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STUDIES IN INFANT PSYCHOLOGY¹

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AT no previous time in the history of the human race has so much interest centered in the life and growth of the infant. One sees evidence of this in the development of various organizations and institutions for furthering the bodily welfare of the child; in the fact that kindergartens are admitting younger and younger children; and in the fact that the whole field of preventive medicine is focusing more and more upon the study of methods by means of which the infant and the child may be kept free from disease. At a recent conference of physicians and psychologists held for the purpose of discussing the feeding and the care of infants and their medical and psychological study, the remark was often made, albeit somewhat grudgingly, "it seems astonishing but true that everything in the last three years in medicine and psychology has been headed toward the infant." From the moment of birth and even before his advent the young human animal is looked after from every material standpoint in a way which would have made our frontier ancestors, who simply let their babies grow, doubt our sanity.

The conviction is growing, however, and rapidly, that our knowledge is still too scanty to enable us to care properly for all phases of the welfare of the infant and child. Pediatricians, dieticians and even general practitioners have had the conclusion forced upon them that merely keeping the bottle plentifully supplied with modified cow's milk or feeding the infant with some new form of "balanced diet" combined with a little welfare work in the home, has not prevented a

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The work at Hopkins was left in such an incomplete state that verified conclusions are not possible; hence this summary, like so many other bits of psychological work, must be looked upon merely as a preliminary exposition of possibilities rather than as a catalogue of concrete usable results.

high rate of infant mortality. Nor have we any guarantee even if the body weight is kept normal by any form of diet other possibly than the mother's milk that the infant will develop properly along psychological lines. And by psychological in this connection we mean the plain matters of common occurrence such as crawling, walking, sitting up, beginning to speak, smiling, blinking, reaching, imitation, the putting on of habits, the expression of emotional activity, and the like. It lies very well within the bounds of possibility that a diet and régime which will keep up the body weight might nevertheless cause an infant to put on its various necessary activities at a very slow rate or possibly at a too rapid rate. This might end in giving us either a child or an adult with a very unbalanced and unstable disposition or an indolent or phlegmatic one. Research work along many lines—nutritional, glandular, the effects of difficult labor, inheritance, and the psychological study of infant activity—is called for from our best qualified men.

On the psychological side our present knowledge of infant life is almost *nil*. If an anxious mother wishes to determine whether her infant is developing normally along psychological lines there are no data at present to guide her and no individual or institution to whom she may turn to get a reasonable answer. Who would pretend to say what the activity chart or stream of activity of a three months', six months' or year old child should reveal? The ordinary doctor will say, "Don't worry about the infant, it is getting along all right. Anyway it is too young for anybody to tell much about it." Nor is this let-alone policy confined solely to the general practitioners. Even our educators do not escape it. A prominent professor of education once said to us, "You will find when you have taught as many children as I have that you can do nothing with a child until it is over five years of age." Our own view after studying many hundreds of infants is that one can make or break the child so far as its personality is concerned long before the age of five is reached. We believe that by the end of the second year the pattern of the future individual is already laid down. Many things which go into the making of this pattern are under the control of the parents, but as yet they have not been made aware of them. The question as to whether the child will possess a stable or unstable personality, whether it is going to be timid and beset with many fears and subject to rages and tantrums, whether it will exhibit tendencies of general over or under emotionalism, and the like, has been answered already by the end of the two year period.

There are several reasons why the minute psychological study of infant life is important. (1) As was pointed out there are no standards of behavior or conduct for young infants. Our own experi-

mental work which, even at the end of two years is just beginning, has taught us that the study of infant activity from birth onward will enable us to tell with some accuracy what a normal child at three months of age can and should do and what additional complexities in behavior should appear as the months go by. Psychological laboratories in many institutions ought to be able to make cross-sections of the activity of any infant at any age and tell whether the streams of activity are running their normal course and whether certain ones are lagging or have not even appeared. After sufficient work has been done to enable us to have confidence in our standards we should be able to detect feeble-mindedness, deficiencies in habit, and deviations in emotional life. If a proper analysis of the activity streams can be made at a very early age the whole care of the child may be altered with beneficial results. (2) Modern psychology catalogues most elaborate lists of instincts and emotions in human beings. These catalogues are not based upon experimental work but upon the preconceived opinions of the men making up the lists. At present we simply have not the data for the enumeration of man's original tendencies and it will be impossible to obtain such data until we have followed through the development of the activity of many infants from birth to advanced childhood. Children of five years of age and over are enormously sophisticated. The home environment and outside companions have so shaped them that the original tendencies can not be observed. The habits put on in such an environment quickly overlay the primitive and hereditary equipment. A workable psychology of human instincts and emotions can thus never be attained by merely observing the behavior of the adult. (3) By reason of this defect the study of vocational and business psychology is in a backward state. The attempt to select a vocation for a boy or girl in the light of our present knowledge of the original nature of man is little more than a leap in the dark. High sounding names like the constructive instinct, the instinct of workmanship and the like, which are now so much used by the sociologists and the economists, will remain empty phrases until we have increased our knowledge of infancy and childhood. The only reasonable way, it would seem to us, of ever determining a satisfactory knowledge of the various original vocational bents and capacities of the human race is for psychologists to bring up under the supervision of medical men a large group of infants under controlled but varied and sympathetic conditions. Children begin to reach for, select, play with and to manipulate objects from about the 150th day on. What objects they select day by day, what form their manipulation takes, and what early habits develop upon such primitive instinctive activity should be recorded day by day in black and white. There will be marked individual differences in the material selected, in the length of

time any type of material will be utilized, and in the early constructive habits which will arise with respect to all materials worked with by the infant. Without instruction one infant (eighteen to twenty months in an observed case) will build a neat wall with her blocks, with one color always facing her. If the block is turned while she is not looking she will quickly change it and correct the defect. In other children such a bit of behavior can be inculcated only with the greatest difficulty. Still another child can not be made to play with blocks but will work with twigs and sticks by the hour. Variations in the election and use of materials are the rule in infancy but until we have followed up the future course of such variations upon *infants whose past we have watched day by day* we are in no position to make generalizations about the original tendencies which underlie the vocations. (4) Finally, until we have obtained data upon the emotional life of the infant and the normal curve of instinctive and habit activity at the various ages, new methods for correcting deviations in emotional, instinctive and habit development can not be worked out. Let us take a concrete example. A certain child is afraid of animals of every type, furry objects, the dark, etc. These fears are not hereditary. Our experiments will be convincing upon that point. What steps can we take to remove these fears, which unless they are removed in infancy, may become an enduring part of the child's personality?

AN EXPERIMENTAL STUDY OF WHAT INFANTS CAN DO AT DIFFERENT AGES. INSTINCTS AND EARLY HABITS

The human infant in general is sturdy and well able to stand all of the simple tests we need to apply. Certainly the stresses and strains upon his nervous system, the muscular pulls and twists he gets in merely being born are a thousand times harder upon him than anything we will later do to him in the laboratory. Probably none of our tests is any more strenuous for him than giving him his morning bath or changing his clothes. We have worked upon more than five hundred infants and so far without the slightest temporary or permanent mishap. These remarks seem necessary in view of the fact that sentimentalists sometimes feel when visiting our laboratory that our work may be a little hard on the infant. The work is done under the constant supervision of physicians and we take the stand that what we are doing will be important in the long run in lessening human misery and maladjustment.

When the newborn infant is first brought into the laboratory and undressed most visitors exclaim: "What can you see to study in that highly unstable but wholly delightful bit of helpless protoplasm?" Observation does seem all but hopeless at first. But closer inspection soon makes it clear that there are many forms of infant adjustment which can be studied easily under controlled experimental conditions.

Our first problem in the psychological study of the infant was the finding out of those activities that can be seen at birth and those that appear as the infant increases in age. Which among those activities drop out or change as age advances? What is the significance for the later make-up of the individual of those that remain in the stream? How are they tied together so as to form suitable bases for the putting on of the stable and constructive habits of the adult? We can possibly present our problem and our methods by considering a few of the activities as they appear under laboratory scrutiny.

Grasping. One of the easiest things to note about the new born human infant is that when any small object such as a stick, a tuft of hair, or a finger is placed in the palm, its fingers close down upon the object and clasp it tightly. For experimental purposes we used a small twisted wire rod covered with a piece of rubber tubing. The infant's fingers are open, the rod is placed in the palm and a gentle shake administered, whereupon its grasp of the rod tightens. The experimenter then catches the two ends of the rod and raises the child up over a soft mattress. One assistant takes the time that the infant hangs suspended while a second assistant puts both hands under it to catch it when it lets go. The evidence seems to be good that all but about two per cent. of normal infants of average weight at birth can suspend themselves for an appreciable interval of time. Many of them will hang suspended for only a fraction of a second while others will hang suspended for many seconds. The longest suspension we have had was one minute. Often times the infant is made to suspend itself with difficulty. In such cases it is emotionally aroused by holding the head, feet or legs or by holding the nose for an instant. If a good healthy cry is started the muscular strength seems to be increased. Whether this bears out Cannon's contention that the major emotions such as fear and rage are biologically serviceable can possibly not be concluded from these experiments. His view is that under the influence of stimuli that produce the major emotions a greater than normal amount of adrenalin is set free by the adrenal glands (one of the so-called ductless glands). This adrenalin attacks the stored sugar in the liver (glycogen) setting it free in the blood stream in such a form that it can serve rapidly as food for the muscles and for neutralizing fatigue products in the muscles. At any rate the fact remains that in many cases when the sluggish infant can be stirred up emotionally it can be made to suspend itself on the rod.

This instinctive reaction undoubtedly begins before birth since it is present in children born prematurely. We have followed it through day by day on a great many children. The daily time of suspension varies greatly. It does not seem to increase or decrease with the age of the child in any regular way. The most significant fact for the

work we are engaged in is that the instinct disappears at about the age of one hundred and twenty-four days, although in some infants it persists to a greater age. Once it disappears from the stream of activity under normal conditions it never returns. It will be seen here at once that this observation of the grasping instinct gives us one of our desirable points. If we take a cross-section of the activities of the child at any time from birth to one hundred and twenty-four days, we shall find this instinct present. After the period of its disappearance, not yet exactly determined, the behavior of the infant would give no evidence that such an instinct had ever been present. Having determined what is called a normal distribution curve for the disappearance of this instinct in normal children, it will be seen that we have a basis or standard for testing infants whose development seems to be delayed; for example, comparing with presumably normal infants, infants whose parents are feeble-minded, since we know that a large percentage of the infants of feeble-minded parents will turn out to be feeble-minded. We are not yet ready to advise the practical use of this test. Our work progresses slowly by reason of the fact that normal infants suitable in age are difficult to obtain in the laboratory and infants suspected of abnormality are still more difficult to obtain. What slender evidence we have would seem to show that in these suspected cases this primitive instinct persists for a much longer time than it does in the supposedly normal infants. A word of warning should be introduced here in order that mothers may avoid needless anxiety in case they find that their infants possess the grasping instinct at a much later age than we have indicated as being the usual one. Our work has not gone far enough for us to say that even if the instinct is present at one hundred and seventy-five days of age the infant must necessarily be abnormally slow in development. One should not draw any conclusions on the basis of either the presence or the absence of any one such hereditary form of activity. It is only when we have established workable standards for many such modes of behavior and find deviations from these norms in many particulars that alarm need be felt.

Reaching. As soon as the grasping reflex begins to disappear a much more serviceable form of activity, partly hereditary and partly *learned* (habit), begins to take its place, and that is extending the hand for an object, grasping it, and carrying it to the mouth or manipulating it. This is probably the most fundamental group of activities appearing in man. Tests for reaching are begun at one hundred days of age. The subject is seated in the lap of an assistant in a well lighted room. The experimenter takes a stick of candy and slowly extends it toward the infant. After the lips have been touched with the candy several times the sight of it, even before the reaching stage is attained, will

tend to bring about heightened activity, especially of the hands. As the days go by this activity becomes greater and at one time or another the experimenter will find, if his patience is sufficient, that the infant will slap the inside of the palm against the candy, will grasp it and carry it towards the face. When this happens the subject is always allowed to suck the candy for just an instant. The candy is then removed and the test repeated. Five or six such tests are given on each weekly experiment. The growth of this combined instinct and habit activity is extremely instructive to watch. In normal infants at one hundred and fifty days who have had weekly practice for several weeks the reaction is fairly definitely established. At that time almost any object will be reached for. One of the most significant factors appearing is that apparently the infant is positive to all objects, that is it reaches out for practically every object and avoids none. With slight exceptions all avoiding reactions, that is drawing back or turning from objects, have to be learned. This can be illustrated very nicely with the lighted candle. We usually establish the reactions of reaching for the candy and avoiding the candle flame at the same time. If the candle is made to approach the infant's face the same eager random activity is exhibited as to the candy. Care is taken always not to allow the hand to come close enough to produce a burn. But the hand is allowed on every trial to be momentarily touched by the flame. This produces a slight reflex withdrawal of the finger, sharp closing, fanning or spreading of the fingers, etc., and, if the temperature is too great, an actual reflex withdrawal of the arm. The candle is then hid for a moment and the child again stimulated. The growth of this activity is very similar to that of reaching for the candy. It takes not one slight burn of the candle but many before the infant learns to let its hands hang at its sides when the candle gets within reaching distance. Possibly if the burn were made severe enough only a few such tests would be required (a "conditioned reflex" would arise instead of the ordinary habit).

Another feature of the reaching reaction has been worked out and that is the distance to which the child will reach for objects. When we started our studies we believed with the poet that the child would reach for any object coming within its ken regardless of the actual distance of the object. Much to our surprise we found that in no case were objects reached for, even when fixated and followed with the eyes, at a greater distance than twenty inches. When a lighted candle is brought slowly across the room and extended toward an infant which has just learned to reach, the hands and arms do not begin to get active until the candle is twenty-five inches from the face. The body then begins to bend toward the object and finally as it is brought nearer still the hands and fingers take on the proper adjustment for grasping; actual reaching then soon follows.

We thus see that in the study of reaching we obtain another point on our infant activity chart. An infant tested at one hundred and fifty days should have as a part of its equipment the ability to reach for objects, to grasp them and to carry them to the mouth or otherwise manipulate them, and the ability to learn to avoid a candle or other harmful stimuli provided proper training has been instituted.

Right- and Left-handedness. At the present time a good deal of interest is manifested in the question as to whether handedness is hereditary or whether it is simply a learned response. The discussion so far has been of the "arm chair" variety. Most individuals are right-handed and it is natural to suppose that we would try to instil in youngsters almost from the beginning the dominance of the right hand. We bring this about possibly even without trying to by handing objects toward the child's right hand, by shaking its right hand, patting its right hand, and by leaving its right hand free in carrying it in our arms. Does this behavior on our part simply carry on right-handedness traditionally or is there something hereditary and instinctive about this reaction? The problem is both an interesting one scientifically and at the same time a practical one since it cuts deep into actual school procedure. All children are told when they come to writing, "Now take your pencil in your right hand." We do not wish to criticize such a custom in the light of our present knowledge. We know that most children thrive more or less well under such a procedure. On the other hand there is a slight but growing body of evidence to show that in some children at least stammering and other emotional mishaps may result when a child has for whatever reason predominantly used its left hand and has been forced to change over to the right. In some cases the bad symptoms disappear if the child is allowed to go back to the free use of its left hand.

We have carried through a rather wide series of studies, not yet completed, however, upon the problem of handedness. Our thesis for the moment is: If the predominant use of one hand is an instinctive and hereditary matter from birth onward, it would be better to let the child learn to use the hand in line with its instinctive endowment. On the other hand if no such instinctive factor is present it would be less embarrassing for the child in most situations if it were forced to use the right hand. In order to test this matter we made a careful study upon twenty infants of the length of time they could hang suspended with the right and left hands. Each of the infants was brought into the laboratory at birth and each day thereafter for a period of ten days and tested. Our results show conclusively that the infant does not suspend itself on the average with the right hand for a longer time than with the left. As a matter of fact the total time of suspension for the ten days was exactly the same for the two hands.

In order to make our results more conclusive still we devised a small "work adder" by means of which the random slashing movements of the infant could be recorded. A cord is attached at one end to the infant's wrist and at the other to a small escapement device which when operated caused a toothed wheel to revolve always in one direction. To the toothed wheel is connected a small drum. A cord bearing a small lead weight is fastened to the drum. As the infant makes its random movements this weight is wound higher and higher from the ground. Such an apparatus is of course attached simultaneously to each wrist. At the end of five minutes the experiment is stopped and the height to which the weights have been wound up from the floor is measured. The same twenty infants whose grasping reflex was tested were used in this experiment. This method gave us abundant opportunity to determine experimentally whether one hand was used more than the other. Our results show that the amount of work done on the work adders is almost identically the same for the two hands (the difference is less than P. E.) if the work of the two hands for the whole ten days is averaged. On any one day there was a disparity in the amount of work done with the two hands, but an infant markedly right-handed today is just as likely to be left-handed tomorrow.

One other step has been taken in the attempt to settle the problem of handedness. Infants from about one hundred and fifty days to one year of age have been tested once each week to find out which hand was first used in reaching for objects. On each weekly test from ten to twenty trials were given. A stick of peppermint candy or a candle was generally used as a test object. The object was brought slowly toward the face of the infant. At the proper distance reaching finally occurred. An assistant recorded on each trial the hand first used and if both hands were used, as was often the case, which one first touched the object. Again our tests fail to show any predominant use of either hand. So that we must conclude, albeit tentatively, that there is yet no evidence for assuming a hereditary basis for handedness.

This result seems to be confirmed by the anatomical measurements we have recently made (so far upon only one hundred infants). The length of the forearm to the tip of the middle finger is measured very accurately with a device which resembles somewhat the instrument that is used for measuring the length of the foot in shoe stores. The breadth of the wrist likewise is measured with calipers and the width of the palm at the knuckles. In these one hundred cases, which we admit are too few for any certain conclusion, we find almost no difference between right and left measurements.

Early Eye Movements. This excursion into the field of our studies upon right-and-left-handedness has taken us a little aside from our main problem which was to show the course and development of those

instinctive movements which will yield us an activity chart. Early eye movements furnish us with at least three definite new points on this chart. The eye movements of the infant are not difficult to study. The infant is placed upon its back with the face held lightly in a vertical position by the observers. Immediately above the baby's head is suspended a perimeter carrying a small light. This perimeter looks like the half of a barrel hoop. The light is thus always equi-distant from the baby's eye. It can be made to appear first on the left side and then on the right. We start with it usually on the left. In a second or two after the light is turned on the infant's eyes swing to the lighted side. There is no fixation in the strict sense of the word but all of the roving movements of the eyes take place in the lighted field. As soon as the eyes have swung over the light is turned out, shifted to the right and again lighted. In a few seconds the eyes swing slowly over to the right. This reaction seems to take place with the same regularity as do the responses to light of lower organisms. Indeed, we have called it the tropism-like response of the human eye. This reaction takes place equally well but more slowly if one eye is screened from the light. At a fairly definite time, which we are not yet ready to state, this response seems to disappear and something corresponding to definite fixation occurs. At that later age the infant begins to focus upon objects. To test this second type of eye movement the infant is placed in a sitting position on an attendant's lap. A lighted candle is then moved to the right side and then over to the left, then up and then down in straight lines. Its eyes fixate the candle and move with it but do not follow the light if it is rotated in a circle. This is the second stage in the development of eye responses. When the candle is held to the right or left, fixation is easier to obtain than when it is placed above or below the eyes. Again fixation is easier to obtain when the candle is held above the eyes than when it is held below them. The third stage is what we have called complete fixation; it occurs, let us say tentatively, around the one hundredth day. The eye of the infant is then able to follow a candle when it is moved in a complete circle. It is worth noting in passing that very few children are born with badly crossed eyes. Occasionally we do find one with the muscular balance so poor that the early tropism response is hard to obtain.

The Babinski Reflex. If the sole of the foot of a normal adult is stroked with the end of a match all five toes show flexion, that is, the toes bend downward toward the ground. On the other hand, in certain pathological cases where there is a lesion in the central nervous system a new type of response appears. When stimulated by the match stick the great toe, instead of showing flexion, shows extension, that is to say, flies upward. The other toes usually spread out like a fan or show the normal flexion described above. This is usually known as the

“sign” or reflex of Babinski. Its presence in the adult is definitely pathological. Strange to say the infant exhibits this reflex. Apparently its presence is due to the fact that there is a lack of complete development of one of the tracts in the central nervous system. It would seem at first sight that its study would give us one of our safest criteria in determining what one might call the activity or developmental age of the child as opposed to its chronological age, since its disappearance does apparently mark the completion of the growth of certain structures in the nervous system. Such seems not to be the case, however. It is a most variable type of response. We have made many hundreds of tests on children from birth to three years of age. In rare cases it is absent from birth. In certain other cases it can be obtained in one foot and not in the other. Sometimes it can be obtained on one day and not on the next. Again it disappears at a very variable age. It is ordinarily said that the Babinski reflex disappears around six months of age. Here are a few actual figures:

0 to 3 months,	24 cases observed,	present in 21 cases,	absent in 3
4 to 6 months,	8 cases observed,	present in 6 cases,	absent in 2
7 to 12 months,	12 cases observed,	present in 7 cases,	absent in 5
Over 1 year,	6 cases observed,	present in 1 case,	absent in 5

These do not represent all of our results but merely those obtained from a rather homogeneous group. The indication on these few cases is that it is absent or approaches senescence at one year of age or thereabouts. It would thus seem that the Babinski can never be used as any safe kind of guide in determining the normal activity age of infants. Nevertheless if it persists to a much greater age than one year one should want to make a pretty thorough examination of the whole reflex and instinctive equipment.

Sitting Alone. The ability to sit alone is an extremely important index of development, comparable probably in all respects to reaching. In order to study progress in this act the infant is placed in a sitting position on a hard mattress with legs outstretched at a given angle. Tests are usually begun at about one hundred days of age. We give below the progress of one infant. The first evidence that sitting alone was possible was obtained at 138 days. She fell over in 2 minutes and 12 seconds to the right side. It was found that if the infant was stimulated by holding some object in front of her or by getting the mother to cause her to smile and reach out her hand the sitting position could be maintained for a longer period of time than if she were left alone. On the 150th day, while the infant did not sit up for a longer period of time, she began to pull at her sock, leaned over and touched the foot with nose and mouth, and looked around, sitting up the while. On the 159th day she sat up steadily, played with her toes, used the hands in striking the mattress, then gradually sagged forward, drop-

ping at the end of 4 minutes. She was making steady progress in this response when one day at home, while sitting alone, she fell over backward and struck her head on a stone, producing a coma-like state which lasted for an hour and a half. This one experience markedly delayed her progress in sitting alone. We have noticed the same thing when children are learning to stand and to walk. If the child has a fall or a mishap while standing it is likely to cry when again placed in a standing position and almost immediately begin to "feel" its way to the ground without attempting to put forth the best that is in it. While our records are few we should say that most infants so far studied are able to sit up for a short length of time at the age of six months.

The types of infant behavior so far discussed serve simply to illustrate the purpose and methods of our work. The development of many other instinctive activities is being followed through. We can only briefly indicate some of them. The early defensive responses of children can be quite readily observed. If one pinches slightly the inside of the right knee the left foot is drawn upward and will begin to push at the offender's hand. If the nose is held the hands are thrust upward and strike at the obstructing object. In normal youngsters these responses are quick and active. They are present from birth and persist throughout life. Again, in infants the thumb is useless and lies folded across the palm. At about one hundred days of age in normal infants it can be brought parallel with the forefinger; a little later it can be used like the other fingers in grasping and takes the adult position when the hand and fingers are extended. Blinking is another activity which has a partly defensive function. This response can be obtained by passing the hand or other object rapidly across the baby's eyes and between the eyes and the source of light. Care must be taken to keep from touching the eyebrows or creating a draft of air. Unless these precautions are taken we can obtain blinking from birth; but blinking due to a rapid shadow passing across the eyes can not be obtained earlier than the sixtieth day. In many supposedly normal infants it can not be elicited before the one hundred and twentieth to one hundred and fiftieth day. Crawling is another most important function. Progression of some kind is undoubtedly instinctive, but the form that the progression takes differs markedly in every child and probably depends upon a lack of balance in structural development and partly upon habit factors. Some infants make progress by springs and dives when the leg and waist muscles are well developed. When the arm muscles are better developed progression takes place by using mainly one or both elbows, and if one arm is weaker than the other the child moves in a circle. By degrees, however, it learns to compen-

sate for this and to make progress even though one arm remains weak. As a forerunner of the ability to stand alone and walk one must observe week by week the development of the "extensor thrust" of the leg. At a certain age, which we are not yet ready to fix exactly, this reflex appears. It is easy to observe. Place the infant on its back, take hold of the two hands and pull it slowly to a sitting position and then gradually upward. As soon as any part of the sole of the foot touches the mat a noticeable stiffening of the leg appears and as the whole weight of the infant is borne by the feet the legs suddenly stiffen and take the whole load. In backward children it is unquestionably delayed; in some cases the reflex can not be brought out in children even three and four years of age.

This almost random sampling of our laboratory studies on the instinctive and habit activities of infants teaches us first that there is a wealth of material to observe and study in the infant at every age and that as this material is worked up it becomes useful from both the scientific and the practical standpoint, in the latter case enabling us to tell when an infant, whatever its régime or diet, is progressing properly on the activity side.

Most of our work has been done upon subjects under ten months of age. Observations which we are just beginning on older infants show that here is a very rich and promising field of work in the period lying between ten and twenty-four months. Imitation of varied kinds appears, spoken language begins, standing and walking develop, and then the whole world of objects is examined by the child under his own steam. Here become more marked and complex the varied activities which most immediately show what, for lack of a better term, we may call personality. It is here that we expect to find most of our data on the human being's repertoire of instincts and vocational bents. Again, during this period we shall have our best opportunity for studying methods by means of which we can shape the early habits along desirable lines, socialize the instincts, break up harmful emotional attachments and stabilize the whole of the general system of emotional expression. The second year of childhood development is from our standpoint the one most fraught with possibilities of mishap along emotional lines. For an understanding of the infant's emotional life and how emotional expression becomes linked up with the instinctive and habit activities such as we have just examined, it seems best to turn once more to the laboratory.

EXPERIMENTAL STUDY OF THE EMOTIONAL LIFE OF INFANTS

The experimental study of the emotions in adults is in a backward state in psychology. For one reason, emotions seem too evanescent and

too complex for study. They run all the way in complexity from the simple blush of the boy or girl to the violent states we see in love and rage in which the individual is totally unfitted to carry out his ordinary activities. Early in our study of the emotional life of the infant we came to the conclusion that in them the emotional patterns are really quite simple and that the later complexity we see in the adult is brought about by training and environmental influence. But this training has been of an accidental character and under the control neither of the person in whom the emotion was built up nor of his parents and other associates. It seemed worth while to test out this hypothesis experimentally because it is important to bring the emotional life under some kind of scientific and practical control and to do this we must study how the early environment of the child forces emotional states upon him. Such a study it was hoped might result in a practical procedure by the use of which the child's life might be so shaped that undesirable emotions might not be implanted. On the other hand, granting that they had been implanted through carelessness or ignorance of parents and associates, we hoped to find methods by means of which they could be got rid of.

Our earliest observation showed that from birth three fundamental inherited emotional patterns could be observed. Without assuming that our observations are complete we feel reasonably sure that *fear*, *rage* and *love* are original and fundamental. Our method of observing these emotions is a purely behavioristic one, that is, we make no effort to read into the mind of the child those things which psychologists have attempted to do for so long. We bring the child into the laboratory and stimulate it with those objects which we know will produce emotion in many adults and in nearly all children who have had the ordinary home bringing up. We then note the reaction that takes place. In other words, in any bit of behavior which can be observed there is always a stimulus or object present which calls out a reaction. The psychologist, then, must search for the objects which will call out emotions and then observe the reactions to each so that new forms of emotional expression may be found. We will apply this simple procedure to the infants brought up in the sheltered environment of the hospital where contact with the outside world has been kept at a minimum.

Fear. What are the stimuli (objects or situations) which will bring out fear responses in infants? Our observation shows that the stimuli to fear are quite constant and quite simple. If the infant is held over a pillow and allowed to drop suddenly, the fear response appears. It can be brought out generally by a sudden shake or push or by suddenly pulling the blanket upon which it is lying. We might

group all of these and say that *sudden removal of support* is an adequate stimulus to fear. The other most far reaching and important stimulus is that of a *loud sound*; for example, the striking of a long steel bar with a hammer is one of the most effective means of calling out this response. These are the common stimuli which are present almost daily in the life of every infant. The reaction or response to such stimuli is a sudden catching of the breath, clutching randomly with the hands, the sudden closing of the eyes, and the puckering of the lips followed in some cases by crying. In older children these reactions appear and in addition there is crawling away, running away and in some cases hiding the face. We have found no other stimuli which will call forth fear in the very young infant. It has been often stated that children are afraid of the dark, or animals, of furry objects in general. We shall show later that this is not the case.

Rage. In a similar way we have studied the question as to the original objects and situations which will produce the response of rage. Our observations show conclusively that the *hampering of the infant's movements* is the one stimulus which apart from all training brings out the movements we should characterize as rage. If the head is held lightly between the hands, if the arms are held closely to the sides or if the legs are held tightly together the response appears. The body stiffens and if the arms are free slashing movements of the hands and arms result. If the legs are free the feet and legs are drawn up and down, the breath is held until the child's face is flushed. There is crying at first, then the mouth is opened to the fullest extent and the breath is held until the face appears blue. These states can be brought on without the pressure in any case being severe enough to produce the slightest injury to the child. The experiments are discontinued the moment the slightest blueness appears in the skin. Almost any child can be thrown into such a state and the reactions will continue until the irritating situation is relieved and sometimes for a considerable period thereafter. We have had this state brought out when the arms are held upward by a cord to which is attached a lead ball not exceeding an ounce in weight. The constant hampering of the arms produced by even this slight weight is sufficient to bring out the response. When the child is lying on its back it can occasionally be brought out by pressing on each side of the head with cotton wool. In many cases this state can be observed quite easily when the mother or nurse dresses the child especially in winter clothing.

Love. The study of this emotion in the infant is beset with a great many difficulties on the conventional side. Our observations consequently have been incidental rather than directly experimental. The stimulus to love apparently is the stroking of the skin, tickling, gentle

rocking, patting and turning the child across the attendant's knee on its stomach; it is especially brought out by the stimulation of what, for lack of a better term, we may call the erogenous zones, such as the nipples, the lips and the sex organs. The response in an infant depends upon its state. If it is crying the crying will cease and a smile may appear. In slightly older children there is a gurgling and cooing and in still older children the extension of the arms which we shall class as the forerunner of the embrace of adults. It is thus seen that we use the term "love" in a much broader sense than it is popularly used. The responses we intend to mark off here are those popularly called "affectionate," "good natured," "kindly," etc. The term "love" embraces all of these as well as the responses we see in adults between the sexes. They all have a common origin.

Whether these are all the emotional patterns that are strictly hereditary and not due to training we are not sure, and whether there are other stimuli which will call out these responses we must also leave in doubt; but if our observations are in any way complete it would seem that the emotional reactions are quite simple in the infant and the stimuli which call them out quite few in number. Our own observations did not at first satisfy us because the whole problem appeared too simple and stereotyped. We determined then to continue with our work along a slightly different line. It was our good fortune to have six or seven older children brought up in the hospital under a strict régime. These children varied in ages from about four months to one year. They had had practically no outside contact with the world, having never left the hospital buildings. They had never seen an animal or any of the objects which were later presented to them in the laboratory. All of these children were extremely well and healthy in view of the fact that they belonged to the wet nurses attached to the hospital.

The infants were brought to the laboratory and seated in the lap of the mother or of an attendant. As soon as the infant became still a hitherto concealed live animal was suddenly presented. We can only illustrate two or three such tests and summarize the general results. For example the following experiment was made upon baby T., a girl, 165 days of age:

A very lively, friendly *black cat* was allowed to crawl near the baby. She reached for it with both hands at once. The cat was purring loudly. She touched its nose, playing with it with her fingers. It was shown three times. Each time she reached with both hands for it, the left hand being rather more active. She reached for it when it was placed on a lounge before her but out of reach.

Then a *pigeon* in a paper bag was laid on the couch. The pigeon was struggling, and moving the bag about on the couch and making a scraping

noise. The baby watched it intently but did not reach for it. The pigeon was taken out of the bag on the couch before her, cooing and struggling in the experimenter's hands. She reached for it again and again and failing, of course, to get hold of it put her hands in her mouth each time. She was allowed to touch its head. The pigeon moved its head about with quick, jerking movements. It was then held by its feet and allowed to flap its wings near the baby's face. She watched it intently, showing no tendency to avoid it, but did not reach for it. When the bird became quiet she reached for it, and caught hold of its beak with her left hand.

Test with a rabbit. The animal was put on a couch in front of her. (The child was sitting on her mother's lap). She watched it very intently but did not reach for it until the experimenter held it in his hands close to her; then she reached for it immediately, catching one of its ears with her left hand, and attempted to put it into her mouth.

The last animal presented to her was a *white rat*. She paid little attention to it, only fixating it occasionally. She followed it with her eyes somewhat when it moved about the couch. When held out to her on the experimenter's arm she turned away, no longer stimulated.

April 24, 172 days old. The baby was taken into a dark room with only an electric light behind her (faint illumination). A stranger held the baby. The mother sat where she could not be seen. A dog was brought into the room and allowed to jump up on the couch beside her. The baby watched intently every move the dog made but did not attempt to reach for it. Then she turned her head aside. The front light was then turned up and the dog again exhibited. The infant watched very closely every move the dog and the experimenter made, but did not attempt to catch the animal. She exhibited no fear reactions no matter how close the dog was made to come to her.

The tests were continued by taking the child in its chair to the dark room and building a small bonfire in front of it. The final trial with every child was made by taking it to the zoological park and confronting it with many different types of animals, special permission being accorded us for close inspection of the primates.

Never in any experiment on any child was the slightest fear response obtained. Almost the invariable mode of behavior was a reaching for the object, followed by handling or manipulation. Our results seem to show conclusively that when children are brought up in an extremely sheltered environment, such as never is afforded by the home, fears are not present to other stimuli than those which we have already enumerated.

How can we square these observations with those which show the enormous complexity in the emotional life of the adult? We know that hundreds of children are afraid of the dark, we know that many women are afraid of snakes, mice and insects, and that emotions are attached to many ordinary objects of almost daily use. Fears become attached to persons and to places and to general situations, such as the woods, the water, etc. In the same way the number of objects and situations which can call out rage and love become enormously increased. Rage and love at first are not produced by the mere sight of

an object. We know that later on in life the mere sight of persons may call out both of these primitive emotions. How do such "attachments" grow up? How can objects which at first do not call out emotions come later to call them out and thus enormously increase the richness as well as the dangers of our emotional life?

Until recently no experimental work had been done which would show such emotional attachments in the making. We were rather loath to conduct such experiments, but the need of this kind of study was so great that we finally decided to undertake the building up of certain fears in the infant and then later to study practical methods for removing them. We chose as our first subject Albert B., an infant weighing twenty-one pounds at eleven months of age. We chose him particularly because of his stolid and phlegmatic disposition.

Before turning to the experiments by means of which we built up fears in this infant it is necessary to give a brief description of a method which has recently been developed in psychology, that of the "conditioning of reflexes." If a subject sits with the palm of his hand upon a metal plate and his middle finger upon a metal bar and an electrical current is sent through the circuit thus completed by the hand, the finger will fly upward from the metal bar the moment the electric shock is given. This painful stimulus is thus the native or fundamental stimulus which calls out the defensive reflex of the finger. The sight of an apple or the sound of a bell will naturally not produce this upward jerk of the finger. On the other hand, if the bell is sounded or the colored object is shown the moment the electric current is completed through the hand, and this routine is repeated several times, the situation becomes wholly different. The finger begins to jerk up reflexly now and then when the bell is rung or the colored object shown even if the electrical current is not sent through the hand. After a longer or shorter period of training the colored object will cause the jump of the finger just as inevitably as does the current. This we call a conditioned motor response and we have shown that these conditioned responses persist for long periods of time, in some cases possibly throughout the life of the individual. There is no "reasoning" or "association of ideas" involved, because we can produce conditioned reflexes in very low forms of animals. The same thing occurs in our glands. If one attaches a small apparatus to the parotid gland—one of the salivary glands in the cheek—in such a way that the saliva flows out drop by drop, it can be shown that the direct stimulus of the gland is *actual contact* with some edible or drinkable substance, for example, weak hydrochloric acid, vinegar, etc. The moment such an acid touches the tongue the gland begins to flow profusely. Ordinarily the sight of objects does not produce an increased flow of the glands, but if combined stimulations are given, the object being shown at the same time the acid is given, the sight of the object

finally will produce an increased flow of the gland. This is of course what happens every time food or drink is brought to the mouth. Thus the youngster's mouth has every reason to "water" when a stick of candy is held in front of him or our own when we are hungry and a toothsome morsel is held before our eyes. It is probable that all of our glands, even the so-called ductless ones such as the thyroid or the adrenals, become conditioned by means of such environmental factors throughout our life.

We began to question, with such results as the above in front of us, whether or not entire emotional reactions such as are seen in fear might be conditioned in this simple way. If so we have an adequate way for accounting for the enormous increase in the complexity of adult emotional life as contrasted with its simpler manifestations in infants. To start the experiment it became necessary to use some simple native or fundamental stimulus which *would* produce fear (corresponding to the electrical shock). We have already pointed out that loud sounds are the most potent of all such stimuli. We determined to take Albert and attempt to condition fear to a white rat by showing him the rat and as soon as he reached for it and touched it to strike a heavy steel bar behind him. We first showed by repeated tests that Albert feared nothing under the sun except loud sounds (and removal of support). Everything coming within twelve inches of him was reached for and manipulated. This was true of animals, persons and things. His reaction, however, to the sound of the steel bar was characteristic and what we had been led to believe is true of most if not all infants. When it was suddenly sounded there was a sudden intake of the breath and an upward fling of the arms. On the second stimulation the lips began to pucker and tremble, on the third he broke into a crying fit, turned to one side and began to crawl away as rapidly as possible with head averted.

The result of this observation showing that the loud sound would produce an expression of extreme fear gave us hope that we might be able to use this stimulus for *bringing about a conditioned emotional response* just as the electric shock combined with the sight of the colored object brought about in the end the conditioned response of the finger just referred to. Our laboratory notes showing the progress of this test are most convincing.

Eleven months, 3 days old. (1) White rat suddenly taken from the basket and presented to Albert. He began to reach for rat with left hand. Just as his hand touched the animal the bar was struck immediately behind his head. The infant jumped violently and fell forward, burying his face in the mattress. He did not cry, however.

(2) Just as his right hand touched the rat the bar was again struck. Again the infant jumped violently, fell forward and began to whimper.

In order not to disturb the child too seriously no further tests were given for one week.

Eleven months, ten days old. (1) Rat presented suddenly without sound. There was steady fixation but no tendency at first to reach for it. The rat was then placed nearer, whereupon tentative reaching movements began with the right hand. When the rat nosed the infant's left hand the hand was immediately withdrawn. He started to reach for the head of the animal with the forefinger of his left hand but withdrew it suddenly before contact. It is thus seen that the two joint stimulations given last week were not without effect. He was tested with his blocks immediately afterwards to see if they shared in the process of conditioning. He began immediately to pick them up, dropping them and pounding them, etc. In the remainder of the tests the blocks were given frequently to quiet him and to test his general emotional state. They were always removed from sight when the process of conditioning was under way.

(2) Combined stimulation with rat and sound. Started, then fell over immediately to right side. No crying.

(3) Combined stimulation. Fell to right side and rested on hands with head turned from rat. No crying.

(4) Combined stimulation. Same reaction.

(5) Rat suddenly presented *alone*. Puckered face, whimpered and withdrew body sharply to left.

(6) Combined stimulation. Fell over immediately to right side and began to whimper.

(7) Combined stimulation. Started violently and cried, but did not fall over.

(8) Rat alone. *The instant the rat was shown the baby began to cry. Almost instantly he turned sharply to the left, fell over, raised himself on all fours and began to crawl away so rapidly that he was caught with difficulty before he reached the edge of the table.* *

This was as convincing a case of a completely conditioned fear response as could have been theoretically pictured. It is not unlikely had the sound been of greater intensity and the child more delicately organized that one or two combined stimulations might have been sufficient to condition the emotion. We thus see how easily such conditioned fears may grow up in the home. A child that has gone to bed for years without a light with no fears may, through the loud slamming of doors or through a sudden loud clap of thunder, become conditioned to darkness. We can easily explain how it is that a sudden flash of lightning finds you all set and tense, often times with the hands over the ears, before the clap of thunder, which is the true stimulus to such action, appears. We can thus see further how it is that the sight of a nurse that constrains the movements of the youngster or dresses it badly may cause the infant to go into a rage, or how the momentary glimpse of a maiden's bonnet may produce the emotional reactions of love in her swain.

The experimental question arose as to whether Albert would be afraid henceforth only of rats, or whether the fear would be *transferred* to other animals and possibly to other objects. To answer this question Albert was brought back into the laboratory five days later and tested. Our laboratory notes again show the results most convincingly.

Eleven months, fifteen days old.

(1) Tested first with blocks. He reached readily for them, playing with them as usual. This shows that there has been no general *transfer* to the room, table, blocks, etc.

(2) Rat alone. Whimpered immediately, withdrew right hand and turned head and trunk away.

(3) Blocks again offered. Played readily with them, smiling and gurgling.

(4) Rat alone. Leaned over to the left side as far away from the rat as possible, then fell over, getting up on all fours and scurrying away as rapidly as possible.

(5) Blocks again offered. Reached immediately for them, smiling and laughing as before.

The above preliminary test shows that the conditioned response to the rat had carried over completely for the five days in which no tests were given. The question as to whether or not there is a *transfer* was next taken up.

(6) *Rabbit* alone. A rabbit was suddenly placed on the mattress in front of him. The reaction was pronounced. Negative responses began at once. He leaned as far away from the animal as possible, whimpered, then burst into tears. When the rabbit was placed in contact with him he buried his face in the mattress, then got up on all fours and crawled away, crying as he went. This was a most convincing test.

(7) The blocks were next given him, after an interval. He played with them as before. It was observed by four people that he played far more energetically with them than ever before. The blocks were raised high over his head and slammed down with a great deal of force.

(8) *Dog* alone. The dog did not produce as violent a reaction as the rabbit. The moment fixation of the eyes occurred the child shrank back and as the animal came nearer he attempted to get on all fours but did not cry at first. As soon as the dog passed out of his range of vision he became quiet. The dog was then made to approach the infant's head (he was lying down at the moment). Albert straightened up immediately, fell over to the opposite side and turned his head away. He then began to cry.

(9) Blocks were again presented. He began immediately to play with them.

(10) *Fur coat* (seal). Withdrew immediately to the left side and began to fret. Coat put close to him on the left side, he turned immediately, began to cry and tried to crawl away on all fours.

(11) *Cotton wool*. The wool was presented in a paper package. At the ends the cotton was not covered by the paper. It was placed first on his feet. He kicked it away but did not touch it with his hands. When his hand was laid on the wool he immediately withdrew it but did not show the shock that the animals or fur coat produced in him. He then began to play with the paper, avoiding contact with the wool itself. He finally, under the impulse of the manipulative instinct, lost some of his negativism to the wool.

(12) Just in play W. put his head down to see if Albert would play with his hair. Albert was completely negative. The two other observers did the same thing. He began immediately to play with their hair. A Santa Claus mask was then brought and presented to Albert. He was again pronouncedly negative, although on all previous occasions he had played with it.

We see that the conditioned fear to the rat, which was experimentally set up, transferred to many other objects. The transfer was immediate and without any additional experience in connection with these other objects. In these transferred emotional reactions we thus would find a reason for the widespread change in the personality of children and possibly even of adults once even a single strongly conditioned emotional reaction has been set up to any object or situation. It accounts for the many unreasoning fears and for a good deal of the sensitiveness of individuals to objects for which no adequate ground for such behavior can be offered in the past history of that individual. The importance of such a factor in shaping the life of the child needs no further emphasis from us.

At present we are engaged upon the study of methods by means of which such directly conditioned fear responses and their transfers may be removed. The importance of establishing methods for the removal of these undesirable reactions is apparent to all. That such conditioned reactions are present in the life of every child many parents can testify. We have repeatedly had children brought to us whose emotional life had been so warped and twisted by such factors that the formation of the stable habits by means of which the race must maintain itself was seriously interfered with. Some practical procedure in the control of these factors must be found if we are to care for those children in whom accidents of nurture have built up emotional reaction systems which, unless corrected, must inevitably bring them to grief. The report on this phase of our laboratory work is not yet completed.

The sceptic will be inclined to say that such things happen in the life of a child every day but that the child immediately puts them aside and soon forgets or outgrows such happenings. We have not the full experimental data to combat this view, but we have the evidence to show that in Albert at least both the original fear of the rat and the transferred emotional reactions remained after a period of thirty days in which no experiments were made. Furthermore, the latter were still called out by the same objects which called them out in the above test. Our view is that such happenings are permanently impressed upon the growing child. They remain not only as a part of his reaction system but also they tend to modify or prevent, by limiting the number of objects that he deals with, the formation of constructive habits. In other words, they modify his vocational future. When we consider that these conditioned emotional responses are being constantly set up in the growing child, not only in the realm of fear but in the realm of love and rage, and that they bring in their train a host of transferred responses, we begin to realize the importance of the pre-school age of the child; we then wonder whether our home system which more or less allows our children to "just grow," like Topsy, until public school life begins, is not a pretty dangerous procedure.

We spend an enormous sum of money each year for the education of our youth in colleges and universities. When it is realized that the college, that institution for teaching the adolescent to become a man, is at present being regarded somewhat critically, and that the universities reach only an extremely small percentage of the population—namely that portion which intends to enter some specialty—it makes us wonder whether it would not be a valuable experiment for the government or other institutions to spend a small amount of our vast educational funds for teaching the infant how to become a child. When one realizes that probably more than the income from a million dollars is spent each year in the several marine biological institutions for the study of three lower forms—the sea urchin and its progeny, the coral, and the jelly fish—it seems not unreasonable to point out that it would not be bad economy to have one or more institutions where continuous researches might be made upon human progeny. An institution where the human infant can be studied from birth to at least three years of age would be one of the most profitable research investments that could be made at the present time. It would lead to an untold wealth of new scientific conclusions and to a practical and common sense set of data upon the psychological care of the infant.