream of the more stirring events, the

* I was on one occasion able to observe this process going on in the transition from waking to sleeping. I partly fell asleep when suffering from toothache. Instantly the successive throbs of pain transformed themselves into a sequence of visible movements, which I can only vaguely describe as the forward strides of some menacing adversary.

* Cf. Radestock, *op. cit.*, pp. 131, 132.

anxieties and enjoyments of the preceding day, appears to show that when the cerebral elements are predisposed to a certain kind of activity, as they are after having been engaged for some time in this particular work, they are liable to be excited by some stimulus brought directly to bear on them during sleep. And if this is so, it is not improbable that many of the apparently forgotten images of persons and places which return with such vividness in dreams are excited by a mode of stimulation which is for the greater part confined to sleep. I say "for the greater part," because even in our indolent, listless moments of waking existence such seemingly forgotten ideas sometimes return as though by a spontaneous movement of their own and by no discoverable play of association.

It may be well to add that this immediate revival of impressions previously received by the brain includes not only the actual perceptions of waking life, but also the ideas derived from others, the ideal fancies supplied by works of fiction, and even the images which our unaided waking fancy is wont to shape for itself. Our daily conjectures as to the future, the communications to us by others of their thoughts, hopes, and fears,—these give rise to numberless vague fugitive images, any one of which may become distinctly revived in sleep.* This throws light on the curious fact that we often dream of experiences and events quite unlike those of our individual life. Thus, for example, the common construction by the dream-fancy of the experience of flight in mid-air, and the creation of those weird forms which the terror of a nightmare is wont to bring in its train, seem to point to the past action of waking fancy. To imagine one's self flying when looking at a bird is probably a common action with all persons, at least in their earlier years, and images of preternaturally horrible beings are apt to be supplied to most of us some time during life by nurses or by books.

Indirect Central Stimulation.—Besides these direct central stimulations, there are others which, in contradistinction, may be called indirect, depending on some previous excitation. These are, no doubt, the conditions of a very large number of our dream-images. There must, of course, be some primary cerebral excitation, whether that of a present peripheral stimulation, or that which has been termed central and spontaneous; but when once this first link of the imaginative chain is supplied, other links may be added in large numbers through the operation of the forces of association. One may, indeed,

safely say that the large proportion of the contents of every dream arise in this way.

The very simplest type of dream excited by a present sensation contains these elements. To take an example, I once dreamt, as a consequence of the loud barking of a dog, that a dog approached me when lying down, and began to lick my face. Here the play of the associative forces was apparent: a mere sensation of sound called up the appropriate visual image, this again the representation of a characteristic action, and so on. So it is with the dreams whose first impulse is some central or spontaneous excitation. A momentary sight of a face or even the mention of a name during the preceding day may give the start to dream-activity; but all subsequent members of the series of images owe their revival to a tension, so to speak, in the fine threads which bind together, in so complicated a way, our impressions and ideas.

Among the psychic accompaniments of these central excitations visual images, as already hinted, fill the most conspicuous place. Even auditory images, though by no means absent, are much less numerous than visual. Indeed, when there are the conditions for the former, it sometimes happens that the auditory effect transforms itself into a visual effect. An illustration of this occurred in my own experience. Trying to fall asleep by means of the well-known device of counting, I suddenly found myself losing my hold on the faint auditory effects, my imagination transforming them into a visual spectacle, under the form of a path of light stretching away from me, in which the numbers appeared under the grotesque form of visible objects, tumbling along in glorious confusion.

Next to these visual phantasms, certain motor hallucinations seem to be most prominent in dreams. By a motor hallucination, I mean the illusion that we are actually moving when there is no peripheral excitation of the motor organ. Just as the centers concerned in passive sensation are susceptible of central stimulation, so are the centers concerned in muscular sensation. A mere impulse in the centers of motor innervation (if we assume these to be the central seat of the muscular feelings) may suffice to give rise to a complete representation of a fully executed movement. And thus in our sleep we seem to walk, ride, float, or fly.

The most common form of motor hallucination is probably the vocal. In the social encounters which make up so much of our sleep-experience, we are wont to be very talkative. Now, perhaps, we find ourselves zealously advocating some cause, now very fierce in denunciation, now very amusing in witty repartee, and so on. This imagination of ourselves as speaking, as distinguished from that of hearing others talking, must, it is clear, involve the excitation of the structures engaged in the production of the muscular feelings which accompany vocal action, as much as, if not more than, the auditory centers. And the frequency of this kind of

* Even the "unconscious impressions" of waking hours, that is to say, those impressions which are so fugitive as to leave no psychological trace behind, may thus rise into the clear light of consciousness during sleep. Maury relates a curious dream of his own, in which there appeared a figure that seemed quite strange to him, though he afterward found that he must have been in the habit of meeting the original in a street through which he was accustomed to walk (*loc. cit.*, p. 124).

dream-experience may be explained, like that of visual imagery, by the habits of waking life. The speech impulse is one of the most deeply rooted of all our impulses, and one which has been most frequently exercised in waking life.

Combination of Dream-Elements.—It is commonly said that dreams are a grotesque dissolution of all order, a very chaos and whirl of images without any discoverable connection. On the other hand, a few writers claim for the mind in sleep a power of arranging and grouping its incongruous elements in definite and even life-like pictures. Each of these views is correct within certain limits; that is to say, there are dreams in which the strangest disorder seems to prevail, and others in which one detects the action of a central control. Yet, speaking generally, sequences of dream-images will be found to be determined by certain circumstances and laws, and so far not to be haphazard or wholly chaotic. We have now to inquire into the laws of these successions; and, first of all, we may ask how far the known laws of association, together with the peculiar conditions of the sleeping state, are able to account for the various modes of dream-combination. We have already regarded mental association as furnishing a large additional store of dream-imagery; we have now to consider it as explaining the sequences and concatenations of our dream-elements.

Incoherence of Dreams.—First of all, then, let us look at the chaotic and apparently lawless side of dreaming, and see whether any clue is discoverable to the center of this labyrinth. In the case of all the less elaborately ordered dreams, in which sights and sounds appear to succeed one another in the wildest dance (which class of dreams probably belongs to the deeper stages of sleep), the mind may with certainty be regarded as purely passive, and the mode of sequence may be referred to the action of association complicated by the ever-recurring introduction of new initial impulses, both peripheral and central. These are the dreams in which we are conscious of being perfectly passive, either as spectators of a strange pageant, or as borne away by some apparently extraneous force through a series of the most diverse experiences. The flux of images in these dreams is very much the same as that in certain waking conditions, in which we relax attention, both external and internal, and yield ourselves wholly to the spontaneous play of memory and fancy.

It is plain at a glance that the simultaneous concurrence of wholly disconnected initial impulses will serve to impress a measure of disconnectedness on our dream-images. From widely remote parts of the organism there come impressions which excite each its peculiar visual or other image according as its local origin or its emotional tone is the more distinctly present to consciousness. Now it is a subjective ocular sensation suggesting a bouquet of lovely flowers, and close

on its heels comes an impression from the organs of digestion suggesting all manner of obstacles; and so our dream-fancy plunges from a vision of flowers to one of dreadful demons.

Let us now look at the way in which the laws of association working on the incongruous elements thus cast up into our dream-consciousness, will serve to give a yet greater appearance of disorder and confusion to our dream-combinations. According to these laws, any idea may, under certain circumstances, call up another, if the corresponding impressions have only once occurred together, or if the ideas have any degree of resemblance, or, finally, if only they stand in marked contrast with one another. Any accidental coincidence of events, such as meeting a person at a particular foreign resort, and any insignificant resemblance between objects, sounds, etc., may thus supply a path, so to speak, from fact to dream-fancy.

In our waking states these innumerable paths of association are practically closed by the supreme energy of the coherent groups of impressions furnished us from the world without through our organs of sense, and also by the volitional control of internal thought in obedience to the pressure of practical needs and desires. In dream-life both of these influences are withdrawn, so that delicate threads of association, which have no chance of exerting their pull, so to speak, in our waking states, now make known their hidden force. Little wonder, then, that the filaments which bind together these dream-successions should escape detection, since even in our waking thought we so often fail to see the connection which makes us pass in recollection from a name to a visible scene or perhaps to an emotional vibration.

It is worth noting that the origin of an association is often to be looked for in one of those momentary half-conscious acts of waking imagination to which reference has already been made. A friend, for example, has been speaking to us of some common acquaintance, remarking on his poor health. The language calls up, vaguely, a visual representation of the person sinking in health and dying. An association will thus be formed between this person and the idea of death. A night or two after, the image of this person somehow recurs to our dream-fancy, and we straightway dream that we are looking at his corpse, watching his funeral, and so on. The links of the chain which holds together these dream-images were really forged, in part, in our waking hours, though the process was so rapid as to escape our attention. It may be added, that in many cases where a juxtaposition of dream-images seems to have no basis in waking life, careful reflection will occasionally bring to light some actual conjunction of impressions so momentary as to have faded from our recollection.

We must remember, further, how great an apparent disorder will invade our imagina-

tive dream-life when the binding-force of resemblance has unchecked play. In waking thought we have to connect things according to their essential resemblances, classifying objects and events for purposes of knowledge or action according to their widest or their most important points of similarity. In sleep, on the contrary, the slightest touch of resemblance may engage the mind and affect the direction of fancy. In a sense we may be said, when dreaming, to discover mental affinities between impressions and feelings, including those subtle links of emotional analogy of which I have already spoken. This effect is well illustrated in a dream recorded by M. Maury, in which he passed from one set of images to another through some similarity of names, as that between *corps* and *cor*. Such a movement of fancy would, of course, be prevented in full waking consciousness by a predominant attention to the meaning of the sounds.

It will be possible, I think, after a habit of analyzing one's dreams in the light of preceding experience has been formed, to discover in a good proportion of cases some hidden force of association which draws together the seemingly fortuitous concourse of our dream-atoms. That we should expect to do so in every case is unreasonable, since, owing to the numberless fine ramifications which belong to our familiar images, many of the paths of association followed by our dream-fancy cannot be afterward retraced.

To illustrate the odd way in which our images get tumbled together through the action of occult association forces, I will record a dream of my own. I fancied I was at the house of a distinguished literary acquaintance, at her usual reception hour. I expected the friends I was in the habit of meeting there. Instead of this, I saw a number of commonly dressed people having tea. My hostess came up and apologized for having asked me into this room. It was, she said, a tea-party which she prepared for poor people at sixpence a head. After puzzling over this dream, I came to the conclusion that the missing link was a verbal one. A lady who is a connection of my friend, and bears the same name, assists her sister in a large kind of benevolent scheme. I may add that I had not, so far as I could recollect, had occasion very recently to think of this benevolent friend, but I had been thinking of my literary friend in connection with her anticipated return to town.

In thus seeking to trace, amid the superficial chaos of dream-fancy, its hidden connections, I make no pretense to explain why in any given case these particular paths of association should be followed, and more particularly why a slender thread of association should exert a pull where a stronger cord fails to do so. To account for this, it would be necessary to call in the physiological hypothesis that among the nervous elements connected with a particular element, *a*, already excited, some, as *m* and *n*, are at the

moment, owing to the state of their nutrition or their surrounding influences, more powerfully predisposed to activity than other elements, as *b* and *c*.

The subject of association naturally conducts us to the second great problem in the theory of dreams—the explanation of the order in which the various images group themselves in all our more elaborate dreams.

Coherence of Dreams.—A fully developed dream is a complex of many distinct illusory sense-presentations: in this respect it differs from the illusions of normal waking life, which are for the most part single and isolated. And this complex or quasi-presentations appears somehow or other to fall together into one whole scene or series of events, which, though it may be very incongruous and absurdly impossible from a waking point of view, nevertheless makes a single object for the dreamer's internal vision, and has a certain degree of artistic unity. This plastic force, which selects and binds together our unconnected dream-images, has frequently been referred to as a mysterious spiritual faculty, under the name of "creative fancy." Thus Cudworth remarks, in his *Treatise concerning Eternal and Immutable Morality*: "That dreams are many times begotten by the phantastical power of the soul itself . . . is evident from the orderly connection and coherence of imaginations which many times are continued in a long chain or series." One may find a good deal of mystical writing on the nature and activity of this faculty, especially in German literature. The explanation of this element of organic unity in dreams is, it may be safely said, the crux in the science of dreams. That the laws of psychology help us to understand the sequences of dream-images, we have seen. What we have now to ask is whether these laws throw any light on the orderly grouping of the elements so brought up in consciousness in the form of a connected experience.

It is to be remarked at the outset that a singular kind of unity is sometimes given to our dream-combinations by a total or partial coalescence of different images. The conditions of such coalescence have been referred to already.* Simultaneous impressions or images will always tend to coalesce with a force which varies directly as the degree of their similarity. Sometimes this coalescence is instantaneous and not made known to consciousness. Thus, Radestock suggests that if the mind of the sleeper is simultaneously invaded by an unpleasant sensation arising out of some disturbance of the functions of the skin, and a subjective visual sensation, the resulting mental image may be a combination of the two, under the form of a caterpillar creeping over the bodily surface. And the coalescence may be prepared by sub-conscious operations of waking imagination. Thus, for example, I once spoke about the cheapness of hares to a mem-

* See p. 16.

ber of my family, who somewhat grimly suggested that they were London cats. I did not dwell on the idea, but the following night I dreamt that I saw a big hybrid creature, half hare, half cat, sniffing about a cottage. As it stood on its hind legs and took a piece of food from a window-ledge, I became sure that it was a cat. Here it is plain that the cynical observation of my relative had, at the moment, partially excited an image of this feline hare. In some dreams, again, we may become aware of the process of coalescence, as when persons who at one moment were seen to be distinct appear to our dream-fancy to run together in some third person.

A very similar kind of unification takes place between sequent images under the form of transformation. When two images follow one another closely, and have anything in common, they readily assume the form of a transmutation. There is a sort of overlapping of the mental images, and so an appearance of continuity produced in some respects analogous to that which arises in the wheel-of-life (thaumatrope) class of sense-illusions. This would seem to account for the odd transformations of personality which not unfrequently occur in dreams, in which a person appears, by a kind of metempsychosis, to transfer his physical ego to another, and in which the dreamer's own bodily phantom plays similar freaks. And the same principle probably explains those dissolving-view effects which are so familiar an accompaniment of dream-scenery.*

But passing from this exceptional kind of unity in dreams, let us inquire how the heterogeneous elements of our dream-fancy become ordered and arranged when they preserve their separate existence. If we look closely at the structure of our more finished dreams, we find that the appearance of harmony, connectedness, or order, may be given in one of two ways. There may, first of all, be a subjective harmony, the various images being held together by an emotional thread. Or there may, secondly, be an objective harmony, the parts of the dream, though answering to no particular experiences of waking life, bearing a certain resemblance to our habitual modes of experience. Let us inquire into the way in which each kind of order is brought about.

Lyrical Element in Dreams.—The only unity that belongs to many of our dreams is a subjective emotional unity. This is the basis of harmony in lyrical poetry, where the succession of images turns mainly on their emotional coloring. Thus, the images that float before the mind of the Poet Laureate, in his *In Memoriam*, clearly have their link of connection in their common emotional tone, rather than in any logical continuity. Dreaming has been likened to poetic composition, and certainly many of our dreams are built upon a groundwork of lyrical feel-

ing. They might be marked off, perhaps, as our lyrical dreams.

The way in which this emotional force acts in these cases has already been hinted at. We have seen that the analogy of feeling is a common link between dream-images. Now, if any shade of feeling becomes fixed and dominant in the mind, it will tend to control all the images of the time, allowing certain congruous ones to enter, and excluding others.* If, for example, a feeling of distress occupies the mind, distressing images will have the advantage in the struggle for existence which goes on in the world of mind as well as in that of matter. We may say that attention, which is here wholly a passive process, is controlled by the emotion of the time, and bent in the direction of congruent or harmonious images.

Now a ground-tone of feeling of a certain complexion, answering to the sum of sensations arising in connection with the different organic processes of the time, is a very frequent foundation of our dream-structure. So frequent is it, indeed, that one might almost say there is no dream in which it is not one great determining factor. The analysis of a very large number of dreams has convinced me that traces of this influence are discoverable in a great majority.

I will give a simple illustration of this lyrical type of dream. A little girl of about four years and three-quarters went with her parents to Switzerland. On their way she was taken to the cathedral at Strasburg, and saw the celebrated clock strike, and the figures of the Apostles come out, etc. In Switzerland she stayed at Gimmelwald, near Mürren, opposite a fine mass of snowy mountains. One morning she told her father that she had had "such a lovely dream." She fancied she was on the snow-peaks with her nurse, and walked on to the sky. There came out of the sky "such beautiful things," just like the figures of the clock. This vision of celestial things was clearly due to the fact that both the clock and the snow-peaks touching the blue sky had powerfully excited her imagination, filling her with much the same kind of emotion, namely, wonder, admiration, and longing to reach an inaccessible height.

Our feelings commonly have a gradual rise and fall, and the organic sensations which so often constitute the emotional basis of our lyrical dreams generally have stages of increasing intensity. Moreover, such a persistent ground-feeling becomes re-enforced by the images which it sustains in consciousness. Hence a certain *crescendo* character in our emotional dreams, or a gradual rise to some culminating point or climax.

This phase of dream can be illustrated from the experience of the same little girl. When just five years old, she was staying at Hampstead, near a church which struck the

* See Maury, *loc. cit.*, p. 146.

* See what was said respecting the influence of a dominant emotional agitation on the interpretation of actual sense impressions.

hours somewhat loudly. One morning she related the following dream to her father (I use her own language). The biggest bells in the world were ringing; when this was over the earth and houses began to tumble to pieces; all the seas, rivers, and ponds flowed together, and covered all the land with black water, as deep as in the sea where the ships sail; people were drowned; she herself flew above the water, rising and falling, fearing to fall in; she then saw her mamma drowned, and at last flew home to tell her papa. The gradual increase of alarm and distress expressed in this dream, having its probable cause in the cumulative effect of the disturbing sound of the church bells, must be patent to all.

The following rather comical dream illustrates quite as clearly the growth of a feeling of irritation and vexation, probably connected with the development of some slightly decomposing organic sensation. I dreamt I was unexpectedly called on to lecture to a class of young women, on Herder. I began hesitatingly, with some vague generalities about the Augustan age of German literature, referring to the three well-known names of Lessing, Schiller, and Goethe. Immediately my sister, who suddenly appeared in the class, took me up, and said she thought there was a fourth distinguished name belonging to this period. I was annoyed at the interruption, but said, with a feeling of triumph, "I suppose you mean Wieland?" and then appealed to the class whether there were not twenty persons who knew the names I had mentioned to one who knew Wieland's name. Then the class became generally disorderly. My feeling of embarrassment gained in depth. Finally, as a climax, several quite young girls, about ten years and less, came and joined the class. The dream broke off abruptly as I was in the act of taking these children to the wife of an old college tutor, to protest against their admission.

It is worth noting, perhaps, that in this evolution of feeling in dreaming the quality of the emotion may vary within certain limits. One shade of feeling may be followed by another and kindred shade, so that the whole dream still preserves a degree, though a less obvious degree, of emotional unity. Thus, for example, a lady friend of mine once dreamt that she was in church, listening to a well-known novelist of the more earnest sort, preaching. A wounded soldier was brought in to be shot, because he was mortally wounded, and had distinguished himself by his bravery. He was then shot, but not killed, and rolling over in agony, exclaimed, "How long!" The development of an extreme emotion of horror out of the vague feeling of awe which is associated with a church, gives a curious interest to this dream.

Verisimilitude in Dreams.—I must not dwell longer on this emotional basis of dreams, but pass to the consideration of the second and objective kind of unity which

characterizes many of our more elaborate dream-performances. In spite of all that is fitful and grotesque in dream-combination, it still preserves a distant resemblance to our actual experience. Though no dream reproduces a particular incident or chain of incidents in this experience, though the dream-fantasy invariably transforms the particular objects, relations, and events of waking life, it still makes the order of our daily experience its prototype. It fashions its imaginary world on the model of the real. Thus, objects group themselves in space, and act on one another conformably to these perceived space-relations; events succeed one another in time, and are often seen to be connected; men act from more or less intelligible motives, and so on. In this way, though the dream-fantasy sets at naught the particular relations of our experience, it respects the general and constant relations. How are we to account for this?

It is said by certain philosophers that this superposition of the relations of space, time, causation, etc., on the products of our dream-fantasy is due to the fact that all experience arises by a synthesis of mental forms with the chaotic master of sense-impressions. These philosophers allow, however, that all particular connections are determined by experience. Accordingly, what we have to do here is to inquire how far this scientific method of explaining mental connections by facts of experience will carry us. In other words, we have to ask what light can be thrown on these tendencies of dream-imagination by ascertained psychological laws, and more particularly by what are known as the laws of association.

These laws tell us that of two mental phenomena which occur together, each will tend to recall the other whenever it happens to be revived. On the physiological side, this means that any two parts of the nervous structures which have acted together become in some way connected, so that when one part begins to work the other will tend to work also. But it is highly probable that a particular structure acts in a great many different ways. Thus it may be stimulated by unlike modes of stimuli, or it may enter into very various connections with other structures. What will follow from this? One consequence would appear to be that there will be developed an organic connection between the two structures, of such a kind that whenever one is excited the other will be disposed to act somehow and anyhow, even when there is nothing in the present mode of activity of the first structure to determine the second to act in some one definite way, in other words, when this mode of activity is, roughly speaking, novel.

Let me illustrate this effect in one of the simplest cases, that of the visual organ. If, when walking out on a dark night, a few points in my retina are suddenly stimulated by rays of light, and I recognize some luminous object in a corresponding direction, I am

prepared to see something above and below, to the right and to the left of this object. Why is this? There may from the first have been a kind of innate understanding among contiguous optic fibers, predisposing them to such concerted action. But however this be, this disposition would seem to have been largely promoted by the fact that, throughout my experience the stimulation of any retinal point has been connected with that of adjoining points, either simultaneously by some second object, or successively by the same object as the eye moves over it, or as the object itself moves across the field of vision.

When, therefore, in sleep any part of the optic centers is excited in a particular way, and the images thus arising have their corresponding loci in space assigned to them, there will be a disposition to refer any other visual images which happen at the moment to arise in consciousness to adjacent parts of space. The character of these other images will be determined by other special conditions of the moment; their locality or position in space will be determined by this organic connection. We may, perhaps, call these tendencies to concerted action of some kind general associative dispositions.

Just as there are such dispositions to united action among various parts of one organ of sense, so there may be among differing organs, which are either connected originally in the infant organism, or have communications opened up by frequent co-excitation of the two. Such links there certainly are between the organs of taste and smell, and between the ear and the muscular system in general, and more particularly the vocal organ.* A new odor often sets us asking how the object would taste, and a series of sounds commonly disposes us to movement of some kind or another. How far there may be finer threads of connection between other organs, such as the eye and the ear, which do not betray themselves amid the stronger forces of waking mental life, one cannot say. Whatever their number, it is plain that they will exert their influence within the comparatively narrow limits of dream-life, serving to impress a certain character on the images which happen to be called up by special circumstances, and giving to the combination a slight measure of congruity. Thus, if I were dreaming that I heard some lively music, and at the same time an image of a friend was anyhow excited, my dream-fancy might not improbably represent this person as performing a sequence of rhythmic movements, such as those of riding, dancing, etc.

A narrower field for these general associative dispositions may be found in the tendency, on the reception of an impression of a

given character, to look for a certain kind of second impression; though the exact nature of this is unknown. Thus, for example, the form and color of a new flower suggests a scent, and the perception of a human form is accompanied by a vague representation of vocal utterances. These general tendencies of association appear to me to be most potent influences in our dream-life. The many strange human forms which float before our dream-fancy are apt to talk, move, and behave like men and women in general, however little they resemble their actual prototypes, and however little individual consistency of character is preserved by each of them. Special conditions determine what they shall say or do; the general associative disposition accounts for their saying or doing something.

We thus seem to find in the purely passive processes of association some ground for that degree of natural coherence and rational order which our more mature dreams commonly possess. These processes go far to explain, too, that odd mixture of rationality with improbability, of natural order and incongruity, which characterizes our dream-combinations.

Rational Construction in Dreams.—Nevertheless, I quite agree with Herr Volkelt that association, even in the most extended meaning, cannot explain all in the shaping of our dream-pictures. The "phantastical power" which Cudworth talks about clearly includes something besides. It is an erroneous supposition that when we are dreaming there is a complete suspension of the voluntary powers, and consequently an absence of all direction of the intellectual processes. This supposition, which has been maintained by numerous writers, from Dugald Stewart downward, seems to be based on the fact that we frequently find ourselves in dreams striving in vain to move the whole body or a limb. But this only shows, as M. Maury remarks in the work already referred to, that our volitions are frustrated through the inertia of our bodily organs, not that these volitions do not take place. In point of fact, the dreamer, not to speak of the somnambulist, is often conscious of voluntarily going through a series of actions. This exercise of volition is shown unmistakably in the well-known instances of extraordinary intellectual achievements in dreams, as Condillac's composition of a part of his *Cours d'Etudes*. No one would maintain that a result of this kind was possible in the total absence of intellectual action carefully directed by the will. And something of this same control shows itself in all our more fully developed dreams.

One manifestation of this voluntary activity in sleep is to be found in those efforts of attention which not unfrequently occur. I have remarked that, speaking roughly and in relation to the waking condition, the state of sleep is marked by a subjection of the powers of attention to the force of the mental images

* It is proved experimentally that the ear has a much closer organic connection with the vocal organ than the eye has. Donders found that the period required for responding vocally to a sound signal is less than that required for responding in the same way to a light signal.

present to consciousness. Yet something resembling an exercise of voluntary attention sometimes happens in sleep. The intellectual feats just spoken of, unless, indeed, they are referred to some mysterious unconscious mental operations, clearly involve a measure of volitional guidance. All who dream frequently are occasionally aware on awaking of having greatly exercised their attention on the images presented to them during sleep. I myself am often able to recall an effort to see beautiful objects, which threatened to disappear from my field of vision, or to catch faint receding tones of preternatural sweetness; and some dreamers allege that they are able to retain a recollection of the feeling of strain connected with such exercise of attention in sleep.

The main function of this voluntary attention in dream-life is seen in the selection of those images which are to pass the threshold of clear consciousness. I have already spoken of a selective action brought about by the ruling emotion. In this case, the attention is held captive by the particular feeling of the moment. Also a selective process goes on in the case of the action of those associative dispositions just referred to. But in each case of these cases the action of selective attention is comparatively involuntary, passive, and even unconscious, not having anything of the character of a conscious striving to compass some end. Besides this comparatively passive play of selective attention, there is an active play, in which there is a conscious wish to gain an end; in other words, the operation of a definite motive. This motive may be described as an intellectual impulse to connect and harmonize what is present to the mind. The voluntary kind of selection includes and transcends each of the involuntary kinds. It has as its result an imitation of that order which is brought about by what I have called the associative dispositions, only it consciously aims at this result. And it is a process controlled by a feeling, namely, the intellectual sentiment of consistency, which is not a mode of emotional excitement enthraling the will, but a calm motive, guiding the activities of attention. It thus bears somewhat the same relation to the emotional selection already spoken of, as dramatic creation bears to lyrical composition.

This process of striving to seize some connecting link, or thread of order, is illustrated whenever, in waking life, we are suddenly brought face to face with an unfamiliar scene. When taken into a factory, we strive to arrange the bewildering chaos of visual impressions under some scheme, by help of which we are said to understand the scene. So, if on entering a room we are plunged in *medias res* of a lively conversation, we strive to find a clue to the discussion. Whenever the meaning of a scene is not at once clear, and especially whenever there is an appearance of confusion in it, we are conscious of a painful feeling of perplexity, which acts

as a strong motive to ever-renewed attention.*

In touching on this intellectual impulse to connect the disconnected, we are, it is plain, approaching the question of the very foundations of our intellectual structure. That there is this impulse firmly rooted in the mature mind nobody can doubt; and that it manifests itself in early life in the child's recurring "Why?" is equally clear. But how we are to account for it, whether it is to be viewed as a mere result of the play of associated fragments of experience, or as something involved in the very process of the association of ideas itself, is a question into which I cannot here enter.

What I am here concerned to show is that the search for consistency and connection in the manifold impressions of the moment is a deeply rooted habit of the mind, and one which is retained in a measure during sleep. When, in this state, our minds are invaded by a motley crowd of unrelated images, there results a disagreeable sense of confusion; and this feeling acts as a motive to the attention to sift out those products of the dream-fancy which may be made to cohere. When once the foundations of a dream-action are laid, new images must to some extent fit in with this; and here there is room for the exercise of a distinct impulse to order the chaotic elements of dream-fancy in certain forms. The perception of any possible relation between one of the crowd of new images ever surging above the level of obscure consciousness, and the old group at once serves to detain it. The concentration of attention on it, in obedience to this impulse to seek for an intelligible order, at once intensifies it and fixes it, incorporating it into the series of dream-pictures.

Here is a dream which appears to illustrate this impulse to seek an intelligible order in the confused and disorderly. After being occupied with correcting the proofs of my volume on *Pessimism*, I dreamt that my book was handed to me by my publisher, fully illustrated with colored pictures. The frontispiece represented the fantastic figure of a man gesticulating in front of a ship, from which he appeared to have just stepped. My publisher told me it was meant for Hamlet, and I immediately reflected that this character had been selected as a concrete example of the pessimistic tendency. I may add that, on awaking, I was distinctly aware of having felt puzzled when dreaming, and of having striven to read a meaning into the dream.

The rationale of this dream seems to me to be somewhat as follows. The image of the completed volume represented, of course, a recurring anticipatory image of waking life. The colored plates were due probably to subjective optical sensations simultaneously

*On the nature of this impulse, as illustrated in waking and in sleep, see the article by Delbœuf, "Le Sommeil et les Rêves," in the *Revue Philosophique*, June, 1886, p. 636.

excited, which were made to fit in (with or without an effort of voluntary attention) with the image of the book under the form of illustrations. But this stage of coherency did not satisfy the mind, which, still partly confused by the incongruity of colored plates in a philosophic work, looked for a closer connection. The image of Hamlet was naturally suggested in connection with pessimism. The effort to discover a meaning in the pictures led to the fusion of this image with one of the subjective spectra, and in this way the idea of a Hamlet frontispiece probably arose.

The whole process of dream-construction is clearly illustrated in a curious dream recorded by Professor Wundt.* Before the house is a funeral procession: it is the burial of a friend, who has in reality been dead for some time past. The wife of the deceased bids him and an acquaintance who happens to be with him go to the other side of the street and join the procession. After she has gone away, his companion remarks to him, "She only said that because the cholera rages over yonder, and she wants to keep this side of the street to herself." Then comes an attempt to flee from the region of the cholera. Returning to his house, he finds the procession gone, but the street strewn with rich nosegays; and he further observes crowds of men who seem to be funeral attendants, and who, like himself, are hastening to join the procession. These are, oddly enough, dressed in red. When hurrying on, it occurs to him that he has forgotten to take a wreath for the coffin. Then he wakes up with beating of the heart.

The sources of this dream are, according to Wundt, as follows. First of all, he had, on the previous day, met the funeral procession of an acquaintance. Again, he had read of cholera breaking out in a certain town. Once more, he had talked about the particular lady with this friend, who had narrated facts which clearly proved her selfishness. The hastening to flee from the infected neighborhood and to overtake the procession was prompted by the sensation of heart-beating. Finally, the crowd of red bier-followers, and the profusion of nosegays, owed their origin to subjective visual sensations, the "light-chaos" which often appears in the dark.

Let us now see for a moment how these various elements may have become fused into a connected chain of events. First of all, it is clear that this dream is built up on a foundation of a gloomy tone of feeling, arising, as it would seem, from an irregularity of the heart's action. Secondly, it owes its special structure and its air of a connected sequence of events, to those tendencies, passive and active, to order the chaotic of which I have been speaking. Let us try to trace this out in detail.

To begin with, we may suppose that the image of the procession occupies the dreamer's mind. From quite another source the

image of the lady enters consciousness, bringing with it that of her deceased husband and of the friend who has recently been talking about her. These new elements adapt themselves to the scene, partly by the passive mechanism of associative dispositions, and partly, perhaps, by the activity of voluntary selection. Thus, the idea of the lady's husband would naturally recall the fact of his death, and this would fall in with the pre-existing scene under the form of the idea that he is the person who is now being buried. The next step is very interesting. The image of the lady is associated with the idea of selfish motives. This would tend to suggest a variety of actions, but the one which becomes a factor of the dream is that which is specially adapted to the pre-existing representations, namely, of the procession on the further side of the street, and the cholera (which last, like the image of the funeral, is, we may suppose, due to an independent central excitation). That is to say, the request of the lady, and its interpretation, are a *resultant* of a number of adaptive or assimilative actions, under the sway of a strong desire to connect the disconnected, and a lively activity of attention. Once more, the feeling of oppression of the heart, and the subjective stimulation of the optic nerve, might suggest numberless images besides those of anxious flight and of red-clad men and nosegays; they suggest these, and not others, in this particular case, because of the co-operation of the impulse of consistency, which, setting out with the pre-existing mental images, selects from among many tendencies of reproduction those which happen to chime in with the scene.

The Nature of Dream-Intelligence.—It must not be supposed that this process of welding together the chaotic materials of our dreams is ever carried out with anything like the clear rational purpose of which we are conscious when seeking, in waking life, to comprehend some bewildering spectacle. At best it is a vague longing, and this longing, it may be added, is soon satisfied. There is, indeed, something almost pathetic in the facility with which the dreamer's mind can be pacified with the least appearance of a connection. Just as a child's importunate "Why?" is often silenced by a ridiculous caricature of an explanation, so the dreamer's intelligence is freed from its distress by the least semblance of a uniting order.

It thus remains true with respect even to our most coherent dreams, that there is a complete suspension, or at least a considerable retardation, of the highest operations of judgment and thought; also a great enfeeblement, to say the least of it, of those sentiments such as the feeling of consistency and the sense of the absurd which are so intimately connected with these higher intellectual operations.

In order to illustrate how oddly our seemingly rational dreams caricature the operations of waking thought, I may, perhaps, be

* *Physiologische Psychologie*. p. 660.

allowed to record two of my own dreams, of which I took careful note at the time.

On the first occasion I went "in my dream" to the "Stores" in August, and found the place empty. A shopman brought me some large fowls. I asked their price, and he answered, "Tenpence a pound." I then asked their weight, so as to get an idea of their total cost, and he replied, "Forty pounds." Not in the least surprised, I proceeded to calculate their cost: $40 \times 10 = 400 + 12 = 33\frac{1}{2}$. But, oddly enough, I took this quotient as pence, just as though I had not already divided by 12, and so made the cost of a fowl to be 2s. 9d., which seemed to me a fair enough price.

In my second dream I was at Cambridge, among a lot of undergraduates. I saw a coach drive up with six horses. Three undergraduates got out of the coach. I asked them why they had so many horses, and they said, "Because of the luggage." I then said, "The luggage is much more than the undergraduates." Can you tell me how to express this in mathematical symbols? This is the way: if x is the weight of an undergraduate, then $x + x^2$ represents the weight of an undergraduate and his luggage together.* I noticed that this sally was received with evident enjoyment.*

We may say, then, that the structure of our dreams, equally with the fact of their completely illusory character, points to the conclusion that during sleep, just as in the moments of illusion in waking life, there is a deterioration of our intellectual life. The highest intellectual activities answering to the least stable nervous connections are impeded, and what of intellect remains corresponds to the most deeply organized connections.

In this way, our dream-life touches that childish condition of the intelligence which marks the decadence of old age and the encroachments of mental disease. The parallelism between dreams and insanity has been pointed out by most writers on the subject. Kant observed that the madman is a dreamer awake, and more recently Wundt has remarked that, when asleep, we "can experience nearly all the phenomena which meet us in lunatic asylums." The grotesqueness of the combinations, the lack of all judgment as to consistency, fitness, and probability,

* I may, perhaps, observe, after giving two dreams which have to do with mathematical operations, that, though I was very fond of them in my college days, I have long ceased to occupy myself with these processes. I would add, by way of redeeming my dream-intelligence from a deserved charge of silliness, that I once performed a respectable intellectual feat when asleep. I put together the riddle, "What might a wooden ship say when her side was stove in? Tremendous!" (Tremend-us). I was aware of having tried to improve on the form of this pun. I am happy to say I am not given to punning during waking life, though I had a fit of it once. It strikes me that punning, consisting as it does essentially of overlooking sense and attending to sound, is just such a debased kind of intellectual activity as one might look for in sleep.

are common characteristics of the short night-dream of the healthy and the long day-dream of the insane.*

But one great difference marks off the two domains. When dreaming, we are still sane, and shall soon prove our sanity. After all, the dream of the sleeper is corrected, if not so rapidly as the illusion of the healthy waker. As soon as the familiar stimuli of light and sound set the peripheral sense-organs in activity, and call back the nervous system to its complete round of healthy action, the illusion disappears, and we smile at our alarms and agonies, saying, "Behold, it was a dream!"

On the practical side, the illusions and hallucinations of sleep must be regarded as comparatively harmless. The sleeper, in healthy conditions of sleep, ceases to be an agent, and the illusions which enthrall his brain have no evil practical consequences. They may, no doubt, as we shall see in a future chapter, occasionally lead to a subsequent confusion of fiction and reality in waking recollection. But with the exception of this, their worst effect is probably the lingering sense of discomfort which a "nasty dream" sometimes leaves with us, though this may be balanced by the reverberations of happy dream-emotions which sometimes follow us through the day. And however this be, it is plain that any disadvantages thus arising are more than made good by the consideration that our liability to these nocturnal illusions is connected with the need of that periodic recuperation of the higher nervous structures which is a prime condition of a vigorous intellectual activity, and so of a triumph over illusion during waking life.

For these reasons dreams may properly be classed with the illusions of normal or healthy life, rather than with those of disease. They certainly lie nearer this region than the very similar illusions of the somnambulist, which with respect to their origin appear to be more distinctly connected with a pathological condition of the nervous system, and which with respect to their practical consequences may easily prove so disastrous.

After-Dreams.—In concluding this account of dreams, I would call attention to the importance of the transition states between sleeping and waking, in relation to the production of sense-illusion. And this point may be touched on here all the more appropriately, since it helps to bring out the close relation between waking and sleeping illusion. The mind does not pass suddenly and at a bound from the condition of dream-fancy to that of waking perception. I have already had occasion to touch on the "hypnagogic state," that condition of somnolence or "sleepiness" in which external impressions cease to act, the internal attention is relaxed, and the weird imagery of sleep begins to unfold itself. And just as there is this anti-

* See Radstock, *op. cit.*, ch. ix.; *Vergleichung des Traumes mit dem Wahnstun.*

pation of dream-hallucination in the presomnial condition, so there is the survival of it in the postsomnial condition. As I have observed, dreams sometimes leave behind them, for an appreciable interval after waking, a vivid after-impression, and in some cases even the semblance of a sense-perception.

If one reflects how many ghosts and other miraculous apparitions are seen at night, and when the mind is in a more or less somnolent condition, the idea is forcibly suggested that a good proportion of these visions are the *débris* of dreams. In some cases, indeed, as that of Spinoza, already referred to, the hallucination (in Spinoza's case that of "a scurvy black Brazilian") is recognized by the subject himself as a dream-image.* I am indebted to Mr. W. H. Pollock for a

fact which curiously illustrates the position here adopted. A lady was staying at a country house. During the night and immediately on waking up she had an apparition of a strange-looking man in mediæval costume, a figure by no means agreeable, and which seemed altogether unfamiliar to her. The next morning, on rising, she recognized the original of her hallucinatory image in a portrait hanging on the wall of her bedroom, which must have impressed itself on her brain before the occurrence of the apparition, though she had not attended to it. Oddly enough, she now learnt for the first time that the house at which she was staying had the reputation of being haunted, and by the very same somewhat repulsive-looking mediæval personage that had troubled her inter-somnolent moments. The case seems to me to be typical with respect to the genesis of ghosts, and of the reputation of haunted houses.

* For Spinoza's experience, given in his own words, see Mr. F. Pollock's *Spinoza*, p. 57; cf. what Wundt says on his experience, *Physiologische Psychologie*, p. 648, footnote 2.

CATALOGUE

OF THE

HUMBOLDT LIBRARY OF SCIENCE

CONTAINING

THE BEST SCIENTIFIC WORKS, AT POPULAR PRICES. --- THE GREAT CLASSICS
OF MODERN THOUGHT. --- STRONG MEAT FOR THEM
THAT ARE OF FULL AGE.

Paper Covers, Price 15 cents each. Double Numbers, 30 cents each.

These Books are complete and unabridged, tastefully gotten up, and are sold, on an average, at one-tenth the prices charged by other publishers

- | | |
|--|--|
| <p>No. 1. Light Science for Leisure Hours. A series of familiar essays on astronomical and other natural phenomena. By Richard A. Proctor, F.R.A.S.</p> <p>No. 2. Forms of Water in Clouds and Rivers, Ice and Glaciers. (19 illustrations). By John Tyndall, F.R.S.</p> <p>No. 3. Physies and Politics. An application of the principles of Natural Science to Political Society. By Walter Bagehot, author of "The English Constitution."</p> <p>No. 4. Man's Place in Nature. (with numerous illustrations). By Thomas H. Huxley F.R.S.</p> <p>No. 5. Education, Intellectual, Moral, and Physical. By Herbert Spencer.</p> <p>No. 6. Town Geology. With Appendix on Coral and Coral Reefs. By Rev. Chas. Kingsley.</p> <p>No. 7. The Conservation of Energy. (with numerous illustrations). By Balfour Stewart, LL.D.</p> <p>No. 8. The Study of Languages, brought back to its true principles. By C. Marcel.</p> <p>No. 9. The Data of Ethics. By Herbert Spencer.</p> <p>No. 10. The Theory of Sound in its Relation to Music. (numerous illustrations). By Prof. Pietro Blaserna.</p> <p>No. 11. } The Naturalist on the River Ama-
 No. 12. } zons. A record of 11 years of travel.
 By Henry Walton Bates, F.L.S. (Double number. <i>Not sold separately</i>).</p> <p>No. 13. Mind and Body. The theories of their relation. By Alex. Bain, LL.D.</p> <p>No. 14. The Wonders of the Heavens. (thirty-two illustrations). By Camille Flammarion.</p> <p>No. 15. Longevity. The means of prolonging life after middle age. By John Gardner M.D.</p> <p>No. 16. On The Origin of Species. By Thomas H. Huxley, F.R.S.</p> <p>No. 17. Progress: Its Law and Cause. With other disquisitions. By Herbert Spencer.</p> <p>No. 18. Lessons in Electricity. (sixty illustrations). By John Tyndall, F.R.S.</p> <p>No. 19. Familiar Essays on Scientific Subjects. By Richard A. Proctor.</p> <p>No. 20. The Romance of Astronomy. By R. Kalley Miller, M.A.</p> <p>No. 21. The Physical Basis of Life, with other essays. By Thomas H. Huxley, F.R.S.</p> | <p>No. 22. Seeing and Thinking. By William Kingdon Clifford, F.R.S.</p> <p>No. 23. Scientific Sophisms. A review of current theories concerning Atoms, Apes and Men. By Samuel Wainwright, D.D.</p> <p>No. 24. Popular Scientific Lectures. (illustrated). By Prof. H. Helmholtz.</p> <p>No. 25. The Origin of Nations. By Prof. Geo. Rawlinson, Oxford University.</p> <p>No. 26. The Evolutionist at Large. By Grant Allen.</p> <p>No. 27. The History of Landholding in England. By Joseph Fisher, F.R.H.S.</p> <p>No. 28. Fashion in Deformity, as illustrated in the customs of Barbarous and Civilized Races. (numerous illustrations). By William Henry Flower, F.R.S.</p> <p>No. 29. Facts and Fictions of Zoology. (numerous illustrations). By Andrew Wilson, Ph. D.</p> <p>No. 30. The Study of Words. Part I. By Richard Chenevix Trench.</p> <p>No. 31. The Study of Words. Part II.</p> <p>No. 32. Hereditary Traits and other Essays. By Richard A. Proctor.</p> <p>No. 33. Vignettes from Nature. By Grant Allen.</p> <p>No. 34. The Philosophy of Style. By Herbert Spencer.</p> <p>No. 35. Oriental Religions. By John Caird-Pres. Univ. Glasgow, and Others.</p> <p>No. 36. Lectures on Evolution. (Illustrated). By Prof. T. H. Huxley.</p> <p>No. 37. Six Lectures on Light. (Illustrated). By Prof. Tyndall.</p> <p>No. 38. Geological Sketches. Part I. By Archibald Geikie, F.R.S.</p> <p>No. 39. Geological Sketches. Part II.</p> <p>No. 40. The Evidence of Organic Evolution By George J. Romanes, F.R.S.</p> <p>No. 41. Current Discussion in Science. By W. M. Williams, F.C.S.</p> <p>No. 42. History of the Science of Politics. By Frederick Pollock.</p> <p>No. 43. Darwin and Humboldt. By Prof. Huxley, Prof. Agassiz, and others.</p> <p>No. 44. The Dawn of History. Part I. By G. F. Keary, of the British Museum.</p> <p>No. 45. The Dawn of History. Part II.</p> |
|--|--|

THE HUMBOLDT LIBRARY OF SCIENCE.

- No. 46. **The Diseases of Memory.** By Th. Ribot. Translated from the French by J. Fitzgerald, M.A.
- No. 47. **The Childhood of Religion.** By Edward Clodd, F.R.A.S.
- No. 48. **Life in Nature.** (*Illustrated.*) By James Hinton.
- No. 49. **The Sun; its Constitution, its Phenomena, its Condition.** By Judge Nathan T. Carr, Columbus, Ind.
- No. 50. **Money and the Mechanism of Exchange.** Part I. By Prof. W. Stanley Jevons, F.R.S.
- No. 51. **Money and the Mechanism of Exchange.** Part II.
- No. 52. **The Diseases of the Will.** By Th. Ribot. Translated from the French By J. Fitzgerald.
- No. 53. **Animal Automatism, and other Essays.** By Prof. T.H. Huxley, F.R.S.
- No. 54. **The Birth and Growth of Myth.** By Edward Clodd, F.R.A.S.
- No. 55. **The Scientific Basis of Morals, and other Essays.** By William Kingdon Clifford, F.R.S.
- No. 56. **Illusions.** Part I. By James Sully.
- No. 57. **Illusions.** Part. II.
- No. 58. **The Origin of Species.** (Double number). Part I. By Charles Darwin.
- No. 59. **The Origin of Species.** Double number). Part II.
- No. 60. **The Childhood of the World.** By Edward Clodd.
- No. 61. **Miscellaneous Essays.** By Richard A. Proctor.
- No. 62. **The Religions of the Ancient World.** By Prof. Geo. Rawlinson, Univ. of Oxford. (Double number).
- No. 63. **Progressive Morality.** By Thomas Fowler, LL.D., President of Corpus Christi Coll., Oxford.
- No. 64. **The distribution of Animals and Plants.** By A. Russell Wallace and W. T. Thistleton Dyer.
- No. 65. **Conditions of mental Development, and other essays.** By William Kingdon Clifford.
- No. 66. **Technical Education, and other essays.** By Thomas H. Huxley, F.R.S.
- No. 67. **The Black Death.** An account of the Great Pestilence of the 14th Century. By J.F.C. Hecker, M.D.
- No. 68. **Three Essays.** By Herbert Spencer. Special number.
- No. 69. **Fetichism: A Contribution to Anthropology and the History of Religion.** By Fritz Schultze, Ph. D. Double number.
- No. 70. **Essays Speculative and Practical.** By Herbert Spencer.
- No. 71. **Anthropology.** By Daniel Wilson. Ph. D. With Appendix on Archaeology. By E. B. Tylor, F.R.S.
- No. 72. **The Dancing Mania of the Middle Ages.** By J.F.C. Hecker, M.D.
- No. 73. **Evolution in History, Language and Science.** Four Addresses delivered at the London Crystal Palace School of Art, Science and Literature
- No. 74. **The Descent of Man, and Selection in**
 No. 75. } Relation to Sex. (*Numerous Illustrations*)
 No. 76. } By Charles Darwin. Nos 74, 75, 76 are
 No. 77. } *Single Nos.; No. 77. is a double No.*
- No. 78. **Historical Sketch of the Distribution of Land in England.** By William Lloyd Birkbeck, M.A.
- No. 79. **Scientific Aspect of some Familiar Things.** By W.M. Williams.
- No. 80. **Charles Darwin. His Life and Work** By Grant Allen. (Double number).
- No. 81. **The Mystery of Matter, and the Philosophy of Ignorance.** Two Essays by J. Allanson Picton.
- No. 82. **Illusions of the Senses; and other Essays.** By Richard A. Proctor.
- No. 83. **Profit-Sharing Between Capital and Labor.** Six Essays. By Sedley Taylor, M. A.
- No. 84. **Studies of Animated Nature.** Four Essays on Natural History. By W. S. Dallas, F. L. S.
- No. 85. **The Essential Nature of Religion.** By J. Allanson Picton.
- No. 86. **The Unseen Universe, and the Philosophy of the Pure Sciences.** By Prof. Wm. Kingdon Clifford, F. R. S.
- No. 87. **The Morphine Habit.** By Dr. B. Ball, of the Paris Faculty of Medicine.
- No. 88. **Science and Crime and other Essays.** By Andrew Wilson, F. R. S. E.
- No. 89. **The Genesis of Science.** By Herbert Spencer.
- No. 90. **Notes on Earthquakes; with Fourteen Miscellaneous Essays.** By Richard A. Proctor.
- No. 91. **The Rise of Universities.** By S. S. Laurie, LL.D. (Double Number.)
- No. 92. **The Formation of Vegetable Mould through the Action of Earth Worms.** By Charles Darwin, LL.D., F. R. S. (Double Number.)
- No. 93. **Scientific Methods of Capital Punishment.** By J. Mount Bleyer, M.D., (Special number.)
- No. 94. **The Factors of Organic Evolution.** By Herbert Spencer.
- No. 95. **The Diseases of Personality.** By Th. Ribot. Translated from the French by J. Fitzgerald, M. A.
- No. 96. **A Half-Century of Science.** By Thomas H. Huxley, and Grant Allen.
- No. 97. **The Pleasures of Life.** By Sir John Lubbock, Bart.
- No. 98. **Cosmic Emotion: Also the Teachings of Science.** By William Kingdon Clifford. (Special number.)
- No. 99. **Nature Studies.** By Prof. F. R. Eaton Lowe; Dr. Robert Brown, F. L. S.; Geo. G. Chisholm, F.R.G.S., and James Dallas, F.L.S.

- No. 100. Science and Poetry, with other Essays. By Andrew Wilson, F. R. S. E.
- No. 101. Esthetics: Dreams and Association of Ideas. By Jas. Sully and Geo. Croom Robertson.
- No. 102. Ultimate Finance: A true theory of Co-operation. By William Nelson Black.
- No. 103. The Coming Slavery: The Sins of Legislators: The Great Political Superstition. By Herbert Spencer.
- No. 104. Tropical Africa. By Henry Drummond, F. R. S.
- No. 105. Freedom in Science and Teaching. By Ernst Haeckel, of the University of Jena. With a prefatory Note by Prof. Huxley.
- No. 106. Force and Energy. A Theory of Dynamics. By Grant Allen.
- No. 107. Ultimate Finance. A True Theory of Wealth. By William Nelson Black.
- No. 108. English, Past and Present. Part I. By Richard Chenevix Trench. (Double number.)
- No. 109. English, Past and Present. Part II. By Richard Chenevix Trench.
- No. 110. The Story of Creation. A Plain Account of Evolution. By Edward Clodd. (Double number.)
- No. 111. The Pleasures of Life. Part II. By Sir John Lubbock, Bart.
- No. 112. Psychology of Attention. By Th. Ribot. Translated from the French by J. Fitzgerald, M. A.
- No. 113. Hypnotism. Its History and Development. By Fredrik Björnström, M. D., Head Physician of the Stockholm Hospital, Professor of Psychiatry. Late Royal Swedish Medical Councillor. Authorized Translation from the Second Swedish Edition by Baron Nils Posse, M. G., Director of the Boston School of Gymnastics. (Double number.)
- No. 114. Christianity and Agnosticism. A Controversy. Consisting of papers contributed to *The Nineteenth Century* by Henry Wace, D. D., Prof. Thos. H. Huxley, The Bishop of Petersburg, W. H. Mallock, Mrs. Humphrey Ward, (Double number.)
- No. 115. Darwinism: An Exposition of the Theory of Natural Selection, with some of its Applications. Part I. By Alfred Russel Wallace, LL. D., F. L. S., etc. Illustrated. (Double number.)
- No. 116. Darwinism: An Exposition of the Theory of Natural Selection, with some of its Applications. Part II. Illustrated. (Double number.)
- No. 117. Modern Science and Mod. Thought. By S. Laing. Illustrated. Double number.
- No. 118. Modern Science and Mod. Thought. Part II. By S. Laing.
- No. 119. The Electric Light and the Storing of Electrical Energy. (Illustrated) Gerald Molloy, D. D., D. Sc.
- No. 120. The Modern Theory of Heat and The Sun as a Storehouse of energy. (Illustrated) Gerald Molloy, D. D., D. Sc.
- No. 121. Utilitarianism. By John Stuart Mill.
- No. 122. Upon the Origin of Alpine and Italian Lakes and upon Glacial Erosion. Maps and Illustrations. By Ramsey, Ball, Murchison, Stüder, Favre, Whymper and Spencer. Part I. (Double number.)
- No. 123. Upon the Origin of Alpine and Italian Lakes, Etc., Etc. Part II.
- No. 124. The Quintessence of Socialism. By Prof. A. Schaffle.
- No. 125. } Darwinism & Politics. By David G. Ritchie, M. A.
} Administrative Nihilism. By Thomas Huxley, F. R. S.
- No. 126. Physiognomy & Expression. By P. Mantegazza, Illustrated. Part I. (Double number.)
- No. 127. Physiognomy & Expression. Part II. (Double number.)
- No. 128. The Industrial Revolution. By Arnold Toynbee, Tutor of Balliol College, Oxford. With a short memoir by B. Jowett. Part I. (Double number.)
- No. 129. The Industrial Revolution. Part II. (Double number.)
- No. 130. The Origin of the Aryans. By Dr. Isaac Taylor. Illustrated. Part I. (Double number.)
- No. 131. The Origin of the Aryans. Part II. (Double number.)
- No. 132. The Evolution of Sex. By Prof. P. Geddes and J. Arthur Thomson. Illustrated. Part I. (Double number.)
- No. 133. The Evolution of Sex. Part II. (Double number.)
- No. 134. The Law of Private Right. By George H. Smith. (Double number.)
- No. 135. Capital. A Critical Analysis of Capitalist Production. By Karl Marx. Part I. (Double number.)
- No. 136. Capital. Part II. (Double number.)
- No. 137. Capital. Part III. (Double number.)
- No. 138. Capital. Part IV. (Double number.)
- No. 139. Lightning, Thunder and Lightning Conductors. (Illustrated.) By Gerald Molloy, D. D., D. Sc.
- No. 140. What is Music? With an appendix on How the Geometrical Lines have their Counterparts in Music. By Isaac L. Rice.
- No. 141. Are the Effects of Use and Disuse Inherited? By William Platt Ball.
- No. 142. A Vindication of the Rights of Woman. By Mary Wollstonecraft. With an Introduction by Mrs. Henry Fawcett. Part I. (Double number.)
- No. 143. A Vindication of the Rights of Woman. Part II. (Double number.)
- No. 144. Civilization: Its Cause and Cure. By Edward Carpenter.
- No. 145. Body and Mind. By William Kingdon Clifford.
- No. 146. Social Diseases and Worse Remedies. By Thomas H. Huxley, F. R. S.
- No. 147. The Soul of Man under Socialism. By Oscar Wilde.
- No. 148. Electricity, the Science of the Nineteenth Century. By E. C. Cairnes (Illus.) Part I. Double number.
- No. 149. The same. Part II.

THE HUMBOLDT LIBRARY OF SCIENCE.

- | | |
|---|--|
| No. 150. Degeneration; A Chapter in Darwinism. Illustrated. By E. Ray Dankester, M. A., LL.D., F. R. S. | No. 165. The same. Part II. |
| No. 151. Mental Suggestion. By Dr. J. Ocho- | No. 166. Problems of the Future. Part I. By Samuel Lang. |
| No. 152. } rowicz. Part I. (Double number.) | No. 167. Problems of the Future. Part II. (Double number.) |
| No. 153. } The same. Part II. | No. 168. The same. Part III. (Double number.) |
| No. 154. } (Double number.) | No. 169. The Moral Teachings of Science. By Arabella B. Buckley. |
| No. 155. } The same. Part III. | No. 170. The Wisdom of Life. By Schopenhauer. (Double Number.) |
| No. 156. } (Double number.) | No. 171. The Mystery of Pain. By James Hinton. |
| No. 157. } The same. Part IV. | No. 172. } What is Property? An inquiry into |
| No. 158. } (Double number.) | No. 173. } the Principle of Right and of Govern- |
| No. 159. Modern Science; The Science of the Future. By Edward Carpenter. | No. 174. } ment. By P. J. Proudhon. Four |
| No. 160. Studies in Pessimism. By Schopenhauer. | No. 175. } Double numbers, \$1.20. |
| No. 161. } Flowers, Fruits and Leaves. Illustrat- | No. 176. The History and Scope of Zoology. By E. Ray Lankester. |
| No. 162. } ed. By Sir John Lubbock, F. R. S. (Double number.) | |
| No. 163. } Glimpses of Nature. Part I. Illustrat- | |
| No. 164. } ed. By Dr. Andrew Wilson, F. R. S. E. (Double number.) | |

A NEW SERIES.

The Social Science Library

OF THE BEST AUTHORS.

PUBLISHED MONTHLY AT POPULAR PRICES.

Paper Cover, 25 cents each; Cloth, extra, 75 cents each.

NOW READY.

- No. 1. Six Centuries of Work and Wages. By James E. Thorold Rogers, M. P. Abridged, with charts and summary. By W. D. P. Bliss. Introduction by Prof. R. T. Ely.
- No. 2. The Socialism of John Stewart Mill. The only collection of Mill's Writings on Socialism.
- No. 3. The Socialism and Unsocialism of Thomas Carlyle. A collection of Carlyle's social writings; together with Joseph Mazzini's famous essay protesting against Carlyle's views. Vol. I.
- No. 4. The same. Vol. II.
- No. 5. William Morris, Poet, Artist, Socialist. A selection from his writings together with a sketch of the man. Edited by Francis Watts Lee.

- No. 6. The Fabian Essays. American Edition, with Introduction and Notes by H. G. Wilshire.
- No. 7. The Economics of Herbert Spencer. By W. C. Owen.
- No. 8. The Communism of John Ruskin.
- No. 9. Horace Greeley and other Pioneers of American Socialism. By Charles Sotheman.

Special Number, 35 cents, in Paper Cover.

IN PREPARATION.

- No. 10. The Socialism of To-day. By DeLaveleye.
- No. 11. The State in Relation to Labor. By Jevons, Ritchie, etc.
- No. 12. Individualism. A series of Essays by Donisthorpe, and others.

LIST OF BOUND BOOKS

—IN—

THE HUMBOLDT LIBRARY SERIES.

The volumes of this series are printed on a superior quality of paper, and bound in extra cloth. They are from fifty to seventy-five per cent. cheaper than any other edition of the same books.

STANDARD WORKS BY VARIOUS AUTHORS.

- | | |
|---|--|
| <p>A Vindication of the Rights of Woman. With Strictures on Political and Moral Subjects. By Mary Wollstonecraft. New Edition, with an Introduction by Mrs. Henry Fawcett. Cloth.....\$1.00</p> <p>Electricity: the Science of the Nineteenth Century. A Sketch for General Readers. By E. M. Caillard, author of "The Invisible Powers of Nature." With Illustrations. Cloth, 75 cts</p> <p>Mental Suggestion. By J. Ochorowicz. Sometime Professor Extraordinarius of Psychology and Nature-Philosophy in the University of Lemberg. With a Preface by Charles Richet. Translated from the French by J. Fitzgerald, M.A. Cloth.....\$2.00</p> <p>Flowers, Fruits, and Leaves. By Sir John Lubbock, F.R.S., D.C.L., LL.D. With Ninety-five Illustrations. Cloth.....75 cts</p> <p>Glimpses of Nature. By Andrew Wilson, F.R.S. E., F.L.S. With Thirty-five Illustrations. Cloth.....75 cts</p> <p>Problems of the Future, and Essays. By Samuel Laing, author of "Modern Science and Modern Thought," &c. Cloth.....\$1.25</p> <p>The Naturalist on the River Amazons. A Record of Adventures, Habits of Animals, Sketches of Brazilian and Indian Life, and Aspects of Nature under the Equator, during Eleven Years of Travel. By Henry Walter Bates, F. L.S., Assistant Secretary of the Royal Geographical Society of England. New Edition, Large Type, Illustrated. Cloth.....\$1.00</p> | <p>The Rise and Early Constitution of Universities, with a Survey of Mediæval Education. By S. S. Laurie, LL.D., Professor of the Institutes and History of Education in the University of Edinburgh. Cloth.....75 cts</p> <p>The Religions of the Ancient World: including Egypt, Assyria and Babylonia, Persia, India, Phœnicia, Etruria, Greece, Rome. By George Rawlinson, M.A., Camden Professor of Ancient History, Oxford, and Canon of Canterbury. Author of "The Origin of Nations," "The Five Great Monarchies, &c. Cloth.....75 cts</p> <p>Fetichism. A Contribution to Anthropology and the History of Religion. By Fritz Schultze, Dr. Phil. Translated from the German by J. Fitzgerald, M. A. Cloth.....75 cts</p> <p>Money and the Mechanism of Exchange. By W. Stanley Jevons, M.A., F.R.S., Professor of Logic and Political Economy in the Owens College, Manchester, England. Cloth.....75 cts</p> <p>On the Study of Words. By Richard Chenevix Trench, D.D., Archbishop of Dublin. Cloth.....75 cts</p> <p>The Dawn of History. An Introduction to Pre-historic Study. Edited by C. F. Keary, M.A., of the British Museum. Cloth.....75 cts</p> <p>Geological Sketches at Home and Abroad. By Archibald Geikie, LL. D., F.R.S., Director-General of the Geological Surveys of Great Britain and Ireland. Cloth.....75 cts</p> |
|---|--|

THE HUMBOLDT LIBRARY OF SCIENCE.

Illusions: A Psychological Study. By James Sully, author of "Sensation and Intuition," "Pessimism," &c. Cloth.....75 cts

The Pleasures of Life. Part I. and Part II. By Sir John Lubbock, Bart. Two Parts in One. Cloth.....75 cts

English, Past and Present. Part I. and Part II. By Richard Chenevix Trench, D.D., Arch-bishop of Dublin. Two parts in One. Cloth.....75 cts

The Story of Creation. A Plain Account of Evolution. By Edward Clodd, F.R.A.S. With over 80 illustrations.....75 cts

Hypnotism: Its History and Present Development. By Fredrik Björnström, M.D., Head Physician of the Stockholm Hospital, Professor of Psychiatry, late Royal Swedish Medical Councilor. Cloth.....75 cts

Christianity and Agnosticism. A controversy consisting of papers by Henry Wace, D.D., Prebendary of St. Paul's Cathedral; Principal of King's College, London. Professor Thomas H. Huxley.—W. C. Magee, D.D., Bishop of Peterborough.—W. H. Mallock, Mrs. Humphrey Ward. Cloth.....75 cts

Darwinism: An Exposition of the Theory of Natural Selection, with some of its applications. By Alfred Russel Wallace, LL.D., F.R.S. With portrait of the author, colored map, and numerous illustrations. Cloth.....\$1.25
The ablest living Darwinian writer.—*Cincinnati Commercial Gazette.*

The most important contribution to the study of the origin of species and the evolution of man which has been published since Darwin's death.—*New York Sun.*

There is no better book than this in which to look for an intelligent, complete, and fair presentation of both sides of the discussion on evolution.—*New York Herald.*

Modern Science and Modern Thought. A Clear and Concise View of the Principal Results of Modern Science, and of the Revolution which they have effected in Modern Thought. With a Supplemental Chapter on Gladstone's "Dawn of Creation" and "Prom to Genesis," and on Drummond "Natural Law in the Spiritual World." By S. Laing. Cloth.....75 cts

Upon the Origin of Alpine and Italian Lakes; and Upon Glacial Erosion. By A. C. Ramsay, F.R.S., &c.; John Ball, M.R.I.A., F.L.S., &c.; Sir Roderick I. Murchison, F.R.S., D.C.L., &c.; Prof. B. Stüder, of Berne; Prof. A. Favre, of Geneva; and Edward Whymper. With an Introduction, and Notes upon the American Lakes, by Prof. J. W. Spencer, Ph.D., F.G.S., State Geologist of Georgia. Cloth.....75 cts

Physiognomy and Expression. By Paolo Mantegazza, Senator; Director of the National Museum of Anthropology, Florence; President of the Italian Society of Anthropology. With illustrations. Cloth.....\$1.00

The Industrial Revolution of the Eighteenth Century in England. Popular Addresses, Notes, and other Fragments. By the late Arnold Toynbee, Tutor of Balliol College, Oxford. Together with a short memoir by B. Jowett, Master of Balliol College, Oxford. Cloth.....\$1.00

The Origin of the Aryans. An Account of the Prehistoric Ethnology and Civilization of Europe. By Isaac Taylor, M.A., Litt. D., Hon. LL.D., Illustrated. Cloth.....\$1.00

The Evolution of Sex. By Prof. Patrick Geddes and J. Arthur Thomson. With 104 illustrations. Cloth.....\$1.00

"Such a work as this, written by Prof. Geddes who has contributed many articles on the same and kindred subjects to the *Encyclopædia Britannica*, and by Mr. J. Arthur Thomson, is not for the specialist, though the specialist may find it good reading, nor for the reader of light literature, though the latter would do well to grapple with it. Those who have followed Darwin, Wallace, Huxley and Haeckel in their various publications, and have heard of the later arguments against heredity brought forward by Prof. Weissman, will not be likely to put it down unread. The authors have some extremely interesting ideas to state, particularly with regard to the great questions of sex and environment in their relation to the growth of life on earth. . . . They are to be congratulated on the scholarly and clear way in which they have handled a difficult and delicate subject."—*Times.*

The Law of Private Right. By George H. Smith, author of "Elements of Right, and of the Law," and of Essays on "The Certainty of the Law, and the Uncertainty of Judicial Decisions," "The True Method of Legal Education, &c., &c." Cloth.....75 cts

THE HUMBOLDT LIBRARY OF SCIENCE.

CAPITAL: A Critical Analysis of Capitalistic Production. By Karl Marx. Translated from the third German edition by Samuel Moore and Edward Aveling, and edited by Frederick Engels. *The only American Edition. Carefully Revised.* Cloth\$1.75

"The great merit of Marx, therefore, lies in the work he has done as a scientific inquirer into the economic movement of modern times, as the philosophic historian of the capitalistic era."—*Encyclopædia Britannica*.

"So great a position has not been won by any work on Economic Science since the appearance of *The Wealth of Nations*. . . . All these circumstances invest, therefore, the teachings of this particularly acute thinker with an interest such as can not be claimed by any other thinker of the present day."—*The Athenæum*.

What is Property? An Inquiry into the Principle of Right and of Government. By P. J. Proudhon. Cloth.....\$2.00

The Philosophy of Misery. A System of Economical Contradictions. By P. J. Proudhon. Cloth.....\$2.00

WORKS BY PROFESSOR HUXLEY.

Evidence as to Man's Place in Nature. With numerous illustrations.

AND

On the Origin of Species; or, the Causes of the Phenomena of Organic Nature.
Two books in one volume. Cloth.....75 cents.

The Physical Basis of Life. With other Essays.

AND

Lectures on Evolution. With an Appendix on the Study of Biology.
Two books in one volume. Cloth.... 75 cents.

Animal Automatism.

AND

Technical Education, with other Essays.
Two books in one volume. Cloth.....75 cents.

SELECT WORKS OF PROFESSOR JOHN TYNDALL.

Forms of Water in Clouds and Rivers, Ice and Glaciers. Nineteen Illustrations.

Lessons in Electricity. Sixty Illustrations.

Six Lectures on Light. Illustrated.
on Cloth.....\$1.00

WORKS BY HERBERT SPENCER.

The Data of Ethics. Cloth..... 75 cents

Education: Intellectual, Moral, and Physical.

AND

Progress: Its Law and Cause. With other Disquisitions.

Two books in one volume. Cloth ...75 cents.

The Genesis of Science.

AND

The Factors of Organic Evolution.

Two books in one volume. Cloth....75 cents

SELECT WORKS OF GRANT ALLEN.

The Evolutionist at Large.

Vignettes from Nature.

Force and Energy. A Theory of Dynamics.

Three books in one volume. Cloth.....\$1.00

SELECT WORKS OF RICHARD A. PROCTOR, F.R.A.S.

Light Science for Leisure Hours.

Familiar Essays on Scientific Subjects.

Hereditary Traits, and other Essays.

Miscellaneous Essays.

Illusion of the Senses, and other Essays.

Notes on Earthquakes, with fourteen Miscellaneous Essays.

Six books in one volume.....\$1.50

SELECT WORKS OF WILLIAM KINGDON CLIF- FORD, F.R.A.S.

Seeing and Thinking.

The Scientific Basis of Morals, and other Essays.

Conditions of Mental Development, and other Essays.

The Unseen Universe.—Also, The Philosophy of the Pure Sciences.

Cosmic Emotion.—Also, the Teachings of Science.
Five books in one volume. Cloth.....\$1.25

THE HUMBOLDT LIBRARY OF SCIENCE.

SELECT WORK OF EDWARD CLODD, F.R.A.S.

- The Childhood of Regillions.
 The Birth and Growth of Myths and Legends.
 The Childhood of the World.
 Three books in one volume. Cloth.....\$1.00

SELECT WORKS OF TH. RIBOT.

- The Diseases of Memory.
 The Diseases of the Will.
 The Diseases of Personality.
 Three books in one volume. Cloth.....\$1.00

THE MILKY WAY.

CONTAINING

- The Wonders of the Heavens. With thirty-two Actinoglyph Illustrations.
 By Camille Flammarion.
 The Romance of Astronomy. By R. Kalley Miller, M.A.
 The Sun: Its Constitution; Its Phenomena; Its Condition. By Nathah T. Carr, L.L.D.
 Three books in one volume. Cloth.....\$1.00

POLITICAL SCIENCE.

CONTAINING

- Physics and Politics. An Application of the Principles of Natural Selection and Heredity to Political Society. By Walter Bagehot, author of "The English Constitution."
 History of the Science of Politics. By Frederick Pollock.
 Two books in one volume. Cloth..... 75 cents

THE LAND QUESTION.

CONTAINING

- The History of Landholding in England. By Joseph Fisher, F. R. H. S.
 Historical Sketch of the Distribution of Land in England. By William Lloyd Birkbeck, M. A.
 Two books in one volume. Cloth.....75 cents

SELECT WORKS BY J. ALLANSON PICTON.

- The Mystery of Matter.—Also The Philosophy of Ignorance.
 The Essential Nature of Religion.
 Two books in one volume. Cloth..... 75 cents

SELECT WORKS BY ANDREW WILSON, F. R. S. E.

- Science and Crime, and other Essays.
 Science and Poetry, and other Essays.
 Two books in one volume. Cloth.....75 cents

SELECT WORKS BY W. MATTIEU WILLIAMS, F.R.A.S., F.C.S.

- Current Discussion in Science.
 Scientific Aspects of Some Familiar Things.
 Two books in one volume. Cloth.....75 cents

SELECT WORKS BY J. F. C. HECKER, M.D.

- The Black Death. An Account of the Deadly Pestilence of the Fourteenth Century.
 The Dancing Mania of the Middle Ages.
 Two books in one volume. Cloth.....75 cents

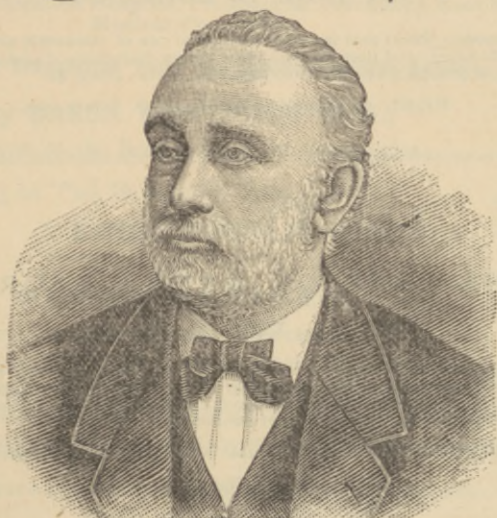
WORKS BY CHARLES DARWIN.

- The Origin of Species by Means of Natural Selection, or the Preservation of Favored Races in the Struggle for Life. New Edition, from the latest English edition, with additions and corrections. Cloth.....\$1.25
 The Descent of Man, and Selection in Relation to Sex. With illustrations. New edition, revised and augmented. Cloth.....\$1.50
 The Formation of Vegetable Mould through the Action of Earth-worms, with Observations on their Habits. Illustrated. Cloth....75 cents

A COMPANION-BOOK TO DARWIN'S WORKS,

- Charles Darwin: His Life and Work. By Grant Allen. Cloth.75 cents

The Liberal Classics, (No. 8.)



FORCE AND MATTER

OR

Principles of the Natural Order of the Universe,

WITH A SYSTEM OF MORALITY BASED THEREON.

BY

PROF. LUDWIG BÜCHNER, M. D.

A scientific and rationalistic work of great merit and ability. Translated from the 15th German Edition, revised and enlarged by the author, and reprinted from the fourth English edition.

One volume, post 8vo, 414 pages, with portrait, vellum cloth, \$1.50; half calf, \$3.00.

CONTENTS :

Force and Matter,
Immortality of Matter,
Immortality of Force,
Infinity of Matter,
Value of Matter,
Motion, Form,
Immutability of Natural
Laws,
Universality of Natural
Laws,

The Heavens,
Periods of the Creation of
the Earth,
Original Generation,
Secular Generation,
The Fitness of Things in
Nature, (Teleology),
Man,
Brain and Mind,
Thought,

Consciousness,
Seat of the Soul,
Innate Ideas,
The Idea of God,
Personal Continuance,
Vital Force,
The Soul of Brutes,
Free Will,
Morality,
Concluding Observations.

HUMBOLDT PUBLISHING CO

NEW YORK.

THE DAWNING.

By J. M. L. BABCOCK.

An Economic Novel that is—what the usual run of economic novels is not—a veritable *novel*; and that is at the same time a dissection of social conditions, present and prospective. Price in paper, 50 cents; cloth, \$1.

Highly commended by Hugh O. Pentecost.

Ideo-Kleptomania :

THE CASE OF HENRY GEORGE.

By J. W. Sullivan.

The author offers evidence to show that Henry George took his doctrines bodily from the works of Patrick Edward Dove, and that "Progress and Poverty" is largely an appropriation without credit of the ideas of Dove, William Godwin, Herbert Spencer and other economists.

With Henry George's denial of plagiarism, complete.

One Hundred Pages. 15 cents.

THE VERY LATEST ON PHILOSOPHICAL ANARCHISM.

Economics of Anarchy :

A Study of the Industrial Type. By DYER D. LUM.

CONTENTS :

- | | | | |
|----------------------------|----------------------------|----------------------------|------------------|
| 1. Fundamental Principles. | 2. Free Land. | 3. Free Labor. | 4. Free Capital. |
| 5. Free Exchange. | 6. Mutual Credit. | 7. Emancipation of Credit. | |
| 8. Industrial Economics. | 9. Insurance, or Security. | 10. Digression on Methods. | |
- PRICE, 25 CENTS.
-

ECONOMIC, SOCIOLOGICAL, SCIENTIFIC,

Liberal and Radical Books.

THE HUMBOLDT PUBLISHING COMPANY

NEW YORK.

HYPNOTISM:

ITS HISTORY AND PRESENT DEVELOPMENT.

BY FREDRIK BJÖRNSTRÖM, M. D.,

Head Physician of the Stockholm Hospital, Professor of Psychiatry, Late Royal Swedish Medical Counselor.

Authorized Translation from the Second Swedish Edition.

By BARON NILS POSSE, M. G.,

Director of the Boston School of Gymnastics.

Paper Cover (No. 113 of The Humboldt Library), - - - 30 Cents
Cloth, Extra, " " " - - - 75 Cents

PRESS NOTICES.

The learned Swedish physician, Björnström.—*Churchman*.

It is a strange and mysterious subject this hypnotism.—*The Sun*.

Perhaps as concise as any work we have.—*S. California Practitioner*.

We have found this book exceedingly interesting.—*California Homoeopath*.

A concise, thorough, and scientific examination of a little-understood subject.—*Episcopal Recorder*.

Few of the new books have more interest for scientist and layman alike.—*Sunday Times* (Boston).

The study of hypnotism is in fashion again. It is a fascinating and dangerous study.—*Toledo Bee*.

It is well written, being concise, which is a difficult point to master in all translations.—*Medical Bulletin* (Philadelphia).

The subject will be fascinating to many, and it receives a cautious yet sympathetic treatment in this book.—*Evangelist*.

One of the most timely works of the hour. No physician who would keep up with the times can afford to be without this work.—*Quarterly Journal of Inebriety*.

Its aim has been to give all the information that may be said under the present state of our knowledge. Every physician should read this volume.—*American Medical Journal* (St. Louis).

Is a contribution of decided value to a much-discussed and but little-analyzed subject by an eminent Swedish alienist known to American students of European psychiatry.—*Medical Standard* (Chicago).

This is a highly interesting and instructive book. Hypnotism is on the onward march to the front as a scientific subject for serious thought and investigation.—*The Medical Free Press* (Indianapolis).

Many of the mysteries of mesmerism, and all that class of manifestation, are here treated at length, and explained as far as they can be with our present knowledge of psychology.—*New York Journal of Commerce*.

The marvels of hypnotic phenomena increase with investigation. Dr. Björnström, in this clear and well-written essay, has given about all that modern science has been able to develop of these phenomena.—*Medical Visitor* (Chicago).

It has become a matter of scientific research, and engages the attention of some of the foremost men of the day, like Charcot, of Paris. It is interesting reading, outside of any usefulness, and may take the place of a novel on the office table.—*Eclectic Medical Journal* (Cincinnati).

This interesting book contains a scholarly account of the history, development, and scientific aspect of hypnotism. As a whole, the book is of great interest and very instructive. It is worthy of careful perusal by all physicians, and contains nothing unfit to be read by the laity.—*Medical and Surgical Reporter* (Philadelphia).

To define the real nature of hypnotism is as difficult as to explain the philosophy of toxic or therapeutic action of medicine—more so, indeed. None the less, however, does it behoove the practitioner to understand what it does, even if he cannot tell just what it is, or how it operates. Dr. Björnström's book aims to give a general review of the entire subject.—*Medical Record*.

This is an able, thoughtful, and scientific examination of a subject of far more serious importance than has generally been conceded to it. Dr. Björnström takes the true and serious view of the subject, and discusses it not only with ample learning, but in a scientific spirit, showing its nature, its origin, its power for good or evil, and its dangers.—*Illustrated Christian Weekly*.

One of the most interesting works that have yet appeared on that intensely interesting, though almost invariably dryly-written subject. It includes accuracy, as well as the gift of entertaining description and discussion. It is not too much to add that for any one who wishes to become *en rapport* with present opinion respecting hypnotism, its phases, nature, and effects, nothing so good has yet appeared upon the subject in the English language.—*Public Opinion*.

The work is purely expository in character, and offers about as convenient an introduction to the subject as we have in English. The topics are well selected, the points clearly stated, and the whole fairly represents the present status of investigation upon this vexed phenomenon. A general historical introduction is followed by a chapter defining the ordinary hypnotic condition, according to various authorities. The method of hypnotizing and the stages of hypnotism are next interestingly discussed.—*Science*.

The discoveries of scientific explorers in this attractive but perilous field have nowhere else been presented in a more condensed yet comprehensive, lucid, and effective form than in this admirable and highly interesting work. The author, instead of wearying the reader with prolix detailing of his personal work and theories, has collated and arranged, systematically and well, the facts clearly established by the best authorities, enabling a clear understanding of the extent and limitation of Western knowledge in this department of science.—*The Path*.

Hypnotism is of late claiming much attention among medical men. This book treats, in a thorough manner, of its discovery, growth, and present status. It gives the physical and psychical effects of the hypnotic sleep, and expresses the opinion that, in so far as it affects the imagination, it may be used as a remedial agent, and also in soothing and invigorating the patient. It is also claimed that by hypnotism negligent and lazy and also mentally weak students may be aroused to successful efforts. This is one of the most interesting numbers of the "Humboldt Library."—*Nassau Literary Gazette* (Princeton).

The recent revival of hypnotism compels every medical man to give some thought to the matter, and to ask the question whether the therapeutic effects are not outweighed by the physical effects of hypnotism, the diminished individuality of the patient, and the great scope which such practices afford for the perpetration of crime. All these questions are very fairly discussed in the work before us. We recommend a careful perusal of the above work to all our professional brethren, that they may realize, to some extent, the gravity of a question that will soon be propounded to them.—*Occidental Medical Times* (San Francisco).

One of the most interesting and remarkable books we have read for many a day, containing revelations regarding this new department of science more startling and extraordinary than anything to be found in the pages of romance. It is not at all a work of the imagination, or by some bold and reckless speculative genius. Its author is Frederik Björnström, M.D., Head Physician of the Stockholm Hospital, and a Royal Swedish Medical Councillor. This eminent scientific writer has devoted his talents to an investigation of a subject which is regarded by the generality of persons as unworthy of serious attention. The present volume is an exhaustive treatise on the subject, embodying all the results of the ablest experimenters and investigators, and leaving nothing to be desired. It is written in a clear and captivating style, and the narratives and experiments are of the most extraordinary character, and were they not attested by scientists, would be regarded as passing the bounds of belief.—*Evening Mercury* (St. John's, Newfoundland).

Mesmerism and animal magnetism are terms that have been used to cover much that is absurdly erroneous, and it is time that they should be rescued from the misuse they have suffered at the hands of ignorant quacks and charlatans, and that the many interesting and remarkable phenomena relating to the subject should be seriously and thoroughly investigated. Few books on the subject are of a truly scientific nature, and it is therefore with pleasure that we record the appearance of such a thorough and satisfactory work as "Hypnotism: Its History and Present Development," by Frederik Björnström, M.D. The author has spent many years in research, and brings to bear upon the subject an experienced mind, scientifically trained, cautious in judgment, and guided by strong common sense. These latter traits are especially valuable in a discussion that involves matters that have too frequently been subjected to the wildest and most extravagant speculation. The book is a complete statement of the truly scientific view of the subject.—*The Book Buyer*.

FOR SALE BY YOUR NEWSDEALER.

THE
KINGDOM OF THE UNSELFISH;
OR,
EMPIRE OF THE WISE.

By JOHN LORD PECK.

Cloth, 12mo.....\$1.00.

"Should be re-read by every seeker after truth."—*Rockland Independent.*

"Polished in style and very often exquisite in expression."—*Natick Citizen.*

"The book is interesting throughout, and the more widely it is read the better."—*Twentieth Century.*

"Shows profound research, original ideas, and what be almost called inspiration."—*Sunday Times (Tacoma).*

"The effort is noble, and the author has not escaped saying many profound and true things."—*Christian Union.*

"One of a large number of 'reformatory' volumes now being printed, but it is better than many of them."—*Truth Seeker.*

"The book is from a widely-read man, and is written for a high end. In its intellectual and 'spiritual' aspects, it is educative and stimulating."—*The New Ideal.*

"The book before us is one of the signs of the times. It prophesies a new age, and exhorts to the life which shall further its coming."—*New Church Messenger.*

"The book is a natural product of the prophetic element of the times, which is reaching forward into the new economic age we are just entering."—*Teacher's Outlook.*

"The chapters on 'Natural and Social Selection' are among the most interesting in the book, and require close reading to take in the whole drift of their meaning."—*Detroit Tribune.*

"It is a real contribution to original and advanced thought upon the highest themes of life and religion—of intellectual, moral, social, material and spiritual progress."—*The Unitarian.*

"There are many golden sentences in the chapter on Love, and the practical good sense shown in the treatment of the marriage question would help many husbands and wives to live more happily together."—*The Dawn.*

"This is a new and thoroughly original treatment of the subjects of morality, religion and human perfectibility, and furnishes a new ground for the treatment of all social questions. It is radical and unique."—*The Northwestern.*

"It is in no sense an ordinary work. It makes strong claims and attempts to carry out the largest purposes. Taking the stand-point of science, it attacks the gravest problems of the times with an endeavor to show that the most advanced science will enable us to reach the most satisfactory conclusions."—*Chicago Inter Ocean.*

"One of the most important recent works for those who are striving to rise into a nobler life, who are struggling to escape the thralldom of the present selfish and pessimistic age. Many passages in Mr. Peck's work strongly suggest the lofty teachings of those noblest of the ancient philosophers, the Stoics. Those who are hungering and thirsting after a nobler existence will find much inspiration in 'The Kingdom of the Unselfish.'"—*The Arena.*

THE HUMBOLDT PUBLISHING CO.

19 Astor Place, New York.

SOLD ONLY BY SUBSCRIPTION.

COMPLETE SETS OF THE HUMBOLDT LIBRARY

CAN BE OBTAINED UNIFORM IN SIZE.
STYLE OF BINDING. ETC.

The Volumes average 600 pages each, and are arranged thus:

Volume	I.	Contains	Numbers.....	I-12
"	II.	"	"	13-24
"	III.	"	"	25-36
"	IV.	"	"	37-48
"	V.	"	"	49-59
"	VI.	"	"	60-70
"	VII.	"	"	71-80
"	VIII.	"	"	81-91
"	IX.	"	"	92-103
"	X.	"	"	104-111
"	XI.	"	"	112-118
"	XII.	"	"	119-127
"	XIII.	"	"	128-133
"	XIV.	"	"	134-139
"	XV.	"	"	140-147
"	XVI.	"	"	148-158
"	XVII.	"	"	159-168
"	XVIII.	"	"	169-175

CLOTH, EXTRA, \$2.00 PER VOLUME,
OR \$36.00 FOR 18 VOLUMES.

The various books contained in this Library of 18 volumes would cost over \$300 if bought in separate volumes as published in London and New York.

PUBLISHED AND SOLD BY

THE HUMBOLDT PUBLISHING CO.,

19 Astor Place, New York.