

SECHENOV, I. M. - SELECTED PHYSIOLOGICAL AND PSYCHOLOGICAL WORKS

I. M. SECHENOV (1829-1905)

All major landmarks in the history of world and Russian physiology are closely linked with the name of Ivan Mikhailovich Sechenov. Pavlov, who carried forward Sechenov's scientific work, called him the "father of Russian physiology".

problems and to solve them by way of experimentation. The period of his preparation for independent scientific activity coincided with a number of highly important events in the development of natural science. The achievements of synthetic organic chemistry, and, above all, the discoveries made by the Russian chemists Zinin and Butlerov, revolutionised physiological thought—they upset the theories about all kinds of "special forces" in organic nature and made it possible to ascertain and master the synthesis of the very substratum of life—organic substances. Ideas testifying to the unity of all chemical processes on earth began to spread all over Europe. Two basic natural laws—the laws of conservation of matter and energy—became the credo of all progressive scientists in the fifties of the last century. Sechenov's stay abroad also coincided with two notable dates in biology—the year 1858, when Charles Darwin read his first paper at a meeting of the Linnaeus Society, and the year 1859 when Darwin's immortal *Origin of Species* first appeared.

These highly important events in the history of science greatly influenced the entire development of physiology.

Already in his doctor's thesis *Data for the Future Physiology of Alcoholic Intoxication*, which was published in 1860, Sechenov, along with conclusions drawn from his experimental research, set forth a number of philosophical propositions; in particular, he advanced the idea of the material unity of the world, unity of the forces operating in organic and inorganic nature, unity of the organism and of the conditions of its existence: finally, he expressed the idea of the possibility of unravelling the great mystery of consciousness by means of the objective methods of natural science.

Waging a bitter struggle against philosophers and naturalists of the idealist camp, Sechenov already in 1861 formulated the postulate which in those days was of revolutionary significance and which still retains its validity: "The organism cannot exist without its supporting external environment; hence, a scientific definition of the organism should include also the environment which influences it."

Sechenov's work in the sphere of the physiology of the higher nervous activity which derives from his fundamental definition of the significance of the unity and interaction of organisms and their environment, was crowned by the major discoveries and generalisations made by his pupil and follower, I. P. Pavlov

In "Reflexes of the Brain" Sechenov developed the thesis that from the point of view of their origin, all acts of conscious and unconscious life are reflexes.

He advanced the idea—quite novel for those days that the entire psychical life with all its motor manifestations is stimulated and maintained by environmental influences which are perceived by the nervous system. He brilliantly substantiated his conclusion that psychical life is inconceivable without stimulation of the sense organs. The propositions that the initial cause of any human action lies outside man, and that without external sensory stimuli psychical activity is impossible even for a single moment, were set forth by Sechenov most convincingly.

Proceeding from his fundamental postulate concerning the influence exerted by the environment on psychical activity Sechenov drew far-reaching conclusions which sharply contradicted the contemporary social and pedagogical views. Nor did he stop at the conclusion, which for those days was revolutionary, that all men are equal, that the most backward nationalities can be raised to a high cultural level by means of education and instruction.

Later, he wrote the article "Who is to Elaborate the Problems of Psychology, and How?" which caused a sensation. In this article Sechenov sharply criticised the assertions of most of the idealist psychologists that man as a corporeal being is subordinated to the laws of the material world, while as a spiritual being he is independent of them. He again stressed the importance of objective, natural-scientific, physiological study of the complex psychical phenomena, and the possibility of an analytical study of "all the main aspects of the various forms of psychical activity".

The same article contained a masterly outline of a plan for radically revising contemporary psychology with the aim of freeing it from the conglomeration of insufficiently substantiated theories and metaphysical concepts, and of bringing it into the highway of "positive science".

Sechenov emphasised the significance of Darwin's teaching for the materialist interpretation of psychical phenomena, pointing out that it leads logically to the necessity of acknowledging the evolution of psychical activity in principle.

N. N. Strakhov, an anti-Darwinist and one of the pillars of metaphysics, sharply criticised Psychological Studies in a review in the reactionary magazine *Grazhdanin* (Citizen). Opposing Sechenov on all of his principal points, Strakhov formulated his own view thus: "The point is that of the duality of our world, of a cardinal difference between physical and psychical phenomena."

Strakhov did not confine himself to criticising Sechenov's book; he returned to the attack in a special work of his own *Fundamental Concepts of Psychology*, published in 1878. It was diametrically opposed to Sechenov's book. This was understandable, since Strakhov, being an idealist and anti-Darwinist, proceeded from the principles which were the reverse of those advocated by Sechenov. For Strakhov man was the centre of the world, whereas for Sechenov man was a link in the development of nature. According to Strakhov, the "spirit" exists independently of the body—the two elements being subordinated to different laws; according to Sechenov, unity of "spirit" and body is the principal factor. That which is called spiritual activity was for Sechenov the property of matter at a definite stage of development of organic nature.

The question of the importance of human practical activity in the process of knowledge, a question which was alien to idealist psychology, arose before Sechenov, who reconstructed psychology on a materialist basis.

Sechenov reached the height of theoretical generalisation in his treatise "The Elements of Thought", which contains an historical analysis of the formation of complex psychical phenomena beginning with the most elementary manifestations of irritability and sensation. He skilfully analysed the laws governing the formation of abstract notions of objects of the external world on the basis of man's perceptions, on the basis of the signalling activity of a number of sense organs; in other words, he was the first in the history of science to advance the idea of the formation of so-called abstract thought in the course of man's development, in the process of his interaction with objects of the external world. In this work he again reverted to the problem—which he had posed previously—of the unity and interaction of organisms and the conditions of existence, the latter being regarded by him as a decisive factor in the evolution of the structure and functioning of the nervous system.

One of the most important of Sechenov's achievements in this field was his discovery of the phenomena of central inhibition. His fundamental conclusion was that in the central nervous system there are special apparatuses the stimulation of which leads to suppression of spinal reflexes. Thus, Sechenov's theory of central inhibition came to life, and his concept of inhibition took its place in physiology.

It was only after the Great October Socialist Revolution that all branches of science, including physiology, were given free rein for development. It can be said that special attention was paid to physiology; and this was because physiology in Russia was headed by Pavlov, the continuer of Sechenov's work, whose researches were considered by V.I. Lenin as being "of enormous significance for the working people of the world".

REFLEXES OF THE BRAIN

There are those who utterly dislike this trait of our society. They usually regard the fluctuations in public opinion as a chaotic fermentation of unsettled thought; they fear the uncertainty likely to accrue from the ferment; finally, in their view, the pursuit of apparitions merely distracts society from business at hand. These gentlemen are, of course, right in their way. Undoubtedly, it would be much better if society, always modest, quiet and respectable, moved directly towards attainable and useful goals without deviating from the straight path. Unfortunately, in life, as in science, almost any goal is attained by devious paths; the straight road to the goal becomes clear only when the goal has been achieved. Besides, these gentlemen forget that there have been cases when unrestrained fermentation of minds eventually led to the emergence of truths. They should recall, for example, what mankind gained from the mediaeval thought which gave rise to alchemy. It is terrible to think what would have become of mankind if the rigid mediaeval guardians of public opinion had succeeded in burning and drowning as sorcerers and evildoers all those who worked hard at imageless ideas and who were unconsciously creating chemistry and medicine. People who value truth in general, i.e., not only present, but future truth, will never ridicule any popular idea, no matter how strange this idea may seem to them.

The infinite diversity of external manifestations of cerebral activity can be reduced ultimately to a single phenomenon—muscular movement. Whether it's the child laughing at the sight of a toy, or Garibaldi smiling when persecuted for excessive love for his native land, or a girl trembling at the first thought of love, or Newton creating universal laws and inscribing them on paper—the ultimate fact in all cases is muscular movement.

Thus, all external manifestations of the functioning of the brain can be reduced to muscular movement. Because of this, the question is simplified to a considerable degree.

Now, since the reader presumably agrees that externally this activity is always expressed in the form of muscular movement, my job is to determine the ways in which muscular movements originate in the brain.

Let us pass directly to our subject. Modern science divides all muscular movements into two groups according to their origin—involuntary and voluntary. Consequently, our task is to analyse the origin of the two groups. We shall begin with the first group—it being the simplest—and, for the sake of clarity, deal not with the brain, but with the spinal cord.

Chapter One – INVOLUNTARY MOVEMENTS

I have now exhausted the sphere of involuntary movements in our interpretation of the term. To conclude the chapter I shall briefly summarise the results of our study of these phenomena.

- 1) Every involuntary movement is the result of a more or less distinct excitation of a sensory nerve.
- 2) A sensory excitation which induces a reflex movement, may, at the same time, evoke certain conscious sensations; the latter, however, are not indispensable.
- 3) In a pure reflex, which is not accompanied by any psychological elements, the relationship between strength of excitation and intensity of the resulting movement remains the same in the given conditions.
- 4) If the reflex is complicated by a psychological factor the relationship may fluctuate in one or in the other direction.
- 5) The reflex movement comes quickly in the wake of the sensory excitation.
- 6) The reflex movement more or less corresponds to the sensory excitation in duration, especially if the reflex is not complicated by the psychological elements.
- 7) All reflex movements are expedient from the point of view of preserving the integrity of the organism.
- 8) The specific properties of involuntary movements described above are equally peculiar to the simplest and to the most complex reflexes—to abrupt movements of several seconds' duration as well as to a series of successive reflexes.
- 9) Frequent repetition of a reflex in one and the same direction is caused either by the presence in the body of a definite inborn mechanism (for example, the mechanism of sneezing, coughing, etc.), or is the result of learning (for example, the act of walking) which is achieved with the participation of the intellect.
- 10) If normal sensibility is dulled in the sphere of one, several or all senses (sight, hearing, smell, etc.), then all the movements caused by these senses—no matter whether acquired by learning or not, whether connected with psychological notion or devoid of it—are, invariably, reflex movements from the point of view of the mechanism of origin.
- 11) This mechanism is formed by sensory and motor nerves, by cells located in the cerebral centres and originating these nerves, as well as by processes which these cells project into the brain and along which the latter influences the reflex movement, intensifying or weakening it.
- 12) The functioning of this mechanism constitutes the reflex.
- 13) The mechanism is brought into action by excitation of the sensory nerves.
- 14) Hence, all involuntary movements are mechanical in origin.

All the above-mentioned properties of involuntary movements must be kept in mind if we do not want to get lost in the extremely intricate world of voluntary movements to which we shall now proceed.

Chapter Two – VOLUNTARY MOVEMENTS

§ 10. Before turning to voluntary movements I must warn the reader that the lack of physiological experience in this sphere will be felt very frequently and that at times I shall have to deviate from the role of physiologist. I believe, however, that even in these difficult cases I shall adhere to the custom of naturalists—frankly admit my lack of knowledge and frame my hypothesis only on the basis of strictly established facts.

The reader will require first of all a list of the properties of a typical voluntary movement. Here is a key which will help in the matter: the reader should keep before him the properties of involuntary movements enumerated at the end of the preceding chapter; he should simultaneously clearly imagine the manifestation of a certain external activity of a person with an ideally

Strong will, one who acts in accordance with high moral principles and who is fully conscious of every step he takes.

- 1) The movements of this person are not based on perceptible sensory excitations (usually such people are not diverted from their chosen path even by the most terrifying forces of environment and are able to suppress all natural instincts).
- 2) The movements of such an individual are determined exclusively by the highest psychical motives, by the most abstract notions, such as welfare of mankind, love of his country, etc.
- 3) Will is able to reduce the external activity of man to absolute dispassion (this proposition chiefly ensues from self observation, i.e., to the fact that man is conscious of this ability); but the external activity can be voluntarily intensified only within certain limits. Enthusiasm, for example, with all its external manifestations, is beyond the control of human will.
- 4) The moment of the onset of the external movement depends on the will, provided the psychical factor giving rise to the act is not complicated by emotion (this proposition, too, chiefly ensues from self-observation).
- 5) The duration of the external movement is also dependent to a degree on will (according to self-observation), and is determined by greater or lesser fatigue of the nerves and muscles. A psychical motive of an exceedingly passionate nature always brings the external activity to the peak, admitted by the organisation of the nerves and muscles.
- 6) Highly voluntary movements often contradict the instinct of self-preservation. They are expedient only from the point of view of the psychical motive which causes them.
- 7) The combination of individual voluntary movements into groups is directed by will (according to self-observation). Here, too, absence of emotion in the psychical motive is an indispensable condition.
- 8) Voluntary movement is always conscious.

The reader will gather that I have described the voluntary movements in the same way as is done by educated people who are aware of their own sensations. It will be appreciated also that I have exaggerated rather than minimised the concepts of volition now prevailing in society. I have done so, on the one hand, because I am dealing with the highest manifestation of volition and, on the other, because I did not want prematurely to approach this phenomenon from the standpoint of an observer, believing, as is customary, in the voice of self-consciousness. I will now, however, approach the problem critically and proceed to examine the first point.

§ 11. Is it really the case that voluntary movement does not derive from sensory excitation? And if there is sensory excitation, why is it disguised in typical manifestations of voluntary movement?

Let me now summarise what has been said concerning the development of the child.

By means of absolutely involuntary learning of consecutive reflexes in all spheres of the senses the child acquires a multitude of more or less complete ideas of objects, i.e., elementary concrete knowledge. The latter occupies in the integral reflex exactly the same place as the sensation of fright in the involuntary movement; hence it corresponds to the activity of the central element of the reflex apparatus.

Analysis of concrete impressions of space and time is the next step in the development of the child.

And now let me summarise what has been said in the following general formula:

All psychical acts without exception, if they are not complicated by elements of emotion (we shall dwell on these elements later) develop by way of reflex. Hence, all conscious movements resulting from these acts and usually described as voluntary, are reflex movements in the strict sense of the term.

Thus, the question whether voluntary movements are based on stimulation of sensory nerves has been answered in the affirmative. It is also clear why in voluntary movements this sensor stimulation often remains unnoticed, or at least cannot be determined.

§ 12. Now I shall pass to the second question: Does the mechanism of inhibition, already known to us from the study of reflexes, play any role in originating voluntary movements? This is a natural question, seeing that we have identified the process of voluntary movements with the development of reflexes.

Are there any phenomena in man's conscious life which show that movements are inhibited? These phenomena are so numerous and so pronounced that it is because of them that all movements effected with full consciousness are called voluntary movements. On what is the usual concept of these movements based? It is based on the fact that man, influenced by one and the same external and moral conditions, can perform a definite series of movements, exhibit no movement at all, or, finally, can perform movements of an altogether reverse nature. As is known, people of strong will can suppress the most irresistible, seemingly involuntary movements; for example, one man screams and struggles when suffering acute physical pain, another endures it silently without making the slightest movement, while a third performs movements which are utterly incompatible with pain, for example, he jokes and laughs.

Consequently in conscious life there are cases of inhibition both of movements generally regarded as involuntary, and of those known as voluntary.

Since, however, voluntary movements develop in accordance with the basic laws of reflexes, we may, naturally, assume that the mechanism of inhibition in both cases is the same.

We also referred to experiments which show that there is no doubt whatever about the existence of these mechanisms in the brain of the frog, and that their presence in the human brain is highly probable. Now we must establish whether this hypothesis is also true for voluntary movements.

Let us now see how the child's ability to inhibit movements, or, strictly speaking, to eliminate the last member of a reflex, is acquired by learning.

Thus, man not only learns to group his movements through the frequent repetition of associated reflexes, he, at the same time, acquires (also by means of reflexes) capacity to inhibit them. That is why psychical activity in the multitude of phenomena remains, so to speak, without external manifestation, i.e., in the form of thoughts, intentions, wishes, etc.

I shall now show the reader the first and most important result of man's capacity to inhibit the last member of a reflex. This can be summarised as the ability to think, meditate, and reason.

Thus, we have replied in the affirmative also to our second question. There are many psychical reflexes whose last member, i.e., movement, is inhibited.

§ 13. I now pass to the third and last part of our investigation of the acts of conscious life, namely, to those psychical reflexes which have an intensified end. The phenomena belonging to these reflexes embrace the entire sphere of emotion. Our task will be merely to show that emotions are, in origin, intensified reflexes.

From this it follows that the development of emotion is subject to the same laws as, for example, the development of images from sensations. It originates in the instinctive craving for sensual pleasure, while frequent repetition of the pleasure or of the psychical reflex, which is the same, is the means by which it is developed.

But there is a difference between these two acts. When a reflex is frequently repeated in one and the same direction, its psychical element (sensation, notion, etc.), apart from the emotional element by which it is accompanied, becomes clearer (through association and analysis); emotion, on the contrary, often disappears. The child becomes tired of its toy.

At the beginning of human life all psychical reflexes without exception are of an emotional character, i.e., they have intensified ends. However, little by little the sphere of emotion narrows, and pale and monotonous images gradually give way to brighter and more mobile ones. This process is based on the analysis of similar concrete sensations which, however, may be more or less vivid and more or less mobile. Frequent repetition of an emotional impression will, to a degree, strengthen the emotion, because reproduction of the emotional notion and of its result, i.e., of desire, becomes more and more frequent.

In social life emotion is measured by its strength or depth and vividness. The strength or depth of emotion just like the clarity of a notion derives from frequent repetition of the reflex. As to the vividness of emotion, it is supported by the mobility of the impression, or by the sum of pleasures possible at the given time.

Negative emotion is subject to the same laws as positive emotion: here, too, the strength is determined by frequency of repetition, while the vividness depends on acuity of the oppressive desire.

Fortunately for mankind, human nature does not favour a steady intensification of negative emotions; being the mental reproduction of an emotional act, desire cannot be as vivid as the latter; at the second reproduction it becomes less vivid, at the third still less, etc. Consequently, pronounced development of negative emotion can be maintained for a long time only by a constant actual deficiency of sensual pleasures, or, as it is often said, by constant failures in life. Indeed, one can get accustomed to cold, hunger and even to the dark, silent prison.

It follows, then, that emotion in children is generally characterised by high mobility.

OBSERVATIONS ON MR. KAVELIN'S BOOK "THE TASKS OF PSYCHOLOGY"

I make bold to express the hope that Mr. Kavelin, no matter how violent my attacks on his fundamental principles may seem to him (of course, not in form, but in essence), will ascribe them exclusively to my sincere and ardent desire to serve the truth. In any cause like ours the only possible driving motive is the desire to reveal the truth.

Some of the greatest minds, from Aristotle to Kant, tried to elaborate psychology as a science. And yet it remains unsettled; this can be convincingly proved in a few words.

Take any expert psychologist, say, a professor of psychology, and ask him to tell you in all frankness whether he organises his own internal life in accordance with the data obtained by his science, or whether he is guided by the empirical psychological rules of everyday life, not verified by science; he will have to answer that it is the latter which determines his mode of life. Indeed, it cannot be otherwise.

Moreover, try to discuss one and the same subject with psychologists belonging to different schools and you will find that every school has its own ideas; but if for the sake of comparison you engage in conversation with a physicist from any country concerning, for example, sound, light, or electricity, you will obtain essentially similar replies

What, then, is the explanation for the fact that so far psychology cannot be regarded as a science?

Here is what Mr. Kavelin says on this subject in his book.

Man's consciousness abounds in facts leading to deductions which always contradict one another: man is conscious of himself as of a single and indivisible entity, but at the same time he distinguishes within himself two absolutely different principles—the spiritual and the corporeal; he is aware of his spiritual freedom and at the same time he is conscious of the tremendous influence which the body and the external environment in general exert on his spirit; the power of the spirit over the body appears to him with the utmost clarity, yet he is aware that the body obeys definite immutable laws and operates fatally

These contradictions—Mr. Kavelin goes on—and the desire to explain them gave birth to the three principal philosophical theories—dualism, spiritualism and materialism. The two last-mentioned try to explain the phenomena of both the spiritual and material worlds by proceeding from a single principle: the idealists from the spiritual principle, and the materialists from the material principle (p. 15). Idealism, which misinterpreted and distorted the profound observations of Kant, made a rapid advance and as rapidly died away; in Hegel's theory it came to such absurdities and incongruities which, at last, revealed to everybody the falsity of the fundamental principle underlying the entire idealist world outlook (p. 16).

Materialism, which in its turn erroneously interpreted the brilliant researches of Locke, proved more viable. At present it tries to side with positive knowledge and the natural sciences (p. 16); but a critical analysis of its basic arguments (pp. 27-35) shows that the days of this doctrine, too, are numbered, because the positive sciences have, little by little, undermined the foundations on which it rested; this fragile and delusive union with the natural sciences will but hasten its demise.

Since, according to Mr. Kavelin, we live on the ruins of these conflicting but equally erroneous views (p. 16), psychology as a science does not exist.

Meanwhile I shall pass on to a description of the means proposed by Mr. Kavelin for raising psychology to the level of a positive science.

The corner-stone of his scientific edifice is formed of the numerous facts amassed by worldly wisdom, facts which, on the one hand, make possible the realisation by our consciousness of the essential difference between material and psychical phenomena and, on the other hand, reveal the close relationship between the spirit and the body. His book abounds in facts of this kind which, by the way, are known to every educated person.

While criticising the fundamental arguments of materialism directed against the spirit as an independent autonomous and free principle differing from the body (pp. 27-35), he logically deduces the spirit with its afore-mentioned attributes from the untenability of the arguments which deny it. He reasons as follows: "Although the spirit and the body differ essentially, they cannot be opposed to each other owing to the numerous facts which testify to their close relationship and profound interaction; they should be regarded as modifications of one and the same principle (p. 55). (In this way Mr. Kavelin, apparently, hopes to eliminate the long-standing cause of controversy on the question of principles which, in his opinion, still divides the psychologists into two hostile camps—idealists and materialists.)

Mr. Kavelin then examines the question of how psychology must be elaborated in order to become a positive science.

On the one hand, acknowledging the usefulness of physiology in the study of the material substrata underlying psychical phenomena and, on the other hand, finding that man's body and spirit are directly and organically interconnected, he believes that psychology must be created by the joint efforts of psychologists studying the facts pertaining to the mind, and by physiologists investigating their material basis (p. 53). According to Mr. Kavelin, this division of labour is explained by the fact that psychical phenomena, being inaccessible to concrete investigation, can be studied only through introspection (p. 50).

Now I shall try to prove that 1) the criteria from which Mr. Kavelin proceeds when distinguishing the two principles in man (consequently, the criteria used by the obsolete idealists and obsolescent materialists) are not axioms and call for strict scientific verification: 2) by passing from concrete facts direct to general principles Mr. Kavelin commits the same gross error which has ruined philosophy as a whole.

Thus, parallel with the analysis of the criteria, underlying Mr. Kavelin's system, I shall explain here why the philosophical doctrines, on the ruins of which we now live, have collapsed and have left psychology an untouched science.

Mr. Kavelin will, of course, agree that if we have in mind only those distinctions between purely psychical facts and so-called exteroceptive impressions of which man is conscious, such distinctions must in any case be the products of man's own self consciousness solely. As to his confidence that all people perceive these distinctions alike, it derives from two facts: a) from the verbal testimony of people to the effect that everything seen, heard or touched in reality manifests itself in their consciousness more distinctly than the notions (in the form of thought) of the same objects seen or heard; b) from the fact that people generally react differently to real impressions and their reproduction in the form of thought.

It is the voice of self-consciousness and the foregoing verifications effected on other people that lead us to the conviction that there is a vast difference between the purely psychical facts of thought and real impressions. But let us see whether we can have absolute confidence in facts obtained from such verifications.

If a person tells you that in one case his sensation is vivid, while in another it is feeble, the matter ends at that; we do not know to what degree the sensation is stronger in one case than in the other. We only know from experience that some people vividly reproduce in their imagination the things they have seen or heard, whereas others are less imaginative. Consequently, in vividness, which is the sole knowable distinction between an actual impression and its reproduction, there are extreme gradations—from an obtuse imagination to morbid hallucinations. Where, then, is the gulf which, according to Mr. Kavelin, separates physical sensations from their reproduction in the form of ideas?

It will be seen, then, that the two verifications do not reveal the profound distinctions by which Mr. Kavelin, like all the outdated philosophical schools, is guided. If these distinctions seem to him strongly pronounced, this is due either to the peculiar character of his personal make-up, or to the fact that he tries to compare things which cannot be compared. The latter, of course, is ruled out; the conclusion is, therefore, that Mr. Kavelin obeys the voice of self-consciousness, of which he himself says the following (p. 21): "Should consciousness alone establish and determine the psychical facts, their positive and exact investigation would be out of the question."

Let us grant for the moment that not only the third point, but also the first two points are axioms. But in this case, too, Mr. Kavelin would ruin his entire system by his next step—by passing from the concrete facts straight to general principles, with the aim of explaining the former by the latter. All the preceding philosophical systems collapsed not only because they tried to derive the universe from a definite single principle, but so because they considered it possible to explain something by a general principle.

Mr. Kavelin, however, follows the old-time philosophers and rushes headlong from the solid ground of facts into the dense cloud of general principles.

The following conclusion can be drawn from what has been said: Mr. Kavelin bases his philosophical system on unreliable and unverified facts; moreover, he makes the same erroneous step which was predominantly responsible for the collapse of philosophy.

I expect, however, that Mr. Kavelin will retort that so far I have examined only his basic criteria for distinguishing two principles in man. I shall, therefore, pass on to Mr. Kavelin's criticism of materialism from which it follows that the spirit is, unlike the body, independent, autonomous and free (pp. 17-40).

The theory which, in Mr. Kavelin's opinion, is common to the materialists of all times (of course, scientific materialists, since there can be no question here of materialists of the salon type) is the desire to derive man's spiritual activity from matter. I shall not argue here about the materialists of the past; as to the present-day materialists, among whom Mr. Kavelin, apparently, reckons all physiologists, I make bold to assure him that his allegation is profoundly erroneous.

Any naturalist who is more or less acquainted with the natural sciences, especially with physics and chemistry, knows the meaning of the word "to explain" well enough to inscribe such an absurdity on his psychological banner. This is all the more true of physiologists, since they know that the essence of the nervous, i.e., somatic activity, which is closest to psychical life, has not yet been elucidated thoroughly enough to disclose which of the known physical agents plays an essential part in the nervous act.

The source of such gross errors as Mr. Kavelin's above-mentioned allegation lies precisely in the fact that the non-naturalists abuse the words "to explain".

If, for example, the naturalist establishes a certain, purely external analogy between the origin of a manifestly psychical act and that of a somatic act, the non-naturalist immediately jumps to the conclusion that the entire given psychical phenomenon is reduced to its material conditions.

I can assure Mr. Kavelin that to the naturalist psychical phenomena are a much greater enigma than they are to the humanists; this will be clearly shown later on.

The fourth argument (p. 30) in favour of the autonomy of the spirit is formulated as follows: "The great variety of psychical phenomena and of the resulting external actions of man are free from any direct external influences and incentives, being caused solely by psychical motives."

The fifth argument treats of the voluntariness of movements, i.e., again of the third basic criterion for distinguishing two principles in man; in view of this I refer the reader once more to the end of the present article.

But I consider it necessary to give here a brief personal explanation in connection with the first part of Mr. Kavelin's fifth argument (p. 31).

He states: "Materialism does not deny these facts, it interprets them in its own way. That which we regard as a psychical process is in the eyes of materialists a nervous or brain reflex which does not presuppose the existence of a psychical medium or the participation of will and which is accomplished mechanically." Mr. Kavelin, apparently, has me in mind when stating this; but he commits a gross error when he affirms that I identify psychical facts with reflexes. It is true that in my book *Reflexes of the Brain* I do advance a hypothesis according to which typical forms of the psychical processes of thought and emotion are of a reflex origin (and consequently bear a machine-like character), but nowhere in the book is it stated that the nature of the psychical processes is explained, for example, by the structure of the nervous centres.

For the present I should like to say a few words about the idea that spirit and matter are modifications of one and the same principle; afterwards I shall examine in detail the method of investigating psychical phenomena proposed by Mr. Kavelin.

As mentioned above, Mr. Kavelin, after examining a number of well-known facts concerning the close link between spirit and body, arrived in a purely logical way at the idea that because of this they cannot be opposed to each other and must be modifications of one and the same principle. This idea is of no great importance, because for Mr. Kavelin both the general principle which is modified to form the spirit and the body and the modifications are mere abstractions.

But perhaps the clue to comprehending the psychical processes should be sought in a broad historical study, from the psychological point of view, of all the products of the human spirit, the study of which Mr. Kavelin speaks in his book? And since the choice of research methods should be made with the utmost care, it is impossible to disregard this important question. Unfortunately, my knowledge in this sphere is restricted, and for this reason I will confine myself to the conclusions drawn from the few facts known to me.

My task will consist exclusively in showing, by means of a few striking examples, the extremes to which we can go when we try to explain psychical facts by the historical method of studying the various manifestations of psychical activity.

Thus, the essence of all philosophical theories concerning the body, the spirit and the objects of the external environment is based (according to Tylor) on real, but wrongly interpreted facts. For our particular purpose we could add: "on the facts of life wrongly interpreted, because the savage is too ready to accept the voice of his self-consciousness."

To sum up, 1) Mr. Kavelin's points of departure are not reliable; 2) his abrupt switching from concrete facts to general principles is a scientific error for which in our days there is no justification; 3) the social instrument which he recommends for psychological research is a fiction; 4) the material suggested by him for elaboration lacks the prerequisites for unfolding the secrets of the psychical processes: while without some special and completely unforeseen help afforded by this material, 5) his entire method boils down to pure speculation. These are the reasons why 6) psychology, on this basis, cannot become a positive science.

WHO IS TO ELABORATE THE PROBLEMS OF PSYCHOLOGY, AND HOW?!

Mental life is governed by definite immutable laws: in this respect psychology can be a positive science.—But this will happen only when the immutability of the laws is proved not only with regard to the whole, but also to its parts.—Of all the phenomena encountered in the world there are but two categories which can be compared to the mental life of man; these are the mental life of animals and the nervous activity of man and animals, which are studied by physiology.—The two categories, being simpler in content, could be a clue to the understanding of the mental phenomena in man.— Comparison of concrete mental phenomena in animals with those in man is the subject of comparative psychology, while comparison of mental phenomena with the nervous activity of the human body is the groundwork of analytical psychology, because the nervous processes taking place in the body have already been subjected to at least partial analysis. Thus, it is clear that only physiologists are qualified to investigate the problems of analytical psychology.

He who says that psychology is not yet an established science is bound to admit that man has no special mental mechanism for perceiving psychological facts, no special inner feeling or psychical vision which, merging with the thing cognised, would enable him to cognise the products of consciousness immediately, in their essence. Indeed, if psychology had this tremendous advantage over the sciences which study material life and which cognise the objects of their study mediately, it would have left natural science far behind, and would have long since established a reputation for itself for infallibility of its deductions and generalisations.

In reality, however, we see that even the very question of who should investigate the problems of Psychology and how they should be studied still awaits solution.

Those who hold that psychology is not an established science are also bound to admit that the subject of its study, i.e., mental phenomena, is of an extremely complex nature. Otherwise, it would be impossible to explain the extreme backwardness of psychology in the scientific elaboration of its subject-matter, although this elaboration dates from ancient times, long before the appearance of physics and chemistry.

On the other hand, he who maintains that psychology is a science cannot but acknowledge that mental life as a whole, or at least part of it, is governed by laws every bit as immutable as those of material life, since this is indispensable for a truly scientific investigation of psychical facts.

Fortunately, this vitally important question is answered in the affirmative even by those schools of psychology which believe that there is an impassable gulf between spiritual and material life. And how could it be otherwise? The basic features of man's mind and of his sensory faculties have not changed in the course of historical development and do not depend on race, geography or cultural level.

Hence, the simpler mental manifestations of animals, not those of 'man, should be used as the initial material for investigating mental phenomena.

But is not the similarity between man's mental manifestations and those of animals purely superficial? Is not the divergence so great that they cannot be compared at all? This view has many supporters; it is reasonable enough as far as the quantitative side of the phenomena is concerned: for the quantitative difference is truly tremendous. But the claim that there is a qualitative difference between the mental organisation of man and that of animals cannot be regarded as being scientifically established: it is merely conjecture and not the product of scientific analysis, because the comparative psychology of animals and human psychology are not yet established as sciences.

Still, let us assume that the similarity of the mental organisation of man and animals is only of a limited nature, and that beyond these limits they differ essentially. In this case, too, the rational way to investigate mental phenomena in man would be to study first the similar aspects leaving the solution of all further problems to the future, if there are no grounds at the moment for their solution.

To this day many physiological phenomena remain absolutely unexplained (for example, impregnation of the ovum, development of the embryo, hereditary transmission of specific and individual characteristics, etc.); but it has never occurred to any physiologist to explain them by claiming the existence of special forces, faced with such problems, the physiologist usually says: "I do not know."

Unfortunately, at present it is still impossible to estimate, even approximately, the importance of the comparative study of psychical phenomena in man and animals. True, the raw material for this study is available (it includes, on the one hand, the results of observations on animals designated as "habits and customs of animals", and on the other hand, the facts accumulated by so-called practical psychology); however, serious attempts at a comparative study have only just begun.

Things are different now: physiology provides a number of facts which establish the affinity of psychical phenomena to the so-called nervous processes in the body, i.e., to purely somatic acts.

Here are the most important of these facts (it should be borne in mind that if a certain idea is supported by a number of arguments its conclusiveness is determined not by separate facts but by the sum of the arguments):

1) Every psychical act, even the simplest, takes a certain time; the more complex the act, the longer is its duration (see textbooks on physiology).

2) The anatomo-physiological integrity of the brain is a condition for any psychical activity (a well-known fact).

3) The rudiments of psychical activity (at least the innate rudiments), develop clearly, from the purely material substrata of the ovum and the sperm (a well-known fact).

4) Numerous individual psychical peculiarities, among them those belonging to the category of higher manifestations, such as inherited talent, are transmitted by the same material substrata (a well-known fact).

5) There are no clear distinctions whatever between the obviously somatic, i.e., bodily, nervous acts and the definitely mental phenomena.

6) Remaining within its sphere, i.e., examining the phenomena of the body in connection with its structure, present-day physiology has proved the existence of a close relationship between the nature of perceptions and the structure of the corresponding sensory mechanisms, or sense organs (see textbooks on physiology).

Should you ask an educated man what is a psychical act and how is it manifested, he would unhesitatingly answer that it is a spiritual phenomenon, the nature of which is unknown and which is reflected in consciousness in the shape of sensations, feelings, impressions and thoughts.

Should you consult one of the older textbooks on psychology, you would find the same definition: psychology is the science which deals with sensations, -feelings, impressions, thoughts, etc. The idea that only the conscious is psychical, in other words, that a psychical act begins from the moment it appears in our consciousness and ends when we pass into a state of unconsciousness is so deep-rooted that it is now widespread even in the everyday language of educated people.

All psychical acts of the reflex type can in their entirety be subjected to physiological study, because the investigation of their beginning and end (i.e., the external sensory stimulation, and the movements) directly concerns this branch of science; this applies also to the intermediate member of the psychical acts (i.e., to the psychical element in the narrow sense), because very often and perhaps always the latter is not an independent phenomenon, as believed previously, but an integral part of the entire process.

In a more general way this idea can be expressed as follows:

the science studying the causes of psychical acts and their manifestations should also study the relationship between these acts and their determinants, on the one hand, and between the external manifestations and the psychic elements, on the other.

Accordingly, physiology should also study those psychical acts in which the external manifestations deviate more or less sharply from the reflex type, because the experience of all science (at least of the natural sciences) teaches that the cause of any deviation of a phenomenon from the basic type should be sought not in the interference of new factors but first of all in the form of relationship between the known factors, especially if this relationship is as complex, as in the case of the psychical processes. It may be, of course, that this method of investigation will lead to negative results, or even bring the investigator to conclusions that are the opposite of those anticipated; but it is the only rational method and is, therefore, obligatory.

No one doubts, of course, that psychology will thereby be in safe hands—modern physiology is guided by sound principles and by a sober view of things. As a science dealing with facts it will first of all separate the psychic realities from the psychological fiction which is all too abundant. Adhering to the principle of induction, it will not rush headlong into the sphere of higher psychological manifestations but will begin with diligent study of the simplest phenomena. Its advance may be slow, but it will be sound and reliable. As a science based on experiment, physiology will not affirm as an incontestable truth that which cannot be confirmed by precise experimentation; operating in this way it will definitely separate the hypothetical from the positive. It may be that psychology will shed some of its brilliant and universal theories: huge gaps may appear in its actual knowledge, instead of explanations we will get in most cases the laconic phrase: "We do not know"; the essence of the psychical phenomena, insofar as they are manifested in consciousness (like the essence of all other natural phenomena) will still be concealed from us. And yet psychology will have made a tremendous advance. It will no longer be based on erroneous reasoning prompted by the delusive voice of consciousness; it will rely instead on positive facts, on verifiable propositions. Its generalisations and deductions, strictly confined to real analogies, will no longer depend on the taste and whims of the investigator, which in the past brought psychology to transcendental absurdities; they will acquire the character of truly objective scientific hypotheses. The subjective, the arbitrary and the fantastic will give way to more or less reliable knowledge. In short, psychology will become a positive science

Only physiology can achieve this, because it alone holds the key to the truly scientific analysis of psychical phenomena.

II

Criticism of the data on which psychology should be built up.—Determination of general criteria for distinguishing psychical realities from psychical fiction.—Classification of psychological problems.

To show how common psychology abuses language I shall cite a few of its propositions concerning human nature.

- 1) Man, as a single unit in the universe, as an integral whole, can be counterpoised to everything else in the universe, abstracted from all that is taking place in the external world. In this sense he is a special kind of unit, one and indivisible.
- 2) If we look at the sum total of the phenomena taking place in man, we shall see in him two principles operating according to dissimilar laws.
- 3) The corporeal man is subject to the laws of the material world, the spiritual man is not.
- 4) The corporeal man is the slave of matter, the spiritual man is its master.
- 5) Man has power not only over his body and behaviour, but also over his thoughts, desires, emotions, etc.
- 6) In this sense man, a free being, determines his actions himself.

At first sight these aphorisms look simple and intelligible, being based on well-known facts and having logical consistency, that is, if human nature can be defined by aphorisms at all.

But when we examine the essence of these propositions, and verify how they conform with reality, we shall see that most of them are merely a string of absurdities. For the concept of man as one and indivisible, as an individual or an entity, in the strict meaning of these terms, cannot be anything else but an abstraction from the facts of his physical place in nature.

Generally speaking, the errors associated with what are commonly called "quibbles" are due mainly to the fact that man performs mental operations with words—which are symbols of objects and their interrelations—just as he does with objects of the external world, and applies the results to reality.

In some cases, for example, the extreme results of abstraction or generalisation are introduced into psychology, with the result that a number of meaningless abstract terms, such as "being", "essence of things", etc., appear as scientific reality.

In others the mind, influenced by the decomposability of language, unreservedly ascribes the same quality to the actual processes denoted by the words; hence the frequent confounding of the logical and psychological aspects of thought and, in general, confounding the purely logical (in words) with the true.

Then there are the cases when man giving, so to speak, free rein to his imagination, attributes a psychical reality to a perfectly innocent grammatical form; take, for example, the naive and widespread play with the concept "I".

It is clear, however, that errors of this kind arise only because facts and inferences drawn from the nominal sphere are carelessly applied to the sphere of real objects, and this in turn is due to the fact that the ordinary mind lacks the general criteria for an assessment of the true psychical reality.

The natural sciences, too, are developed through words which give definite shape to their inferences and generalisations: but quibbling is practically ruled out here because the features of the material realities are strictly established.

It is obvious that in the case of psychology, too, words will cease to be a source of errors when science clearly and firmly establishes the general properties of the psychical realities.

Thus, the problem of the general methods of critically assessing the facts of common psychology boils down to the following: What is implied by the term psychical reality which is the sole subject of psychological research?

When drawing a parallel between nervous and psychical acts, I endeavoured to show their close relationship and thus prove the possibility of investigating the latter by analogy with the former. The analogy was confined almost exclusively to the external manifestations of the acts, the elements of both kinds of phenomena. But an analogy of this kind presupposes a more substantial similarity—similarity of original causes in both cases. In other words, if the sum of the material processes taking place in a certain part of the nervous system is the most substantial and the only real factor of a nervous act, then in a psychical act, too, only the material side can be real.

In this sense the psychical reality would be strictly definite and tangible, and could be as easily distinguished from psychological fiction as, say, ether is distinguished from air by the physicist.

Unfortunately, our knowledge of the nervous processes, even in the case of the most elementary reflexes, is negligible. All we know is the material form in which the particular phenomenon develops, some of the conditions of its normal variability, we can artificially reproduce a phenomenon possessing certain characteristics, and we know the role played by some of the parts in the phenomenon as a whole, etc. But the nature of the processes taking place in the nerve and nervous centres is still a mystery.

Elaboration or at least elucidation of this aspect of the nervous and psychical phenomena belong to the distant future; we are compelled at the moment to confine our research to external manifestations. Nevertheless, the concept of a psychical act as a process or motion having a definite beginning, course and end, must be retained as fundamental.

In the first place, this concept is actually the extreme limit of possible abstraction from the sum of manifestations of psychical activity, a limit within which reality still conforms to thought; in the second place, even in this general form, it is a convenient and simple criterion for testing the facts: lastly, it determines the general nature of the problems to be elaborated by psychology as the science dealing with psychical realities. In the first sense, i.e., as the fundamental principle of scientific psychology, the concept of psychical activity as a process or motion is merely the further development of the concept of the relationship between psychical and nervous acts and must be accepted as axiomatic, just as the idea of the indestructibility of matter is regarded as a fundamental principle of chemistry.

Once this axiom is accepted as a criterion, psychology is obliged to approach every aspect of psychical activity from the point of view of a process or motion. Should this method prove successful with regard to the typical forms of psychical activity (beginning with the simplest), for example, with regard to the various aspects of sensation and with all their external manifestations, then the point of departure will be correct. In this case, anything too complicated, which does not fit the accepted principle must be resolutely left for future investigation.

As regards the general nature of the problems of psychology, our principle demands that psychology, like physiology, to which it is closely related, should confine its investigation to the questions of how a certain psychical process—expressed in feeling, sensation, notion, voluntary or involuntary movement—takes place, and how thought develops.

This conclusion shows that the daily picture of man's psychical activity cannot be taken as the starting-point for our investigation. Still, it is useful to consider it, since it suggests the following classification of the problems of our science:

- 1) psychology should study the development of the separate elements forming the picture;
- 2) it should investigate the manner in which the separate elements combine into a continuous whole and, lastly,
- 3) it should study the mechanisms which determine the resumption of psychical activity after each break.

In the language of science this means:

- 1) that psychology should study the development of sensations, thoughts, feelings, etc.;
- 2) that it should investigate the ways in which all types and kinds of psychical activity combine with each other, as well as the consequences of this combination (it should be borne in mind, however, that the term "combination" is used in the purely figurative sense); and lastly,
- 3) it should study the conditions which determine the reproduction of psychical activity.

III

Generally speaking, the question of whether psychical activity is of a reflex character or not can be answered in the affirmative provided we can prove that the initial forms from which it originates are reflex acts, and that the nature of the processes remains unchanged during the subsequent stages of psychical development

Further, every educated person knows that it is the child's contacts with the external world that provide the basis for its further psychical development.

Hence, with regard to the beginning of the acts (sensory stimulation), the initial forms of psychical activity must be similar to reflexes

Helmholtz, one of the greatest thinkers of our time who has contributed more than any other scientist to the psychological theory of the evolution of spatial concepts, has summed up all the facts obtained by observation on the evolution of spatial vision. According to him, concepts of magnitude, distance, outline and corporeity of objects derive, as it were, from unconscious inferences.

In this sense, such phrases as "the tree is green", "the stone is solid", "the man is standing, lying, breathing, walking", etc., contain all the essential elements of thought, namely, 1) the separateness of the two objects, 2) their juxtaposition (in the consciousness), and 3) the inference (in the foregoing examples it is confined to proving the separateness of the objects of thought).

The adult, however, can compare objects even if at the given moment he does not see the real standard with which he is comparing the object (visual appreciation of shape, colour or size, manual determination of weight, etc.). But even in this case there is a definite standard: this is the mental reproduction of the object that would be taken as the standard were it present at the given moment.

Moreover, comparisons can be made not only between two objects, but between many; in this case the process is absolutely the same, because the comparison is effected in pairs, giving us a series of comparisons instead of one. When two distinct objects (for example, two stones, two trees, etc.) are mentally compared, two successive impressions, separated in time and space, comprise the act of comparison (the eyes pass from one object to the other); hence no special mental process takes place in this case.

In point of fact man's faculty of decomposing concrete sensations is an indispensable condition for the emergence of such thoughts; clearly, this faculty must already be present, i.e., it predates thinking. And, as we know, it develops at an early age, when the child's sensations are beginning to decompose and develop into notions.

But the mind is familiar with another result of object comparison—their dissimilarities are more pronounced the more rapid the sequence of impressions compared, other conditions being equal. This is the phenomenon of contrast, by virtue of which light seems brighter after darkness, cold seems colder after heat, a small object looks smaller alongside a large one, the ugly seems to be beautiful, and the disgusting a source of delight. As to the deduction or the inference, selfobservation or introspection fails to reveal any specific process for it; the mind simply affirms that the comparison has revealed similarity or dissimilarity.

The content of the inference, which is determined by the nature of the thing stated at the given moment, is a different matter. When in connection with a whole we affirm the dissimilar attribute (a part) of the whole, we are dealing with the actual substratum of the thoughts which usually define the quality or state of the object; for example, we say: "the oak is green", "the diamond is hard", "Peter is sitting", "Ivan is walking", etc. And conversely, when we affirm a similarity in the features of the objects compared, we are dealing with the actual substrata of thoughts in which the relationship between all the members is identical, but the object is decomposed to a greater degree; a part of it is, so to speak, abstracted and raised to the level of a concept; in this sense, we say: "the tree is green", "the stone is hard", "the man is sitting, walking", etc.

But the process of decomposition can be carried further—not only the object, but even one of its attributes can be decomposed. Along with dissimilar attributes (the tree is green, yellow, brown, etc.) the mind can affirm (one should not forget that this word is used figuratively!) similarities in the attributes. Just as in the previous case, this is an abstraction of a part from the whole; the real elements of thought here are the same, but in this case, the attribute is decomposed as well; in this sense we say; "the tree is coloured", "the man is motionless", "the man moves", etc. (but in the thought "the stone is hard" the second member does not undergo change, the reason being that hardness, like cold, hunger, the desire to urinate, etc.), is the product of a sensation that cannot be decomposed.

When more and more decomposed concepts are juxtaposed, it is not the concrete forms, but their attributes which become objects of comparison. Hence it is possible to compare the most dissimilar forms (for example, a man with a tree, stone, etc.). Thanks to this the boundaries of our thoughts are extended immeasurably, and the only obvious limit to comparison is set by the structure of the instruments which decompose the concepts into separate elements (in our case—the sense organs). Science shows, however, that even this limit is not absolute; whenever the natural powers of the sense organs do not suffice science equips them with artificial means of analysis, with the result that the decomposition of concrete facts and the comparison of objects with their parts, and of the separate parts, is resumed.

Science has been doing this for centuries: our knowledge of reality ends where the limit of comparisons (even if aided by artificially perfecting the sense organs) is reached, and where the possibilities of the perfecting have been fully exhausted.

In this endless chain of thoughts, arising in the course of comparison, it would seem that the real substrata of the mental process remain invariable; the starting point is the decomposition of the image in keeping with the analysing capacity of the sense organ, an act which makes it possible to concentrate on a particular aspect of the image; the second phase of the process, or its end, can be designated as commensuration of the decomposed image with a previous similar image, reproduced mentally according to the law of association (a mental standard), or if two objects are compared with another real image.

The first phase is of prime importance, because it is then that the child's capacity to compare objects and to deduce things is perfected. This is proved by the fact—already mentioned—that the entire spatial aspect of vision (concepts of size, distance, corporeity, etc.) which can be expressed by a number of examples similar to those cited, is, according to Helmholtz, developed, as it were, by means of unconscious inferences.

Repetition of one and the same stimulation of a sense organ under varying conditions of perception leads to the decomposition of the sensations; this determines their conversion into notions. Simultaneously the conditions for the mental reproduction of impressions are multiplied: the reproduction takes place in accordance with what is known as the law of similarity, and the result of this reproduction is a mental comparison of similar things.

Reproduction of a psychical act in the body simply means that it is repeated in full; consequently, in the case of a visual impression the act of reproduction also includes the movements performed by the eyes during examination of the object. These movements, falling upon the real image, are the real substratum of what we call commensuration of images from the point of view of form, length, etc. No new processes are introduced into our consciousness by these acts; they are merely a repetition of the habitual acts of seeing, hearing and touching, but applied to a new object.

It is clear, however, that commensuration is accompanied by effects: experience teaches that thorough knowledge of even the purely external attributes of an object always presupposes frequent and repeated stimulation of the sense organs by similar objects. We are accustomed, for example, to the faces of Europeans and we easily discern even their most delicate features. But we seldom see Negroes or Chinese; hence, their faces seem to us so much alike that I, personally, made the mistake of taking a Negro girl for a Negro boy; this means that in this case I was unable to distinguish even the most typical features of the faces of young people of different sexes.

If we accept the viewpoint outlined above it will become quite clear that, essentially, the comparison of two real objects does not differ from the commensuration of a real object with a mentally reproduced image taken as the standard.

Thus, in essence, the mental process of comparison is nothing but frequent stimulation of the sense organs and simultaneous reproduction of similar past impressions together with their motor effects.

Before passing to the second turning-point in psychical development it will be necessary to dwell on the application of the foregoing conclusions to two particular cases of highly abstract thought—mathematical and metaphysical thought.

The first case is striking for the following reasons. Mathematics, as a science which analyses spatial and quantitative relations, is obliged to decompose its initial concrete concepts. And it does this to a greater degree than all the natural sciences, reducing the notion of space to the concept of a mathematical point which has no dimensions, and, in general, the notion of value to the concept of infinitesimal quantity. This process does not necessitate instruments that would improve the functioning of our sense organs, such as the microscope which is indispensable for investigation of extremely minute objects, or the magnetic needle which is necessary for recording electrical phenomena. The decomposition is a purely mental process (this is one of the many reasons why mathematics is called a purely theoretical science). The mind acts, as it were, in advance of the sense organs and penetrates deeper into the spatial and quantitative relations. How are we to reconcile these facts with our previous conclusion to the effect that thinking begins with analysis of real impressions under the control of the sense organs? And how are we to explain the fact that mathematical speculation, which deals with pure abstractions, is foolproof, while its supposed source—concrete thought (or to be precise, thought dealing with realities)—swarms with errors and blunders? At first sight this looks like a contradiction, but the point is that mathematical speculation has its source in realities as well.

It is easy to see that to decompose space to a mathematical point, and, in general, to decompose any value to the concept of infinitesimal quantity, is by no means a difficult mental process; it can be done quite easily even by those who are not particularly strong in mathematics (for example, myself) and by children. On the other hand, it is obvious that these notions, taken separately, cannot evoke definite images even in the best mathematician in the world, so that in this respect, too, all men are equal. Taken separately, the mathematical point can be understood only from the viewpoint of its logical origin; it is a material point deprived of its essential attributes, i.e., of the three dimensions: it is, as it were, form without content (a symbol!). Actually it is the antithesis not only of space but of reality in general (the concept of space is invariably included in the concept of reality as part of the whole); thus, it is nothing. The logical origin of the "mathematical point" is clearly seen from the fact that it can be obtained by direct application of the mental process of decomposition not only to real objects (spatial, of course), but also to the verbal image or verbal definition of the material point. For the mathematician, this material point is a value which possesses only one property or attribute—measurability in three dimensions. Since we are able mentally to separate the attributes from the object (the separation is effected verbally), we can do the same in this case and, by so doing, obtain the same (?!) object, i.e., the point minus its attribute. The concept of "infinitesimal value" is of a still more general nature than the concept of the mathematical point, but of the same origin: from the standpoint of disintegration it, too, is the antithesis of everything finite and real—a value which, as we say, is approaching nought, but which is actually nought itself, i.e., nothing. But how can mathematical speculation be foolproof if it deals with pure abstractions? The answer is that these concepts are never applied by mathematics independently, they are included in the process of analysis as a logical element.

Metaphysical theories have their origin in the natural and, consequently, perfectly legitimate human desire (its physiological basis is known to us) mentally to separate the attributes of the facts and to classify these attributes in accordance with their importance and constancy. This is the starting-point for any scientific classification; furthermore, it is a well known fact that a rational classification contains all the essential inferences of a science; hence, as far as its purpose is concerned, metaphysics has every right to exist.

Unfortunately, however, it makes a grave blunder at its very next step: instead of decomposing its objects within the limits of reality (in the same way as the zoologist divides animals into vertebrates and invertebrates) and instead of basing its inferences exclusively on the facts obtained in this way, metaphysics holds that in all cases without exception, i.e., in all the principal branches of gnoseology (the external world, the human spirit, etc.), the mind can go beyond the limits of strictly sensory cognition (indirect cognition as distinct from direct cognition, i.e., via cognition by the mind or by pure speculation) in the same way as the mathematician arrives in a purely speculative way at the concepts of the mathematical point, infinitesimal quantity, positive, negative, imaginary values, etc.

Proceeding from this idea, the metaphysician, compelled to disregard all that is visible, audible and tangible, i.e., the world of real impressions, turns to a more delicate sphere to notions of things seen, heard, etc., i.e., to the world of thought.

But what kind of world is this? A thought always retains in greater or lesser degree the features of its primary image, i.e., of the actual impression which produced it. By no means, however, is it an exact photographic copy of the image; as the thought moves away from its primary source, it becomes, so to speak, increasingly less tangible; the extraneous is lost and only the quintessence of the object is left. This abstraction from all that is sensory, now no longer divisible, is regarded by the metaphysicians as the essence of things as the fundamental property of objects (a kind of soul) accessible only to direct cognition through pure speculation. And this essence is the subject-matter of metaphysics

But before tracing the development of metaphysical thought I consider it necessary to cite two well-known facts which show whither metaphysics leads.

The phenomena of the external world have long been studied both experimentally and in a purely speculative way, i.e., from the philosophical point of view. These two trends have existed side by side almost up to the present time; whereas the first modestly limited its study to phenomena perceived by our more or less perfected sense organs, the second has always tried to penetrate deeply into the essence of things. The development of the philosophical trend was crowned (and terminated) by German natural philosophy; as to the experimental trend, it still exists. Whereas natural philosophy was about as useful as, say, the ravings of a madman and has long been forgotten, the experimental natural-science trend has penetrated into life, often determining its forms and, at the same time, deepening and extending our knowledge of the external world. The speculative method ended in absurdity, whereas the experimental method is gradually approaching the very goal of metaphysics—ever deeper penetration into the essence of phenomena.

The reason for the predominance gained by the purely speculative method in the study of psychical phenomena is that the principles on which the methods of natural science can be more or less widely applied to the sphere of psychology were established only recently. The speculative method had been widespread in Europe since the rise of Greek civilisation, whereas the more or less considerable application of the methods of natural science to the study of psychical phenomena dates only from 1838, i.e., from the invention of the stereoscope by Wheatstone.

The stereoscope was invented by Wheatstone in 1833, but the theory of stereoscopy in the sense mentioned above appeared only in 1838.

But why does the metaphysical method of studying psychical phenomena lead to absurd deductions? Does the fallacy lie in the logical form of metaphysical reasoning, or only in the objects of the reasoning?

We are already acquainted with the logical side of reasoning: it consists in comparing two objects (i.e., either two concrete forms or the whole and one of its parts, or two parts of one and the same form, or of two separate forms) and in their commensuration from the point of view of similarities, dissimilarities, causal relationships, etc. Besides, we can detect by intuition any, at least serious, fallacy in logical reasoning: in such cases we say; "the inference is illogical", "the reasoning is inconsistent", etc. Metaphysics, however, cannot be accused of inconsistency: otherwise its doctrines would not have held sway for such a long time. On the contrary, it is the consistency of metaphysical reasoning, along with the universality of the problems it undertakes to solve, that attracts most. Hence the error must lie in the objects of metaphysical investigation. This circumstance is of extreme importance to us, because it convincingly shows that the real substrata of all psychical processes are invariable, no matter whether our reasoning is based on reality or on pure metaphysical abstractions.

But what kind of error is contained in the objects of metaphysical investigation?

When the metaphysician in his desire to obtain more profound knowledge ignores the world of real impressions (which for him are a kind of profanation of the essence of things by our sense organs), and turns of necessity to the world of ideas and concepts (since there is no other place to which he can retire), and does so with the conviction that that which is truly ideal, that is, the least real, is what really matters, he inevitably deals with abstractions: he forgets that these abstractions are fractions, i.e., conventional values, and, without a moment's hesitation, objectivises or transforms them into essences.

I say, and I say it with deep conviction without any exaggeration, that the metaphysician tries to prove that $1/2=1/10=1/20=1$. etc. He does the very thing a mathematician would do if he were to take it into his head to isolate a mathematical point or an imaginary value without acknowledging their conventional character.

What is more, conventional mathematical values even in their isolated form are still abstractions, while the ultimate objects of metaphysics or its essences, are products of decomposition not of real impressions but of their verbal expressions. This is the second deadly sin of metaphysics, a striking example of which is confounding the name of an object, i.e., mere sounds, with the object itself, for instance, the name Peter with the man Peter, this lapse is rooted in the peculiarities of language and in the attitude of the human mind towards its elements

But are the metaphysicians really so entangled in their generalisations that they are unable to distinguish between the nominal and the real? The ranks of the metaphysicians have known many brilliant minds. I am not saying that their errors were caused exclusively by the properties of language. The latter merely aggravated the errors; but, as stated earlier, the basic source of the metaphysical fallacies is the conviction that man can acquire absolute knowledge without the help of the sense organs. This conviction is so widespread and seems so sound that I feel compelled to say a few words about the causes of this self-delusion.

Man has his place among all the things which exist on our planet, and even the whole of his spiritual life, to the extent that it can be the subject of scientific study, is an earthly phenomenon. Mentally we can separate our body and spiritual life from our surroundings, in the same way as we separate in our minds colour, shape or size from the object as a whole. But can we say that this separation is real? Clearly, we cannot, since this would mean isolating man from all the conditions of his earthly existence. And yet it is precisely this isolation of man's spiritual life from his material existence that constitutes the fundamental principle of metaphysics: and this self-delusion is constantly fostered in people by the clarity of their self-perceptions.

Once committed, this error leads to the following logical argumentation: "Since the environment is something external to me it must have a specific form of existence unlike that which reality conveys to me through my sense organs. And this latter form, being mediate, cannot be true; the truth is contained in the original form of existence, independent of the perception of my sense organs, and I gain my knowledge of this form by means of a more delicate, non-sensory instrument —the mind." Now everything in this argument is absolutely correct except the last idea; but it is precisely this last idea that contains the above-mentioned error; separating the mind from the sense organs is the same as separating something from its source, or an effect from its cause. It is true that the external world exists apart from man and has its independent life, but man acquires knowledge of this world solely through his sense organs because the results of their activity are the source of all mental life.

I shall sum up this rather long argument concerning the real psychical substratum of thought in the following proposition.

1. Thinking develops in the child simultaneously with the process of decomposing the complex sensations transmitted by the sense organs because at this stage all real psychical elements of thinking, namely, the decomposition of concrete, integral sensations and the reproduction of previously experienced sensations are already present in the organism.
2. When the child has learned to see and hear, the process of decomposing its visual and aural sensations becomes much more developed. The first objective indications of this are the signs by which the mother knows that the child now recognises her voice and face. At this stage the real psychical elements of elementary thinking, contrasting the characteristic attributes of the objects—are, perhaps, already present.
3. But when the child begins to manifest an obvious capacity to distinguish the distances of objects (for example, when it grasps the mother's nose without stretching its body, or when it attempts to reach more distant objects), this shows that new processes are developing in its mind, processes which have absolutely all the features of visual thinking, including comparison and inference. These are the processes that Helmholtz designated "unconscious inferences".*
4. With frequent stimulation of the sense organ by the same or similar objects, the sensation becomes ever clearer, owing to the fact that certain changes are constantly taking place in the conditions of perception; in the child's mind this produces the effect which examination of an object not from one, but from different aspects produces in the adult.
5. But along with each new impression, or to be more precise, after each impression, a similar act which took place in the past is inevitably reproduced in the mind; consequently, every time the two intermediate members are compared in the mind, the reproduced impression, i.e., the older and more familiar one serving as a sort of mental standard. I shall cite an example. I am used to seeing a certain man without a pimple on his nose. But suddenly I see a pimple, and the sight affects me strongly. Why? Because I mentally compare the familiar image (serving as a standard) with the new impression.
6. In the visual acts which form the substratum of complexly formulated thoughts, whose essence is comparison, we know also the real substratum of the last element—the mentally reproduced muscular process of the act of seeing the end member of the reproduced act. It is now superimposed on the real impression, and a real commensuration takes place which resembles the superimposition of triangles in geometry.
7. An inference has no real substratum; but its content, and consequently the content of the whole thought, is determined by the way in which the real factors of the thought are compared (it should be borne in mind that it is possible to compare an object and one of its attributes or states, two whole objects and, lastly, the attributes and states of two objects). For example, when the actual impression of a complete image is compared with a mentally reproduced attribute of a similar past impression this makes it possible to ascertain the attribute in the complete image; if we compare two dissimilar facts which constantly and inevitably follow each other, it is the causal relationship between them that constitutes the content of our thought.
8. The process of thinking remains unchanged, no matter whether we compare many real objects, or juxtapose already decomposed by means of scientific methods, although it is this thinking that gives us all our knowledge of the real world.
9. Even in mathematical reasoning the process of thinking remains the same, though in this case the objects of thought are often abstractions—products of decomposition—which go far beyond the bounds of the analysing capacity of the sense organs.
10. Lastly, this process remains unchanged even in the case of erroneous philosophical reasoning when the objects of the thinking are not realities but pure fiction. This is explained by the fact that the thinking, itself correct, operates with correctly obtained products of the decomposition of the verbal expression of the thinking, which products, being abstractions, do not correspond to anything real.

To solve the last problem of our investigation—the voluntariness of human actions—it is necessary first of all to elucidate the approach of physiology to voluntary movement.

My purely objective, physiological analysis has come to an end; I, therefore, deem it necessary to sum up all that has been said, before turning to the psychological side of the phenomena. Here, then, are the general conclusions.

1. All elementary movements of the arms, legs, head a trunk, like all the combined movements acquired by learning in childhood, such as walking, running, speaking, moving the eyes in the act of looking, etc., become voluntary only after they have been acquired. . .
2. The more habitual the movement, the easier it becomes subordinated to will and vice versa (an extreme fact is that the will has no power whatever over those muscles which, owing to definite conditions of everyday life, remain unused).
3. In all cases will can but initiate an act, discontinue it, and intensify or weaken it; as to the movement itself, it proceeds without the interference of will, being the actual reproduction of what has been performed many thousand times in childhood, when there can be no question of any interference of will.

Now let us pass to the psychological side of the problem.

Here we meet with various theories of will; some of them directly contradict the foregoing conclusions, to others our conclusions are related in the same way as a distant and incomplete echo is related to a complete harmonious melody. Indeed, whom can we convince that our first conclusion is fully applicable also to movements acquired by learning at a mature age, for example, to the decorative and technical skill of the artisan, where the process of learning is prompted by the practical purposes of which the artisan is fully conscious, and where the success of learning actually depends on his free will? And how is it possible to cram the extreme diversity of human voluntary actions into the narrow, rigid frame of our third conclusion? Will can bring into action not only that form of movement which is most appropriate to the given moment, but any other action known to man.

Will is not an impersonal agent in sole control of our movements; it is the active side of our mind and of our moral feeling which directs our movements in the name of certain principles, and in many cases even contrary to the instinct of self-preservation.

The question of whether will interferes with the mechanism of acquired complex movements is immaterial; what is important is its capacity (of which man is profoundly conscious) to interfere at any moment with the natural course of a movement and to change its intensity or direction. Precisely this capacity, usually expressed by the words "I want and I shall*", is the seemingly impregnable citadel which shelters the popular concept of will.

A FEW WORDS IN REPLY TO MR. KAVELIN'S "LETTERS"

Having read the "Letters of Mr. Kavelin" and being fully convinced that it is hopeless to think of reaching agreement with him on the psychological problems under discussion, I have come to the conclusion that any further discussion on the subject would be useless; I cannot, however, leave unanswered his charge that I read his book without due attention, and that I ascribe to him ideas which had not even entered his head.

Since this charge questions my good faith, I cannot leave it unanswered.

The main reason why Mr. Kavelin often fails to recognise himself in my critical review is this. In *The Tasks of Psychology* he departs from the idea that positive science has not yet applied itself to the psychological phenomena (p. 9), and he ends the first chapter by saying that he intends to show in general outline how the methods of strict scientific research can be applied to psychical facts.

I reasoned thus, in order to create a new system of psychology it is necessary either to use another kind of raw material for elaboration instead of that used hitherto, or to change the method of investigation, because to follow the old paths in either direction would simply mean a repetition of the old errors.

THE ELEMENTS OF THOUGHT

The study should begin with the development of the child's mental activity from sensation. The modern development of the anatomy and physiology of the sense organs, especially the works of Helmholtz, makes this study feasible. Herbert Spencer's service in solving the general problem of the relationship between thought and sensation.—The essence and significance of Spencer's theory compared with the views of the sensualists and the idealists on the same subject.—Co-ordination of Spencer's hypothesis with the views of Helmholtz

1. In the mental life of man it is only in early childhood that thoughts or the shaping of ideas derive directly from psychological products of a lower order which do not bear the character of thought. It is only here that observation reveals the existence of a period when man is not yet capable of thinking and then, gradually, begins to manifest this faculty.

It is clear that the mind of the adult either presents derivative forms of the child's mind, i.e., higher stages of development of the same processes, or it is based on altogether different activity and forces. In any case, being immeasurably more complex in form, it cannot serve as the point of departure for the study of thinking as a process.

The beginning of this study must be the history of the development of the child's thinking from sensation, or the history of the development of object thinking from sensation, in general.

It is necessary to start this study from the natural beginning, even if later on it proves that the development of thinking from sensation is inapplicable to the subsequent, superior forms of thought.

2. There is no doubt that this point of view has long since been shared by many thinkers belonging to the various philosophical schools; but until the second half of the last century it did not lead to any practical results, and the theory of thinking was doomed for ages to develop exclusively on ready-made patterns of thought embodied in speech. In other words, the study began not from the natural beginning but from the middle, and, what is more, not from the primary, basic forms, but from the secondary, derivative ones.

3. For another, equally important achievement in the study of thinking, or of man's mental development generally, we are indebted to the famous English thinker Herbert Spencer, Spencer's hypothesis concerning the successive stages of neuropsychical evolution from generation to generation enabled the human mind to find a satisfactory solution to the secular philosophical problem of the development of mature thought from the initial forms of the thought of the child, or, what amounts to the same thing, to solve the problem of the development of thinking as a whole from sensation.

To Spencer we are indebted also for establishing, on the basis of very broad analogies, a general type of mental development in man, and for the proof that the ways of evolution of the mind remain invariable at all stages of the development of thinking.

The essence of Spencer's hypothesis will stand out only if we compare it with the preceding philosophical views concerning man's psychical development, namely, with the views of two famous schools—the "sensualists" and the "idealists"; since the theories of these schools are the two extremes, they, it follows, summarise all the intermediate opinions, i.e., all possible views on this subject, in general.

But in order to obtain a better understanding of the views of the two schools, it is essential to know something about the basic features of the development of thinking which have always been accessible to observation and which have long belonged to the domain of empirical psychology, constituting the basis of both the sensualist and idealist theories. We shall, therefore, begin with them.

The sensualists attribute these processes not only to primary products, but also to all their derivatives; thus, they reduce the entire successive chain of intellectual development to a repetition of the activity which lies at the base of sensory transformations, ...

Denying the presence of any organisation in man, except the sensory one, they regard the influences emanating from the external world with all the relations and interdependences existing between its objects as the sole source of thought, both in form and content. In their view, the entire rational side of thought is determined not by man's intellect and not by some extra sensory organisation of his nature, but by the relations and interdependences of the objects of the external world. To this school, thought is merely a sensation developed as a result of diverse groupings of its elements.

The idealists approach this question in a totally different way. Proceeding from the idea that the external world is perceived and cognised by man in a mediate way, they regard the entire rational aspect of thought not as a reflection of the relations and interdependences of objects, but as forms innate in man or as laws of the perceiving and cognising mind which accomplishes all the work of transforming impressions into ideas, thus creating what we call relations and interdependences of objects.* Whereas the sensualists consider the external world with all its variety of relations and interdependences as the basic determinant of mental life, the idealists believe that this role is played by man's inborn spiritual organisation which, obeying its own definite laws, transmits to the external world the symbolic forms known to us as impressions, notions, concepts and thoughts.

The scientific groundlessness of the two systems is, in our days, evident.

Sensualism had always lacked the data needed to determine the properties and limits of man's sensory organisation; for this reason the followers of this school have never had any solid scientific grounds for their claim that the phenomena of association, reproduction and commensuration, both of the sensory products and of the ensuing states of ideation—which they could not ignore—are the outcome of sensory organisation.

No less groundless, however, was the theory of the idealists.

Their first error was that, contrary to all the evidence, they tried to deduce man's entire psychical life from one factor only—his spiritual organisation, completely disregarding the other factor—the influences exerted by the external world, on the grounds that direct cognition of these influences is impossible. But who in our day would be bold enough to assert that the external world does not exist outside man's consciousness, that the inexhaustible wealth of its activities has not served as a source of material for the endless chain of acts of thinking which have produced the science of the external world?

The other error of the idealists is that they isolate the subjective factors participating in the psychical development into a special group of agents which differ from everything else on earth not only by virtue of their cognoscibility, but also by virtue of their innate properties. One would think that some of the idealists tried to deduce psychical activity from all the known earthly principles, and only after exhausting their efforts in this direction, were compelled to admit the specific nature of the psychical factors. Judged from this standpoint, the views of the idealists are at least premature.

Naturally, in the history of the philosophical problem which we are considering now, there were, along with the men of these extreme schools, other thinkers who adhered to intermediate opinions, i.e., who did not run to the extremes of the antagonistic schools. But as long as the discussion remained on the soil of pure speculation and traditional philosophical dialectics, no conciliation of the extreme views was possible. Some attempts were made to reconcile, to obliterate the flagrant contradictions of the two schools by finding examples which would fit in with both; but in the absence of any well-established principles, the basic contradictions could not be resolved.

Modern biological science has, however, furnished these principles, and their application to the problem we are investigating here is the merit of Herbert Spencer.

6. I shall try first to expound as briefly as possible the substance of Spencer's theory.

Psychical activity, like the structure of organisms and the physiological functions of the body, is one of the aspects or manifestations of organic animal life. These three aspects of the animal organism are not only always concomitant, they stand in definite correlation to each other, simultaneously varying from one animal species to another in complexity, variety and precision of individual manifestations.

This correlation is necessitated by the fact that in the vital processes which ensure the existence of the organisms all three factors (structure, physiological functions of the body and psychical activity) cooperate; consequently, their activities must in some way or other be co-ordinated.

Granting that all the three aspects of organic life develop along parallel lines from one animal species to another, let us allow for a moment that in one of these aspects, say, the structure of the body, the entire animal world is simply a successive chain of past transformations or evolutions from one form to another; it follows, then, that the two other aspects of organic life also derive from the parallel transformations or evolutions of corresponding substrata. In other words, the evolution of all the three aspects, i.e., form, functions of the body and psychical activity, take place in the animal kingdom along parallel lines.

Actually Spencer's hypothesis can be called Darwinism in the sphere of psychical phenomena. Having appeared simultaneously with Darwin's theory and being but a part of the general theory of the evolution of organic life, it has the same strong and weak points, the same merits and demerits. Even from the point of view of probability, the two hypotheses are equal.

Spencer's entire work is aimed simply at proving the following two points (which are, however, of tremendous significance):

- 1) the existence in various representatives of the animal world of parallel correlations between the three aspects of organic life, i.e., between the form of the body, the functions of the body and the psychical functions, from the point of view of complexity, variety and precision of their individual manifestations;
- 2) the idea that in all animals, man included, the type of evolution is basically the same in all the three aspects.

At all times and in all places life derives from the co-operation of two factors: a definite but variable organisation and external influences. It makes no difference whether we consider life from the point of view of its final aim, i.e., preservation of the individual, or from the point of view of evolution, because the preservation of life at any given moment is achieved through continuous transformations.

Together with this general progress of organisms, there takes place, of course, the separate development of their component systems or organs (actually the general progress of the organism is the sum total of the progress of its separate parts):

consequently, the progress of the nervous system as a whole presupposes the progress of that of its parts which should properly be called the sensory organisation. It is precisely from this point that the special part of Spencer's theory begins.

At the lowest level of development of the animal kingdom sensibility is equally distributed throughout the body, there being no signs of any differentiation in this respect or formation of special organs. In its initial form sensibility hardly differs from the so-called irritability of certain tissues (for example, muscular tissue) in the higher animals, because anatomically and physiologically it is represented by a piece of protoplasm capable of irritation and contraction. But with the progress of evolution, this single form gradually breaks up into separate organised systems of movement and sensation: the contractile protoplasm is now replaced by muscular tissue, and the equally distributed irritability—by a definitely located sensibility which develops parallel with the nervous system.

To continue, the sensibility becomes specialised, so to speak, qualitatively—it breaks up into the so-called systemic senses (hunger, thirst, sexual attraction, respiration, and others), into the activity of the higher sense organs (sight, touch, hearing, etc.). Here again the type of evolution is much the same, namely, the division or differentiation of the whole into parts and their isolation into groups performing different (specialised) functions. But what a considerable advance is made by the animal organism, as compared with the initial form, in adapting its life to the conditions of the surrounding world!

Where sensibility is evenly distributed throughout the body, it can serve the latter only if the external influences act immediately on the sensitive body; but where sensibility has developed into sight, hearing and smell, the animal is able to orientate itself even in influences emanating from a distance, or, in other words, to orientate itself in space. This, of course, presupposes the capacity of the animal body to move; but the evolution of the senses always proceeds parallel with the development of locomotion (by virtue of the law of correlative development of all parts of the body aimed at ensuring its adaptation to the conditions of existence), because even in the initial form sensibility is connected with the contractibility of the body.

When the sensibility is evenly distributed throughout the body, which excludes the capacity to move in space, life can be preserved only if the animal is directly surrounded by a medium capable of maintaining its existence. The sphere of life here is limited. On the contrary, the higher the sensory organisation, by means of which the animal orientates itself in time and space, the wider the sphere of the possible life contacts and the more diverse the medium influencing the organisation of the animal, as well as the means of possible adaptation to the environment. From this it clearly follows that, in the long chain of the evolution of animal organisms, the complexity of the organisation and the complexity of the medium acting upon it are interdependent factors.

But is it possible that no other factors, apart from the inborn changeability of the initial sensory form and the modifying action of the external influences, participate in the break-up of the general sensibility into such qualitatively different forms as the sensations of light, sound and smell? While there is no direct proof of this a number of facts indicate that separate forms of sensibility differ in quantity rather than in quality.

Basing himself on these facts Spencer advanced his hypothesis about the existence of a general unit of sensation in the form of a nervous shock; from this he drew the conclusion that all complex forms of sensation are the result of various combinations of these units. From this point of view, the evolution of the senses from an initial elementary form is really analogous in type to the development of the organism from an egg; it should, however, be admitted that this part of Spencer's hypothesis seems at present to be rather bold.

In any case, it is clear that the evolution of sensation in the animal kingdom is associated with the extension of the sphere of vital adaptations in time and space, and especially with adaptations to a greater variety of spatial combinations (coexistences) and of successions in time. This is clearly seen, for example, from the evolution of vision in the animal kingdom from its most elementary forms, when the eye can but distinguish light from darkness, to the higher forms, when the eye can discern the shape and details of objects, their colour, distance, motion, etc.

The next stage in the evolution of sensation can be defined as co-ordination of the activity of the special forms of sensation with each other and with the motor reactions of the body. Whereas the preceding phase consisted in a grouping of the units of sensation and motion in various directions, the subsequent phase is a combination of these groups (of course, still more varied) among themselves. Being equipped with specific instruments of sensation, the animal must necessarily receive highly diverse groups of simultaneous or consecutive impressions; but even at this stage of development sensibility as a whole is bound to be a means of orientation of the animal in space and time, and this orientation is, apparently, much more precise than that of which lower animal forms are capable.

Consequently, it is necessary that the separate elements which constitute the sensory group (or chain) be co-ordinated, or the sensory group be decomposed into its elements, because without this the sensation would remain a chaotic and fortuitous mixture.

These two processes take place simultaneously at this stage of development; both co-ordination and decomposition are achieved by the same means—by the inborn variability of the sensory organisation (in animals which possess the five higher senses the organisation of the latter is undoubtedly progressing), as well as by the variability of the external influences.

The results of evolution are so numerous at this stage of development that it is impossible to follow them one by one; fortunately, however, we know two definite forms of transformation:

The decomposed and co-ordinated sensation ultimately develops into instinct and intellect, and when combined with motor reactions—into instinctive and intellectual acts.

According to Spencer the difference between instinct and intellect is purely quantitative; in instinct the sphere of distinctions is much more limited, and this, naturally, severely restricts the aims of the actions. Moreover, instinctive actions are more monotonous in relation to the conditions by which they are caused; their interconnection is, therefore, more fatalistic, more automatic. Among other proofs of the equivalence of instinct and intellect Spencer reckons the impossibility of determining the exact demarcation line between the two. Thus, along with the inborn, automatic capacity to perform certain actions, animals often show a capacity for using the circumstances of the moment or the conditions of the locality, which can be explained only by their intelligence, by their faculty of reasoning, or more generally, by their capacity to think. On the other hand, man's habitual actions are usually so automatic that in this respect they hardly differ from the instinctive actions of animals.

As soon as the development of sensation into instinct and into intellect proves to be similar both in type and in the nature of the factors which determine it. The development of the entire psychical life of man from the sensory acts which initiate his mental life becomes a logical necessity, as a particular case of general evolution. But the habit of seeing an unbridgeable gulf between the mental life of man and that of animals is so ingrained that our thought involuntarily stops before drawing a conclusion about the existence of a certain succession between them.

Thus, in the intellectual evolution of the human race, the highest cycle of organic life, we again see the same general type and the same basic factors of development typical of the lower stages of life. It is clear, then, that the cycle of individual mental development of man, as an intermediate stage is not an exception.

Here, too, evolution must:

- 1) begin with the development of a relatively small number of primary undivided forms, which can only be sensory products;
- 2) consist in an ever-increasing differentiation of these forms and their grouping in different ways;
- 3) be determined by the interaction of two variable factors inborn organisation and external influences.

Such is the essence of Herbert Spencer's hypothesis.

His theory is of great significance not only because it is the first serious and systematic attempt to explain psychical life from the point of view of its content and progressive development, and on the basis of the general principles of organic evolution, but also because it actually terminates the secular controversy between the sensualists and idealists and reconciles the fundamental contradictions of the two schools.

Actually, Spencer's hypothesis accords with the theory of the sensualists in the sense that it regards external influences as factors determining the psychical processes at all stages of psychical development.

But, according to Spencer's theory, in every man these influences act not on a shapeless, organic basis, as claimed by the extreme sensualists: they act on a soil which, owing to heredity, has been cultivated from century to century by the widening life experience of the race and which, influenced by this experience, has acquired a more and more complex organisation, with a path of further development mapped out. This aspect of Spencer's hypothesis includes the basic viewpoint of the idealists concerning the inborn nature of the psychical organisation. But this is not all: by reconciling the two extreme views on man's spiritual life, Spencer's hypothesis, in my opinion, puts an end to the existence of different schools in psychology, the more so since this hypothesis has no need to spiritualise the principle of the inborn organisation, as is done by the idealists, or to materialise it to the utmost, as is done by the materialists.

For this hypothesis it is not absolutely essential that the subjective side of sensation should be a direct product of the nervous organisation; it merely attaches importance to the incontestable fact that sensory acts, as subjective states, are accompanied by definite nervous processes, or—which is the same thing—by activities of a definitely-organised nervous mechanism. This is the chief thing which Spencer proves in his work; in doing so, he departs from the identity of the basic physiological conditions which determine the origin of subjective sensations and nervous activities in general, leaving the question of the form of the linkage between them to future investigation.

In the particular case which we are considering here, Spencer's hypothesis serves as a general programme of research into the development of the process of thought, because it provides the primary material, shows the general character of its evolution and determines the factors that participate in it.

My task, then, boils down, in essence, to reconciling the physiological data concerning the evolution of sensation into thought, as established by Helmholtz, with Spencer's general programme.

II

Our way of studying the process of thinking.—Conclusion

1. We have now at our disposal all the data needed for a general description of the way we intend to follow in studying the process of thinking.

This essay deals in the main with the particular case of development of thought in the individual, whose sensory capacity already at birth is formed into definite systems and organs producing so-called sensations under the influence from without.

These sensations are, in our view, the starting-point of development of thought, and we get them, so to say, ready-made.

If Spencer's hypothesis concerning the duality of the factors of evolution is correct, then in the life of man, throughout his mental evolution, nothing is involved but the influences exerted by the external world on his neuro-psychical organisation; the reactions (and consequently, the structure) of this organisation gradually change, and, as a result, thought develops with its diversity of objects, its transition from the concrete to the abstract, from the general to the particular, from the domain of sensory facts to that of extra-sensory contemplations, etc. In short, it is one of the basic factors of the development of thought or the interaction of these factors which make possible the transformation of sensation into thought—both in form and content.

Further, if it is true that these transformations proceed according to the general laws of organic evolution, then the transformation must be reduced to a decomposition of uniform sensations and their re-combining—wholly or partly—into groups. In other words, either the neuro-psychical organisation, or the conditions of the external influences, or, finally, the co-operation of both factors should provide the data needed for analysing and synthesising whole or fragmentary sensations.

2. What, then, are the properties of the organisation and of the external influences by which the general elements of thought are determined?

The more frequent the impression, the clearer and the more stable the trace it leaves in our mind. The term "stability" denotes here the capacity of the trace to remain in the mind for a long time, while "clarity" means the capacity of the sensory image to become more definite as a result of repetition. This, as we know, is what takes place when man learns to perform certain movements: the more the movements are repeated, the better they are remembered.

It is clear that the inborn neuro-psychical organisation of the child possesses the faculty of being able to change under the influence of external factors. The latter leave their traces, in the same way as impressions leave traces in the mind, and the more frequent the action of the external factors, the more stable and definite the trace.

It follows, then, that repetition of impressions of uniform appearance, or, to be more precise, closely similar, are bound to be accompanied, in respect of the neuro-psychical organisation, by an isolation of the pathways of excitation into groups of varying excitability and, in respect of the impression, by a transition from an indistinct and integral form into a more definite and differentiated one; at the same time the so-called basic nucleus of the impression and its satellites become manifest, and the external conditions giving rise to the reproduction of the impression in our consciousness are bound to increase in number.

Even in its first encounters with the external world the child is influenced not by single, isolated external factors, but by groups, chains or complexes of factors which are part of the surroundings. If these complexes of factors and the conditions of their perception by the organism remained invariable, then, by virtue of the laws of association, they would be imprinted on the memory as an integral complex impression. But if in the course of repeated encounters the complex of factors is modified to the degree that some of its members disappear, the invariable members of the former complex group become isolated, and the more stable the members the more pronounced, of course, is the isolation.

In short, in the case of a complex impression evoked by a group of external objects the process is the same as in the case mentioned above of an impression produced by a single object accompanied by secondary accessories. It will be appreciated, however, that if the decomposition of complex groups proceeded in this way only, much time would be needed before the final effect of the decomposition of the group into separate links manifested itself—the disappearance of one or another member of the group would be of a purely accidental nature. In reality, this is a very rapid process: the groups are decomposed every minute and in the most diverse ways, owing to the following property of the neuro-psychical organisation.

I shall, however, dwell here on the beneficial influence exerted by the movements on the development of impressions.

This influence is threefold. Ensuring the displacement of the sensory mechanisms in space, movements greatly diversify the conditions of perception and by doing so contribute to the decomposition of sensation; they divide a continuous sensation into a number of separate acts which have their own beginning and end; lastly, they serve as an indirect link between qualitatively different sensations (for example, optic and acoustic, optic and tactile, etc.)

There is no need to dwell here on the first of these influences, the thing is clear; but to understand the second it is necessary to bear in mind that the child is always surrounded by an environment in which the most varied simultaneous or successive movements take place continuously in the form of impacts or impulses and periodic shocks. But even in this chaos of light, heat, sounds, smells and tactile sensations there must be a current of stronger sensations corresponding to the more powerful impulses and fluctuations taking place in the external environment; it is this current, apparently, which helps the child to emerge from the chaos of sensations.

But the current alone cannot perform this task, as it is indistinct and its intervals are irregular and casual. Things would be different if the organism possessed the means of reinforcing this current at the expense of contiguous sensations, and if these means were brought into action by the same factors which engender the current of stronger sensations. Then the current would, apparently, become more vivid and definite. These means exist in the neuro-psychical organisation, and we can describe them as adaptive motor reactions of the body with the aim of intensifying the sensations.

At any rate, the differentiation of the separate links in complex impressions too proves to be dependent on the variability of the subjective and objective conditions of perception, i.e., on the neuro-psychical organisation and external influences.

Just how these processes take place will be shown in detail below; for the present enough has been said to understand the essence of the following conclusion: The muscular sense which is located at the turning-points of sensation, i.e., in the intervals between sensations of a different kind, not only serves the latter as a connecting link, but also determines, in the course of objectivising sensations, the interrelations of their external substrata in space and time.

III

Experimental data on memorising (registering) and recollecting (reproducing) impressions

1. Memory is rightly regarded as the corner-stone of psychical development; everybody knows that the basic condition for its manifestation is the repetition of impressions. And yet one can hardly find another phenomenon in the psychical processes of which the idea is as vague and confused as that of memory.

Most harmful in this respect is our tendency (though natural and, within limits, useful) to separate memory from the thing memorised and to consider it as an isolated capacity.

Memory is inseparable from what is memorised. The latter, however, like any other psychical product, undergoes diverse transformations in the course of life, has its definite history of development, and, because of the transformations, can be modified beyond recognition.

If man could remember his early childhood and all the phases of the transformation of the primary psychical products, there would be no cause for arguing about the principles governing his mental development; psychology, in this respect at least, would have based itself on a solid foundation from earliest times.

Consequently, if we approach the mental content of man from the point of view of the content of his memory, it will become clear that its development derives from the repetition of impressions under the greatest possible diversity of the conditions of perception, both subjective and objective.

IV

External influences as complexes of movements.—The grouping of their foci of action in space and time.—Correlation between the grouping of external influences and that of sensations, as determined by the structure of the mechanisms of perception.—The eye as an instrument of spatial relations and relations of succession.—General summary

1. The greater part of the preceding two chapters was devoted to elucidating in general outline the first steps of evolution or decomposition of integral sensations. True to Spencer's hypothesis. I have tried to deduce the entire process exclusively from the repeated interaction of two variable factors—the external influences and the ground on which they fall, i.e., from the repeated external influences and the reactions of the neuro-psychical organisation, both sensory and motor.

I have already touched on this point, though in passing and in a very general way. To explain the isolation of the impressions from the integral forms of sensation I had to present the external influences in the form of "variable sums" or chains, admitting at the same time that a definite group of sensations always corresponds to a definite sum of phenomena. But I did not pursue the point. The formula of the "variable sum" sufficed to elucidate the processes of decomposition and grouping of impressions in general, and to show the importance of the participation of external influences in these processes; but this formula, being too general, does not disclose the directions of the variability. It must, therefore, be extended.

As shown above, this condition is strictly observed in the organisation of the visual and aural mechanisms. So that generally speaking a definite sensory group always corresponds to a definite simultaneous complex of external factors, and a definite sensory chain corresponds to a successive complex.

Inasmuch as the complexes of external influences are constant, any external object or phenomenon (i.e., objectivised sensation) is fixed in the memory and reproduced in the consciousness only as a member of a spatial group or as a member of a successive chain, or both.

Inasmuch as the complexes of the external influences are variable, any external object or phenomenon is fixed in the memory and reproduced in the consciousness as a similar member of variable groups and chains.

Or more briefly: Any external object or phenomenon is fixed in the memory and is reproduced in the consciousness in the following three main directions: as a member of a spatial group, as a member of a successive chain and as a member of a similar chain (in the sense of our systems of classification).

In view of this, the relationships between objects are conceivable only in the following three principal forms: as a similarity, as a spatial or topographical connection, and as a succession.

V

Concrete thinking.—Distinguishing and recognising external objects.—Distinguishing parts, attributes and states.—Abstraction of parts, attributes and states from the object as a whole

1. The lower forms of a differentiated complex (i.e., grouped) sensation—distinguishing and recognising external objects, are innate not only in the child, but also in animals capable of locomotion. No matter what it is that makes the animal move, it must at every step apprehend the topographical conditions of the locality in order to adapt its locomotion to them; sometimes the animal grasps the topography of the place while on the run, i.e., when careful examination of the external objects is physically impossible.

Consequently, even this simple case presupposes, on the one hand, ability to take in the properties of the locality at a glance and, on the other hand, ability to appreciate the advantages which they offer for locomotion, i.e., the animal must know these properties from experience. Still more complicated is the process of distinguishing when in pursuit of prey; in this case the animal adapts its movements not only to the conditions of the locality, but also to the movements of the prey it is obliged to distinguish time as well as space relationships'. The capacity to choose food, to discriminate between friend and enemy and to find the way home shows that the animal apart from distinguishing objects, in the sense of their isolation from groups, can also recognise in them old acquaintances.

VI

Thinking in symbols or abstractions.—Inner symbolisation of impressions or formation of concepts and notions.—External symbolisation or expression of impressions, concepts and notions by means of conventional signs, i.e., by elements of speech.

1. Let us imagine for a moment that the world is filled with absolutely identical trees, lakes and mountains, or that all objects in general lack individual distinctions. In this case the job of memorising these objects would be a simple matter: once differentiated and memorised, the given concrete form would be ideal for all further life encounters. Man's memory, however, would be filled not with symbols but with reproductions of reality. All mountains would be known by one name, say "Mount Kazbek", and there would be no difference between this name and the word mountain.

Let us imagine, on the other hand, that there are distinctions between objects, and that it is man's misfortune to have to memorise all objects with all their particular traits. In this case he would have in his mind thousands of images for all, even the most ordinary, objects—tree, stone or horse—and his thinking in all probability would be confined to concrete objects. Fortunately, this is not so.

By virtue of the law—already known to us—of the registration of impressions by similarity, identical objects merge in man's memory into average standards. He thinks, for example, of an oak, birch or fir, though he has seen these objects thousands of times in a variety of forms. These average products are no longer exact reproductions of reality, because the impressions varied with every encounter; but in essence they are single sensory images or signs which replace the numerous uniform objects.

These are symbols of the first order, and they figure even in the thinking of the child, provided it has already seen dozens of birch-trees, dogs or horses.

From the average oak, fir or birch the child's thought is transferred to the "tree" as a single image or symbol for a multitude of similar (not uniform) objects. "The tree", even in the child's mind, is not only a verbal symbol, it is a highly differentiated image. When drawing a tree correctly, i.e., first the trunk, then the branches and, finally, the leaves, the child demonstrates its capacity not only to abstract the outline from the object, but also to distinguish its parts and to appreciate their topographic relationships. These are symbols of the second order.

At this stage of abstraction from the original sensory images (i. e. from the impressions produced by actual trees) all the less constant attributes are excluded (size, volume, direction of vision, colour of various parts); the remainder, i.e., the general image of the tree, which most people retain in their memory for life, becomes an abbreviated symbol or sign for a definite category of external objects.

3. It is, of course, impossible to enumerate all the results of the transformations described above; but if we bear in mind Spencer's idea that here, too, the only possible factors of evolution are the external influences and the variable ground of the neuro-psychical organisation which parallel to each other become increasingly complex, the consequences of these processes can be summed up as follows:

1) Multiplicity and growing diversity of encounters with uniform objects (of the same species or variety—as the naturalist would say—or at least of the same kind) lead to average results, which are usually termed notions of objects.

2) Multiplicity and growing diversity of encounters with dissimilar objects lead to average results of a still more general character—the so-called concepts.

3) Multiplicity and growing diversity of encounters associated with perfecting the means of observation and analysis lead to the symbolisation of parts, attributes and relationships which yield products belonging directly to the extra-sensory sphere.

4) All these results are obtained by way of analysis, synthesis and comparison or classification.

VII

Active forms of thinking.—Self-sensations.—Self-consciousness. Deductions in general and deductions in particular. From action to cause

VIII

Extra-sensory thinking.—General characteristics of extra-sensory products.—Four categories of the extra-sensory.—The preparatory ground.—Examples.—The sensory roots and the evolution of extra-sensory thinking.—Conclusion

THE THEORY OF NON-FREEDOM OF WILL CONSIDERED FROM THE PRACTICAL ASPECT?!

... theory of non-freedom of will.

At first glance the consequences are innumerable, because this theory, which radically changes man's approach to the actions of others, as well as to his own, concerns all the private and social relations which rest directly or indirectly on recognition of free will. Moreover, a superficial acquaintance with this theory could create the impression that the changes which it has wrought in the views of human relations are highly pernicious.

Previously every human action presupposed a free man behind it, a man fighting against evil temptations and remaining free even in his moral degradation. Now, behind each human action there is a slave who is obedient to his own character, tastes, inclinations, desires, passions, etc., and who is driven, willy-nilly, in the direction prompted by his own spiritual make-up. The free man enjoyed the merit of struggle in the event of victory and bore the burden of guilt in the event of degradation; the slave, of course, cannot be held responsible in either case. Hence the conclusion: the new theory shelves all the crimes and good deeds and, together with them, all the precious qualities which we are accustomed to deduce from strong will, such as perseverance, courage, loyalty, etc., i.e., exemplary qualities of tremendous educational significance.

the light of the old theory any agreement between a community and one of its members, or between some of its members, was guaranteed by the freedom of action of the parties concerned: now there is no such guarantee. How can the person who is not free to act assume any commitment? Hence the conclusion: the new theory undermines one of the principles of social intercourse and thus threatens the very foundations of society as a whole.

No less pernicious are the consequences resulting from this change in man's views on his own actions. As soon as he is convinced that he does not bear responsibility for any action, whatever it may be, he is no longer interested in perfecting himself morally and intellectually, especially if he has no liking for the task. Hence the conclusion: the idea of non-freedom of will is likely to engender immorality, the limits of which cannot be foreseen.

Clearly a theory which involves such dreadful consequences deserves the appellation of an "accursed" theory. Fortunately, however, it is easy to see that not a single one of these horrors is really engendered by this theory: it is easy, because in practice—as I shall try to prove—private and social relations are based not on metaphysical fictions, such as the philosophical freedom of will not subject to any earthly law, but on facts (of course, generalised) elaborated as a result of individual and social experience. The sole exception to this is the prevailing opinion about the significance of "punishment"; but even here, as we shall see later, practice is always at loggerheads with the: current theory.

Thus, according to both theories action is a conscious thing, and conscience and reason take part in it, i.e., in both cases in equal measure action can be ascribed to man as a moral and rational being.

From the point of view of theory, the difference between the two cases is the same, because of the addition of free will, but in practice this addition loses its significance. In reality in the case of freedom of will action is regarded as being good or bad depending on whether will accords with the dictates of conscience and reason, but in the case of non-freedom of will it depends on whether the action is the result of these dictates.

But in practice this is obviously the same.

IMPRESSIONS AND REALITY

§1. The subject which I shall examine in this brief essay is, in my opinion, of interest not only to scientists but to intellectuals generally. After all it would be interesting to know whether there is any similarity between the objects and phenomena of the external world, on the one hand, and the impressions of them in the human consciousness, on the other, and what kind of similarity it is.

For example, are the outlines, colours, lights and shadows of a mountain landscape real, do they exist, or are they simply sensory mirages created by our neuro-psychical organisation under the influence of external factors the specific nature of which cannot be cognised by us?

The following propositions are the corner-stone of the compromise. The identity of the sensory signals emanating from external objects must correspond to the identity of reality; the similarity of the signals—to the similarity of the reality, and the difference in the signals—to the difference in reality.

Further, by assuming that the laws of the imagined and of the real are in strict conformity, we admit the possibility of partial similarity between the imagined and the real as the simplest case of the conformity.

OBJECT THINKING AND REALITY?

1. In the article "Impressions and Reality" I examined the question of whether there is a similarity between the impressions we receive from the external world and reality; I tried to show that this similarity can be proved only for some aspects of the visual and tactile impressions, namely, for the linear configuration, disposition and displacement of objects in space. In other words, similarity was established only for some of the features isolated from the impression as a whole.

Consequently, our task is to ascertain the relationship between all three elements of thought—the objects, their attributes and their interrelations—and reality. The first two elements appear in the consciousness so distinctly that none can doubt the existence of "something" real corresponding to these elements: but the links and relationships which unite the objects into thought are often so elusive and immaterial that many regard them as products of the mind

For this reason our question will take the following form: in what way do the links and relationships between the external objects perceived by us reflect reality, and in what way are they products of our sensory organisation and ascribed by the mind to the external world?

The answer to this question will, undoubtedly, be of profound interest to any educated person, because, as we shall see later, the answer is associated with the role of the mind in cognising the external world.

No matter where man finds himself, he is always surrounded by objects! Some of the objects are immobile, others are sometimes in motion, still others, though motionless, manifest more or less protracted changes, etc. At the same time man can distinguish the separateness of objects; the ability to do so is described as the faculty of isolating objects in space, and his ability to distinguish changes in the position and state of objects as the faculty of isolating phenomena in space and time. These two faculties are acquired in infancy, and this acquisition marks the beginning of man's conscious acquaintance with the external world.

Since this science studies the structure, composition and properties of bodies, and defines the factors of phenomena, it actually repeats the same mental operations as performed by the child when distinguishing the attributes of objects and phenomena. The sole difference is in the way the study is conducted; whereas the child is content with the direct indications of its natural senses, the scientist will use an arsenal of artificial means of analysis.

For each of the foregoing acts—isolating objects, distinguishing their attributes, recognising them by their characteristics, their comparison by similarity and determination of their causal interdependence—it is necessary to ascertain the role of both variable factors in the development (decomposition) of complex impressions and in their conversion into object thinking, i.e., the role of the variable external influence as well as of the receptor organ or sense organ which develops as a result of exercise.

Let us, then, begin with the acts of isolating immobile objects in space.

2. As we know, this isolation presupposes a fixed limit for any terrestrial body accessible to the senses. For sensation this is really the sole criterion of separateness. No one designates the sea as "an object"; only scientists regard air as a "body"; light, smell and sound are held to be only properties of bodies. Conversely, a grain of sand, a cloud and the sun appear as separate objects even in the consciousness of uneducated people.

But, as we have seen from the article "Impressions and Reality", the limits of bodies can be ascertained only by vision and touch; hence, the spatial isolation of terrestrial bodies is the result solely of visual or tactile acts (or of both together), and insofar as the latter express the real outlines of the objects (see the article "Impressions and Reality"), the sensory isolation corresponds to reality.

In other words, the separateness of objects in space, as felt and conceived by us, is imposed upon the mind from without.

3. The examination of the question of the discernment of attributes in objects can be best started with an example. Externally, an orange is characterised by the following attributes; a spheric form, a furrowed surface, an orange colour, a certain size, a certain weight and, lastly, a certain aroma. The discrete character of these attributes is due to the discrete character of the reactions of the receptor organs—the eye (form, colour, size and properties of the surface), the touching hand (form, size and properties of the surface), the muscular sense (weight) and the olfactory organ. But this is not all. If the discrete character of all the perceptive reactions were felt by us as distinctly as that of the attributes, the question would have been solved long ago even for the layman; in reality, however, this is not so. Distinguishing between attributes is regarded as their mental separation, or, in any case, as a psychical process.

This explanation is true in the same measure as the explanation based on the discrete character of the reactions; but there is nothing mental in the psychical process of separation: this process develops in the unconscious recesses of memory.

The point is this. If all the objects in the world were transformed into oranges, it is more than likely that man would never learn to distinguish all the attributes of this fruit. But since he has to deal with spherical forms of highly diverse colours, sizes and weights, as well as with the odours of objects of other forms and colours, and since in the recesses of his memory the impressions—no matter how different—are always compared by similarity (or, what is the same, by similar reactions of perception), it is these comparisons that result in the separation from each other of the forms, colours, sizes, odours, etc.

No matter what explanation we may choose (actually they are identical), it will prove that the organisation of the sensory mechanisms plays an essential role in separating the attributes. That is why it is impossible to affirm in general that something really discrete corresponds to a discrete sensation and that the two are always parallel. The only exceptions are those attributes the discernment of which is possible owing to the displacements of the receptor organ during the perceptive reaction; they are: the outlines of the object, its size, the topography of its components and its displacement in space. These attributes are as discrete in reality as in sensation, both types of discretion being parallel.

Thus, so long as the distinguishing of attributes concerns the analysis of objects and phenomena in space and time, the indications of the sense organs (vision, touch and hearing) are parallel to reality.

At first sight this may appear to be a major defect of the eye. Why isn't the structure of the retina as a whole the same as that of the yellow spot? If this were so all the work of examining objects with the resulting loss of time would be unnecessary. Actually, however, this perfection would be a misfortune for man: while able to take in all the details of the objects with equal clarity, he would have no reason to move his eyes and thus would be deprived of the sole reliable means of discerning the topographical relations between the parts of a visual picture. It is doubtful if he would be able visually to ascertain the disposition of objects and of their parts in space.

But thanks to the constant exercise of the eyes in visual acts, man learns to distinguish by means of the muscular sense the movements of the eyes upwards and downwards, to the right and to the left, and once they are distinguished, he simultaneously differentiates, by way of sensation, the topographical relations between those parts of the object which we designate by the terms; top, bottom, left side and right side

5. In some cases memorising the outline suffices not only to isolate an object, but also to recognise it as such, i.e., to distinguish it from similar objects. But as a rule the constant and distinctive sign of the object is formed not by one but by a number of attributes. For example, we have enumerated more than six attributes of an orange, of which only three constitute its external distinctive sign—form, colour and odour. Consequently, recognition presupposes ability to isolate from the sum of attributes those which are most characteristic and to memorise them as a group.

It is the axiom which lies at the base of the empirical and scientific knowledge of the external world and which states:

No matter what the external objects are by themselves, independently of the consciousness—even if the impressions obtained from them are merely conventional signs—a real similarity and a real difference always correspond to the perceived similarity and perceived difference.

Similarities and differences distinguished between the objects perceived are real similarities and differences.

Thus, reality corresponds to all the elements of object thinking as far as it concerns those links and relations between objects in space and time that are perceived by us. In relation to any human being the world of objects existed before his thought: hence, the external world with all the links and relations between its objects has always been the primary factor in the development of thinking. But this does not mean that thought, which borrows its elements from reality, only reflects them like a mirror; this reflection, one of the precious faculties of the memory, exists alongside the equally precious faculty of decomposing variable sensations into their components and of combining facts separated by time and space into a single whole.

In man's encounters with the external world, the latter offers him only single cases of links and relations between objects in space and time; nature is, so to say, a conglomeration of individuals: it knows no generalisations, whereas memory begins to generalise the moment it first manifests itself in the child.