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AUTHOR	Wachs, Theodore D.
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ABSTRACT

Following a review of research on the effects of early experience upon subsequent cognitive and intellectual development, an alternative Piagetian-based strategy for the study and evaluation of these concerns is presented. Using this paradigm, infants were observed naturalistically for one year. The observations were coded according to the four categories of the Purdue Home Stimulation Scale. Infants were also tested on the Uzgiris-Hunt Infant scales. Results of correlations between these two instruments are presented and discussed, although data analyses are preliminary. (SBT)

UTILIZATION OF A PIAGETIAN APPROACH IN THE INVESTIGATION OF EARLY EXPERIENCE EFFECTS: A RESEARCH STRATEGY AND SOME ILLUSTRATIVE DATA[1]

Theodore D. Wachs
Department of Psychological Sciences
Purdue University

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My purpose today is first to illustrate the utility of a Piagetian research strategy in overcoming current methodological problems in human early experience research and second to present some data in this area we have recently analyzed.

To begin with I would like to discuss the current status of our knowledge on the role of experience in early cognitive-intellectual development. In looking at this field, a review of what we actually know is at best a sobering and depressing experience. In terms of the available research evidence, one major difficulty is the existence of some crucial gaps in our knowledge. To quote from a recent review paper by White (1969) "We are appallingly ignorant of....(1) What infants are like, (2) What their worlds are like, or (3) How environmental circumstances and resulting experiences affect the development of an infants abilities."

Even when evidence is available, the evidence more often then not is completly contradictory. Thus, in terms of the question: when do the effects of living in a disadvantaged environment begin to effect cognitive abilities, it can be unequivocally stated that these effects first become manifest at four months of age (Pasamanick, 1946), at eleven months of age (Wachs, Uzgiris and Hunt, 1971), not until 18 months of age but certainly before three years of age (Hindley, 1961), at age 3 years though not earlier (Golden, Birns, Britcher and Moss, 1971) and certainly not earlier than 3 years, 8 months (Palmer, 1970), depending upon whom one reads. In terms of evidence on the effects of early stimulation upon cognitive-intellectual development there are also a number of discrepancies. For example, one study (Williams and Scott, 1953) finds early parental restrictiveness inhibiting infants cognitive-intellectual development; a second study (Bayley and Schaefer, 1964) finds parental restrictiveness associated with increased levels of development. A number of studies have indicated that early stimulation of orphanage reared infants is beneficial to their intellectual development (Casler, 1965; Dennis and Sayegh, 1960); evidence is also available (Rheingold, 1956) indicating that this type of stimulation has no significant effect upon the intellectual development of orphanage reared infants. There is evidence (Levenstein and Sunnley, 1967) reporting the occurance of IQ gains when parents verbally interact more with their infants. However, one of our students (Holm, 1972) finds no significant effects as a result of this type of interaction.

In terms of attempts to manipulate early experience to facilitate human development the picture seems equally bleak. In a recent paper (Wachs and Cucinotta, 1971) we reviewed evidence on whether the gains initially obtained through enriched early stimulation remained stable over time. Of the six studies found in which some follow-up was attempted, only one (Solkoff, Yaffe, Weintraub, and Blaise, 1969) found differences between stimulated and non-stimulated groups remaining stable over time. (The paucity of follow-up studies is in itself a comment on the inadequacies in this area). Evidence from studies attempting broad-based general stimulation of infant development show essentially the same pattern of findings: initial gains in IQ which tend to dissipate or decline during subsequent years (Long, cited in Fowler, 1969; Weikert, 1967; Westinghouse Learning Corporation, 1969).

Overall, it would seem that whether one talks of research studies or applied efforts the evidence suggests that early experience manipulations with humans have not lived up to their original promise. An obvious question, of course, is "Why?" It will perhaps be easy to say, as some have said, that early experience is really not relevant to human cognitive-intellectual development since this development is due mainly to genetic factors (Jensen, 1969). In general, the available evidence suggests that this type of answer is probably not viable. There is too much data, using lower organisms as subjects, which shows clear-cut, consistent, and permanent effects of early experience upon such behaviors as exploration (DeNelsky and Denenberg, 1967a, 1967b), learning (Thompson and Heron, 1954; McCall and Lester, 1969 and animal intelligence (Hymovitch 1952; Schwartz, 1964) to simply dismiss early experience as irrelevant. Human studies comparing purely genetic models of intellectual development with interactive models involving both genetics and environment clearly support the validity of an interactive over a purely genetic model (Scarr-Salapatek, 1971). Finally, it should be noted that evidence on the biological determination of intelligence is not totally consistent itself; there are inconsistencies in the genetic as well as in the environmental area (See McCall (1972) vs Wilson (1972) as one example).

Given the fact that genetic influence may not be the complete answer, we are still left with the question as to why early experience results with humans have been so disappointing. In my opinion, it is not early experience per se that is at fault but rather the way in which we have researched human early experience. We have perhaps been so enchanted by the promises this approach offers ("Raise your childs IQ 100 points") that we have ignored or oversimplified certain principles and problems in the early experience area. In previous papers (Wachs, 1972a,b; Wachs and Cucinotta, 1971) we have suggested a number of ways in which our current methodological strategy has failed us. For our present discussion, I would like to briefly re-emphasize two problems which I believe are particularly relevant to the pattern of inconsistent results noted earlier.

The first, a predictor variable problem, I have called the problem of environmental specificity. It is based on the fact that an overwhelming majority of studies supposedly investigating the role of early experience upon cognitive development, are in reality, investigating nothing more than the relationship between development and demographic variables such as socio-economic status. The problem with this strategy, as has been eloquently pointed out by behavioral ethologists, (Caldwell, 1970; Schoggen and Schoggen, 1971) is that differences in development as a function of differences in distal variables such as socio-economic status tell us nothing at all about the specific, proximal experiences actually responsible for the developmental differences. Even within a given socio-economic level, evidence (Wellman, 1940; Pavenstedt, 1965; Tulkim, 1968) indicates that variations between home environments are so great as to make impossible any firm conclusions about the adequacy of experience a child is receiving. In spite of which, with some notable exceptions, researchers have generally seemed to be satisfied with labels or second-hand descriptions of the environment.[2]

Our second problem, a criterion variable problem, we have labelled the problem of intellectual hetrogeneity. It is based on a growing body of evidence indicating that intelligence is not a unitary but rather a multivariate phenomina (Hunt, 1961; Guilford, 1966). As described by McCall (McCall, Hogarty and Hurlburt, 1972) early intelligence is best characterized as a series of skills which define intellectual functioning at a given developmental level and which may stabalize, change and/or disappear as the child develops. Yet, in spite of these conceptual changes, the majority of early experience studies use, as a criterion variable, measures of infant development which yield only a single, hetrogeneous score. If intellectual development is multi-dimensional and progressive it is difficult to see how this development can be accurately reflected by a single score. Evidence is available indicating that the use of measures of specific ability rather than a single composite score dramatically increases the prediction of later intelligence (Moore, 1967; Cameron, Livson and Bayley, 1967). Further, the use of multiple measures illustrates differences in level of cognitive functioning between groups which are hidden by use of a composite measure (Wachs, in press). These differences are of course due to the masking of items with real developmental significance or discriminatory power in a composite score. These examples serve to illustrate how utilization of a single score measure may hide rather then reveal ongoing developmental patterns.

[2]Listeners may point out that I have apparently ignored a large group of studies relating parental attitudes to childrens cognitive-intellectual development. In general, I feel that these studies cannot be considered as very encouraging. As Kagan (1967) has pointed out, the proper source of measurement of the nature of parent attitudes should be the child and not the parent; it is not the parent but the child who determines if he feels loved or rejected. Unfortunately, one cannot easily ask this of a 12 month old infant with much hope of a satisfactory answer. The use of detailed observations of infant's reactions to their parents (Ainsworth Bell - Stayton, 1971) may offer one solution for those who wish to study the effect of attitudes.

THE UTILITY OF A PIAGETIAN RESEARCH STRATEGY

We have identified two major pitfalls which, it is contended, have hampered progress in the early experience area. Could these errors have occurred if researchers had adopted a Piagetian research strategy as a means of studying early experience and early cognitive development. If we consider two major aspects of the Piagetian approach I believe the answer will be obvious.

Let us first look at our predictor variable problem. In appreciating Piagets research it must always be remembered that Piaget was initially trained as a Biologist with particular emphasis on how Flora and Fauna adapt to their habitat and how their adaptive structures develop (Baldwin, 1967). This type of research requires detailed and systematic observation, not only of the organisms themselves, but also of their habitats. It is only natural therefore that Piaget, defining intelligence as an adaptive phenomenon, (White, 1969b) would utilize the same basic research strategy to study intelligence as he had earlier utilized on more biological problems -- i.e., detailed observation of the organisms interactions with its environment. These observations form the basis of Piaget's theory of cognitive development (Hunt, 1969). As Piaget himself has said: "observation must be at once the starting point of all research dealing with child thought and also the final control on the experiments it has inspired" (Piaget, 1963, p. 4). Piaget further elaborates these thoughts by stating "the good experimenter must in fact unite two often incompatible qualities. He must know how to observe, that is to say, to let the child talk freely without ever checking or side-tracking his utterance, and at the same time he must be constantly alert for something definitive,at every moment he must have some working hypothesis, some theory true or false which he is seeking to check." (Piaget, 1963, p. 9).

It is obvious from the above that the Piagetian strategy is based not on the use of labeled environments, nor on retrospective studies, or on questionnaires but rather on the detailed observations of children and their environmental interactions. From this, it is easy to see that what we have called the error of environmental specificity could not occur in a Piagetian system since detailed observations form the heart of this system.

In terms of our second problem, that of intellectual hetrogeneity we again see the utility of the Piagetian system. In Piaget's system, the basic unit of intelligence is not MA or IQ but rather the schema (Flavell, 1963). Unlike IQ or MA, which define a heterogeneous series of behaviors, a particular schema is restricted to a specific class of behaviors. The focus of interest in Piaget's system is not so much the development of intelligence per se but rather, initially, the development of specific schemas (Piaget, 1952). Of course, what we call functioning intelligence, particularly with older infants, is not simply the functioning of individual schemas but rather their inter-coordination and inter-action. While this inter-coordination or "reciprocal assimilation" might suggest a heterogenous structure similar to our traditional IQ this does not occur in Piaget's system. Indeed, in Piaget's system, this inter-coordination among different schemas serves only to accentuate the distinctiveness between the individual schemas. As Piaget has stated on this point: "the coordination of schemata bears upon two or several separate objects produced together... in such a way that the reciprocal assimilation of the schemata surpasses simple fusion to construct a series of more complicated relationships. In short, the generic character of the schemata is accentuated according as the relations (spatial, causal etc.) of the object to each other multiply" (Piaget, 1952, p. 232). Piaget further goes on to note "the coordination of the schemata is correlative to their differentiation... these virtual totalities are not encased and preformed in the combined totality but result from it precisely to the extent that the combined totalities inter-coordinate and thereby become differentiated." (Piaget, 1952, p. 245).

Thus, in Piaget's system, it seems clear that the likelihood of occurrence of what we have called the problem of intellectual heterogenity is quite small. This is because, in the Piagetian system, the focus of interest is on the development of specific internalized action sequences, the schemas, which continue to display their uniqueness even in combination.

SOME DATA

Up to now the focus of the present paper can be said to have been essentially negative -- that is, what is wrong with the human early experience area and how some of the existing problems could be avoided by a Piagetian based research strategy. I wish to take a somewhat more positive approach now and present the types of data one can obtain if one is influenced by a Piagetian approach. For the past 3½ years we have been collecting data which has attempted to relate the types of specific experiences the infant encounters to his cognitive-intellectual development. Our subjects have been 39 infants, from a wide range of homes, who, starting at 12 months of age, were observed for 45 minute periods twice a month in their own homes. These observations continued longitudinally until the infant either dropped out of the project or reached 24 months of age. These observations were coded into the four item classes of what we have called the Purdue Home Stimulation Inventory (PHSI). Section I of the PHSI consists of 10 questions asked the mother once a month on details beyond the scope of observations -- these included the number of times a month the child is taken outside of the neighborhood, whether the child has a regular nap time. Section II, also taken once a month, consisted of 13 items obtained by directly observing the stimulus characteristics of the child's home. These items included the number of decorations in the child's room, whether these have been changed since the last observation, any toys the child has received since the last observation. Section III, taken after every 15 minutes of every observation period consisted of seven items measuring activity level, auditory level, and number of people in the home. Section IV items were obtained by having a trained observor follow the child around for the 45 minutes of each observation period dictating into a portable tape recorder everything the child did and every child-person or child-environment interaction. These naturalistic observations were then transcribed and coded into the 42 items of section IV.

Besides these observations, every three months the children were tested on the Piaget-Based infant scale developed by Drs. Uzgiris and Hunt. This scale measures the childs level of cognitive development in eight areas of functioning. For any scale, a childs score was the highest level he reached on that scale plus an additional score ranging from .5 thru .2 which reflected the proficiency with which the child reached that particular level.

The data to be presented today are correlations between section I, II, and III items of the PHSI and performance on the Uzgiris-Hunt scale at each three month interval.[3] The PHSI items and their code numbers can be seen in table 1.

Insert Table 1 about here

Section IV data, though the most crucial aspect of our project, are not being presented today because we estimate it will take another 12 months to finish coding and analyzing these data. In the interim, we hope the available data will illustrate some of the specific environmental variables related to the development of specific cognitive abilities at different ages. Let us first look at object permanence.

The correlations between object permanence and PHSI sections I, II, III are to be found in Table 2.

Insert Table 2 about here

As can be seen in Table 2 during the 12-14 month period, we find that the development of object permanance is positively and significantly related to items measuring the regularity of the childs environment (Items EP1, EP2), positively related to the accessability of objects in the childs environment (VS4), positively related to the number of toys producing an audio-visual response when activated (CE1) and negatively related to the presence of too many people interacting with the child (VS3) in too small a space (SL3). In the 15-17 month period, we again see the importance of the presence of audio-visually responsive toys (CE1). The negative effects of too many people (SL7, SL7A) is again confirmed and expanded in this period to include a

[3] Significant inter-observer reliabilities have been found for all PHSI section I, II, and III items. These data can be obtained from the author.

negative relationship between intense auditory level in the childs home (SL5) and the development of object permanence. In the 18-20 month period, circumstances allowing the child to escape from intense stimulation (SL2) are found to be positively related to the level of object permanence. The importance of adequacy of stimulation during this period is seen in the positive relationships between the degree of change in stimulation offered the child, (VS10), the lack of visual (VS11) and Physical (VS12) restraints placed on the childs interactions with his environment, and the childs level of object permanence. In the 21-24 month period, the level of object permanence is again seen to be positively related to the variety of stimulation offered the child (VS8, VS10) and to the lack of physical restraints (VS12). The earlier positive relationship seen between the presence of audio-visually responsive toys and object permanence (CE1) again reappears. Overall then, the development of object permanence in the 12-24 month period can be seen as being positively related to the regularity of the childs environment during the first-quarter of this period; negatively related to the presence of intense stimulation during the 12-20 month period and positively related to the variety of stimulation available to the child during the 18-24 month period. The presence of audio-visually responsive toys appears to be positively related to the level of object permanence during almost the whole 12-24 month span.

The objects as means data is seen in Table 3

Insert Table 3 about here

In contrast to object permanence, the development of the use of objects as means seems to suggest a critical or sensitive period phenomena. The level of objects as means is seen to have few significant relationships with measures of environmental stimulation during the 12-17 month period. However, in the period between 18-20 months a number of significant relationships become manifest. During this time period we find that the development of means is positively related to the amount of manipulable objects in the childs environment (VS5) and to a lack of visual restrictions (VS11). In contrast, the number of adults actively involved in a caretaking role with the child (VS3) is negatively related to the development of means; this relationship suggests the possibility that too much adult intervention may hinder the child in his active exploration of the environment. This suggestion receives partial support from the fact that during this period the number of strangers encountered by the child (SL7a) (who presumably would have less intense interaction) is positively related to the development of means. From 21 months on, we again see a lack of relationship between measures of the childs environment and level of use of objects as means. Thus, it would seem that in terms of the development of use of objects as means, our data suggests that this ability is primarily related to the chance the child has to freely interact with and explore his envrionment, particularly during the 18-20 month period.

The foresight data is shown in Table 4.

Insert Table 4 about here

In terms of foresight, in the 12-14 month period we find the development of foresight to be positively related to the adequacy of visual stimulation (VS7) and negatively related to the amount of adult caretaking (VS3). In the 15-17 month period, we again see the relevance of adequate visual stimulation (VS6); in addition we also find positive relationships between the development of foresight and the presence of audio-visually responsive toys (CE1) and with circumstances which allow the child to escape from too much stimulation (SL2). In the 18-20 month period we again see the relevance of adequacy of visual stimulation, though in this period, the items reflect a lack of visual restriction (VS11) and variety of stimulation (VS10) rather than the amount of stimulation. The relationship between intense auditory stimulation and the development of foresight, seen earlier, emerges more strongly during the 18-20 month period (SL2, SL5). During the period after 21 months, we see that the positive relationship between adequacy of visual stimulation and foresight has disappeared. However, the negative relationship between intense stimulation and foresight still remains significant (SL2, SL5). Thus, looking at the development of foresight between and [illegible] months, our data suggests two major environmental factors effecting the development of this ability. During the 12-20 month period, the adequacy and variety of visual stimulation the child is exposed to is positively related to the development of foresight. Overlapping this first trend at 15 months, and continuing on thru 24 months of age, we see our second trend in which items tapping the presence of intense stimulation, particularly auditory, are negatively related to the development of foresight.

The data on level of schemes relating to objects is seen in Table 5.

Insert Table 5 about here

Turning to Table 5 we find that this development seems most affected by environmental variables in the first and last three month periods of the 12-24 month time block. In the first quarter of the second year of life, schemes development is found to be positively related to items tapping the amount and variety of stimulation offered to the child (CE1, VS9, VS10). A positive relationship is also found between level of schemes development, environmental predictability (EP2) and maternal language rate (LS2). We also find a negative relationship between schemes development and items indicating the presence of too many people (SL2, SL4, SL5). Unfortunately, most of these significant correlations disappear during the next six months, though the positive relationships between environmental predictability (EP2) and schemes and between circumstances allowing the child to escape intense stimulation (SL2) and schemes do re-appear in the 18-20 month period. During the time period after 21 months, the positive relationship between environmental predictability and level of schemes again continues (EP4); the negative relationship of intense stimulation to schemes is also seen during this period, though unlike the 12-14 month period the 21-24 month correlations are between items reflecting physical (SL2, SL4, SL5) rather than people stimulation. The earlier importance of adequacy of stimulation again re-appears in the positive relationship between presence of audio-visually responsive toys and schemes development (CE1). In addition, a positive relationship between indices of maternal-child language interaction (LS1, LS2) and schemes level again re-appears after 21 months. Overall, then, for schemes relating to objects we find a positive relationship between level of schemes and variety of visual stimulation, mother-child language interaction, and environmental predictability; there is a negative relationship between schemes and intense stimulation indices. These relationships appear to hold mainly in the first and last quarters of the second year of life. Why they should fade during the middle half is unclear at present.

The data on causality is seen in Table 6.

Insert Table 6 about here

For causality, we see a developmental pattern resembling that of objects as means. That is to say, during the 12-17 month period the development of an understanding of causality is found to be related to very few environmental indices, mainly those tapping the variety of stimulation offered the child (CE1, VS7). This early and tentative relationship between the adequacy and variety of stimulation and the development of causality is strongly confirmed during the 18-20 month period. During this time, we find the level of understanding of causality primarily and positively related to items measuring the adequacy and variety of visual-tactual stimulation offered the child (CE1, VS4, VS8, VS1) as well as to a lack of visual restrictions (VS11). Again, as with the development of means, after twenty months all significant relationships disappear. Thus, the development of an understanding of causality seems related to one class of experiental measures, namely adequacy and variety of visual-tactual stimulation, particularly during the 18-20 month period.

The data for an understanding of objects in space is seen in Table 7.

Insert Table 7 about here

In Table 7, a sensitive period phenomina is also seen in the development of an understanding of objects in space. Prior to 21 months, the development of an understanding of objects in space is seen as related negatively to exposure to too many people (VS3) between 12 and 14 months and positively to the childs being able to avoid intense stimulation after 14 months (SL2) and to allowing the child access to a variety of stimulation the 18-20 month period (VS11). In the 21-24 month period, these early trends are confirmed and expanded. Again we see the importance of allowing the child to escape from intense stimulation (SL2) to the development of objects in space, with additional evidence that exposure to too many people may be particularly detrimental to this development (SL3, SL5, SL7). Coupled with these findings is a positive relationship between the development of an understanding of objects in space and items measuring the amount (CE1) and Variety of stimulation (VS10) offered to the child. The relationship of these two classes of items to the development of objects in space during the 21-24 month period clearly confirms the tentative relationships noted at earlier age periods.

The Verbal Imitation data is seen in Table 8.

Insert Table 8 about here

For verbal imitation, several trends relating the development of this ability to environmental stimulation are noted. During the first half of the second year of life the development of verbal imitation is found to be positively related to the degree of predictability of the childs environment (EP1, EP2) and to the amount of play material offered the child (CE1, VS10). During the 18-24 month period, while adequacy of stimulation is still positively related to verbal imitation (CE1, VS9), the negative effects of intense auditory stimulation (SL4, SL5) and the positive effects of verbal stimulation (LS1) also appear. Thus, it would seem that in terms of the development of verbal imitation, during the 12-17 month period the child is acquiring a store of experiences to base his verbal performance on; after this time, environmental factors directly relevant to verbal behavior, such as intense auditory input, which Deutsch (1964) has suggested may lead to habituation of auditory stimuli, and the adequacy of language stimulation itself seem more relevant to the development of verbal imitation.

The data on gestural imitation are seen in Table 9

Insert Table 9 about here

For gestural or non-verbal imitation, we find surprisingly little relationship between this ability and environmental variation. The relationships we do find are scattered and inconsistent. Whether this is due to inadequacies in this particular scale or to greater genetic input in the development of non-verbal imitation is unclear and a subject for further study.

In spite of the failure of gestural imitation, in general our data have shown reasonably clear developmental patterns relating specific classes of environmental stimulation to the development of specific cognitive-intellectual abilities. Because the mass of data presented may predispose to some confusion let me try to sum up our findings by looking at our data in a somewhat different way. Ignoring specific patterns of correlations, let us look at the types of environmental measures that seem particularly and consistently related to development. Looking at the data this way we can see that there are four major classes of experience that seem particularly relevant to early cognitive development.

First, we have a group of items measuring the predictability of the environment for the child -- an environment where things have their time and place. The possible relevance of environmental predictability to cognitive development was suggested by the work of Susan Gray and her colleagues (Klaus and Gray, 1968) who reported that the homes of disadvantaged pre-school children seemed particularly unpredicatable and irregular. Our data, indicating a positive relationship between early cognitive development and environmental predictability not only confirms Gray's speculations but also indicates that the effects of environmental predictability occur at a much earlier age than the four and five year olds studied by Gray. Whether environmental predictability is relevant to development in the first year of life is an empirical question; my guess, based on the patterns of findings for object permanence, schemas and verbal imitation would be that it would be relevant if studied with a sample younger than ours.

Our second class of items relates to the adequacy of stimulation offered the child. Previous discussions and uses of this concept have generally been based on vague generalizations. Our data seems to give this and similar terms a more operational footing. Specifically, our data suggests that there are four components defining adequacy of stimulation. First, there is the amount of available stimulation, particularly visual stimulation early in the second year of life, and tactual-visual stimulation after 18 months. Our second component of adequate stimulation refers to the degree of variety or change in stimulation offered the child. Our data seems to suggest that variety of stimulation is more important after 18 months of age than before this time. A similiar pattern is seen for our third component, namely lack of physical or visual restraints placed on the childs interactions with his environment; the positive relationship between lack of restraint and cognitive development also seems to become more evident after 18 months. Finally, there are the amount of toys producing auditory-visual feedback when activated; an item which was found to be more consistently and significantly related to cognitive development than any other item. There are a number of theoretical and empirical factors which support the importance of this single item. McCall (McCall et al, 1972) in his factor-analytic studies of early intellectual development and Piaget (1952) in his conception of secondary circular reactions both suggest that the results of perceptual contingencies are incorporated as one component of intelligence in the first year of life. Other researchers have shown the importance of the childs being able to gain feedback from his environment for early cognitive development, whether this feedback is human (Provence and Lipton, 1962; Yarrow et al, 197?) or mechanical (Yarrow et al, 1972). The relevance of environmental feedback to motivational aspects of intelligence has also been noted (Hunt, 1965). Our current data extends this previous work and suggests the importance of mechanical feedback (i.e., toys) to cognitive development after 12 months of age. Discussion of the importance of human feedback to cognitive development after 12 months of age must unfortunately wait until our section IV data has been analyzed.

While our second class of items, measuring adequacy of stimulation, indicates that a certain minimum of stimulation is necessary to facilitate cognitive-intellectual development, our third class of items, items measuring the presence of intense stimulation gives ample warning that the presence of too much stimulation may be as detrimental to development as too little stimulation. In previous research (Wachs, et al, 1971) we have discussed this negative relationship between intense stimulation and development. Our current data extends our previous findings in two important ways. First, our current data suggests that perhaps the most crucial factor is not the stimulation level of the home per se but rather whether the home is provided with some sort of shelter from which the child can escape the effects of stimulus bombardment. Our item tapping the existence of this stimulus shelter was the second most frequently related item to development. Second, our current data reveals a distinction between physically intense stimulation and intense stimulation caused by the presence of too many people. These two sources apparently are related to the development of different abilities or have their effects at different ages. While the nature of the relationship of physically intense stimulation to development can be seen as due to physical (Bruner, 1957) or psychological changes (Deutsch, 1964) caused by cumulative exposure to this stimulation, the nature of human generated intense stimulation is less clear. Perhaps the section IV data, detailing the nature of the childs interactions may help us answer this question.

Discussion on the positive relationship to development of our final class of stimulation items, verbal stimulation will be brief. The majority of our measures of verbal stimulation are contained in section IV. The fact that the few verbal stimulation items we have analyzed were positively related to development, and mainly during the latter part of the second year, thus replicating our previous research in this subject (Wachs et al, 1971) is definitely gratifying.

In closing, I would like to make two points. First, I would like to emphasize that the results presented today are only the tip of our data iceberg. Even for our present data a number of crucial analyses remain to be done including breakdowns by sex, multivariate analysis to determine what combinations of items are related to development, and analysis for cumulative or "sleeper" effects. Further, our main body of data, that of section IV is not yet ready for analysis. While I do not believe that these future analyses will negate the general conclusions we have drawn today, I must caution that our current conclusions should be seen as only tentative until all our data is run. Further, the fact that our data is correlational means of course that we must be careful in making causal statements. Clearly, however, there are any number of experimental hypotheses that could be derived from our present data; to many in fact for me to test alone; help would be welcome.

Finally, I must state that in spite of my pessimistic comments earlier in this paper I have recently become more encouraged by the state of the human early experience field. It is not only the pattern of our results that I find encouraging. I am also encouraged by the fact that other researchers in this field are independently utilizing what we have called a Piagetian research strategy and are also beginning to find specific relationships between proximal measures of the environment and specific aspects of early cognitive-intellectual development. If this trend continues, I suspect that within the next decade an answer to the question posed by Freeberg and Payne in 1967: "What can I do to give my child a superior mind" will not be answered in terms of vague generalities like: "Provide maximal environmental enrichment," but rather in terms of specifics. Some of these specifics will come from other fields such as genetics and nutrition; others will come from our own field. Put together, they may give us a model of human cognitive development and the factors that effect it which is both empirically based, and interactive. This possibility, more than any other I find truly encouraging.

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Table 1

Purdue Home Stimulation Inventory

Section I.

VS1* Ask the mother to estimate the number of times per month the child is taken shopping, out of the immediate neighborhood, etc. (to visit relatives, etc.). ________

VS2** Ask the mother to estimate the number of times she and the child visit neighbors. Check the appropriate category:

1. Rarely ______
2. 2-3 times per week ______
3. Almost every day ______

SLS** Ask mother for the number of sibs (or other children living in home) the child has living at home. ______

SLA** Ask mother for the number of adults living at home. ______

VS3** Ask mother for the number of adults (include older sibs) who actively take care of the child (feed, dress, etc.). ______

PI1** Check those categories in which the child is receiving any training:

toileting _____
dressing _____
self-feeding _____
language _____
walking or other motor behavior _____

LS1** Ask mother to estimate the amount of time spent per day reading to the child. (If possible, confirm by observation and note.)

______

EP1 Determine if child has regular naptime or is put down whenever sleepy. Note which ________________________________

EP2 Determine if child is fed supper at regular time or whenever the child seems hungry. Note which ________________________

EP3 Determine if the child has any toys that are exclusively the child's (parents will punish if other sibs take them) ________ If only child, note thus and do not score.

Section II. Items under this category are to be scored through observation of relevant parts of the environment--child's room, etc. Question when observation alone does not yield clear information.

SL2* Home has a place where child can be put where he will be out of earshot of noises of home and away from other people. ________
(If unclear, go into designated room and see for yourself.)

VS4* Home contains newspapers, magazines, or adult books in places where child has free access to them. ________________

VS5** Home has adequate supply (several) of small, manipulatable items (not toys; ashtrays, bric-a-brac, household items):

a. Yes ____; No ____
b. If "Yes," these items are placed where child has access to them ________________

LS2* Rate maternal speech:

1. Speaks very little or speech almost unintelligible ______
2. Average speech pattern or flow ______
3. Talks almost constantly ______

SL3** Obtain the following ratio:

$\frac{\text{\#rooms in the home}}{\text{\#people in the home}}$ = ____________

VS6** Determine the number of children's books in the home ________

CE1** Determine if the child has any toys that make a definite audio-visual response when activated (rattle, musical clowns, pull toys, etc.). If so, give the number and a description of each:

VS7 Determine if the child has a mobile over the crib.__________

VS8 Determine if the child's room or place where he sleeps is decorated with pictures which stand out from the background of the wall. (If there are decorations, note them for the next items.) ________________

VS9 Has there been any change in the decoration of the child's room since the last visit?________________

EP4 Determine if the child's toys are typically kept in one place or scattered all over the home. (Note toys child has in terms of next item). ________________

VS10 Note if child has received any new toys or play objects since the last observation period ________________

VS11 Determine if the set-up of the home is such that the child's view is restricted mainly to the interior (due, for example, to high windows and no way to climb to them, shades or curtains drawn all the time, etc.) of the home. ____________

Section III TIME-SAMPLING OBSERVATIONS. Items in this category are to be rated at the start of the observation period; thereafter, these items are to be rated again at 15-minute intervals during the observation period.

State of the child during the past 15 minutes: (if sleepy and irritable, (score both)

1. Irritable ________
2. Awake active ________
3. Awake passive ________
4. Sleepy ________

SL4* The following stimulus sources are turned on at the time of rating. (If home does not have the above,note):

TV ________
Radio ________
Phonograph ________

SL5* Rate sound level in home over the past 15 minutes:

1. Only human voices ________
2. Human voices or TV, radio, etc, but all at a moderate or low level ________
3. Constant babble of voices or TV or radio, etc., at high intensity but less than half of 15 minute period ________
4. Constant babble of voices or TV or radio, etc., at high intensity for most of rating period ________

SL6* Rate activity level in home over past 15 minutes

1. Slow moving ________
2. Active, but not hurried ________
3. Constant rush, turmoil, but for less than half of 15 minutes________
4. Constant rush, turmoil, etc., for most of 15 minutes ________

VS12** During past 15 minutes, child has spent most of time:

1. Restricted to crib or playpen (jumpseat, etc.); do not count being held and fed ________
2. Unrestricted in motility ________

SL7* Total number of people in house during rating period ________

SL7** Note number of people not in immediate family (i.e.,not living at home) who have been in house during past 15 minutes ________

Table 2

Correlations Between Object Permanence and PHSI Scores Obtained in The Three Months Preceeding Each Test

	Age of Measurement of Object Permanence			
PHSI. Items	15 Months	18 Months	21 Months	24 Months
VS1	-.04	.04	.32	.31
VS2	.03	.10	.28	.08
SLS	-.21	-.02	-.22	-.01
SLA	.02	-.06	.33	.33
VS3	-.46*	.06	.11	.06
PL1	.13	.14	.17	.03
LS1	.14	.30	.24	.16
EP1	.44*	.07	.03	.16
EP2	.37*	.18	-.04	.02
EP3	-.46	-.17	.20	.29
SL2	.26	.06	.43*	.37
VS4	.46**	.34	.25	.40
VS5	.15	-.08	.11	-.08
LS2	.34	-.03	-.00	.04
SL3	.38*	.22	-.06	.24
VS6	.01	-.02	.08	-.06
CE1	.54**	.35*	.35	.47*
VS7	.17	.19	.19	.12
VS8	.24	-.06	.22	.43*
VS9	.02	-.16	.06	.27
EP4	.13	-.02	.19	-.04
VS10	.15	-.06	.42*	.48*
VS11	.24	.28	.43*	-.07
STE	.11	.08	.14	-.08
SL4	-.16	-.32	-.30	-.26
SL5	-.35	-.38*	-.37	-.21
SL6	.06	-.22	.04	.10
VS12	-.11	.08	.42*	.71*
SL7	-.18	-.44**	-.09	.06
SL7A	.02	-.53**	.06	.08

n at 15 months = 30
n at 18 months = 34
n at 21 months = 25
n at 24 months = 21
except for variable EP3
where n 15 = 18
n 18 = 17
n 21 = 13
n 24 = 10

* $P < .05$
** $P < .01$

Table 3

Correlations Between Use of Objects as Means and PHSI Scores Obtained in The Three Months Preceeding Each Test.

	Age of Measurement of Objects as Means			
PHSI. Items	15 Months	18 Months	21 Months	24 Months
VS1	.29	.09	.12	.11
VS2	.12	-.20	-.03	-.09
SLS	.02	.18	-.04	-.01
SLA	.36*	.00	-.11	-.15
VS3	-.01	.14	-.43*	-.11
PI1	.02	.15	.05	.14
LS1	-.08	.20	.32	.10
EP1	.19	.17	.28	.00
EP2	.18	02	-.02	-.10
EP3	.21	-.18	-.35	.39
SL2	.20	.26	.27	.21
VS4	.24	.18	.13	.02
VS5	.07	.10	.42*	-.15
LS2	-.06	-.13	.21	.05
SL3	.19	.07	.24	.14
VS6	-.01	.46**	.20	-.12
CE1	.34	-.07	.05	.20
VS7	-.07	-.29	.04	.18
VS8	.08	.21	.13	.02
VS9	-.05	.13	.12	-.21
EP4	.22	.13	.21	-.12
VS10	.05	-.19	.24	.35
VS11	.09	.27	.47*	-.25
STE	.02	-.02	.09	-.22
SL4	.03	-.04	-.15	-.14
SL5	-.29	-.04	-.11	-.17
SL6	-.31	.11	.38	.12
VS12	.06	-.16	-.28	.26
SL7	-.06	-.13	.24	-.08
SL7A	.08	-.16	.40*	.07

n - Same as in Table 2

* $P < .05$
** $P < .01$

Table 4

Correlations Between Foresight and PHSI Scores
Obtained in The Three Months Preceeding Each Test

	Age of Measurement of Foresight			
PHSI. Items	15 Months	18 Months	21 Months	24 Months
VS1	.19	-.09	.33	.28
VS2	-.02	.04	-.12	-.04
SLS	-.13	.26	-.08	-.22
SLA	.20	-.28	.28	.10
VS3	-.41*	-.30	.11	-.15
PI1	.33	-.17	-.00	-.17
LS1	.05	-.08	.34	.30
EP1	-.05	.21	.01	.08
EP2	.26	.07	.12	-.13
EP3	.25	-.38	.11	.00
SL2	.23	.35*	.51**	.63**
VS4	.33	.19	.18	.00
VS5	.14	.11	.16	-.18
LS2	.07	.04	.33	.20
SL3	-.09	.03	.10	.37
VS6	-.01	.50**	.09	.10
CE1	.14	.37*	.24	.36
VS7	.47**	.22	.37	.08
VS8	-.07	.32	.17	.38
VS9	.02	.02	.21	.36
EP4	.04	.06	.12	-.19
VS10	.04	.10	.49*	.19
VS11	.30	.07	.53**	.06
STE	.10	-.24	.04	.16
SL4	.18	-.11	-.26	-.31
SL5	-.07	-.17	-.48*	-.49*
SL6	-.18	.10	-.00	.18
VS12	.14	.10	.01	.35
SL7	.12	-.14	.19	-.27
SL7A	.05	-.13	.16	-.12

n - Same as in Table 2

* $P < .05$
** $P < .01$

Table 5

Correlations Between Most Dominant Schemes (SD), Highest Level of Schemes Obtained (SL) and PHSI Scores Obtained in The Three Months Preceeding Each Test

Age of Measurement of Schemes

PHSI Items	15 Months SD	15 Months SL	18 Months SD	18 Months SL	21 Months SD	21 Months SL	24 Months SD	24 Months SL
VS1	-.22	.07	-.02	-.03	-.21	.14	.14	.24
VS2	-.10	-.14	-.13	-.21	-.33	-.16	-.07	-.27
SLS	.00	-.08	-.02	-.06	-.06	.10	-.59**	-.59**
SLA	-.25	.06	-.20	.07	-.18	.02	-.14	-.26
VS3	-.08	.20	-.36*	.27	-.04	.19	-.32	-.23
PI1	.33	.09	.03	-.03	-.24	-.11	-.19	-.13
LS1	.00	.26	-.03	.27	.22	.25	.33	.48*
EP1	.29	.12	.12	.04	.17	.09	.34	.34
EP2	.43*	.29	.04	-.14	.30	.73**	.21	.30
EP3	-.25	-.08	-.32	.04	-.62*	-.31	-.56	-.60
SL2	.40*	.09	.17	.30	.26	.49*	.60**	.55**
VS4	.20	.34	-.09	-.08	.15	.55**	-.09	.12
VS5	-.11	-.02	.00	-.06	.42*	.05	.13	.29
LS2	.59**	.34	.28	.14	-.11	.06	.50*	.37
SL3	.17	.08	.16	.39*	.09	.10	.51*	.50*
VS6	.35	.17	.26	.18	.05	.08	-.09	-.12
CE1	.48**	.54**	.20	.26	.22	.46*	.32	.58**
VS7	-.05	-.01	.45**	.27	.23	.28	.39	.39
VS8	.18	.26	.31	.30	-.04	.15	.22	.30
VS9	.21	.36*	.10	.20	-.02	-.02	-.14	-.35
EP4	.05	-.02	.04	-.04	.34	.22	.30	.44*
VS10	.33	.50**	.03	.17	-.06	-.03	.29	.37
VS11	.06	.02	.10	.23	-.03	.19	.38	-.01
STE	-.06	-.00	-.09	-.09	.15	.03	-.07	-.22
SL4	-.41*	-.37*	.23	.15	-.03	-.11	-.11	.04
SL5	-.35	-.40*	.10	-.15	-.11	-.08	-.21	-.14
SL6	.47**	.35	.10	.01	-.03	-.06	.09	.08
VS12	-.09	-.05	-.03	-.13	-.29	-.08	.13	.17
SL7	-.15	-.29	-.04	-.14	.07	-.08	-.53*	-.63**
SL7A	-.28	-.19	-.01	-.13	.16	.07	-.39	-.17

n - Same as in Table 2

* $P < .05$
** $P < .01$

Table 6

Correlations Between Understanding of Causality and PHSI Scores Obtained in The Three Months Preceeding Each Test

	Age of Measurement of Understanding of Causality			
PHSI Items	15 Months	18 Months	21 Months	24 Months
VS1	.26	-.07	.49*	-.39
VS2	.13	.29	.12	.19
SLS	.16	.17	.21	-.25
SLA	.07	-.11	.01	-.32
VS3	-.10	-.08	.35	-.02
PI1	.19	-.16	-.06	.06
LS1	.07	-.13	.15	.19
EP1	-.02	.29	-.10	.03
EP2	.28	-.11	-.05	-.16
EP3	.11	.11	.04	.21
SL2	.13	-.02	.39	.02
VS4	.31	.11	.47*	-.18
VS5	.06	.11	-.24	-.29
LS2	.16	.06	.15	.06
SL3	-.15	-.15	-.01	.40
VS6	.05	-.05	.28	.01
CE1	.47**	.26	.50*	.34
VS7	.48**	.45**	.37	-.07
VS8	.13	.21	.69**	-.17
VS9	.04	.22	.08	-.02
EP4	-.23	-.22	-.08	-.20
VS10	.20	.21	.28	-.03
VS11	.24	.20	.45*	-.29
STE	-.21	-.11	-.04	-.34
SL4	.15	.19	-.22	-.30
SL5	.03	-.01	-.13	-.31
SL6	.21	-.18	.28	-.10
VS12	.23	.21	.37	-.01
SL7	.24	.27	-.02	-.02
SL7A	.23	.22	.33	.18

n - Same as in Table 2

* $P < .05$
** $P < .01$

Table 7

Correlations Between Understanding of Objects in Space and PHSI Scores Obtained in The Three Months Preceeding Each Test

	Age of Measurement of Understanding of Objects in Space			
PHSI Items	15 Months	18 Months	21 Months	24 Months
VS1	-.06	-.01	.26	.13
VS2	-.17	-.26	-.12	-.08
SLS	-.14	.25	.15	-.45*
SLA	-.19	-.04	.31	-.21
VS3	-.39*	.14	.20	-.09
PI1	-.12	-.00	-.11	.03
LS1	-.18	.16	.28	.49*
EP1	.14	.18	-.12	.25
EP2	.03	.06	.23	.11
EP3	-.27	-.27	-.16	-.09
SL2	.31	.38*	.41*	.65**
VS4	.29	.08	.26	.30
VS5	-.15	-.05	-.01	.25
LS2	.23	.05	-.02	.23
SL3	.30	.02	- 10	.57**
VS6	-.13	.27	.13	-.05
CE1	.34	.14	.01	.73**
VS7	.06	-.18	.32	.31
VS8	.13	.29	.36	.31
VS9	-.15	-.01	.22	-.23
EP4	.10	-.07	.13	.32
VS10	.13	-.11	.20	.43*
VS11	.02	.13	.45*	.01
STE	.19	-.27	.11	-.21
SL4	-.22	-.05	-.32	-.06
SL5	-.15	-.23	-.36	-.36
SL6	.10	.20	.10	-.09
VS12	.04	-.11	-.03	.31
SL7	-.34	-.09	.27	-.48*
SL7A	-.30	-.11	.15	.05

n - Same as in Table 1

* $P < .05$
** $P < .01$

Table 8

Correlation Between Level of Verbal Initation (VI), Number of Words Sequentially Imitated (NS) and PHSI Scores Obtained in The Three Months Preceeding Each Test

Age of Measurement of Verbal Imitation

PHSI Items	15 Months VI	15 Months NS[a]	18 Months VI	18 Months NS	21 Months VI	21 Months NS	24 Months VI	24 Months NS
VS1	-.04	-	.05	-.03	-.03	-.08	.15	-.04
VS2	-.25	-	-.19	-.21	-.08	.24	-.07	-.25
SLS	.02	-	-.06	-.07	-.00	.04	-.01	-.06
SLA	.12	-	.24	.12	.28	.25	-.01	-.11
VS3	-.27	-	-.01	.17	.33	.17	-.02	-.15
PI1	.38*	-	.19	.08	.04	.18	-.19	-.25
LS1	.01	-	.18	.29	.07	-.06	.46*	.39
EP1	.35	-	.37*	.39*	-.07	-.16	.17	.18
EP2	.55**	-	.14	.18	-.05	-.03	.23	.29
EP3	-.03	-	-.17	-.45	.17	-.26	.16	-.24
SL2	.26	-	.44**	.33	.08	.10	.09	.16
VS4	.17	-	.02	.02	.08	.22	.21	.20
VS5	.05	-	.16	.29	.33	.22	-.27	-.30
LS2	.30	-	.23	.17	-.03	-.00	.09	.11
SL3	.18	-	.38*	.35*	-.17	-.29	.39	.28
VS6	.11	-	.18	.19	-.03	.21	.39	.36
CE1	.48**	-	.05	.13	.19	.14	.49*	.43
VS7	.27	-	-.27	-.01	.21	-.01	.20	.22
VS8	.16	-	.17	.27	-.05	.04	.23	.21
VS9	.15	-	.13	-.01	27	.45*	.24	.33
EP4	-.16	-	.17	.16	.02	.19	.05	.18
VS10	.22	-	.16	.35*	.22	.28	.00	-.02
VS11	-.02	-	.22	.19	.36	.29	-.30	-.19
STE	-.06	-	-.29	-.04	.33	.39	.22	.08
SL4	.04	-	.02	-.01	-.09	-.11	-.54*	-.32
SL5	.01	-	-.17	-.25	-.16	-.07	-.53*	-.51*
SL6	.38*	-	.16	.18	-.18	-.23	-.18	.05
VS12	.14	-	-.30	-.04	.05	.26	.41	.38
SL7	-.10	-	-.14	.01	.22	.15	.02	-.03
$SL7_A$	-.08	-	-.21	-.04	.24	.11	.00	-.06

n - Same as in Table 1

* P .05
** P .01

a - Subjects did not use sequential imitation at this age level.

Table 9

Correlations Between Level of Gestural Imitation and PHSI Scores Obtained in The Three Months Preceeding Each Test

	Age of Measurement of Gestural Imitation			
	15 Months	18 Months	21 Months	24 Months
VS1	.19	.17	-.03	-.14
VS2	-.09	.04	.01	-.09
SLS	-.13	.07	.12	-.41
SLA	.20	.03	.28	-.04
VS3	-.23	.15	.05	-.19
PI1	-.07	-.03	-.09	-.18
LS1	.09	.18	.20	.29
EP1	-.19	.18	-.04	-.08
EP2	-.25	.02	.22	.15
EP3	-.24	.26	-.19	-.18
SL2	-.06	.14	.05	.12
VS4	.12	.34*	.20	.00
VS5	-.05	.14	.35	-.33
LS2	-.28	.05	-.08	-.06
SL3	.04	.18	.10	.31
VS6	.02	.15	.22	-.11
CE1	.08	.10	.38	.43*
VS7	-.13	-.16	.15	.27
VS8	-.19	.10	.10	.04
VS9	-.14	.19	.23	.18
EP4	.09	.10	.26	.20
VS10	-.04	.04	.29	-.11
VS11	-.12	.29	.18	-.25
STE	.19	-.33	-.21	-.07
SL4	.13	.12	-.16	-.12
SL5	.10	-.11	-.23	-.34
SL6	-.04	.20	.08	-.19
VS12	-.18	-.34*	-.18	.39
SL7	-.09	.00	.36	-.21
SL7A	.04	.05	.42*	-.05

n - Same as in Table 2

* $P < .05$