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HOW SCIENCE STUDIES THE CHILD

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SCIENCE is a mixture of curiosity and reasoning. It represents the determined, systematic effort of man to understand the world in which he lives. The child is part of that world—a very important part. The child is a portion of the scientifically explorable universe, quite as much as the sun, the stars and the ether. Prompted by curiosity and by the needs of civilization, the physical sciences are penetrating the mysteries of heaven and of earth. There is now a huge fund of knowledge which gives increasing control over the natural forces of the physical world.

In comparison, our knowledge of the child is meager. But the child is part of one vast order of nature, within the scope of science. The laws which govern his behavior and his development are discoverable. He challenges the same scientific inquisitiveness which impels chemist and physicist to investigate the constitution of the atom. The child is more complicated than the atom, but not less lawful. The very conquests of physics, chemistry and engineering have created new problems for society. Our mechanical civilization has grown so complex that we can not perpetuate it without a deeper comprehension of human nature. Each generation must rear a stronger army of children, mentally fit to carry forward an increasingly complex culture. As a measure of self-protection and of survival, the race must learn new methods for improving mental stamina and psychological adaptability in the young.

Consequently, the scientific study of child development has expanded at a very rapid rate in recent years. Centers of child research have sprung up at points as far flung as Moscow, Geneva, Vienna, Berlin, California, Iowa, Minnesota, Washington, New York. America has become a leading country in this scientific movement. Everywhere our universities are establishing laboratories, nursery schools, guidance clinics and institutes for the investigation of child development. Infants and young children are no longer strange sights on a college campus. They have become part of the scheme of science and of education. And this has had a humanizing effect on all concerned. Adults have benefited along with the children.

At present we know as little about the psychology of the child, about the nature and the needs of his mental life, as was known about the geography of the world at the time of Columbus. There are large, almost unknown continents of truth into which hundreds of investigators have entered. An important field of exploration has to do with the significant problem of individual differences of perception, of memory, of speed and accuracy, of movement, differences in posture, in imagination, intelligence, endurance, talents, interests, skills and aptitudes. Even in such a simple trait as right-handedness or left-handedness there are individual variations. These variations are being investigated by methods of careful measurement, by comparative observations, and by inten-

sive individual studies. Sometimes children are observed continuously night and day, or at brief intervals, or over a period of years.

Instruments of great precision are frequently used. Reactions are recorded on strips of waxed or smoked paper; movements are photographed; stenographers register full details; even sensitive electrical apparatus, like the galvanometer, may be brought into use. Literally hundreds of mental tests and scales have been devised to measure human differences. When an amateur without scientific training or scientific standards attempts to apply these tests they become useless and misleading; but when applied with critical caution they are valuable. We must remember that mental measurement is only in its beginnings. The time will come when the sciences of human behavior will have techniques which will not only measure the capacities of the child but will predict and guide the development of his characteristics.

To study the genesis of individual differences it is necessary to study the processes of mental growth. The mind grows. Behavior grows. This growth begins even before birth. It expresses itself in changing patterns of behavior. So swift and continuous are the changes that it is difficult to keep up with the pace that the infant sets. In the Yale Clinic of Child Development we have had to call to our aid the motion picture camera. The cinema sees with an all-seeing, impartial eye and it records with an infallible memory. We need such a powerful recording instrument for the exploration of the bewildering and almost kaleidoscopic eventfulness of human infancy.

Normal infants are periodically studied at four-week intervals throughout the first year of life with the aid of a specially designed clinical crib which permits the application of psychological test situations under controlled condi-

tions. The crib is housed in a hemispherical photographic dome equipped with a one-way vision screen which permits free observation by effectively concealing the observers stationed outside. The dome is equipped with cinema cameras which make permanent systematic records of the behavior characteristics of the infant—his posture, locomotion, perception, prehension, manipulation, social reactions and spontaneous and problem-solving activities. Simple test materials like small red cubes, pellet, string, bell and formboard are used to call out characteristic patterns of behavior.

The cinema captures this visible behavior. The records are then subjected to detailed analytic study by means of a specially designed projector which throws the image of the behavior on a viewing glass. The infant relives on the cinema screen. We can see him as he was at four weeks, eight weeks, twelve weeks, sixteen weeks, and so on. By simultaneous projection we can make an immediate comparison of any two age levels of maturity. By such methods it is possible to measure and to chart the patterns of behavior which express the laws and norms of early mental growth.

Many studies both in this country and abroad show that important individual differences declare themselves early. Take, for example, such important traits as artistic and musical ability, drawing, dramatic and mechanical abilities. They have been studied at many age levels. Recent research has pushed the quest for early indicators down to infancy and the preschool years. If scientific progress continues at the present rate, it will be possible for later generations to detect individual variations from the normal at very early ages. That will lead to prevention and cure of many behavior disorders. It may some time also be possible to discover gifted individuals of the community in the cradle and the nursery. Indeed, it will

become necessary for future society to greatly perfect the education of all children in the first five fundamental years of life. Science alone can determine the scope and the hygiene of that fundamental education.

What are the limitations of education? What are the relationships between heredity, environment and development? This is an important field of inquiry, approached from many angles. Numerous comparative studies are under way, dealing with children from different stocks and races; from different social levels; from different family origins and contrasting educational opportunities. There is a large and growing literature on twins. The study of twins has almost become a science in itself. Identical twins and dissimilar twins, twins reared apart, twins reared together, have been compared and intercompared; their psychological traits, their diseases, their crimes, their achievements, their relative responses to different methods of training have been investigated. Identical twins are an experimental touchstone to the old and fundamental problem of nature *versus* nurture.

The great problems of inheritance, however, are being solved through study of plants and animals as well as of children. The biological sciences are all closely related and they draw upon each other. The more fundamental laws of growth and development are universal. Science seeks and finds truth everywhere. Many of the important facts that we know about the nutrition, the disease, the nervous system, and even the behavior of children have come in a roundabout way, through the study of plants and animals in the laboratory. We must be duly grateful for what the

scientist has learned from the white rat, if not grateful to the white rat itself!

The child is part of the whole order of nature. To some degree his growth is governed by the same wonderful laws which control the growth of plant and animal organisms. But the child is also enmeshed in an invisible web of social relationships. His spiritual growth depends upon this web of human relationships. Science must study him as a social being in reaction to parents, to brothers and sisters and to companions. By investigating the growth of his social behavior from the moment of birth it becomes possible to define the laws and the processes of personality formation. Here lies the ultimate goal of child research.

Science may never solve the deeper mysteries of the soul, but it has already begun to cope successfully with the interpretation of human personality. Numberless studies emanating from laboratories, clinics, schools and hospitals have described varying patterns of personality in health and disease. These studies, too, are being pushed backward to the stages of infancy and early childhood. Human personality begins to loom up as something tangible, which in measure can be understood and controlled.

Our scientific knowledge of child personality is still meager and imperfect. But if this present meager knowledge could be put into application it would perceptibly improve the social and the family life of the nation. Even difficult human problems yield to the methods of science. And some of the most perplexing of these problems will be solved by delving deeper, through child research, into the processes of personality formation.