To Educate the Human Potential

Maria Montessori

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Introduction

This book is intended to follow Education for a New World and to help teachers to envisage the child's needs after the age of six. We claim that the average boy or girl of twelve years who has been educated till then at one of our schools knows at least as much as the finished High School product of several years' seniority, and the achievement has been at no cost of pain or distortion to body or mind. Rather are our pupils equipped in their whole being for the adventure of life, accustomed to the free exercise of will and judgment, illuminated by imagination and enthusiasm. Only such pupils can exercise rightly the duties of citizens in a civilised commonwealth.

The first four chapters are mainly psychological, showing the changed personality with which the teacher has to deal at six years of age, and the need for a corresponding change of approach. The secret of success is found to lie in the right use of imagination in awakening interest, and the stimulation of seeds of interest already sown by attractive literary and pictorial material, but all correlated to a central idea, of greatly ennobling inspiration—the Cosmic Plan, in which all, consciously or unconsciously, serve the great Purpose of Life. It is shown how the conception of evolution has been modified of late through geological and biological discoveries, so that self-perfection now has to yield precedence to service among the primary natural urges.

The next eight chapters show how the Cosmic Plan can be presented to the child, as a thrilling tale of the earth we live in, its many changes through slow ages when water was Nature's chief toiler for accomplishment of her purposes, how land and sea fought for supremacy, and how equilibrium of elements was achieved, that Life might appear on the stage to play its part in the great drama. Illustrated as it must be by fascinating, charts and diagrams, the creation of earth as we now know it unfolds before the child's imagination, and always with emphasis on the function each agent has to perform in Nature's household, whether consciously or unconsciously, failure in this alone leading to extinction. So the talc proceeds till Palaeolithic Man appears,

most significantly traced by the tools he used on his environment rather than by physical remains of so slight a creature. The new element of mind is brought to creation by man, and from that time the children are helped to see the great acceleration that has taken place in evolution. They learn to reverence the earliest pioneers, who toiled for purposes unknown to them but now to be recognised. Nomadic men and settlers alike contributed to build up early communities, and by interchanges of war and peace to share and spread social amenities.

From chapter thirteen brief descriptions are given of some of the earliest civilizations, particularly with a view to their impacts on each other, showing human society as slowly organising itself towards unity, just as, in the individual human being, organs are built around separate centres of interest, to be later connected by the blood-circulatory system and the nerves, into an integrated human organism. So the child is led, by review of some of the most thrilling epochs of world-history, to see that so far humanity has been in an embryonic stage, and that it is just now emerging into true birth, able to consciously realise its true unity and function.

The last chapters go back to the psychological point of view, urging on educators the supreme importance, to the nation and to the world, of the tasks imposed on them. Not in the service of any political or social creed should the teacher work, but in the service of the complete human being, able to exercise in freedom a self-disciplined will and judgment, unperverted by prejudice and undistorted by fear.

1. The Six-Year-Old Confronted With the Cosmic Plan

Education between the ages of six and twelve is not a direct continuation of that which has gone before, though to be built upon that basis. Psychologically there is a decided change in personality, and we recognise that nature has made this a period for the acquisition of culture, just as the former was for the absorption of environment. We are confronted with a considerable development of consciousness that has already taken place, but now that consciousness is thrown outwards with a special direction, intelligence being extroverted, and there is an unusual demand on the part of the child to know the reasons of things. Knowledge can be best given where there is eagerness to learn, so this is the period when the seed of everything can be sown, the child's mind being like a fertile field, ready to receive what will germinate into culture. But if neglected, during this period, or frustrated in its vital needs, the mind of the child becomes artificially dulled, henceforth to resist imparted knowledge. Interest will no longer be there if the seed be sown too late, but at six years of age all items of culture are received enthusiastically, and later these seeds will expand and grow. If asked how many seeds may be sown, my answer is: "As many as possible!" Looking around us at the cultural development of our epoch of evolution, we see no limit to what must be offered to the child, for his will be an immense field of chosen activity, and he should not be hampered by ignorance. But to give the whole of modern culture has become an impossibility, and so a need arises for a special method, whereby all factors of culture may be introduced to the six-year-old; not in a syllabus to be imposed on him, or with exactitude of detail, but in the broadcasting of the maximum number of seeds of interest. These will be held lightly in the mind, but will be capable of later germination, as the will becomes more directive, and thus he may become an individual suited to these expansive times.

A second side of education at this age concerns the child's exploration of the moral field, discrimination between good and evil. He no longer is

receptive, absorbing impressions with ease, but wants to understand for himself, not content with accepting mere facts. As moral activity develops, he wants to use his own judgment, which often will be quite different from that of his teachers. There is nothing more difficult than to teach moral values to a child of this age; he gives an immediate retort to everything that we say, having become a rebel. Mothers often feel hurt because their children, formerly all love and affection, have become impertinent and rudely domineering. An inner change has taken place, but nature is quite logical in arousing now in the child not only a hunger for knowledge and understanding, but a claim to mental independence, a desire to distinguish good from evil by his own powers, and to resent limitation by arbitrary authority. In the field of morality, the child now stands in need of his own inner light.

Yet a third interesting fact to be observed in the child of six is his need to associate himself with others, not merely for the sake of company, but in some sort of organised activity. He likes to mix with others in a group wherein each has a different status. A leader is chosen, and is obeyed, and a strong group is formed. This is a natural tendency, through which mankind becomes organised. If during this period of social interest and mental acuteness all possibilities of culture are offered the child, to widen his outlook and ideas of the world, this organisation will be formed and will develop; the amount of light a child has acquired in the moral field, and the lofty ideals he has formed, will be made useful for purposes of social organisation at a later stage.

All other factors however sink into insignificance beside the importance of feeding the hungry intelligence, and opening vast fields of knowledge to eager exploration. If we set about this task without any method, we shall find it absolutely impossible to accomplish. But we are already in possession of the secret by which the problem can be solved, having been initiated into it by the child himself in his earlier years. We are not unknown to him nor he to us, and we have learnt from him certain fundamental principles of psychology. One is that the child must learn by his own individual activity, being given a mental freedom to take what he needs, and not to be questioned in his choice. Our teaching must only answer the mental needs of the child, never dictate them. Just as a small child cannot be still because he is in need of co-ordinating his movements, so the older child, who seems troublesome being curious over the what, why and wherefore of everything he sees, is building up his mind by this mental activity, and must be given a wide field of culture on which to feed. The task of teaching becomes easy, since we do not need to choose what we shall teach, but should place all before him for the satisfaction of his mental appetite. He must have absolute freedom of choice, and then he requires nothing but repeated experiences

which will become increasingly marked by interest and serious attention, during his acquisition of some desired knowledge.

The child of six who has been in a Montessori School has the advantage of not being so ignorant as the child who has missed that experience. He knows how to read and write, has an interest in Mathematics, Science, Geography and History, so that it is easy to introduce him to any amount of further knowledge. The teacher is confronted with an individual who has already acquired the basis of culture, and is anxious to build on it, to learn and penetrate deeper into any matter of interest. How clearly then lies the path before the teacher; it would almost seem that he has nothing to do! Not so; the teacher's task is no small or easy one! He has to prepare a huge amount of knowledge to satisfy the child's mental hunger, and he is not, like the ordinary teacher, limited by a syllabus, prescribing just so much of every subject to be imparted within a set time, and on no account to be exceeded. The needs of the child are clearly more difficult to answer, and the teacher can no longer defend himself behind syllabus and time-table. He has himself to acquire a reasonable acquaintance with every subject, and even then only the outer shell of the problem will have been pierced. But let him take courage, for he shall not be, without help, and a scientifically devised and tested plan.

Since it has been seen to be necessary to give so much to the child, let us give him a vision of the whole universe. The universe is an imposing reality, and an answer to all questions. We shall walk together on this path of life, for all things are part of the universe, and are connected with each other to form one whole unity. This idea helps the mind of the child to become fixed, to stop wandering in an aimless quest for knowledge. He is satisfied, having found the universal centre of himself with all things.

It is certainly necessary to centralise the interest of the child, but the usual methods to-day are not effective to that end. How can the mind of a growing individual continue to be interested if all our teaching be around one particular subject of limited scope, and is confined to the transmission of such small details of knowledge as he is able to memorize? How can we force the child to be interested when interest can only arise from within? It is only duty and fatigue which can be induced from without, never interest! That point must be very clear.

If the idea of the universe be presented to the child in the right way, it will do more for him than just arouse his interest, for it will create in him admiration and wonder, a feeling loftier than any interest and more satisfying. The child's mind then will no longer wander, but becomes fixed and can work. The knowledge he then acquires is organised and

systematic; his intelligence becomes whole and complete because of the vision of the whole that has been presented to him, and his interest spreads to all, for all are linked and have their place in the universe on which his mind is centred. The stars, earth, stones, life of all kinds form a whole in relation with each other, and so close is this relation that we cannot understand a stone without some understanding of the great sun! No matter what we touch, an atom, or a cell, we cannot explain it without knowledge of the wide universe. What better answer can we give to those questers for knowledge? It becomes doubtful whether even the universe will suffice. How did it come into being, and how will it end? A greater curiosity arises, which can never be satiated; so will last through a life-time. The laws governing the universe can be made interesting and wonderful to the child, more interesting even than things in themselves, and he begins to ask: What am I? What is the task of man in this wonderful universe? Do we merely live here for ourselves, or is there something more for us to do? Why do we struggle and fight? What is good and evil? Where will it all end?" This plan of cosmic education as a foundation stone of the Advanced Method was first explained in England in 1935, and it has already proved itself to be the only path on which our feet can firmly tread in further educational research. It cannot be used with the wholly illiterate or ignorant, but it is received with joy by the child who has indirectly been prepared for it in the Montessori School. Truly it is no new idea, for it has been the natural plan wherever there has been education in the real sense of the word, though lately fallen into disuse, for children first to be taught the creation of the world, and man's place in it, so far as these questions could be answered in the light of religion and philosophy. The answer was ever what it still is, "God has sent you upon the earth to work and do your duty!" This principle can now, however, be developed on a scientific plan, and be made far more attractive.

2. The Right Use of Imagination

The six-year-old who comes from a Montessori class, for whom primarily this further course is devised, is already possessed of many cultural interests, and has a sort of deep passion for order and even for mathematics, so often regarded as an obstacle to the average child. Moreover his hand is already controlled, possessed and directed by the mind in minute movements. The practical work done in our early schools found such public approbation that our scientific manual exercises have largely been adopted by schools professing other methods in regard to most aspects of education. In this more advanced period we continue to afford children the opportunity to learn through the activity of the hand, especially in mechanics and physics. For instance, the children learn the laws of pressure and tension by being asked to build an arch of stones, so placed as to hold together without need of cement. By building bridges, aeroplanes, railroads (calculating the curvature), they become familiar with the principles of Statics and Dynamics as part of the daily school routine, wherever our method is properly applied with full equipment. Wherever possible mechanical contrivances are introduced for every detail of practical life, that our children may be fitted to take part in a civilization which is entirely based on machines.

In their adoption of this part of our method some modern schools, especially in the United States, have gone too far, so that children in this intellectual stage of growth are made to occupy themselves solely with these machines, devised as they are for developing intelligence. In such schools freedom too has entered with the machines, children being allowed to choose their work, which is so far good. But whatever cannot be learnt in this way is barred out, as insignificant and negligible, as mathematics and other abstract subjects, considered as beyond the child's comprehension by free and spontaneous activity. These schools based on practical work are opposed to the so-called "old-fashioned" schools where mainly abstract subjects are taught and facts memorised; but we oppose both alike.

Personality is one and indivisible, and all mental attitudes depend on one

centre. This is the secret which the small child has himself revealed to us by doing work far beyond our dreams and expectations in all fields, including the intellectual and abstract, provided his hand was allowed to work side by side with the intelligence. Children show a great attachment to the abstract subjects when they arrive at them through manual activity. They proceed to fields of knowledge hitherto held inaccessible to them, as grammar and mathematics. I wonder how the theory arose that in order to work with the hand one must have an uncultivated mind, or that a cultivated mind consorted with manual helplessness! Must a man be classified either as a worker with his head or with his hands, instead of being allowed to function with his whole personality? Where is the logic in the view that one-sided development can be beneficial to the whole? In modern conferences highly distinguished people, who have given their lives to the cause of education, seriously discuss which is to be preferred, the practical method or an intellectual discipline. But to us the children have themselves revealed that discipline is the result of an entire development only, of mental functioning aided by manual activity. Allow the whole to function together and there is discipline, but otherwise not! Tribes, groups, nations are the results of such spontaneous discipline and association. There is only one problem, and it is human development in its totality; once this is achieved in any unit—child or nation—everything else follows spontaneously and harmoniously.

Being persuaded then that the whole personality must be engaged, and that it needs centralising first by the cosmic idea, the question comes as to how and when the idea should be presented. From the smaller children we have learnt the effectiveness of an indirect approach, as by addressing older children in their presence, for in our schools the ages are, to a limited extent, mixed. When we try to show something to the older children, the younger ones crowd around showing eager interest. Especially has this interest been shown by a child of six towards a chart illustrating the relative sizes of the sun and the earth by globe and point. The younger children were thrilled by the realisation that this invoked in them, and were unable to tear themselves away, though the older child for whom the instruction was planned found it rather commonplace, and needed some other thing to arouse in him similar interest. There is a difference between such enthusiasm and mere understanding. The point and the sphere touched the imagination of the younger child, leaving him full of enthusiasm for something beyond his former limits, belonging not to the physical environment, which is not possible to be grasped by hand. If moreover this particular illustration left the older child unmoved, it was not that nothing had the power similarly to touch his imagination, bearing him beyond his little world into wider realms, by great strides into the unknown universe; but he could not reach without help such marvels and mysteries. It is along this path of the higher realities, which

can be grasped by imagination, that the child is led between the ages of six and twelve. Imaginative vision is quite different from mere perception of an object, for it has no limits. Not only can imagination travel through infinite space, but also through infinite time; we can go backwards through the epochs, and have the vision of the earth as it was, with the creatures that inhabited it. To make it clear whether or not a child has understood, we should see whether he can form a vision of it within the mind, whether he has gone beyond the level of mere understanding.

Human consciousness comes into the world as a flaming ball of imagination. Everything invented by man, physical or mental, is the fruit of someone's imagination. In the study of history and geography we are helpless without imagination, and when we propose to introduce the universe to the child, what but imagination can be of use to us? I consider it a crime to present such subjects as may be noble and creative aids to the imaginative faculty in such a manner as to deny its use, and on the other hand to require the child to memorise that which he has not been able to visualise. These subjects must be presented so as to touch the imagination of the child, and make him enthusiastic, and then add fuel to the burning fuel that has been lit.

The secret of good teaching is to regard the child's intelligence as a fertile field in which seeds may be sown, to grow under the heat of flaming imagination. Our aim therefore is not merely to make the child understand, and still less to force him to memorise, but so to touch his imagination as to enthuse him to his inmost core. We do not want complacent pupils, but eager ones; we seek to sow life in the child rather than theories, to help him in his growth, mental and emotional as well as physical, and for that we must offer grand and lofty ideas to the human mind, which we find ever ready to receive them, demanding more and more.

Educationists in general agree that imagination is important, but they would have it cultivated as separate from intelligence, just as they would separate the latter from the activity of the hand. They are the vivisectionists of the human personality. In the school they want children to learn dry facts of reality, while their imagination is cultivated by fairy-tales, concerned with a world that is certainly full of marvels, but not the world around them in which they live. Certainly these tales have impressive factors which move the childish mind to pity and horror, for they are full of woe and tragedy, of children who are starved, ill-treated, abandoned and betrayed. Just as adults find pleasure in tragic drama and literature, these tales of goblins and monsters give pleasure and stir the child's imagination, but they have no connection with reality.

On the other hand, by offering the child the story of the universe, we give him something a thousand times more infinite and mysterious to reconstruct with his imagination, a drama no fable can reveal. If imagination be educated merely by fairy-tales, at most the pleasure it gives will be continued later in novel reading, but we should never so limit its education. A mind that is habituated to seek pleasure only in fantastic tales slowly but surely becomes lazy, incapable of nobler preoccupations. In social life we find too many examples of this sloth of mind, people caring only to be well-dressed, gossip with friends and go to the cinema. Their intelligence is hopelessly buried under barriers which cannot now be removed. Their interest becomes increasingly narrow, till it is centred round the petty self, excluding the wonders of the world and sympathy with suffering humanity. Theirs is a veritable death in life.

3. The New Psychology of the Unconscious

Since the beginning of this century, a great change has taken place in psychological study, and very significantly the new psychologists are in conflict with the established methods of education, though unable themselves to conceive how schools are to be induced to follow the new lines. But actually this new trend has already found expression in our schools, with which the older psychological theories have nothing to do, either in practice or organisation. Modern psychology exactly suits our method, for whereas the older science was based on the observation of superficial facts of consciousness, the new seeks to observe the unconscious mind, and probe its secrets in order to discover the mind's relation to the facts of life.

Older psychologists made a strong distinction between the facts of life and psychological factors, keeping them poles apart; but explorers of the field of the unconscious have discovered that the study of the latter can be placed on the same footing as biological factors, and that moreover the mind is a unity, a whole, not divisible into a number of separate mental faculties, such as Memory, Reason, Attention and Association of Ideas, each to be consciously trained. Education used to concern itself mainly with the separate training of Attention, or the power of reasoning in order to grasp what is taught, and Will, the voluntary effort to learn, and the mind was looked on as superior to the vital instincts, to be impressed and trained from without. Today the mind is thought of as one whole, not as separate mental faculties, and vitally connected with the whole personality; thus modern psychology forms a complement to our method of education.

In accordance with these new ways of thought, we are concerned with three main mental factors, of which the first is the vital element, part of life itself. This has the power of retaining part of all experiences that the individual has undergone, and it is not peculiar to human beings, but is the same with all living creatures. In order to gain something from life,

we must retain traces of experiences undergone, and here comes memory to our aid. But we soon realise the short comings of conscious memory, how blurred and indefinite are its impressions. Modern psychology however affirms that the unconscious—or subconscious—mind remembers everything, so memory now takes on the aspect of a vast mystery, needing close study for its elucidation.

This sub-conscious memory has marvellous mobility, and everything is there on record though we are not consciously aware of it. Thus there is a racial memory, by the help of which all living things reproduce their own species, and perpetuate manners of living. By it birds are enabled to build their nests according to the traditional manner of their kind. This greater memory is called the 'Mneme,' and it is that by which a child unconsciously recognises the sounds of human speech, and retains those sounds for imitation. Only a very small part of the mneme penetrates the conscious limits, and that part is what we call Memory. All the experiences through which an individual passes in life are retained in the mneme, not only the infinitesimal part that enters the consciousness.

For an easy experiment in psychology, a person may be asked to memorise a list of detached syllables, and to repeat the same from memory after a few days' interval since dropping the exercise. He will have forgotten the syllables; but will now be able to memorise them again in a much shorter time, because they were retained in the mneme. It is not an accumulation of memories that is left in the mneme, but a power to recall experiences to the conscious memory whence it has dropped. An educated man may have no memory of many things that he was taught at school, but he has intelligence, a power of quick apprehension on those subjects, which has been retained by the mneme. Thus it is not the experiences in themselves, but the traces of them left behind in the mneme, which make a mind powerful, such traces being known as engrams.

The sub-conscious is full of these engrams, by which the intellect grows much more than by conscious memory. By our use of this fact it follows that in our schools the child's intellectual powers become far augmented, whereas in ordinary schools the only object is to store knowledge in the conscious memory, and no opportunity is given to the child, by continuous and varied experiences, to increase his engrams.

Another vital factor of the mind is the urge to carry an action to completion, and it is part of what has been called the 'Élan Vitale.' The philosopher Bergson gave this name to the vital urge which drives every living creature into experiences, for the storing of engrams. This power brings children in our school to work spontaneously, persisting in

repeating the same experience, till completely satisfied. It is sometimes called the 'Will to Live,' and in connection with the human being is classed among conscious, psychic factors, while in other living creatures it ranks as biological and sub-Conscious. Truly the Élan Vitale is in every facet of life, and when it emerges into the conscious part of the mind becomes a voluntary factor, as the will. The far greater sub-conscious vital urge is now called by psychologists the Horme, which has a field relatively as vast in extent as compared with that of the conscious will as has the mneme compared with that of memory. Human beings may be forced into action through the horme without the will entering consciously into the action, as in hypnotism, and this is rightly felt to be dangerous to humanity, for these are forces of which we are yet unaware, so accordingly cannot well defend ourselves against them. The inter-relations of minds occupy a most important chapter of human psychology, men often performing acts the reason for which they are quite unable to explain. Certain actions which children perform, with serious reactions on themselves, are of this type, and that the younger generation may grow up better defended against these dangers it is necessary that they be understood, and that the conscious will be from the first rightly developed and exercised, as by the Montessori Method of education.

The third important factor in this labyrinth of the sub-conscious mind is what used to be called the Association of Ideas, or the principle of sequential formation of thoughts. On this mainly all methods of education have been based; around some initial idea more ideas may be assembled, in tune with or diametrically opposed to that idea. Modern psychologists now regard this as of only secondary importance, and only superficially true. They attach importance less to the ideas than to the engrams, which associate within the subconscious whenever the mind becomes interested in something. This association of engrams is spontaneous, and far more actively powerful and lasting than any induced chain of related ideas. It is well-known that a mathematical student may ponder for hours over some problem without success, till he decides to "sleep on it," and on waking finds solution easy. Is it because he has rested, and so can understand and think better. No, for immediately on waking he is conscious of the problem being already solved in his mind, as if the solution itself had forced him to wake and register it. It could only happen because the engrams did not sleep, but in association had done the work and forced it into the consciousness.

Thus it may be said that every human being does his most intelligent work in the sub-conscious, where psychic complexes are the construction of engrams. These do much more than create an association of ideas, for they organise themselves to carry out work which we are unable to

consciously. Psychic complexes help a writer to create beautiful ideas, new to his conscious mind and vaguely attributed to inspiration. The working of these complexes is of immense importance in education.

In accordance with these discoveries, we are now advised not to labour at memorising some important piece of work, but rather to con it lightly and then set it aside for some days without quite forgetting it, so allowing the engrams time to organise themselves in concentration. This is exactly what is observed to happen in a Montessori School, where children's revelations of their own mental processes have anticipated psychological research. Children are often seen walking alone by themselves while others are working, for just after learning something they feel the need of quiet; on return to the class they will show new ability, just as a child returning to school after holidays finds himself able to understand what was obscure before. In the light of these facts, how futile and even mischievous appears cramming for examinations!

Though we gladly acknowledge these many points of agreement with modern psychologists, whose work is complementary to our own, we yet must disagree with them on one major point. They have hitherto failed in the application of their theories to educational problems, and have become convinced that the application will be achieved only by future generations of men, whereas we know them to be immediately applicable under the right conditions. Psychological study has been pursued outside the schools, conclusions being derived from adult humanity and experimental probing into the unconscious, and they have been disappointed in their expectation that children would react in a special manner when their new methods were practised on them. But we have learnt that child-psychology is not that of the adult, and its essential condition is freedom to act in a prepared environment where the child can be intelligently active. As long as teachers thrust their conclusions on the child, however sound their study of psychology in the abstract may be, they will never attain their end, which is the child's spontaneous interest and application. Thus, much has been said of late, following psycho-analysis, of the sublimation of the instincts, and they have sought to accomplish this by the cultivation of sentiment and the emotions, but school-children prove unresponsive.

Psychologists base their theories on animal-behaviour and on adult response to psycho-analysis, and move forward towards educational reform, joining us at a certain point on the way, as we proceed starting from the child himself! They seek a method of education to suit their theory, while we seek a psychological theory to suit our method.

As an example of this Sublimation of the Instincts, a modern writer has

led to realise how these subjects first came to be studied and who studied them. We write and read, and the child can be taught who invented writing and the instruments wherewith we write, how printing came and books became so numerous. Every achievement has come by the sacrifice of someone now dead. Every map speaks eloquently of the work of explorers and pioneers, who underwent hardships and trials to find new places, rivers and lakes, and to make the world greater and richer for our dwelling.

Let us in education ever call the attention of children to the hosts of men and women who are hidden from the light of fame, so kindling a love of humanity; not the vague and anaemic sentiment preached to-day as brotherhood, nor the political sentiment that the working classes should be redeemed and uplifted. What is first wanted is no patronising charity for humanity, but a reverent consciousness of its dignity and worth. This should be cultivated in the same way as a religious sentiment, which indeed should be in us all, for we should not need to be reminded that no man can love God while remaining indifferent to his neighbour.

itself, but being an intrinsic part of creation, it does its part in transforming the world, its variations being more related to the earth's needs than to its own urge to perfection.

Life is a cosmic agent. How shall this truth be presented to the children so as to strike their imagination? Perhaps the child is likely to be most impressed by size, and the tremendous extent and magnitude of life on the globe may easily be introduced, because he already has in his possession the power of numbers. First he may be given the figures of the human population in every country, these being easily obtained, and then let us pass on to life in the depths of ocean, which are known to be incalculable. First we deal with those impressive giants of the sea, the whales, which must logically, from their size, be much fewer in number than the smaller fish. Whales live in herds in the northern seas, but swim in the cold season to the warmer regions, where they are joined by other groups, as the sperm-whales, from the Antarctic. Their herds can then be counted not by hundreds, but by thousands of hundreds, so we can imagine the rest of the life of the sea, consisting of myriads of swarms of lesser creatures. We need the help of numbers for painting the imaginative picture, and if statistics be not available we can speak in terms of the areas covered in some seas where fishes at certain seasons are thrown up to the surface. They have been known at such times to cover an area of thirty to forty square miles, and those are only the few that come to the surface from a submarine disturbance. Further, when we find that from a comparatively small region it takes as many as 10,000 boats to bring to land the yearly haul of fish, and that the Sale in Europe alone of just one sort of fish, the cod, amounts to 40 millions a year, we begin to realize something of the extent of marine life. Again, consider the rates of breeding, the herring laying 70,000 eggs at a time, and the cod laying a million twice a year, and prolonging its life normally ten years to do it.

Children like to work out these colossal figures, and may then be told that fish belong to the aristocracy of life, and that the lower orders are yet far more prolific, not even the extremest limits of numbers sufficing to count them. Jelly-fish are known sometimes to swarm to the surface in such numbers that the fastest of steamers takes three days to go through them, and these vast hordes themselves live by feeding on the far more numerous smaller living creatures, which they catch with their innumerable tentacles, but which in number seem inexhaustible. We can imagine how many there must be of those microscopic creatures that light up miles and miles of a tropic sea with phosphoresence, rivalling the stars on a clear night. In a single drop of water under the microscope one can detect hundreds of minute living things, so what must be their number in the great ocean? It has been estimated that one of the smallest