ORIGINS OF INTELLIGENCE

Infancy and Early Childhood

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Preface

A preface is an excellent opportunity for an editor to speak directly to the reader and share with him the goals, hopes, struggles, and production of a volume such as this. It seems to me that I have an important obligation to tell you the origins of this volume. This is no idle chatter, but rather an integral part of scientific inquiry. It is important before delving into content, theory, and methodology to talk about motivation, values, and goals. Indeed, it is always necessary to explicate from the very beginning of any intellectual and scientific inquiry the implicit assumptions governing that exercise. Failure to do so is not only an ethical but a scientific failure. We learn, albeit all too slowly, that science is a moral enterprise and that values must be explicitly stated, removing from the shadows those implicit beliefs that often motivate and determine our results. No better or more relevant example can be found than in the review of the implicit assumptions of the early IQ psychometricians in this country (see Kamin's book, *The Science and Politics of IQ*, 1975). What might have been the result had we known their biases? What might have been the result had we known from the very beginning that their scientific quest was not one in which their values were removed, but in fact their hypotheses and their values were highly integrated? The comments that are to follow are an attempt to elucidate the reason for this volume.

The thought of this book occurred nearly fourteen years ago when I first became interested in the subject of infant mental activity. In the early 1960's there was relatively little work on the subject of infancy. When Jerome Kagan and I first set out to look at infant behavior, we had in mind the idea of studying infant mental abilities. The major question that we confronted was, "What do we mean by mental abilities?" Was there such a thing or things, and how might they be measured? We have both struggled with these questions.

Although I knew relatively little about infant intelligence tests, the notion of intelligence testing, specifically infant intelligence testing, was never one that particularly interested me. I chose instead to study particular cognitive functions of the infant and sought through this means to come to an understanding of mental activity. Specifically I chose to explore infants' attentional behavior with the hope of understanding through the infant's transactions with the environment what might be the structure and processes guiding some mental activities. From the outside, an important guiding premise has been to study the infant's changing behaviors as a function of demand characteristics of a situation in which he might find himself. The specific model that I chose was the attention paradigm. I chose to look at the organism's attending behavior—defined in a variety of ways—through the presentation of redundant information. From the results of these studies and others, one finds that the infant's attentive behavior declines as it interacts with redundant information. Moreover, when that information is altered, attentive behavior recovers. I saw in that paradigm and in the organism's changing transaction with its environment the basic feature of intelligence behavior, namely, the adaptation of the organism to its environment. Having undertaken these studies, it appeared important to determine the relationship between attending behavior and other measures of infant intellectual capacity. Supported by the National Science Foundation I undertook a longitudinal study in which attentive behavior, object permanence as measured on the Corman–Escalona Sensorimotor Scales, infant intelligence tests as represented by the Bayley, and language capacity as represented by the Peabody Picture Vocabulary Test, were all administered to groups of children in the first two years of life. The aim, quite frankly, was to show that attentive behavior to redundant and changing information was related to other measures of infant intelligence. To my surprise, several results emerged and it was in the emergence of these findings and their significance that the seeds of this volume were sown.

First, to my dismay, I found that the infant's attentive behavior bore no relationship to the infant's performance on the other intellectual tasks. However, when I looked carefully at the infant's performance on the Bayley, Object Permanence test, and language test, I found: (1) Within the first two years of life these tests were not highly correlated with one another. Thus a notion of a unitary concept of intelligence which could be tapped over a variety of different tasks was seriously questioned. (2) Within any particular task there was little individual stability over the first two years of life. Thus a child who performed well on object permanence at three months was not necessarily the child at 18 months or 24 months who likewise performed well. The same was true for the Bayley Mental Development Index. Parenthetically, the infant's attending task did show more individual stability than did either of these two other infant tasks.

These results confused and then shocked me. What did I mean by infant intelligence? What in fact did others mean by infant intelligence? The reviews of the literature on infant intelligence quickly revealed that our findings were not unique and in fact Bayley herself had written:

> The findings of these early studies of mental growth of infants have been repeated sufficiently often so that it is now well established that test scores earned in the first year or two have relatively little predictive validity.

With this rather late but startling insight, I began to explore the issue of infant intelligence. This exploration has led to the present volume.

The creation of this volume is motivated by the desire to come to understand what people think and study about when they think and study about infant intelligence and intelligence scores. What I wanted to do was a volume which would look at infant intelligence from a wide variety of perspectives—a biological perspective, a social perspective, a cognitive and affective perspective. By viewing infant intelligence from a multi-perspective in this way, the end result should be the emergence of a picture of a construct which could not possibly be obtained by its examination from any particular single perspective. Thus it seemed absolutely essential from the very beginning that a multi-dimensional perspective be given, because it was only through this perspective that one could come to view clearly this conceptualization. Simply stated, I wished to get the best people there were—in terms of their effort, interest, and knowledge—to examine the concept from the perspective they were most comfortable with. In that way, each perspective would have an advocate. There is no summary statement to be found in this volume. No one will do the work for the reader—it must be the reader himself interacting with each of these perspectives (and their sum) that will enable the emergence, successful or otherwise, of the concept that is being grappled with here. Thus in some sense it is a truly interactive process between the perspectives of the various authors and the mind of the reader.

As the contents of this volume make clear, the perspective is broad—the views personal and educated. Thus it is left to the interaction between the reader and this volume; the hope is for a clearer understanding of the concept of infant intelligence.

Finally, to Rhoda, Benjamin, and Felicia, who molded reason with love and who altered knowledge with experience, I dedicate this volume.

Princeton, New Jersey MICHAEL LEWIS

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1 What Do We Mean When We Say "Infant Intelligence Scores"? A Sociopolitical Question

MICHAEL LEWIS

The concept of intelligence—the belief that it is relatively easy to measure and that, as a monolithic construct, it is a useful predictor of subsequent human behavior—is firmly entrenched in the mind of Western man.

In any discussion of the construct it is necessary to define as precisely as possible what we mean when we say *intelligence*. This essay will attempt to do this. As a consequence of the discussion we will discover that this construct is rather frail. It lacks the strength usually associated with it in theory and therefore fails to support the elaborate superstructure based on the premise of its existence. Such a discussion must lead the reader into a serious consideration of the uses and misuses of the IQ score in a technological society.

THE CONCEPT OF INTELLIGENCE

In common with many others Burt *et al.* (1934) expressed a view of intelligence that is a good starting point for our discussion. Burt *et al.* viewed intelligence as a finite potential with which the individual is endowed at conception and that is subject neither to qualitative change nor to environmental influence. Finally, they believed intelligence is easily measured. This definition possesses a wide assortment of features

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that must be carefully explicated. These features are specified:

1. There is a *single* factor called *g* that subsumes all mental activity.
2. *All* performance in mental activity can be predicted by this factor.
3. It is an easily measured factor.
4. This factor can be measured by the measurement of a subset of behavior.
5. This factor is innate.

Since we are interested here in a rapidly developing organism, we must consider a final feature derived from Burt's view:

6. Intelligence is not subject to qualitative change.

While these features can be discussed for organisms at any age, we will restrict our discussion here to the opening years of life, as our subject is infant intelligence.

A Single Factor

Probably no one feature is more central to the construct of intelligence than that it is a single potential, a single factor—often referred to as the *g* factor. Intelligence, therefore, is not like cognitive activity, since cognitive activity never has been considered a single capacity but rather a wide and varied set of skills.

Is there any basis in fact for this single-factor view of intelligence, especially in infancy? First, in order to understand the multifaceted nature of this question, it is necessary to consider how tests of intelligence are constructed. One central feature in test construction is the production of items and subtests that are related to one another and to the score on the test as a whole. Items are so constructed and eliminated that this may be the case. Thus if there are 10 test items, 9 of which are highly related to one another and to the total test score, the tenth item will be eliminated. It is no wonder that these tests have high interitem agreement as well as high split-half reliability (consistency); they are designed that way! Thus test construction perpetuates the notion of a single factor by the manipulation of items designed to produce just such an outcome.

More direct evidence comes from studies of infant performance on standardized tests of infant IQ. McCall *et al.* (1972) took great pains to find individual or factor item stability across tests and age; nevertheless they were forced to conclude that even with this type of analysis and the use of a variety of other multivariate techniques, the correlational relationship between different ages "remains modest and of minimal practical utility." In conclusion, they rejected the simple conceptualization of a *g* factor in infancy:

> The search for correlational stability across vastly different ages implies a faith in a developmentally constant, general conception of intelligence that presumably governs an enormous variety of mental activities. Under that assumption, the nature of the behavioral manifestations of *g* would change from age to age, but *g* itself is presumed constant, and this mental precocity at one age should predict mental precocity at another. Confronted with the evidence reviewed above, this *g* model of mental development must be questioned. (p. 736)

Perhaps if we turn from the standardized kinds of tests, such as the Bayley or the Gesell, to the more recent approaches suggested by the Genevan school, we can find a single factor of infant mental ability. It may be necessary to utilize Piagetian theory and explore tasks more closely related to sensorimotor development to find this factor. King and Seegmiller (1971) applied the Uzgiris and Hunt sensorimotor scales (1966) to 14-, 18-, and 24-month-old infants. The consistency of scores on these seven scales was compared across three ages, as was the relationship at 14 months across the different scales. Not only did the authors find relatively little consistency in terms of the correlations of scores (only 4 out of 24 possible correlations were significant) but they also found relatively little consistency across the various scales at a single age. Uzgiris (1973), in trying to understand the patterns of sensorimotor intelligence, measured a limited number of subjects' performance on seven subscales of the Uzgiris and Hunt (1966) sensorimotor intelligence scale. The most parsimonious explanation of her results was that there was almost no agreement between performance on one scale and performance on the others. Thus, even when we consider the nonstandard intelligence tests and look at sensorimotor development, at least as measured by the Uzgiris and Hunt scales, we find no evidence for a *g* factor.

Lewis and McGurk (1972) obtained and related three different types of infant intelligence tests. Infants were seen longitudinally from 3 to 24 months, at which time they received the Bayley Scales of Infant Development (1969) and the object permanence scale from the Corman and

Escalona sensorimotor scales (1969). In addition, at 24 months the children received a modified Peabody Picture Vocabulary Test in which both comprehension and production language scores were obtained. For the Bayley scales and the object permanence scales, the interage correlations proved to be relatively weak. Lewis and McGurk also observed the correlation between the Bayley and the object permanence scales at each age and between language development at 24 months and the Bayley and the object permanence scores at each age. In general the results failed to indicate any consistent pattern across the tests that might be likened to a *g* factor.

There is little consistency across different measures of intellectual functioning, for example, between the Bayley scales and the sensorimotor scales, and little consistency within the sensorimotor scales or across different factors such as those found by McCall *et al.* (1972) for the Gesell scales. The data, therefore, offer little support for the notion of a single *g* factor in infant intelligence.

The Predictability of Behavior

An important source of the glamour of intelligence scores is the belief that by knowing an organism's IQ score we also know a great deal about the organism's potential performance in all activities. IQ scores might not be important for some activities, but which ones? Presumably those activities not involving intellectual capacity. Here we encounter a difficulty: We believe, on the one hand, that IQ is an underlying general capacity predicting performance in some activities, but on the other hand we have no good theory to tell us which activities. Thus, if we believe carpentry involves intellectual activity, we must conclude that IQ scores will predict carpentry ability. On the other hand, if we do not think carpentry has intellectual components, then one's IQ should not predict his performance as a carpenter. Thus, to a large extent, what we believe falls within the domain of intellectual activity will determine how broadly our IQ can predict behavior.

Historically the IQ test was designed around school performance (see Chapter 2 by Brooks and Weinraub). Thus the high relationship between IQ and school performance is not a measure of the validity of the IQ construct but rather only an example of how a test can be constructed to predict performance in a particular type of activity. If we choose not to consider carpentry or hockey playing intellectual activity, there is no reason for IQ and performance in these skills to be related.

For the first time in this discussion it becomes apparent that we must choose specific criteria to define *intellectual activity* (a choice not based on any apparent scientific theory). These criteria should be as explicit as possible. Toward such a goal we might ask why school performance has been and continues to be the intellectual activity most related to IQ scores. That this is a reasonable relationship should be questioned.

Our doubts about the predictability of behavior from IQ scores are further reinforced by our knowledge that intelligence has not been shown to be a unitary factor. If this is indeed the case, by what logic could IQ test performance be related to all intellectual activity (given that we could logically define the domain)? It could well be that we have tapped only a certain portion of that intellectual domain by our test and at the same time related it to an activity within the domain but not within that portion tapped by the test. In such a case, there would be no relationship between IQ score and performance. Our everyday experience lends at least some face validity to the belief that this is indeed the case.

In terms of infant behavior the relationship between IQ performance and alternative intellectual behavior has received almost no attention. In a recent study Lewis and Lee-Painter (1974) related the Bayley intelligence performance scores of 100 twelve-week-old infants from a wide variety of socioeconomic backgrounds to their behavior in interaction with their mothers in a naturalistic home situation. The results showed that there were no significant relationships between performance on the Bayley intelligence scores and the infant behaviors as measured by the infant–mother interaction. Moreover, although infant IQ performance has been related to infant trauma (see Chapter 8 by Hunt), there is no evidence that infant IQ test performance is related to other infant intellectual activities. Finally, we have already discussed the findings indicating a lack of relationship between performance on a variety of different tests, all reporting to measure intellectual activity.

It is necessary to discuss one further set of findings having to do with infant IQ performance, namely, the relationship of test performance over age within infancy and test performance in infancy as related to older ages. Bayley (1970) has concluded, "The findings of these early studies of mental growth of infants have been repeated sufficiently often so that it is now well established that test scores earned in the first year or two have relatively little predictive validity" (p. 1174). Stott and Ball (1965), Thomas (1970), and McCall *et al.* (1972) have all reported relatively little predictive validity between the early scores of infant IQ and later measures of intelligence. One might argue that intelligence is stable but the behaviors in its service may vary in an ontogenetic fashion. Thus there may be no reason to predict consistency from epoch to epoch. McCall *et al.* (1972), in their structural consideration, give little support to such a view. Finally, it has been amply demonstrated that even within an epoch—within the first two years of infancy—there is little consistency in IQ performance (Lewis, 1973).

From logical as well as from empirical considerations we have reason to question the feature of intelligence that allows us to predict performance in activities from scores on IQ tests, even when the activities in question are themselves labeled as IQ tests. Our difficulties are only compounded when we consider activities not directly related to school performance. That school performance has been singled out as the criterion measure of intelligence is a historical accident with sociopolitical implications. Since, in our culture, success is so interwoven with school performance, it is no wonder that IQ seems to be predictive of a wide range of human activity. Unfortunately we have not seriously considered the relationship of intellectual activity to activities in general. This being the case, we cannot possibly review the predictability of IQ performance in terms of human activity. Until we are able to develop a taxonomy of human activity and are able to see the functional significance, intellectual or otherwise, of the activities organisms perform at each age, it will not be possible for us to talk about how accurately IQ scores predict performance in other activities involving intellectual capacity. Until our theory has caught up with our bias, it may still be necessary to select a carpenter for his carpentry skills rather than his IQ scores, as it may be important to select a teacher for his teaching performance rather than his IQ scores.

Measurement of IQ

The measurement of IQ is based upon a series of assumptions that must be reviewed. First, the criterion measure of intellectual behavior is