Piagetian and Psychometric Conceptions of Intelligence

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Professor Elkind devotes much of his discussion to the concept of intelligence. He finds both similarities and differences when comparing the Piagetian description of intelligence with Jensen's (and the psychometrician's) definition of intelligence. Operating from quite different assumptions than those of J. McV. Hunt (Piaget's Structuralism, rather than neurology) Elkind also finds reason to believe that intelligence is developed in experience. For Piaget and Elkind, intelligence is "an extension of biological adaptation" and is characterized by ability to assimilate (develop in response to internal processes) and accommodate (respond to environmental intrusions).

I have been asked to respond to Professor Jensen's paper from the standpoint of Piaget's genetic psychology of intelligence. While I clearly cannot speak for Piaget, only the "Patron" can do that, I can react as someone steeped in Piagetian theory and research and as one who looks at cognitive problems from the Genevan perspective. Accordingly, while I hope that what I have to say would be acceptable to Piaget, I cannot guarantee that this is in fact the case, and must take full responsibility for whatever is said below. I plan to discuss, in the first section of the paper, some of the similarities between the Piagetian and psychometric positions. Then, in the second section, some of their differences will be pointed out. Finally, in the third section, I want to consider two related practical issues regarding the modification of intelligence.

Conceptual Similarities

What struck me in reading Professor Jensen's paper, and what had not really occurred to me before, were the many parallels and affinities between the psychometric or mental test approach to the problem of intelligence and the developmental approach as represented by Piaget. It brought to mind the fact that Piaget began his career as a developmental psychologist by working in Binet's laboratory where he sought to standardize some of Burt's (1962) reasoning tests on Parisian children. Indeed, Piaget's *method clinique* is a combination of mental test and clinical interview procedures which consists in the use of a standardized situation as a starting point for a flexible interrogation. The affinities, however, between the Piagetian and psychometric approaches to intelligence run more deeply than that. In this section I want to discuss such affinities: the acceptance of genetic and maturational determination in intelligence, the use of nonexperimental methodologies and the conception of intelligence as being essentially rational.

Genetic Determination

Implicit and often explicit in both the psychometric and Piagetian positions is the assumption that mental ability is, in part at least, genetically determined. With respect to the psychometric position, it assumes that at least some of the variance in intelligence test performance is attributable to variance in genetic endowment (Burt & Howard, 1957, Jensen). Piaget (1967a) also acknowledges the importance of genetic factors for intellectual ability but qualifies this by pointing out that what may be genetic in one generation may not always have been so and could be the partial result of prior environmental influences. So, for Piaget, as for the biologist Waddington (1962a) there is a certain relativity with respect to what is attributed to genetic endowment because what is genetic now may not always have been genetic. To illustrate, Waddington (1962a) observed that after several generations a strain of the fly grub drosophilia developed enlarged anal papillae when reared on a high salt diet. When the insects were returned to a "normal" low salt diet the anal papillae of successive generations became less large but never returned to their original size. Waddington speaks of this as "genetic assimilation" by which he means that the effects of an altered environment upon the selection process within a species may not be completely reversible even when the environment returned to its unaltered state.

One consequence of their joint acceptance of the partial genetic determination of intellectual ability, is that both psychometricians and Piaget recognize the im-

portance of maturation in human development. To illustrate their commonality in this regard, consider these two passages, one written by Harold Jones in 1954 and the other by Piaget in 1967.

> Dubnoff's work, together with other related studies, may lead to the speculative suggestion that between natio-racial groups, as within a given group, a slight tendency exists for early precocity to be associated with a slower mental growth at later ages and perhaps with a lower average intelligence level at maturity. A parallel situation may be noted when we compare different animal species; among the primates, for example, the maturity of performance at a given age in infancy can be used inversely to predict the general level of adaptive ability that will be attained at the end of the growth span. (Jones, 1954, p. 638)

And Piaget writes:

> We know that it takes 9 to 12 months before babies develop the notion that an object is still there when a screen is placed in front of it. Now kittens go through the same substages but they do it in three months—so they are six months ahead of the babies. Is this an advantage or isn't it? We can certainly see our answer in one sense. The kitten is not going to go much further. The child has taken longer, but he is capable of going further so it seems to me the nine months were not for nothing. (Piaget, 1967b)

Non-Experimental Methodology

In addition to their shared genetic or maturational emphasis, the Piagetian and psychometric approaches to intelligence have still another characteristic in common. This common feature is their failure, for the most part, to use the experimental method in the strict sense of that term. It seems fair to say that most of the studies which attempt to get at the determinants of test intelligence are correlational in nature. By and large such studies attempt to relate the test scores of parents and their children, of twins or of adopted children and their parents, or of the same children tested at different points in time and so on. Only in rare instances such as the Skeels (1966) study is an attempt made to modify intelligence by active intervention and with the utilization of a control group which does not receive the experimental treatment. While experimental work on human intelligence might well be desirable, such research often raises serious moral and ethical questions.

Piaget, for his part, has not employed the experimental method simply because it was not appropriate for the problems he wished to study. This is true because Piaget has been primarily concerned with the diagnosis of mental contents and abilities and not with their modification. To illustrate, the discovery of

what the child means by "more," "less" and "same" number of things requires flexible diagnostic interview procedures and not experimental procedures. Once the concept is diagnosed, then experimental methods are appropriate to determine the effects of various factors on the attainment and modification of the concepts in question. The sequence of events is not unlike the situation in medicine where the discovery or diagnosis of a disease is often the first step to its experimental investigation. In short, Piaget has focused upon the discovery of what and how children think and not with the modification of thinking which is a subsequent and experimental question. In every science there is a natural history stage of enquiry during which relevant phenomena must be carefully observed and classified. American psychology has often tried to bypass this stage in its headlong rush to become an experimental science. In his studies Piaget has revealed a wide range of hitherto unknown and unsuspected facts about children's thinking, which have in America now become the starting points for a great deal of experimental investigation. What is often forgotten, when Piaget is criticized for not using the experimental method, is that such a method would not have revealed the wealth of phenomena which experimental investigators are now so busily studying.

Rationality as the Definition of Intelligence

There is a third and final commonality in the mental test and Piagetian approaches to intelligence which should be mentioned. This commonality resides in what these two positions regard as the nature or essence of intelligence. While there is considerable variability among psychometricians in this regard, many agree in general with the position taken by Jensen (1969). Jensen argues that the *g* factor which is present in all tests of mental ability appears in its purest forms on tests of generalization and abstraction. Spearman (1923) called these activities the education of relations (A is greater than B; B is greater than C; so A is in what relation to C?) and of correlates (Complete the series A AB ABC ———). While intelligence tests contain measures of many different types of mental abilities, including language and perceptual skills, the psychometric approach holds that the most central feature of human intelligence is its rationality, or as Wechsler put it: "Intelligence is the aggregate or global capacity of the individual to act purposefully, to think rationally and to deal effectively with his environment" (Wechsler, 1944, p. 3).

For Piaget, too, the essence of intelligence lies in the individual's reasoning capacities. Piaget, however, is more specific in his description of these abilities

and defines them in terms of mental operations which have the properties of mathematical groupings in general and the property of reversibility in particular. An operational grouping is present when in the course of any mental activity one can always get back to the starting point. For example, if the class *boys* and the class *girls* is mentally combined to form the class *children,* it is always possible to recapture the subclass by subtraction. That is to say, the class of children minus the class of boys equals the class of girls. Put differently, the operation of subtraction can be used to undo the operation of addition so that each of the combined classes can be retrieved. Verbal material learned by heart is, however, not rationally organized as is illustrated by the fact that no matter how well a passage is learned, it is impossible, without additional effort, to say it backwards. If an operational system were involved, having learned the passage forward would automatically imply the ability to say it backwards. In Piaget's view, neither perception nor language are truly rational since neither one shows complete reversibility. So, while perception and language play an important part in intellectual activity, they do not epitomize that activity.

The psychometric and Piagetian approaches to intelligence thus agree on its genetic determination (at least in part), and on the use of non-experimental methodology and upon the essentially rational nature of mental ability. After this look at their commonalities, it is perhaps time to look at their differences.

Conceptual Differences

Despite the commonalities noted above, the psychometric and developmental approaches to intelligence also differ in certain respects. These differences, however, derive from the unique ways in which the psychometricians and Paiget approach and view intelligence and not from any fundamental disagreements regarding the nature of intelligence itself. In other words the differences are due to the fact that the two approaches are interested in assessing and describing different facets of intelligent behavior. Accordingly the differences arise with respect to: (a) the type of genetic causality they presuppose; (b) the description of mental growth they provide; and (c) the contributions of nature and nurture which they assess.

Genetic Causality

Although the Piagetian and psychometric approaches to intelligence agree on the importance of genetic determination, at least in part, of human mental ability, each approach emphasizes a somewhat different mode of genetic deter-

mination or causality. In order to make these differences clear, it is necessary to recall some of the basic features of evolutionary theory upon which all modern conceptions of intelligence are based.

Within the Darwinian conception of evolution there are two major phenomena that have to be taken into account: within-species variability and natural selection. For any given species of animal or plant one can observe a range of variations in such features as color, shape and size. Among a flock of robins, to illustrate, one can see that some adult birds differ in size, in richness of breast coloration and that some even manifest slight variations in head and wing conformation. Similar variations can be observed among a group of collies, Persian cats and even among tomato plants in the garden. This within-species variability, we know today, is due to the chance pairings of parental genes and to gene complexes which occur because each parent contributes only half of its genetic complement to its offspring. Variations within a given species at a given time are, therefore, primarily due to chance factors: namely the random genetic assortments provided by the parent generation. One determinant of variability among animals and plants is then, simply, chance.

Now in the psychometric conception of intelligence, this random type of variation is just what is presupposed. Test intelligence, it is assumed, is randomly distributed in a given population at a given time and such distributions should resemble the bell shaped curve of the normal probability function. Measurement of human abilities does in fact reveal a tendency for such measurements to fall into normal distributions. In addition evidence such as "regression toward the mean" (children of exceptionally bright or dull parents tend to be less bright and less dull than their parents) is also characteristic of genetic traits which are randomly determined. In short, when the psychometrician speaks of genetic determination, he is speaking of the chance gene combinations which produce a "normal" bell-shaped distribution of abilities within a given population.

Obviously this description of genetic determination is extremely over-simplified; we know that a test score is a phenotype which is determined by many different factors not all of which are genetic. Jensen, to illustrate, breaks down the variance of test intelligence into a large number of components such as genotypic variation, environment, environment genotype interaction, epistasis, error of measurement variance and so on. With the exception, perhaps, of the selective mating variable, however, all of these factors can again be assumed to operate in a random manner so that one might say that the chance distribution of observed test scores is the product of many underlying chance distributions. That the psy-

chometric approach does in general presuppose a random distribution is also shown by the fact that the criterion of a true change in intellectual ability is the demonstration that such a change could *not* be attributed to chance factors.

That variability within a species is in part determined by chance gene and gene complex assortments has of course been demonstrated by Mendel and all of the research which has derived from his theory of genetics. There are, however, other forms of organismic variability which cannot be attributed to chance. Natural selection, the other component of evolution, is never random but always moves in the direction of improved adaptation to the milieu. To illustrate, over the past hundred years there has been a gradual predominance of dark over light colored moths in the industrial sections of England. Kettlewell (1955) demonstrated the survival value of dark coloration by showing that light moths placed on soot darkened bark were more readily eaten by insectivorous birds than were similarly placed dark moths. When variations across generations are considered, the variations are not random but rather show a clear cut direction.

The same holds true within the course of individual development. In the case of individual growth, however, the direction of progress is not determined by mating practices but rather by biochemical mechanisms which are only now in the process of being understood. That these biochemical agents determine the direction of development, however, cannot be doubted. As Waddington (1962b) points out, animals consist of a limited variety of cells such as nerve cells, muscle cells and so on. Likewise the organs of the body are also distinct from one another in form, composition and function. What direction particular cells will take as the egg matures will depend upon the action of chemical agents which Spemann (discussed in Bertalaffny, 1962) called *organizers* with definite loci in the cell material called *organization centers.* It is the organizer which determines whether particular cells will become nerve, muscle or organ tissue. Individual development, therefore, is not determined by random factors but rather by biochemical organizers which specify the nature and direction of organismic differentiation.

Now when Piaget speaks of the genetic determination of intelligence, he has in mind not the random factors which determine gene combinations, but rather the non-random action of biochemical organizers and organization centers. Indeed, this is the kind of determination which Piaget assumes when he argues that the *sequence* in which the child attains the successive components of a concept or in which he acquires systems of mental operations, is invariant. In the formation of body organs the order of differentiation is fixed because each new

phase of differentiation produces the organizer for the next stage. In Piaget's view this is equally valid for the growth of cognitive structures because the preceding cognitive structures, say the concrete operations of childhood, are a necessary prerequisite to the elaboration of the more complex formal operational structures of adolescence. For Piaget, then, genetic determination means that there are factors which give development a definite non-random direction.

In pointing out that the Piagetian and psychometric approaches to intelligence postulate different forms of genetic determinism, I want to reiterate that these two positions are not in contradiction one with the other. The mental test approach to intelligence is concerned with inter-individual differences in ability and these are, in so far as we know, largely randomly determined. Piaget, in contrast, is concerned with the intra-individual changes which occur in the course of development and these, to the best of our knowledge, are not random but rather have a direction given them by specific organizing mechanisms. Accordingly, and this is the genius of evolution, human intelligence manifests both determinism *and* freedom.

The Course of Mental Growth

Let us look now at a somewhat different issue, the age-wise course of mental growth. Here again we find a difference in perspective rather than a contradiction in conception as between the two positions. In psychometric terms, the course of mental growth is plotted as a curve which measures the amount of intelligence at some criterion age that can be predicted at any preceding age. As Bloom (1964) has pointed out, when age 17 is taken as the criterion age, some 50% of the total IQ at that age can be predicted at age four, and an additional 30% can be predicted from ages four to eight. Based on correlational data of this sort, curves of mental growth appear to rise rapidly in early childhood and taper off to a plateau in late adolescence. Such curves, it must be noted to avoid a frequent misinterpretation, say nothing as to the *amount* or *quality* of knowledge at given age levels. (See Jensen, pp. 115-117.)

From the mental test perspective, therefore, intellectual growth is pretty much a statistical concept derived from correlations of test scores obtained at different age levels on the same individuals in the course of longitudinal studies. Such curves can be interpreted as reflecting the rate of mental growth but say nothing as to the nature of what is developing. Indeed, if intelligence is defined in the narrow sense of the abilities to generalize and abstract, then any qualitative differences in these abilities will necessarily be obscured by the curve of mental

growth which suggests merely a quantitative increase in mental ability with increasing age.

Looked at from the standpoint of Piagetian psychology, however, mental growth involves the formation of new mental structures and consequently the emergence of new mental abilities. The child, to illustrate, cannot deal with propositional logic of the following sort, "Helen is shorter than Alice and taller than Ethel, who is the tallest of the three?" (Glick & Wapner, 1968), nor can children grasp the metaphorical connotations of satirical cartoons or proverbs (Shaffer, 1930). Adolescents, in contrast, have no trouble with either propositional logic or with metaphor. In the Piagetian view, therefore, mental growth is not a quantitative but rather a qualitative affair and presupposes significant differences between the thinking of children and adolescents as well as between preschool and school age children.

These qualitative differences are, as a matter of fact, built into the items of mental tests but are masked by the assignment of point scores to successes and failures. On the Wechsler Intelligence Scale for Children various of the sub-tests recognize qualitatively different responses only by assigning them additional points (Wechsler, 1949). For example, a child who says that a peach and a plum are alike because "they both have pits" is given a single point, whereas a child who says "they are both fruit" is given two points. On other sub-tests, such as the arithmetic sub-test, there is no point differential for success on problems which patently require different levels of mental ability. To illustrate, correct answers to the following two problems are both given only a single point: "If I cut an apple in half, how many pieces will I have?" A correct answer to that question is given the same score as the correct answer to this problem:

> Smith and Brown start a card game with $27 each. They agree that at the end of each deal the loser shall pay the winner one third of what he (the loser) then has in his possession. Smith wins the first three deals. How much does Brown have at the beginning of the fourth deal?

Clearly, the items on any given sub-test can tap quite different mental processes but these qualitative differences are obscured by assigning equivalent point scores to the various items regardless of the mental processes involved.

This is not to say that Piaget is right and that the mental test approach is wrong, or vice versa. The quantitative evaluation of mental growth is necessary and has considerable practical value in predicting school success. The qualitative approach is also of value, particularly when diagnosis of learning difficulties and

educational remediation are in question. Which approach to mental growth one adopts will depend upon the purposes of the investigation. The only danger in the quantitative approach is to assume that, because sub-tests include items of the same general type and are scored with equal numerical weights, that they therefore assess only quantitative differences in the ability in question.

The Contributions of Nature and Nurture to Intelligence

Still a third way in which the psychometric and Piagetian views of intelligence differ has to do with the manner in which they treat the contributions of nature and nurture to intellectual ability. In the psychometric approach this contribution is treated substantively, with regard to the amount of variance in intellectual ability that can be attributed to nature and nurture respectively. Piaget, on the contrary, treats these contributions functionally with respect to the regulative role played by the environment or inner forces for any given mental activity. Both positions now need to be described in somewhat more detail.

The psychometric approach is substantive (and static) in the sense that it regards intelligence as capable of being measured and holds that such measures can be used to assess the extent to thich nature and nurture contribute to intellectual ability. In the discussion of genetic causality the various components into which test scores could be analyzed were briefly noted. We are indebted to writers such as Burt & Howard (1957) and Jensen for making clear the many and complex determinants into which test performance can be analyzed. Without wishing to minimize these other determinants, the needs of the present discussion will be served if we consider only how the psychometric approach arrives at the contribution of the heredity and environmental factors.

As Jensen points out, heritability is the proportion of variability among observed or phenotypic intelligence (test scores) that can be attributed to genotypic variations. Estimates of heritability are obtained from correlational data for subjects with known kinship relations such as parents and children, siblings, and identical twins. The contribution of the environment is arrived at somewhat differently. Variability in intelligence test scores attributable to the environment is estimated from that variability which cannot be attributed to any other factors. It is, in fact, the residual variance, that which is left after all the other factors contributing to intelligence test performance have been accounted for. For the psychometrician, then, nature and nurture are regarded as substantive and static, and their contributions are assessed quantitatively with the aid of statistical procedures.

When we turn to the work of Piaget, however, we encounter quite a different conception of the contributions of nature and nurture. In Piaget's view, these contributions must be conceived functionally and dynamically with respect to their regulatory control over various mental activities. In this regard Piaget's views are not unlike those of David Rapaport (1958) who spoke of "the relative autonomy of the ego," a conception which may help to introduce Piaget's somewhat more difficult formulation. Rapaport argued that we are endowed with some mental processes, such as perception, that are responsive to the environment and so tend to guarantee or insure a certain independence of the mind from the domination of instinctual drives. Other mental processes, such as fantasy, are most responsive to internal forces and these in turn guarantee a certain independence of the mind from the domination of the environment. The presence and activity of both types of processes thus insures that the mind is enslaved neither by the environment nor by drives but retains a "relative autonomy" from both.

Piaget's view (1967c) is roughly similar. He argues that intelligence is an extension of biological adaptation which, in lieu of the instinctive adaptations in animals, permits relatively autonomous adaptations which bear the stamp not only of our genetic endowment, but also of our physical and social experience. On the plane of intelligence we inherit the processes of assimilation (processes responsive to inner promptings) and of accommodation (processes responsive to environmental intrusions). Assimilative processes guarantee that intelligence will not be limited to passively copying reality, while accommodative processes insure that intelligence will not construct representations of reality which have no correspondence with the real world. To make this functional conception of the contributions of nature and nurture to intelligence concrete, let us consider several different mental abilities which are differently regulated by internal and external forces.

If we look at imitation (Piaget, 1951), it is clear that it is largely accommodative in the sense that it is most responsive to environmental influence and is relatively independent of inner forces. The vocal mimic, for example, is expert to the extent that he can capture the pitch, timbre and inflections of his model's voice and to the extent to which he can suppress those aspects of his own speech which differ from the model's. Play, in contrast, is largely assimilative in that it is most responsive to inner needs and is relatively independent of environmental influence. The child who uses a stick alternatively as a gun, as an airplane and as a boat has responded to the object largely in terms of his own inner needs and with a relative disregard of its real properties.

Between the two extremes of imitation and play is intelligence which manifests a balance or equilibrium between assimilative and accommodative activities and is thus relatively autonomous both of inner *and* outer forces. To illustrate, suppose we deduce, from the premise that Helen is taller than Jane and that Jane is taller than Mary, that Helen is the taller of three girls. We have in so doing attained a new bit of knowledge, an adaptation, but without altering the elements involved (assimilation without transformation of the objects) and without modifying the reasoning processes (accommodation without alteration of mental structures). Reason, or intelligence, is thus the only system of mental processes which guarantees that the mind and the environment will each retain its integrity in the course of their interaction.

Accordingly, for Piaget as for Rapaport, the question is not how much nature and nurture contribute to mental ability, but rather the *extent to which various mental processes are relatively autonomous from environmental and instinctual influence.* Such a conception is functional and dynamic, rather than substantive and static, because it deals with the regulatory activity of nature and nurture upon various mental processes. Those processes which show the greatest independence from environmental *and* internal regulation, the rational processes, are the most advanced of all human abilities. It is for this reason that Piaget reserves for them, and for them alone, the term intelligence.

In summary then, the psychometric and Piagetian approaches to intelligence differ with respect to: (a) the type of genetic causality which they presuppose; (b) their conceptions of the course of mental growth; and finally (c) the manner in which they conceive the contributions of nature and nurture to intellectual ability. In closing this section on the differences between the two positions I want to say again that the differences arise from differences in perspective and emphasis and are not contradictory but rather complementary. Both the psychometric and the Piagetian approaches to the conceptualization of human intelligence provide useful starting points for the assessment and interpretation of human mental abilities. Let us turn now to a couple of practical issues related to the modification and stimulation of mental abilities.

Practical Issues

In his essay, Jensen has tried to clarify many of the ambiguities regarding the nature and modification of intellectual ability and to put down some of the myths and misinterpretations prevalent with regard to test intelligence. For the most

part, I find myself in agreement with Jensen and in this section, I would like to discuss two practical issues related to the modification and stimulation of intellectual abilities which seem to involve some misinterpretation of the Piagetian position. First, Piaget's insistence upon the qualitative differences between the modes of thinking at different age levels has been wrongly taken to suggest the need for preschool instruction in order to move children into concrete operational stage more quickly. Secondly, Piaget's emphasis upon the non-chance or self-directed nature of mental development has mistakenly been taken as justification for the use of methods such as "discovery learning" which supposedly stimulate the child's intrinsic motivations to learn. I would like, therefore, to try in the following section to clarify what seems to me to be the implications of Piaget's conception of intelligence for preschool instruction and for the implementation of intrinsic motivation.

Preschool Instruction

There appears to be increasing pressure these days in both the popular and professional literature for beginning academic instruction in early childhood, i.e., from 3 to 5 years. Bruner's famous statement that "We begin with the hypothesis that any subject can be taught effectively in some intellectually honest form to any child at any stage of development" (Bruner, 1962, p. 33) as well as the work of Hunt (1961), of Bloom (1964), of O. K. Moore (1961), of Fowler (1968), and of Skeels (1966) have all been used in the advocacy of preschool instruction. Indeed Piaget and Montessori have been invoked in this connection as well. The argument essentially is that the preschool period is critical for intellectual growth and that if we leave this period devoted to fun and games, we are lowering the individual's ultimate level of intellectual attainment. Parental anxiety and pressure in this regard have been so aroused that legislation has been passed or is pending for the provision of free preschool education for all parents who wish it for their children in states such as New York, Massachusetts and California.

What is the evidence that preschool instruction has lasting effects upon mental growth and development? The answer is, in brief, that there is none. To prove the point one needs longitudinal data on adults who did not have preschool instruction but who were equal in every other regard to children receiving such instruction. With the exception of the Montessori schools, however, the preschool instruction programs have not been in existence long enough to provide any evidence on the lastingness of their effects. Indeed, most of the earlier work on the effects of nursery school education (see Goodenough, 1940, and Jones, 1954,

for reviews of this literature) has shown that significant positive effects are hard to demonstrate when adequate experimental controls are employed. It is interesting that no one, to my knowledge, has done a longitudinal study of adult Montessori graduates. Have they done better in life than children from comparable backgrounds not so trained? In any case, it is such unavailable longitudinal data that is crucial to the proposition that the preschool period is a critical one for intellectual development.

I am sure that someone will object at this point that studies of mental growth such as those of Bloom (1964) suggest that half of the individual's intellectual potential is realized by age four. Does this not mean that the preschool period is important for intellectual growth and that interventions during this period will have lasting effects? Not necessarily, if we look at the facts in a somewhat different way. Bloom writes, "Both types of data suggest that in terms of intelligence measured at age 17, about 50% of the development takes place between conception and age 4, about 30% between ages 4 and 8, and about 20% between 8 and seventeen" (Bloom, 1964, p. 88). Now an equally feasible implication of this statement is quite in contradiction to that of preschool instruction: the child has only 50% of his intellectual ability at age 4 but 80% at age 8, why not delay his education three years so that he can more fully profit from instruction? With 80% of his ability he is likely to learn more quickly and efficiently and is not as likely to learn in ways that he will need to unlearn later. That is to say, without stretching the fact, it is possible to interpret the Bloom statement as implying that instruction should *not* be introduced into the preschool program.

Not only is there no clear-cut longitudinal data to support the claims of the lastingness of preschool instruction, there is evidence in the opposite direction. The work cited by Jones (1954) and by Piaget (1967b) in the quotations given earlier in this paper are cases in point. This evidence, together with more recent data reported in Jensen's paper, suggest a negative correlation between early physical maturation and later intellectual attainments. Animals are capable of achieving early some skills (a dog or a chimp will be housebroken before a child is toilet trained) but perhaps at the expense of not being able to attain other skills at all. This data suggests the hypothesis that *the longer we delay formal instruction, up to certain limits, the greater the period of plasticity and the higher the ultimate level of achievement.* There is at least as much evidence and theory in support of this hypothesis as there is in favor of the early-instruction proposition. Certainly, from the Piagetian perspective, there are "optimal periods" for the growth of particular mental structures which cannot be rushed.

Please understand, I am not arguing against the benefits of preschool enrichment for children. Even preschool instruction may be of value for those disadvantaged children who do not benefit from what Strodtbeck (1967) called the "hidden curriculum of the middle class home." What I am arguing is that there is no evidence for the *long term effects* of either preschool instruction or enrichment. Nursery school experience most assuredly has immediate value for the child to the extent that it helps him to appreciate and enjoy his immediate world to the full and to better prepare him for future social and intellectual activities. Everyone, for example, recognizes the value of a vacation without expecting that it will produce any permanent alterations. Isn't it enough that we lighten the burdens of childhood for even a brief period each day without demanding at the same time that we produce permanent results? The contributions of the nursery school, no less than that of the vacation, do not have to be long-lived to be of value.

In closing the discussion, I would like to emphasize another side to this issue of preschool instruction. This is the consideration that the emphasis on preschool education has obscured the fact that it is the elementary school years which are crucial to later academic achievement. It is during these years that the child learns the basic tool subjects, acquires his conception of himself as a student and develops his attitudes towards formal education. In this connection it might be well to quote a less publicized finding of Bloom's (1964) study:

> We may conclude from our results on general achievement, reading comprehension and vocabulary development, that by age 9 (grade 3) at least 50% of the general achievement pattern at age 18 (grade 12) has been developed whereas at least 75% of the pattern has been developed by age 13 (grade 7). (Bloom, 1964, p. 105)

With respect to the intellectual operations of concern to Piaget, similar trends appear to hold true. While children all over the world and across wide ranges of cultural and socioeconomic conditions appear to attain concrete operations at about the age of 6 or 7 (Goodnow, 1969), the attainment and use of formal operations in adolescence, in contrast, appear to be much more subject to socioculturally determined factors such as sex roles and symbolic proficiency (Elkind, 1961; Elkind, Barocas & Rosenthal, 1968; Goodnow & Bethon, 1966). Apparently, therefore, environmental variation during the elementary school period is more significant for later intellectual attainments of the Piagetian variety. In short, there is not much justification for making the preschool the scapegoat for our failures in elementary education. Like it or not, the years from six to twelve are still the crucial ones with respect to later academic achievement.

Motivation and Intellectual Growth

In recent years there has been an increasing recognition among psychologists such as Berlyne (1965), Hunt (1965), and White (1959), that certain mental activities can be self-rewarding and do not have to be externally reinforced. European writers such as Piaget (1954) and Montessori (1964) long ago recognized the existence of "intrinsic motivation" (to use Hunt's apt phrase), and Montessori in particular gave incomparable descriptions of children who suddenly discover they can read and proceed to read everything in sight. Piaget (1967d) too, has argued that needs and interests are simply another aspect of all cognitive activities.

Educators, however, in their efforts to capitalize upon this intrinsic motivation seem to have missed the point of what Montessori and Piaget had in mind. To maximize intrinsic motivation and to accelerate mental growth we have recently had an emphasis upon "learning by discovery" and upon "interesting reading materials" and so on. These approaches miss the point because they assume that intrinsic motivation can be built into materials and procedures which will in turn maximize mental growth. But as Piaget and Montessori pointed out (Elkind, 1967) intrinsic motivation resides in the child and not in methods and procedures. It is the child who must, at any given point in time, choose the method of learning and the materials that are reinforcing *to him.* Without the opportunity for student choice and the provision of large blocks of time in which the child can totally engross himself in an activity, the values of intrinsic motivation will not be realized.

Indeed, I am very much afraid that by the time most children have reached the third or fourth grade a good deal of their intrinsic motivation for learning has been stifled. This is because spontaneous interest follows only the timetable of the child's own growth schedule. We can all remember, I am sure, those periods when we were so totally immersed in an activity that we forgot time, food and rest. During such periods we are at our creative and productive best and afterwards the feeling of exhaustion is coupled with a deep sense of accomplishment. In the school, however, we do not permit children to become totally engrossed in an activity but rather shuttle them from activity to activity on the hour or half hour. The result is what might be called *intellectually burned children.* Just as the burned child shuns the fire so the intellectually burned child shies away from total intellectual involvement.

How is this condition produced? In clinical practice we often see children (and adults) who are unwilling to form any emotional attachment. In the history of such children one always finds a series of broken relationships due to a wide vari-

ety of causes including the death of parents or the forced separation from them. Such children have learned that every time they reached out and became emotionally involved, rejection, hurt and misery were the result. Consequently they prefer not to get involved any more because the pain and anguish of still another broken relationship is just too high a price to pay for an emotional attachment. The intellectually burned child is in somewhat the same position. He refuses to become totally involved in intellectual activities because the repeated frustration of being interrupted in the middle is just too much to bear. Our lockstep curricula, thirty minutes for this and an hour for that, have the consequence, I suspect, of producing children who shun the fire of intense mental involvement.

Accordingly, the educational practice which would best foster intrinsically motivated children in the Piagetian and Montessori sense would be the provision of "interest areas" where children could go on their own and for long periods of time. Only when the child can choose an activity and persist at it until he is satiated can we speak of true intrinsically motivated behavior. Where such interest areas and time provisions have been made, as in the World of Inquiry School in Rochester, New York, the results are impressive indeed.[1]

In summary then, the Piagetian conception of intelligence provides no support either for those who advocate formal preschool instruction or for those who argue for new methods and materials to stimulate intrinsic motivation. As we have seen, there is no evidence as yet for the lastingness of preschool instruction. In addition, intrinsic motivation seems best stimulated by allowing the child to engage in the activity of his choice for unbroken periods of time. As Jensen has so rightly pointed out, if we really want to maximize the effects of instruction, it does not pay to blink at the facts whether they have to do with racial or socioeconomic differences in intelligence, the effects of preschool instruction, or the nature of intrinsic motivation.

[1] The results of our preliminary evaluation of this school suggest that World of Inquiry pupils are significantly higher in their need for achievement and more positive in their self evaluations than are their matched controls (children taken from the waiting list) who are attending other schools.

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