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ABSTRACT

The popular view among American psychologists has been that there is a continuity of psychological structure that is shaped by early experience. Data gathered in studies of Guatemalan villages imply serious discontinuities in the development of particular cognitive competencies and capacities for affect through preadolescence. The first two years of life are not a good predictor of future functioning in all environmental contexts. Separate maturational factors seem to set the time of emergence of basic cognitive functions, although experience can slow or speed up that emergence to a degree. In the Guatemalan villages observed, infants are permitted very little activity in the first 15 months, are not allowed outside, have little to play with, and are seldom played with. These infants exhibit extreme motoric passivity, but they develop normally in childhood. Identical procedures involving color and movement were administered to American and Guatemalan infants. Guatemalan infants were significantly less attentive than the Americans, and Americans had longer fixation times. To test the reversibility of the apparent slowing of cognitive growth in the Guatemalan child, cognitive tests were administered to rural and urban middle-class and economically disadvantaged preadolescents. Their performance on tests of perceptual analysis, perceptual inference, recall and recognition memory was comparable to American middle-class norms. Certain data suggest that economically disadvantaged American and Guatemalan children aged 5-9 are from one to three years behind middle-class children in demonstrating some cognitive skills but that these competencies emerge by age 10 or 11. (KM)

CROSS-CULTURAL PERSPECTIVES ON EARLY DEVELOPMENT[1]

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Most American psychologists believe in the hardiness of habit and the premise that experience etches an indelible mark on the mind not easily erased by time or trauma. The application of that assumption to the first era of development leads to the popular view that psychological growth during the early years is under the strong influence of the variety and patterning of external events and that the psychological structures shaped by those encounters have a continuity that stretches at least into early adolescence. This hypothesis, which owes part if its popularity to Freud and Piaget, is neatly contained in the American adage, "Well begun is half done."

I was certain of the unshakable truth of that ideological position and set out to find the form of those initial stabilities and the earliest time one might obtain a preview of the child's future. I have spent fifteen years in that search and although I have uncovered fragile lines that seem to travel both backward and forward in time, the breadth and magnitude of those continuities are not overwhelming, and each seems to be easily lost or shattered (Kagan and Moss, 1962). I rationalized the modest empirical support for continuity by arguing that although behaviors similar in manifest form might not be stable over long time periods, the underlying structures might be much firmer (Kagan, 1971). Hence, if

the operational manifestations of those hidden forms were discerned, continuity of cognitive, motivational, and affective structures would be affirmed. Then I observed some children living in an isolated Indian Village on Lake Atitlan in the highlands of northwest Guatemala. I saw listless, silent, apathetic infants; passive, quiet, timid 3 year olds; but active, gay, intellectually competent 11 year olds. Since there is no reason to believe that living conditions in this village have changed during the last century, it is likely that the alert 11 year olds were, a decade earlier, listless, vacant-staring infants. That observation has forced me to question the strong form of the continuity assumption in a serious way.

The data to be presented imply serious discontinuities in the development of particular cognitive competences and capacities for affect from infancy through preadolescence. The first two years of life are not a good predictor of future functioning in all environmental contexts. The specification of the context of early growth is critical to the continuity question. Consider the long-term stability of passivity as an example.

The vast majority of the infants in the Indian village were homogeneously passive and retained this characteristic until they were 5 or 6 years old. A preschool child rarely forced a submissive posture on another. However, by 8 years of age, some of the children had to assume a dominant position

because the structure of the peer group required that role to be filled. Factors other than early infant passivity were critical in determining that differentiation. Physical size, strength, competence at peer and adult valued skills were more important than the infant's disposition. In modern American society, there is much greater variation among young children in degree of passivity and dominance. Hence, a passive 4 year old will always encounter a large group of dominant peers who enforce a continuing role of submissiveness on him. As a result, there will be firmer stability of behavioral passivity during the first years in an American city than in the Indian village. But the stability of that behavior is more dependent on the presence of dominant members in the immediate vicinity than on some inherent force within the child.

Continuity of a psychological disposition is not the product of some neurological structure residing in the person, separate from external pressures. The small group of scientists who champion stability -- I have been among them -- envision a small box of different colored gems tucked deep in the brain with names like intelligent, passive, irritable, or withdrawn engraved upon them. These material entities guarantee that, despite behavioral disguises, an inherent set of psychological qualities, independent of the local neighborhood and knowable under the proper conditions, belongs to

each individual. This belief in a distinct and unchanging mosaic of core traits -- an identity -- is fundamental to Western thought and is reflected in the psychological writings of Erik Erikson and the novels of popular Western writers. Only Herman Hesse, among the more gifted modern Western novelists, fails to make a brief for personal identity. Siddartha, Magister Ludi, and Narcissus and Goldmund are not trying to discover "who they are," but are seeking serenity. Each appreciates the relevance of setting in that journey. Hesse's prejudice for the philosophy of the East is likely to be one reason for his awarding secondary status to the identity theme.

A secondary theme concerns the differential, complementary influences of maturation and environment, an issue that has seized academic conversation because of the renewed debate surrounding the inheritance of intelligence. But there is a broader issue to probe. The majority of American psychologists remain fundamentally Lockean in attitude, believing that thought and action owe primary allegiance to experience and that reinforcements and observations of models set the major course of change. Despite Piaget's extraordinary popularity, the majority of American psychologists do not believe that maturation supplies the major impetus for psychological growth. We have forgotten that many years ago Myrtle McGraw (1935) allowed one twin to climb some stairs

and prevented his co-twin from practicing that skill. This homely experiment occurred only a few years after Carmichael (1926) anesthetized some Amblystoma embryos to prevent them from swimming. The twin not allowed to climb was behind his partner in learning this skill, but he eventually mastered it. Carmichael's embryos swam perfectly when the anesthetic was pumped out of the tank. In both instances the organisms could not be prevented from displaying species specific properties.

My observations in these Indian villages have led me to reorder the hierarchy of complementary influence that biological and environmental forces exert on cognitive development. Separate maturational factors seem to set the time of emergence of basic functions. Experience can slow down or speed up that emergence by several months or three to four years, but nature will win in the end. The capacity for perceptual analysis, imitation, inference, language, deduction, symbolism, and memory will eventually appear in sturdy form, for each is an inherent competence in the human program.

The Guatemalan Settings

The observations to be reported were made in several settings in Guatemala. One set of data came from three subsistence farming mestizo villages in eastern Guatemala. The villages are moderately isolated, Spanish-speaking, and contain between 800 and 2500 inhabitants. The families live in

small thatched huts of bamboo or adobe with a dirt floor and no separate sanitary facilities. Books, pencils, paper, pictures are typically absent from the experience of children prior to school entrance and, even in school, the average child has no more than a thin lined notebook and a stub of a pencil.

A second location was a more isolated Indian village of 850 people located on the shores of Lake Atitlan in the northwest mountainous region of the country. Unlike the Spanish-speaking villages, the Indians of San Marcos have no easy access to a city and are psychologically more detached. The isolation is due not only to geographical location but also to the fact that few of the women and no more than half of the men speak reasonable Spanish. Few adults and no children can engage the culture of the larger nation, and the Indians of San Marcos regard themselves as an alien and exploited group.

The infant in San Marcos. During the first 10 to 12 months the San Marcos infant spends most of his life in the small, dark interior of his hut. Since women do not work in the field, the mother usually stays close to the home and spends most of her day preparing food--typically tortillas, beans, and coffee--and perhaps doing some weaving. If she travels to a market to buy or sell, she typically leaves her infant with an older child or relative. The infant is usually close

to the mother, either on her lap or enclosed on her back in a colored cloth, sitting on a mat, or sleeping in a hammock. The mother rarely allows the infant to crawl on the dirt floor of the hut and feels that the outside sun, air, and dust are harmful.

The infant is rarely spoken to or played with, and the only available objects for play, besides his own clothing or his mother's body, are oranges, ears of corn, and pieces of wood or clay. These infants are distinguished from American infants of the same age by their extreme motoric passivity, fearfulness, minimal smiling, and, above all, extraordinary quietness. A few with pale cheeks and vacant stares had the quality of tiny ghosts and resembled the description of the institutionalized infants Spitz called marasmic. Many would not orient to a taped source of speech, not smile or babble to my vocal overtures, and hesitate over a minute before reaching for an attractive toy.

An American woman who lived in the village made five separate 30-minute observations in the home on 12 infants 8 to 16 months of age. If a particular behavioral variable occurred during a 5-second period it was checked once for that interval. The infants were spoken to or played with 6 percent of the time, with a maximum of 12 percent. The comparable averages for American middle class homes are 25 percent

with a maximum of 40 percent (Lewis and Freedle, 1972). It should be noted that the infant's vocalizations, which occurred about 6 percent of the time, were typically grunts lasting less than a second and not the prolonged babbling typical of middle class American homes. The infants cried very little because the slightest irritability led the mother to nurse her child at once. Nursing was the single, universal therapeutic treatment for all infant distress, be it caused by fear, cold, hunger, or cramps. Home observations in the eastern villages are consonant with those gathered in San Marcos and reveal infrequent infant vocalization and little verbal interaction or play with adults or older siblings. The mothers in these settings seem to regard their infants the way an American parent views an expensive cashmere sweater -- keep it nearby and protect it but do not engage it reciprocally.

One reason why these mothers might behave this way is that it is abundantly clear to every parent that all children begin to walk by 18 months, to talk by age three, and to perform some adult chores by age ten, despite the listless, silent quality of infancy. The mother's lack of active manipulation, stimulation, or interactive play with her infant is not indicative of indifference or rejection, but is a reasonable posture given her knowledge of child development.

Comparative Study of Cognitive Development

Although it was not possible to create a formal laboratory setting for testing infants in San Marcos, it was possible to do so in the eastern mestizo villages and we shall summarize data derived from identical procedures administered to rural Guatemalan and American infants. Although the infants in the mestizo villages were slightly more alert than the Indian children of San Marcos, the similarities in living conditions and rearing practices are such that we shall assume that the San Marcos infants would have behaved like the mestizo children. In these experiments the Guatemalan mother and child came to a special laboratory equipped with a chair and a stage that simulated the setting in our Harvard laboratories where episodes were administered to cross sectional groups of infants — 84 American and 80 Guatemalan at 5 1/2, 7 1/2, 9 1/2, and 11 1/2 months of age, with 10 to 24 infants from each culture at each age level.

Before describing the procedures and results it will be helpful to summarize the theoretical assumptions that govern interpretation of the infant's reactions to these episodes. There appear to be two important maturationally controlled processes that emerge between 2 and 12 months that influence the child's reactions to transformations of an habituated event (Kagan 1971, 1972). During the first six weeks of life the duration of the child's attention to a visual event is

controlled by the amount of physical change or contrast in the event. During the third month the infant shows prolonged attention to events that are moderate discrepancies from habituated standards. Maintenance of attention is controlled by the relation of the event to the child's schema for the class to which that event belongs. The typical reactions to discrepancy include increased fixation time, increased vocalization, and either cardiac deceleration or decreased variability of heart rate during the stimulus presentation. These conclusions are based on many independent studies and we shall not document them here (Cohen, Gelber and Lazar, 1971; Kagan 1971; Lewis, Goldberg and Campbell 1970).

However, at approximately 8 to 9 months a second process emerges. The infant now begins to activate cognitive structures, called hypotheses, in the service of interpreting discrepant events. A hypothesis is viewed as a representation of a relation between two schemata. Stated in different language, the infant not only notes and processes a discrepancy, he also attempts to transform it to his prior schemata for that class of event and activates hypotheses to serve this advanced cognitive function. It is not a coincidence that postulation of this new competence coincides with the time when the infant displays object permanence and separation anxiety, phenomena that require the child to activate an idea of an absent object or person.

There are two sources of support for this notion. The first is based on age changes in attention to the same set of events. Regardless of whether the stimulus is a set of human masks, a simple black and white design, or a dynamic sequence in which a moving orange rod turns on a bank of three light bulbs upon contact, there is a U shaped relation between age and duration of attention across the period three through thirty-six months, with the trough typically occurring between 7 and 10 months of age (Kagan, 1972).

The curvilinear relation between age and attention to the human masks has been replicated among American, rural Guatemalan, and Kahlahari desert Bushman children (Kagan 1971; Konnor 1973). If discrepancy were the only factor controlling fixation time a child's attention should decrease with age, for the stimulus events are becoming less discrepant as he grows older. The increase in attention toward the end of the first year is intepreted as a sign of a new cognitive competence, which we have called the activation of hypotheses.

A second source of support for this idea is that the probability of a cardiac acceleration to a particular discrepancy increases toward the end of the first year; whereas, cardiac deceleration is the modal reaction during the period two through eight months of age (Kagan, 1972). Since studies with both adults and young children indicate that cardiac acceleration is likely to accompany mental work, while

deceleration is likely to accompany attention to an interesting event (Lacey, 1967; van Hover, 1971), the appearance of acceleration toward the end of the first year implies that the infants are performing active mental work, or activating hypotheses.

Since increased attention to a particular discrepancy toward the end of the first year is one diagnostic sign of the emergence of this stage of cognitive development, cultural differences in pattern of attention to fixed discrepancies could provide information on the developmental maturity of the infants in each cultural group.

Method

Block Episode. Each child was shown a two inch wooden orange block for six or eight successive trials (6 for the two older ages, and 8 for the two younger ages) followed by three or five transformation trials in which a 1 1/2 inch orange block was presented. These transformations were then followed by three representations of the original two inch block.

Light Episode. The child was shown eight or ten repetitions of a sequence in which a hand moved an orange rod in a semi-circle until it touched a bank of three light bulbs which were lighted upon contact between the rod and the bulbs. In the five transformation trials that followed,

the hand appeared but the rod did not move and the lights lit after a four second interval. [illegible]g the transformations, the original event was presented [illegible]e [illegible]itional trials.

During each of the episodes, two observers coded (1) how long the infant attended to the event, (2) whether the infant vocalized or smiled, and (3) fretting or crying. Inter-coder reliability for these variables was over 0.90.

Results

The Guatemalan infants were significantly less attentive than the Americans on both episodes and the cultural differences were greater at the two older than at the two younger ages. Figures 1 and 2 illustrate the mean total fixation time to four successive trial blocks for the two episodes. The four trial blocks were: first three standard trials, last three standards, first three transformations and the three return trials.

Insert Figures 1 and 2 here

The American infants of all ages had longer fixation times to the Block during every trial block (F ranged from 30.8 to 67.3, $p < .001$, df = 1/154). The American infants also displayed longer fixations to the Light during every trial block (F ranged from 9.8 to 18.4, $p < .01$, df = 1/141). It is important to note that the American 9 1/2 and 11 1/2 month olds maintained more sustained attention to the return of the standard than the Guatemalans, who showed a sharp drop in fixation time toward the end of the episode. These data suggest that more of the American than of the Guatemalan infants had entered the stage of activation of hypotheses. Since the mestizo infants appeared more mature than the San Marcos children, it is possible that the American infants were 3 to 4 months

advanced in cognitive function over the San Marcos children during the first year and a half of life. This conclusion is in accord with other observations on the San Marcos children indicating that stranger anxiety and object permanence appeared 3 to 4 months later in the San Marcos infants than in American children.

Plasticity of Cognitive Development

The second theme of this paper centers on the plasticity of intellectual development, on the potential for recovery rather than the retardation of the rural Guatemalan infant. How reversible is the apparent slowing of cognitive growth in the Guatemalan child? When the San Marcos child becomes mobile at around fifteen months he leaves the dark hut, plays with other children, and provides himself with cognitive challenges that demand accommodations. Since all the children experience this marked discontinuity in variety of experience between the first and second birthday, it is of interest to compare the competence of the older Guatemalan and American children to determine if differences are still present.

Tests of recall and recognition memory, perceptual analysis, and perceptual and conceptual inference were given to children in San Marcos, the eastern mestizo villages, and two different groups of children from Guatemala City. One of the Guatemala City settings, the "guarderia," was a

day care center for very poor children. The second group, middle class children attending nursery school, resembled a middle cl... merican sample in both family background and opportun... Not all tests were administered to all children, but the data permit several generalizations. The discussion is organized according to the cognitive function assessed, rather than the sample studied. The sample sizes range from 12 to 40 children at any one age.

Recall memory for familiar objects. The ability to organize experience for commitment to long term memory and to retrieve that information on demand is a basic cognitive skill. It is generally believed that the form of the organization contains diagnostic information regarding cognitive maturity for, among Western samples, both number of independent units of information as well as the conceptual clustering of that information increase with age.

A 12 object recall task was administered to two samples of Guatemalan children. One group lived in a mestizo village 17 kilometers from Guatemala City; the second group was composed of the Indian children of San Marcos. The 80 subjects form the mestizo village were 5 and 7 years old, equally balanced for age and sex. The 55 subjects from San Marcos were between 5 and 12 years of age (26 boys and 29 girls).

The twelve miniature objects to be recalled were common to village life and belonged to three conceptual categories:

animals (pig, dog, horse, cow); kitchen utensils (knife, spoon, fork, glass); and clothing (pants, dress, underpants, hat). Each child was first required to name the objects and [illegible] child was unable to he was giver the name. The child was then told that after the objects had been arranged he would have 10 seconds to inspect them, after which they would be covered with a cloth, and he would be required to say all the objects he could remember.

Table 1 contains the average number of objects recalled and the number of pairs of conceptually similar words recalled -- an index of clustering -- for the first two trials. A pair was defined as the temporally contiguous recall of two or more items of the same category. A child received one point for reporting a pair of contiguous items, two points for three contiguous items, and three points for all four contiguous items. Hence the maximal clustering score for a single trial was 9 points. As Table 1 reveals most children showed a level of clustering beyond chance expectation -- between 3 and 4 points -- and both recall and clustering increased with age.

Insert Table 1 here

No 5 or 6 year old in either village and only 12 of the 40 - 7 year olds in the mestizo village were attending school. School for the others consisted of little more than semi-organized games. Moreover, none of the children in

San Marcos had ever left the village, and the 5 and 6 year olds typically spent most of the day within a 500 yard radius of their homes. Hence, school attendance and contact with books and a written language do not seem to be prerequisites for clustering in young children.

The recall and cluster scores obtained in Guatemala were remarkably comparable to those reported for middle class American children. Appel, Cooper, McCarrell, Knight, Yussen and Flavell, (1971) presented 12 pictures to American children in Grade 1 (approximately age 7), and 15 pictures to children in Grade 5 (approximately age 11) in a single trial recall task similar to the one described here. The recall scores were 66 percent for the 7 year olds and 80 percent for the 11 year olds. These values are almost identical to those obtained in both Guatemalan villages. The cluster indices were also comparable. The American 7 year olds had a cluster ratio of 0.25; the San Marcos 5 and 6 year olds had a ratio of 0.39.[2]

Recognition Memory. The cultural similarity in recall also holds for recognition memory. In a separate study 5, 8, and 11 year old children from mestizo villages in the east and Cambridge, Massachusetts were shown 60 pictures of objects, some familiar and some unfamiliar. After 0, 24, or 48 hours delay each child was shown 60 pairs of pictures, one of which was old and the other new, and asked to decide which one he had seen. Although the 5 and 8 year old Americans performed significantly better than the Guatemalans, there was no cultural difference for the 11 year olds, whose scores ranged from 85 to 98 percent after 0, 24, or 48 hours delay (Kagan, Klein,

Haith and Morrison, in press) (See Table 2).

Insert Table 2 Here

A similar result was found on a recognition memory task for 32 photos of faces, balanced for sex, child versus adult and Indian versus Caucasian, administered to 35 American and 38 San Marcos children 8 to 11 years of age. Each child initially inspected 32 chromatic photographs of faces, one at a time, in a self-paced procedure. Each child's recognition memory was tested by showing him 32 pairs of photographs (each pair was of the same sex, age, and ethnicity), one of which was old and the other new. The child had to state which photograph he had seen during the inspection phase. Although the American 8 and 9 year olds performed better than the Guatemalans (82 versus 70 per cent) there was no significant cultural difference among the ten and eleven year olds (91 versus 87 per cent). Moreover, there was no cultural difference in any age for the highest performance attained by a single child.[3] The favored interpretation of the poorer performance of the younger children in both recognition memory studies is that some of them did not completely understand the task, and others did not activate the proper problem-solving strategies during the registration and retrieval phases of the task.

It appears that recall and recognition memory are basic cognitive functions that seem to mature in a regular way in any natural environment. The intellectual retardation

observed during the first year does not have any serious predictive validity for these important domains of cognitive functioning for children ten to eleven years of age.

Perceptual analysis. The Guatemalan children were also capable of solving difficult Embedded Figures Test problems. The test consisted of twelve color drawings of familiar objects in which a triangle had been embedded as part of the object. The child had to locate the hidden triangle and place a black paper triangle so that it was congruent with the design of the drawing. The test was administered to rural Indian children from San Marcos, as well as another Indian village, the mestizo villages, and two groups residing in Guatemala City.

The Guatemala City middle class children had the highest scores and, except for San Marcos, the rural children the poorest. The surprisingly competent performances of the San Marcos children are due, we believe, to the more friendly conditions of testing. This suggestion is affirmed by the fact that an independent attempt to test rural 5-year-old children under unusually optimal circumstances raised their scores on this test. (See Figure 3.)

Insert Figure 3 here

Although the rural 5- and 6-year-olds were about three years behind the middle class Guatemala City children, their growth curves had similar slopes. It is important to note that no 5- or 6-year-old was completely incapable of solving some of these problems. The village differences in mean

score reflect the fact that the rural children had difficulty with two or three of the harder items. This was the first time that many rural children had ever seen a two-dimensional drawing and most of the 5, 6, and 7 year olds in San Marcos had no opportunity to play with books, paper, pictures, or crayons. Nonetheless, these children solved seven or eight of the test items. Investigators who have suggested that prior experience with pictures is necessary for efficient analysis of two dimensional information may have incorrectly misinterpreted failure to understand the requirements of the problem with a deficiency in cognitive competence. This competence seems to develop in the world of moving leaves, chickens, and water. As with recall and recognition memory, the performance of the San Marcos child was comparable to that of his age peer in a modern urban setting.

Perceptual inference. The competence of the San Marcos children on the perceptual analysis test is affirmed by their performance on a test administered in San Marcos and Cambridge and called Perceptual Inference. The children (60 American and 55 Guatemalan, 5 to 12 years of age) were shown a schematic drawing of an object and asked to guess what that object might be if the drawing were completed. The child was given a total of four clues for each of 13 items, where each of the clues added more information. The child had to guess an object from an incomplete illustration, to make an inference from minimal information (see Figures 4 and 5).

Insert Figures 4 and 5 here

There was no significant cultural difference for the children 7 to 12 years of age. In San Marcos, performance improved from 62 per cent correct on one of the first two clues for the 5 and 6 year olds to 77 per cent correct for the 9 to 12 year olds. The comparable changes for the American children were from 77 to 84 per cent. (See Figure 6).

Insert Figure 6 here

Familiarity with the test objects was critical for success. All the San Marcos children had seen hats, fish and corn and these items were rarely missed. By contrast, the American children often failed these items. No San Marcos child not attending school, and therefore unfamiliar with books, correctly guessed the book items; whereas, most of those in school guessed it correctly. As with memory and perceptual analysis, the retardation seen during infancy did not predict comparable retardation in the ability of the 11 year old to make difficult perceptual inferences.

Conceptual inference. The San Marcos child also performed well on questions requiring conceptual inference. In this test, the child was told verbally three characteristics of an object and required to guess the object. Some of the examples included: what has wings, eats chickens, and lives in a tree; what moves trees, cannot be seen, and makes one cold; what is

made of wood, is used to carry things and allows one to make journeys. There was a regular increase in quality of performance with age. The 5 and 6 year olds obtained an average of 9 out of 14 correct, and the 11 and 12 year olds obtained 12 out of 14 correct. The San Marcos child was capable of making relatively difficult inferences, be they perceptual or conceptual.

Motivation: Draw a line slowly. One of the tests measured motivation, rather than a combination of competence and motivation. The child, after demonstration and practice, was asked to draw a line on two separate trials. This was the only task on which the Guatemala City middle class children did not perform "as well" as the rural children, where "well" means in accord with the requirements of the test. But this is a boring test for young children, and the more autonomous Guatemala City children were not highly motivated to conform to the examiner's request. The rural children, by contrast, were more afraid of authority and since they were more conforming to adult requests, produced slow speeds. The children who had the least satisfactory relation with authority, those living in the institutional setting, had the fastest speeds.

Discussion

The major implications of this corpus of data is that there must be major discontinuities in cognitive development. Retardation in the time of emergence of important cognitive functions during infancy is not highly predictive of serious deficit on memory, perception, and inferential abilities

during preadolescence. Although the rural Guatemalan infants were moderately to severely retarded with respect to activation of hypotheses and general alertness, the preadolescents were remarkably competent in both absolute and relative terms. Performance on the tests of perceptual analysis, perceptual inference, recall and recognition memory were comparable to American middle class norms. Infant retardation seems to be reversible, and cognitive development during the early years more plastic than had been supposed.

Although the Guatemalan children were two to three years behind the American children on some tests during the period 5 through 9 years of age, rate of improvement in performance was equivalent among all the samples, and by age 11, the rural Guatemalan child was performing at levels comparable to American and Guatemala City middle class youngsters.

A consideration of why the rural Guatemalan children lagged behind the Americans on some tests during the period 5 through 9 years of age comprises a second implication of these data. It will be recalled that on the embedded figures test and the recognition memory test the performance of rural children was several years behind both the American and Guatemala City middle class children. The differences were minimal for the object recall and perceptual inference tests. The approximately three year lag in performance is paralleled by comparable differences between lower class and middle class children in urban Western cities. For example, Bosco (1972)

found that middle class first and third graders were able to tolerate smaller interstimulus intervals in a backward masking procedure than lower class children, but this difference had vanished among sixth grade children. We interpret this result to indicate that the lower class children were not able to mobilize the research strategies necessary to solve this task, but achieved that level of maturity by the time they were eleven years of age. Similarly Bakker (1971) compared good and poor readers from urban centers in Holland on a task that required operating simultaneously on two items of information in a temporal integration task. The poor readers performed less well than the good readers at ages 6 to 8, but were comparable to the good readers during the preadolescent years.

These data have implications for America's educational problems. There is a tendency to regard the poor test performances of economically impoverished minority group 6 year olds in the United States as indicative of a permanent and, perhaps, irreversible defect in intellectual ability - as a difference in quality of function rather than slower maturational rate. These data, together with those of Bosco and Bakker, suggest that children differ in the age at which basic cognitive competences emerge and that experiential factors influence the time of emergence. Economically disadvantaged children from rural and urban areas appear to be from one to

three years behind middle class children in demonstrating some of the executive problem solving skills characteristic of Piaget's stage of concrete operation. But these competences eventually appear in sturdy form by age ten or eleven. The common practice of arbitrarily setting seven years--the usual time of school entrance--as the age when children are to be classified as competent or incompetent confuses differences in maturational rate with permanent, qualitative differences in intellectual ability. This practice is as logical as classifying children as permanently sexually potent or impotent depending on whether or not they have reached physiological puberty by their thirteenth birthday. When educators note that poor children tend to remain permanently behind middle class children on intellectual skills they are referring to a relative retardation due to the rank ordering of children on academic achievement. That statement does not imply that poor children are not growing intellectually at the same rate as economically advantaged ones.

The suggestion that cognitive competences emerge at different times and retain plasticity until a late age is not substantially different from Dennis' report of fifteen years ago. Although the infants living in poorly staffed Lebanese institutions were retarded on developmental test items, the 5 year olds who had resided in the same institutions performed normatively on memory tests (Dennis, 1957). Hence the present Guatemalan data are not the first of their kind

to be reported. Their importance derives from the fact that the San Marcos 11 year olds performed so well, considering the homogeneity and isolation of their environment. Additionally, there is a stronger feeling now than there was in the 1950s that environmentally produced retardation during the first two years may be irreversible, even though the empirical basis for that belief is no firmer in 1972 than it was in 1957.

Environmental experiences exert a non-trivial influence on intellectual development. But that influence seems to be more reversible and more temporary than many have surmised. Further support for the notion that cognitive development is malleable comes from recent experimental studies by Harlow and his colleagues. Several years ago Harlow's group demonstrated that although monkeys reared in isolation for the first six months displayed abnormal and often bizarre social behaviors they could, if the experimenter were patient, solve the complex learning problems normally administered to feral born monkeys. The prolonged isolation did not destroy their cognitive competence (Harlow, Schlitz and Harlow, 1969). More recently, Suomi and Harlow (1972) have shown that even the stereotyped and bizarre social behavior shown by 6 month isolates can be altered by placing them with female monkeys three months younger than themselves over a 26 week therapeutic period. "By the end of the therapy period the behavioral levels were virtually indistinguishable from those of the socially competent

therapist monkeys." (Suomi and Harlow, 1972, p. 491). If the extreme behavioral sequellae of isolation can be altered by less than 7 months of experience, it is not difficult to believe that the San Marcos infant is capable of as dramatic a recovery.

These data suggest that exploration of the new and the construction of objects or ideas from some prior schematic blueprint must be inherent properties of mind. The idea that the child carries with him at all times the essential mental competence to understand the new in some terms and to make a personal contribution to each new encounter is only original in our time. Despite the current popularity of Kant and Piaget, the overwhelming prejudice of Western psychologists is that higher order cognitive competences and personality factors are molded by the environment. Locke's image of an unmarked tablet on which senation played its patterned melody had a parallel in Darwin's failure to realize, until late in his life, that the organism made a contribution to his own evolution. Darwin was troubled by the fact that the same climate on different islands in the Galapagos produced different forms of the same species. Since he believed that climatic variation was the dynamic agent in evolution he was baffled. He did not appreciate that the gene was the organism's contribution to his own alteration. Western psychologists have been blocked by the same prejudice that prevented young Darwin from solving his riddle. From Locke to Skinner we have viewed the perfectibility

of man as vulnerable to the vicissitudes of the objects and people who block, praise, or push him, and resisted giving the child any compass of his own. The mind, like the nucleus of a cell, has a plan for growth and can transduce a new flower, an odd pain, or a stranger's unexpected smile into a form that is comprehensible. This process is accomplished through wedding cognitive structures to selective attention, activation of hypotheses, assimilation, and accommodation. The purpose of these processes is to convert an alerting unfamiliar event, incompletely understood, to a recognized variation on an existing familiar structure. This is accomplished through the detection of the dimensions of the event that bear a relation to existing schemata and the subsequent incorporation of the total event into the older structure.

We need not speak of joy in this psychological mastery, for neither walking nor breathing are performed in order to experience happiness. These properties of the motor or autonomic systems occur because each physiological system or organ naturally exercises its primary function. The child explores the unfamiliar and attempts to match his ideas and actions to some previously acquired representation because these are basic properties of mind. The child has no choice.

The San Marcos child knows much less than the American about planes, computers, cars, and many hundreds of other phenomena that are so familiar to the Western youngster, and he is a little slower in developing some of the basic cognitive

competences of our species. But neither appreciation of these events nor the earlier cognitive maturation are necessary for a successful journey to adulthood in San Marcos. The American child knows f r less about how to make canoes, rope, tortillas, or how to burn an old m lpa in preparation for June planting. Each knows what is necessary and each assimilates the cognitive conflicts that are presented. Moreover, each seems to have the potential to display more talent than his environment demands of him. There are few dumb children in the world if one classifies them from the perspective of the community of adaptation, but millions of dumb children if one classifies them from the perspective of another society.

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Table 1

Mean number of objects and pairs recalled

Mestizo village

	Trial 1		Trial 2	
Age	Recall	Pairs	Recall	Pairs
5	5.2	2.1	5.4	2.1
7	6.7	3.3	7.8	3.7

Indian village

	Trial 1		Trial 2	
Age	Recall	Pairs	Recall	Pairs
5-6	7.1	3.4	7.8	3.8
7-8	8.6	3.4	8.3	3.6
9-10	10.3	4.9	10.3	4.3
11-12	9.6	3.4	10.1	3.6

Table 2

Mean Percent of Correct Responses

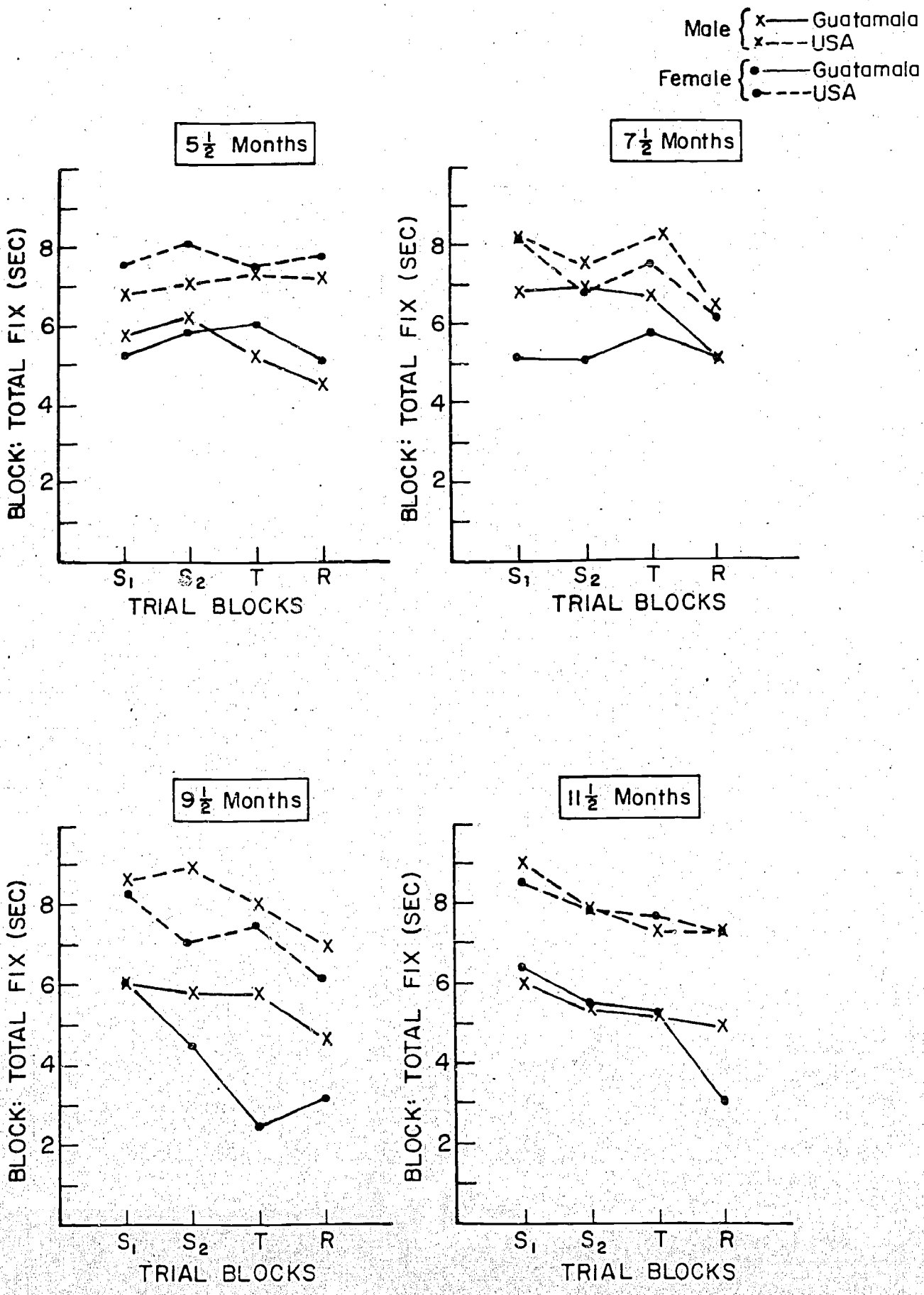
	Americans			Guatemalans		
	Age			Age		
Delay	5	8	11	5	8	11
0	92.8	96.7	98.3	58.4	74.6	85.2
24 hrs	86.7	95.6	96.7	55.8	71.0	87.0
48 hrs	87.5	90.3	93.9	61.4	75.8	86.2

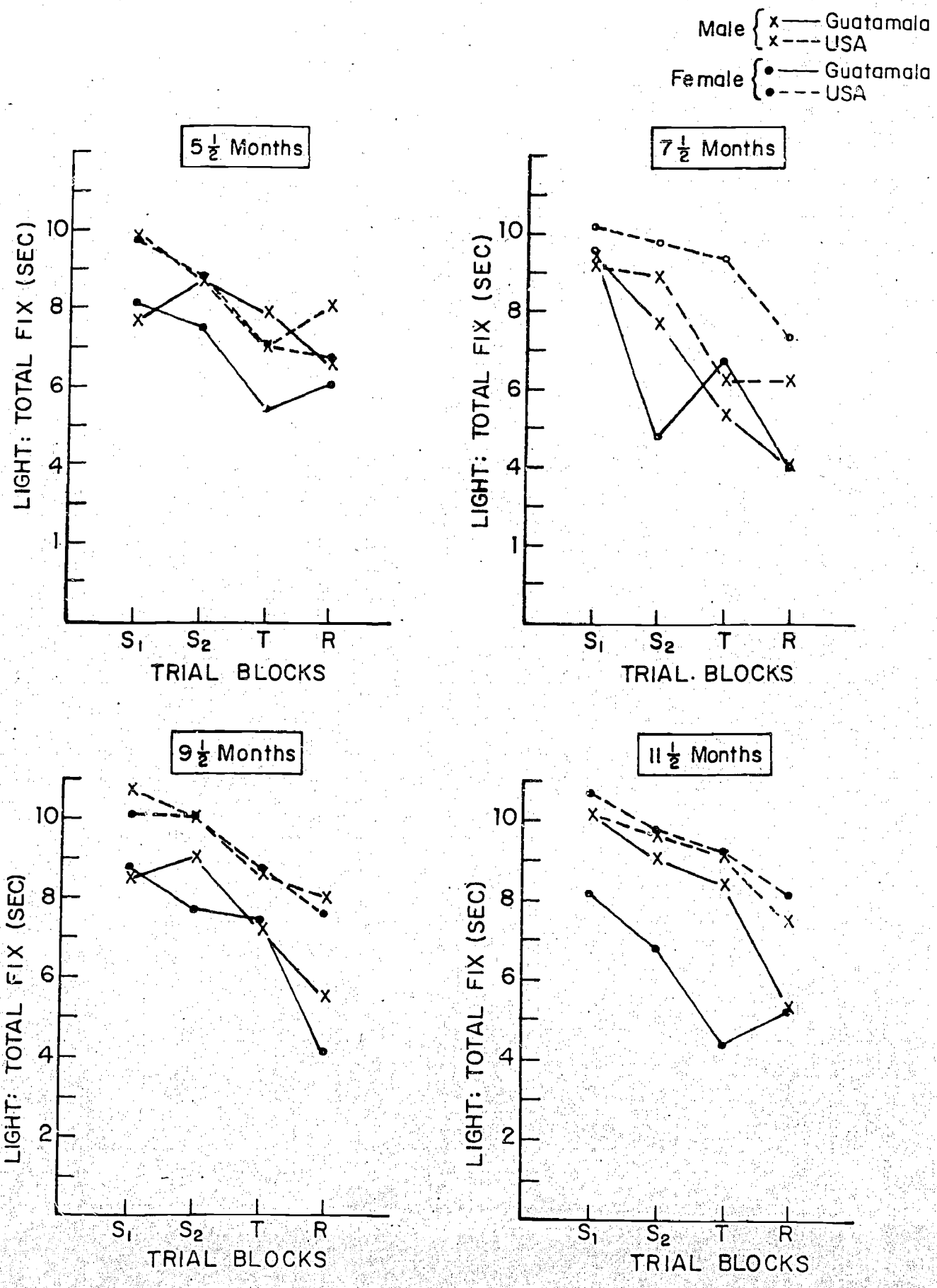
Footnotes

1. This paper was presented as an invited address to the Annual Meeting of the American Association for the Advancement of Science, Washington, D. C., on December 26, 1972.
This research was conducted while the author held a Belding Fellowship awarded by the Association for the Aid of Crippled Children, New York City, for the 1971-1972 academic year. The empirical data were gathered as part of a continued collaboration with Dr. Robert E. Klein, INCAP, Guatemala City. Special thanks are due Martha Julia Sellers, Stephen Sellers, and Lisa Shulman for their participation. Dr. Klein's work is supported by contract number PH 43-65-640 from the National Institute of Child Health and Human Development. Portions of the work were also supported, in part, by grants to the author from the Carnegie Corporation of New York, National Institute of Child Health and Human Development, grant number HD-04299, and grant number GS-33048, Collaborative Research on Uniform Measures of Social Competence, the National Science Foundation.
2. The cluster index is the ratio of the number of pairs recalled to the product of the number of categories in the list times one less than the number of words in each category.
3. These photographs were also used in an identical procedure with 12 Kipsigis-speaking 10 and 11 year olds from a rural village in eastern Kenya. Despite the absence of any black faces in the set, the percent of items recognized correctly was 82 percent for this group of African children.

Figure Captions

1. Average total fixation time to the Block episode by age and culture.
2. Average total fixation time to the Light episode by age and culture.
3. Mean number correct on the Embedded Figures Test.
4. Sample item from the Perceptual Inference Test.
5. Sample item from the Perceptual Inference Test.
6. Number correct on the Perceptual Inference Test.


Male x—— Guatamala
x--- USA
Female •—— Guatamala
•--- USA
5½ Months
7½ Months
9½ Months
11½ Months
BLOCK: TOTAL FIX (SEC)
2
4
6
8
S1
S2
T
R
TRIAL BLOCKS


Male x—— Guatamala
x--- USA
Female •—— Guatamala
•--- USA
5½ Months
7½ Months
9½ Months
11½ Months
LIGHT: TOTAL FIX (SEC)
TRIAL BLOCKS
S1 S2 T R
1
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4
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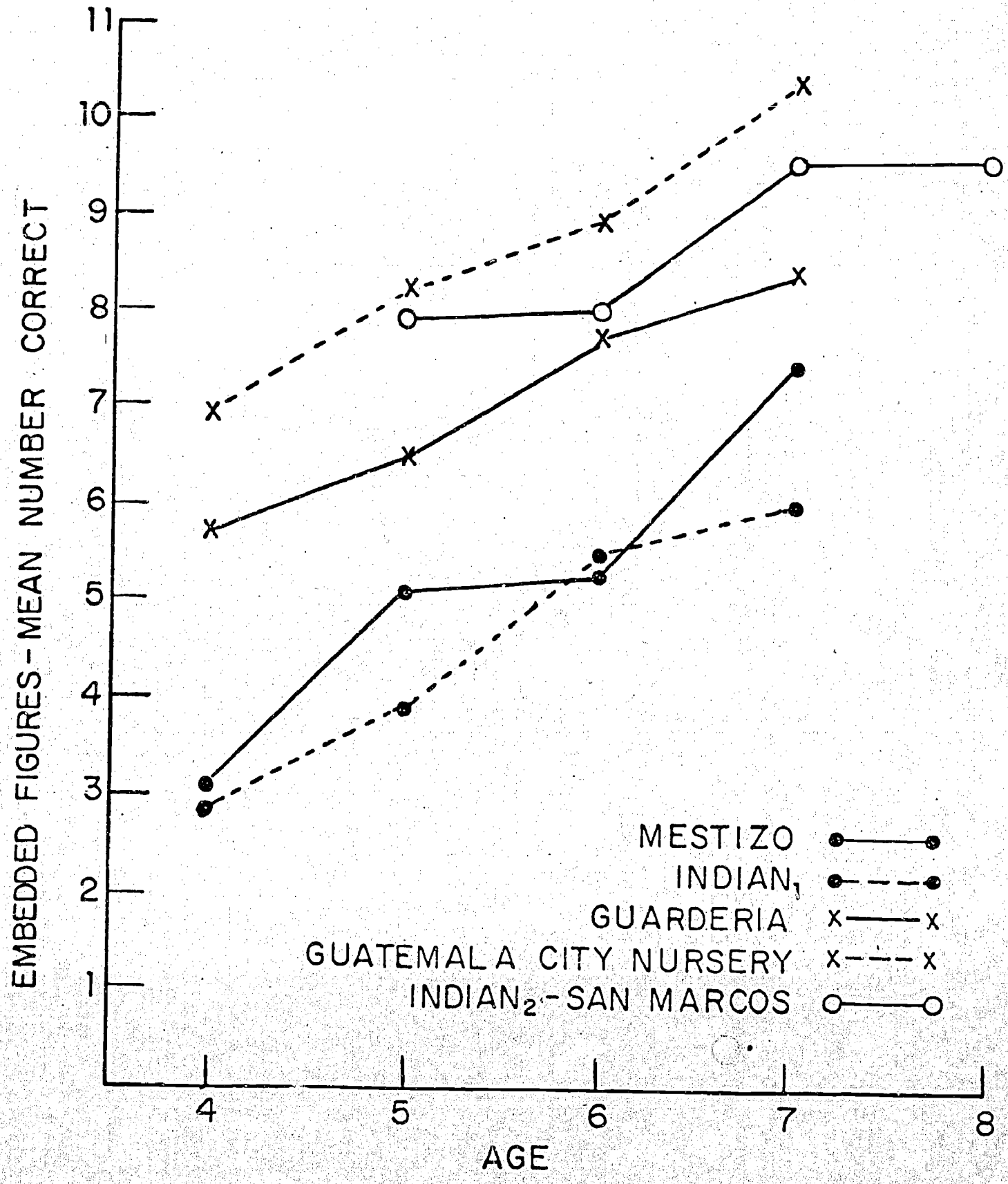
8
10


EMBEDDED FIGURES - MEAN NUMBER CORRECT
11
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8
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6
5
4
3
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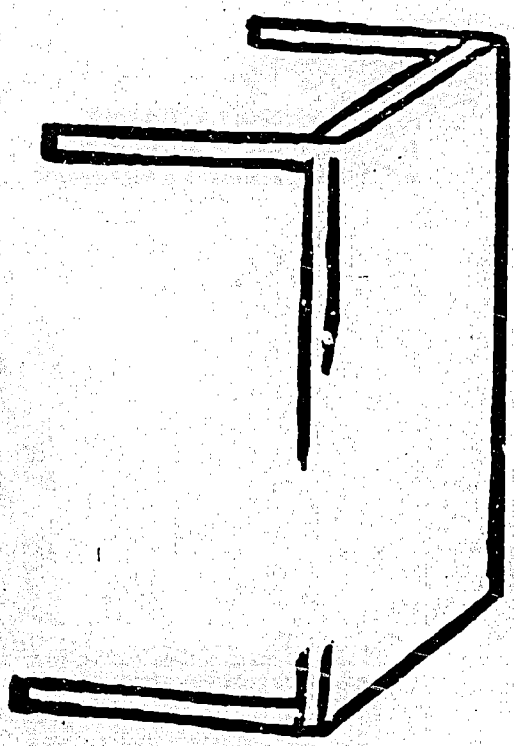
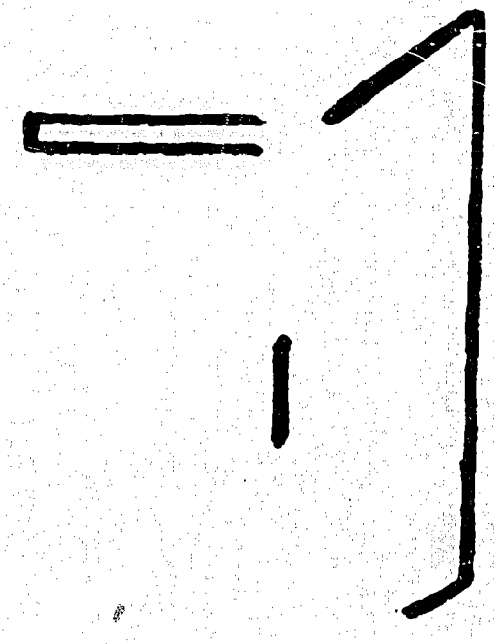
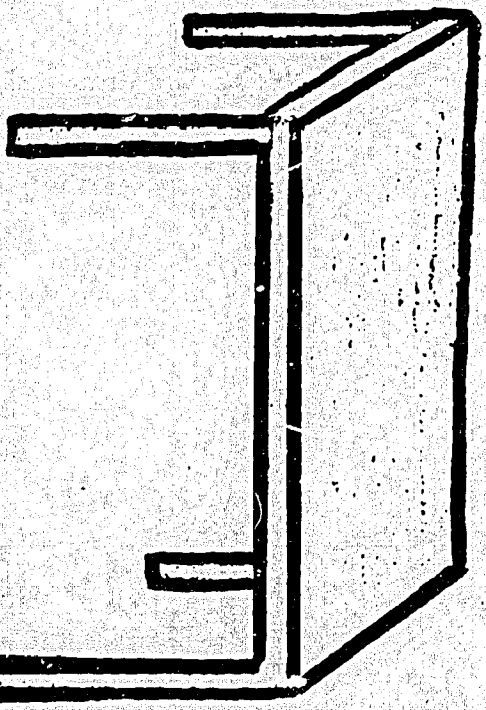
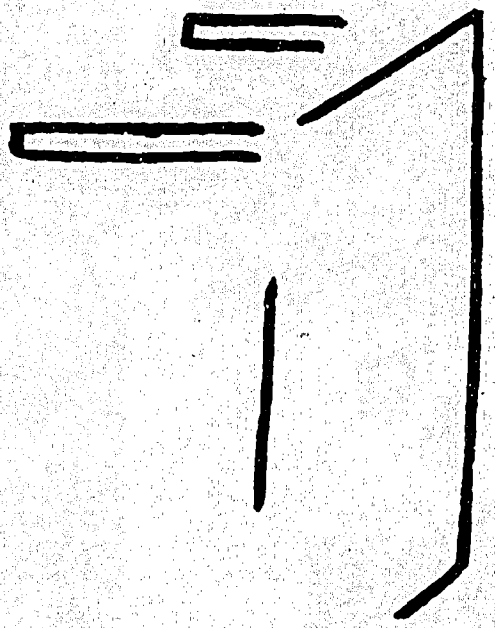
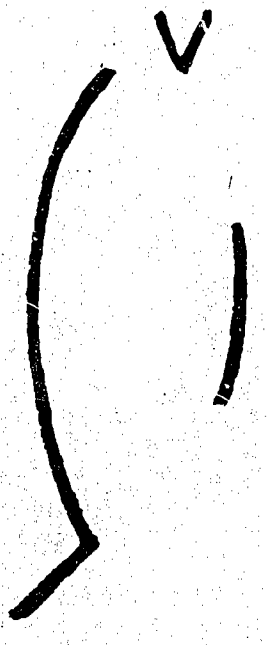
AGE
MESTIZO
INDIAN1
GUARDERIA
GUATEMALA CITY NURSERY
INDIAN2 - SAN MARCOS

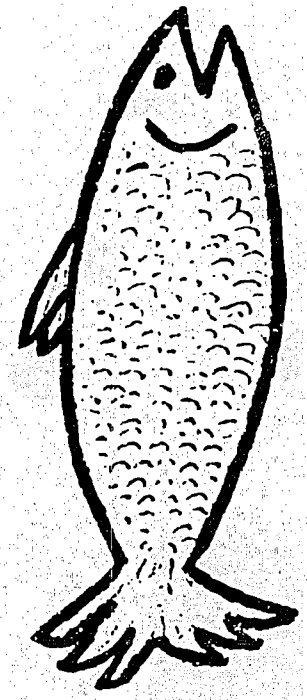


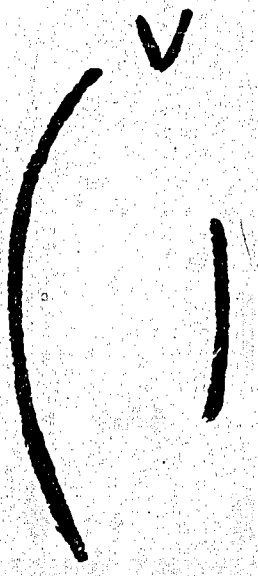


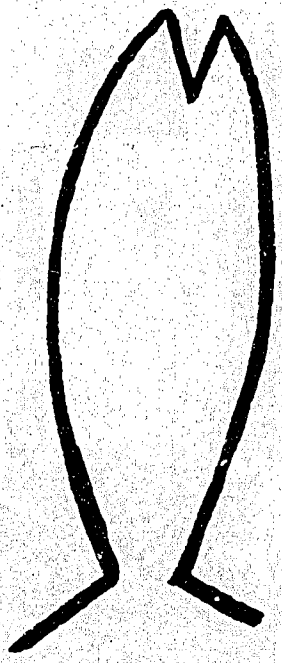


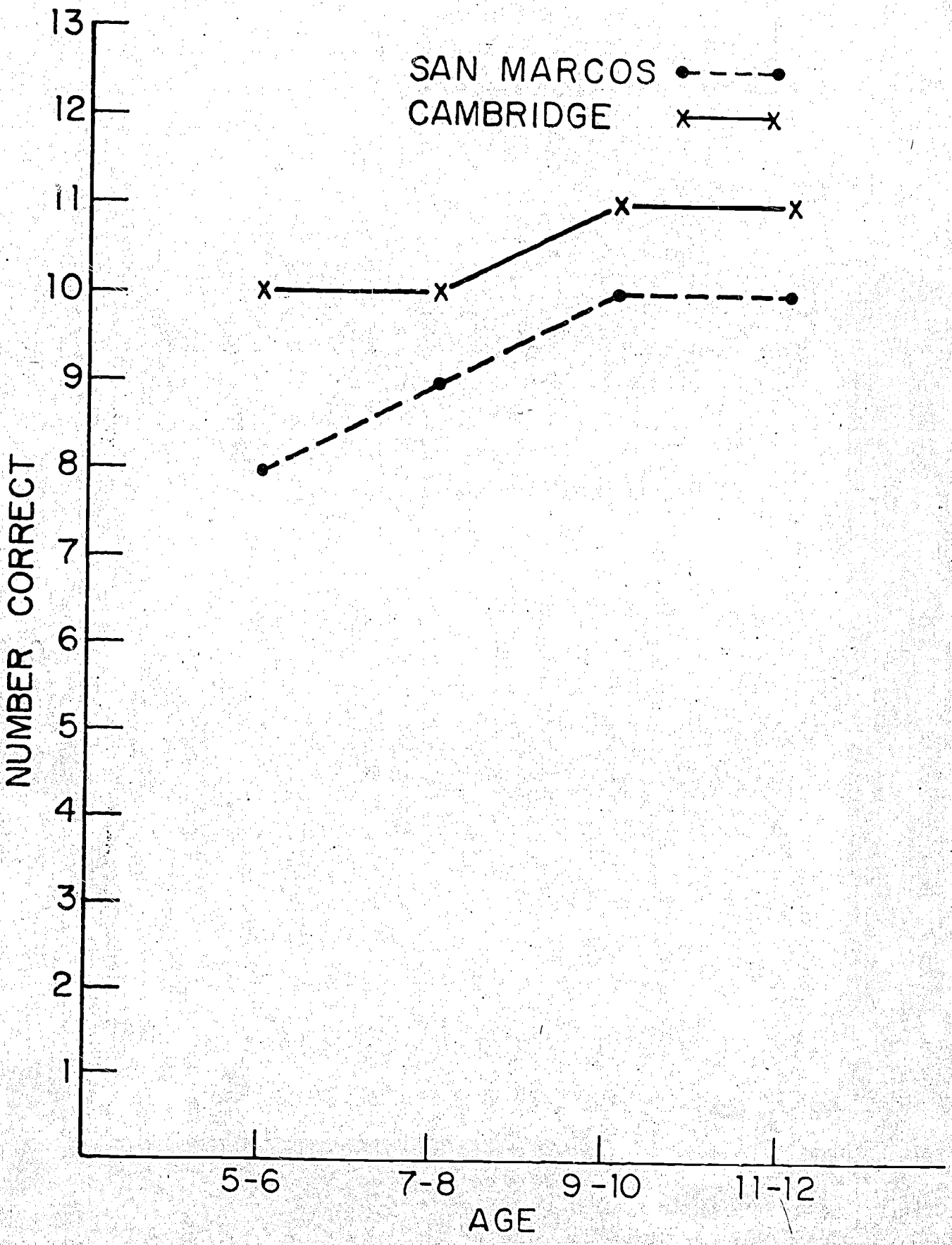











SAN MARCOS
CAMBRIDGE
NUMBER CORRECT
13
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AGE