DOCUMENT RESUME

ED 081 492 PS 006 754

AUTHOR Kagan, Jerome; Kearsley, Richard
TITLE Effects of Day Care on Early Child Development. Progress Report.
INSTITUTION Harvard Univ., Cambridge, Mass. Dept. of Psychology and Social Relations.
SPONS AGENCY Office of Child Development (DHEW), Washington, D.C.
PUB DATE Apr 73
NOTE 83p.

EDRS PRICE MF-$0.65 HC-$3.29
DESCRIPTORS Affective Behavior; Caucasians; *Child Development; Chinese Americans; Cognitive Development; *Comparative Analysis; *Day Care Programs; Lower Class; Middle Class; *Multilingualism; *Preschool Tests; Social Development; Spanish Americans
IDENTIFIERS Family Day Care; Home Care; Separation Anxiety; Stranger Anxiety

ABSTRACT

A research project attempted to discover whether residence in the Tremont Day Care Street Infant Center for 27 months had any significant effect on the cognitive, social and affective development of infants. Children entered this multilingual day care setting at 3 1/2 months and were from Chinese-speaking, Spanish-speaking, or English-speaking homes. Three matched groups of children received different treatments: (1) 28 attended the Tremont Street center, (2) 28 were raised at home, and (3) 10 were in custodial day care programs. Preliminary research results are discussed in this progress report. Interpretation is largely concerned with maturational processes that appear to significantly affect the child's reactions to change in habituated events. Most of the report is concerned with assessment and data analysis, although some logistical issues are reviewed. (MS)

FILMED FROM BEST AVAILABLE COPY

ED 081492

U S DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

Progress Report

Effects of Day Care on Early Child Development

Principal Investigators: Jerome Kagan
Department of Psychology
and Social Relations
Harvard University

and

Richard Kearsley
Principal Research Associate
in Pediatrics
Harvard Medical School

Period of Research: September 1, 1972 - April 1, 1973

Submitted to the Office of Child Development, April 1973

PS 006754

Brief Summary of Progress

During the past year we designed, pre-tested and implemented the assessment battery at 20 months and have evaluated one-half of our sample at that age. We are currently making final plans for the last assessments, which will occur when the children are 28 and 30 months of age. The software computer program that will permit machine analysis of all of our data is now in operation and we anticipate that the total backlog of records will be analyzed by late Fall. Finally, preliminary analyses of our data suggest no important differences in intensity of maternal attachment or stranger and separation anxiety between day care and home reared children. However, there seems to be a difference in degree of anxiety and timidity in new social situations between our working class Chinese children and our middle class Chinese and Caucasians, and this difference is independent of presence in day care. The working class Chinese children in day care are more timid and fearful and less social than other children.

This result has two major implications. First, it suggests that the mere fact of being with other children five days a week in a permissive day care context does not necessarily make a child more disposed toward social behavior and less disposed to anxious withdrawal with a strange child or adult. These data imply that the effect of the home environment is stronger than that of a day care experience, even though the latter extends from 3 1/2 months through the second year of life.

The remainder of this report deals first with some logistical lessons we have learned from administering the day care center, followed by a detailed description of the evaluation procedures, and finally a summary of research results.

Logistic Lessons

Our two year experience in operating a day care center for infants and toddlers has led to some tentative conclusions on several issues associated with caring for young children in full time day care. Although the Tremont Street Infant Center is, in some respects, a unique program, we have had to resolve a number of problems common to all day care centers.

Staffing: Adult - Child Ratio

We are fortunate in being able to maintain a ratio of three infants to one adult between the ages of 3 1/2 and approximately 14 months. Each infant is assigned to one caretaker who has primary responsibility for that child's care until the child moves into the toddler section of the nursery (usually between 12 and 14 months of age). While members of the "infant staff" assist one another in caring for the total group of 15 babies, each maintains her identity as principal care-giver for her three infants. This practice has facilitated the establishment of a warm nurturant relationship between infant and caretaker, and has resulted in a close liaison between mother and caretaker with regard to the daily exchange of pertinent information about the child.

In addition to the five primary caretakers, we have provided "teacher aides" to assist in general care taking tasks like feeding, diapering, changing crib linen, and picking up toys. Were it not for the fact that the primary caretakers are also required to complete daily reports on the infants under their care, it is our feeling that an infant-adult ratio of 4 to 1 could be maintained without seriously compromising the quality of the relationship between infant and caretaker.

We have found a ratio of five toddlers to one adult to be satisfactory over the age span of 14 to 30 months. The practice of assigning a child to a specific caretaker is continued in the toddler section of the nursery. Although the toddler's mobility and the increasing complexity of his social activities lead to greater sharing of caretaking responsibilities, each of the older children demonstrates a preferential relationship with his particular caretaker. A "teacher aide" is also provided to assist the four primary caretakers in caring for the twenty toddlers presently enrolled.

It is our impression that this 5:1 ratio approaches the maximum level of responsibility that one adult is capable of handling while maintaining a reasonable degree of individualized attention among this group of toddlers.

Criteria for Staff Selection

We have come to appreciate the importance of the following characteristics in selecting a primary caretaker.

The primary caretaker:

a. Is a parent with first hand experience in caring for infants.

b. Enjoys being with infants and small children.

C. Is capable of accepting culturally specific differences in child-rearing values and practices.

d. Appreciates the importance of her contribution to the infant's development.

e. Is able to work well with the other primary caretakers.

f. Is intelligent and able to accept and offer constructive criticism.

Although all of the nursery staff have at least a high school education (or its equivalent) it is our impression that the level of formal education per se is not a good predictor of satisfactory performance in our nursery setting.

Staffing Pattern

The nursery opens at 8 AM and closes at 5PM. We have found that both the infants and toddlers are alert and most active during the morning and early afternoon. Because of this rather consistent daily pattern in the child's behavior, we utilize our trained primary caretakers during the morning and early hours of the afternoon. Caretaking during the latter portion of the day is provided by part time high school students under the supervision of two of the senior nursery staff. This has proved to be a more satisfactory arrangement than staggering

the hours of the trained nursery teachers. In addition it has given us the opportunity to observe high school students functioning in this supervised caretaking role. While we have not explored this particular aspect of the program in any systematic fashion it is our impression that the students have not only functioned quite satisfactorily but also have acquired considerable knowledge and experience in child rearing.

The necessity for providing coverage for the nursery staff during unexpected illness and regular vacation time required us to develop a cadre of substitute teachers available for part time work on short notice. The composition of this substitute cadre has been stable and we have not found it necessary to bring a number of strange caretakers into the nursery.

General Operating Policies: Age of Child

On several occasions we have witnessed behavior that closely resembled sibling rivalry when a newly enrolled infant (3 1/2 months) was assigned to a primary caretaker who already had two older children (10-12 months). This behavior on the part of the older infant was persistent and sufficiently disruptive to warrant our reassigning the younger infant. We have gradually adopted the policy of limiting the age spread of any one caretaker's infants to 3 or 4 months.

Infants enrolled at 3 1/2 months adjust rapidly to the new environment of the nursery. The process is usually completed by the second or third day. Infants enrolled at 5 1/2 months of age

required a considerable longer period of adjustment often lasting through the first week. Our single attempt to enroll a 13 1/2 month old baby was completely unsuccessful. The infant's intense anxiety on being separated from her mother in a strange setting continued unabated over a ten day period.

These tentative observations suggest that the psychological processes underlying stranger anxiety and separation protest may impose severe constraints on the optimal time for enrolling an infant in full time day care.

Our experience also indicates that it is highly desirable to maintain regular attendance once the infant has been enrolled in a day care program. We have observed repeated instances of anxious behavior extending over a one to two day period in infants who have been away from the nursery for relatively short periods of time (3-4 days). While the appearance and the intensity of this readjustment behavior varies from child to child, and is most noticeable in 12-16 month old infants, there is little doubt that irregular and inconsistent attendence place a considerable burden on the infant in day care.

The Infants' Adjustment to the Toddler Program

Most of the infants move into the toddler program by the fourteenth month. Since infants and toddlers are housed primarily in one large room, divided by furnishings and low partitions, the transition is not to a completely novel environment. However it does entail the infants being cared for by a different primary

caretaker. We have been impressed by the relative ease with which the infants make this change and by the brevity of the adjustment period. Typically the newly "graduated" infant moves back and forth between toddler and infant area for several days, visiting his original caretaker and playing in the company of the smaller children. However, the varied and more interesting activities at the toddler end seem to capture his attention so that by the end of the first week the majority of his day is spent among the toddlers with his new caretaker. In fact it is the original caretaker who goes through a period of adjustment following the "loss" of one of her infants. We have found it prudent to delay the infant's transfer to the toddler end until he is capable of walking with a reasonably steady gait and has some experience with self-feeding.

Transporting Infants

We have found it necessary to provide transportation for approximately 2/3 of the infants and toddlers enrolled in our nursery. At the present time we are using a 12 passenger Dodge Van equipped with Ford Motor Company infant safety seats. Since arrival and departure times coincide with peak rush hour traffic, and since we do not want any infant to ride longer than 25-30 minutes on the van, we have limited enrollment in the nursery to a geographic area contained within 15 minutes riding time from the day care center.

We have been impressed by the magnitude of the problem that transportation presents to the center caring for infants. It requires both careful planning and a conscientious staff to insure the safety of the infant.

Management of Illness

It has been our policy to ask parents to keep their child at home during the acute, febrile phase of an upper respiratory or gastro-intestinal illness. The child is readmitted after he has been afebrile for 24-48 hours. We accept infants with mild upper respiratory symptoms as well as infants on medication who are in the recovery phase of their illness. If the infant is considered well enough to attend the day care center he is not isolated or segregated from the other children. The decision as to his fitness is made by the parents with the approval of the nursery staff and the pediatrician co-investigator on the project.

Infant Day Care in a Multilingual Community

Approximately half of the children enrolled in our day care center are from Chinese speaking parents, 20 percent are from Spanish speaking homes and for the remaining 30 percent English is the language spoken in the home. The nursery staff reflects this multilingual aspect of the program, for four are bilingual in Chinese, three are bilingual in Spanish and one is bilingual in French (just in case).

Although social conversations take place in Chinese and Spanish, English is the principal language used in the nursery. Depending

on the parents' wishes, either English or the language spoken in the home is used by the primary caretaker in communicating with a particular infant. However all infants are exposed to a multilingual atmosphere.

At the toddler end of the nursery, picture books, nursery rhymes, "story hours" and phonograph records come in three languages, although the majority of the verbal exchange is in English. Without exception the parents have indicated their desire for the child to learn English even though another language may be spoken in the home.

Since the assessment of language acquisition at the 20 and 30 month assessments is conducted in both English and the language of the home, we hope to acquire some insight into the impact of this unusual nursery setting on the development of verbal skills. However regardless of its effects on the child, there is little doubt that the presence of Chinese and Spanish speaking nursery teachers has facilitated our capacity to establish a close mutually satisfying relationship between the day care staff and the parents of the children enrolled in the program.

Detailed Summary of Research Progress

The remainder of this report shall describe, in some detail, the findings obtained to date, as well as a more complete summary of the evaluation procedures and rationale of the project. It will be recalled that the study consists of three groups of

children, matched on sex, ordinal position and social class and ethnicity (Chinese, Spanish-speaking Caucasian, English-speaking Caucasian).

Group 1. Group 1 subjects attend an experimental day care center located on Tremont Street in Boston and administered by our trained staff. Each female caretaker is responsible for a maximum of three infants. These caretakers, who were highly selected, have been trained to interact with the infants in ways that will facilitate cognitive development. The caretaking staff are primarily middle-aged mothers who reside in the area in which the day care center is located, an area that borders the working-class areas of Chinatown and Roxbury.

Group II. Group II children are being raised at home by their parents.

Group III. Group III infants spend most of the day in a form of custodial day care, typically family day care, where a woman other than the mother cares for one to three infants in her own home. In all of these cases the woman caring for the infants views her role as primarily custodial rather than educational.

The analysis of the data will involve, first, creation of trios of children matched on sex, ordinal position, social class and ethnicity in which each member of the trio will belong to one of the three groups. Approximately half of the subjects are Chinese, a quarter are Spanish-speaking Caucasian and the remaining 25 percent are English-speaking Caucasian. Approximately 75 percent of the infants are from working or lower class families.

The day care setting

The children in all groups are enrolled in the experiment when they are 3 1/2 months old. The children in Group I are usually in residence at the day care center 5 days a week from 8:30 in the morning until about 4 in the afternoon. Each infant is assigned to a primary caretaker and in most cases the caretaker is of the same ethnicity as the child. A manual of procedures for interaction with the infant and toddler forms the basis for play between caretaker and infant. These proscribed interactions are administered when the infant is alert, biologically satisfied, and not playing alone happily. Typically, an infant experiences between one and two hours of this interaction each day. The low child to adult ratio, together with the caretaker's assumption that she is, in part, an educator, makes this an unusual day care setting and not representative of typical infant day care in the United States.

The main question we wish to ask is whether residence in this particular day care setting for 27 months has any significant

effect on the cognitive, social and affective development of these infants.

At present, there are 28 infants in the day care group, 28 in the home control group and 10 in the day care control group.

The Tremont Street Infant Center, with its program of research, has managed to achieve widespread support from the community in which it is located. This is evidenced not only by the increasing number of families seeking enrollment, but also by our being offered voting membership in one of the influential community organizations. As a result, we feel confident in being able to meet our projected patterns of enrollment in both the Nursery and Home Control Group. Furthermore, we are now in a position to select from the increasing pool of applicants those infants whose sex, ordinal position and family background match subjects already enrolled in the program. This will markedly facilitate the completion of matched sets of trios.

In the past, our major problem has been that of locating infants for the Day Care Control group. However, in recent months the rate of enrollment in this group has increased as parents whose infants cannot be accommodated in our nursery find alternate sources of day care and agree to participate in the Day Care Control group. For this reason, we have deferred to a certain extent the projected pattern of enrollment in the Home Control Group in order to accommodate the increase in our

testing load anticipated by the rising numbers of Day Care Control infants.

Finally, we have been pleased by the small number of infants who have withdrawn from the program before the 27 month period of participation was completed. During the past 18 months, only 3 infants from the Nursery Group and 4 from the Home Control have dropped out of the project. The degree of parent involvement and the careful screening of potential applicants have combined to minimize the attrition problem.

The assessments

Each child is assessed by a research staff who are not involved in any aspect of caretaking. Moreover, the main offices of the research staff are in William James Hall in Cambridge, several miles from the day care center. All infants are assessed at 3 1/2, 5 1/2, 7 1/2, 9 1/2, 11 1/2, 13 1/2, 20 and 30 months of age. The test procedures at each age shall now be described, along with the major variables derived from these procedures.

Battery at 3 1/2 and 5 1/2 months

Episode	Variables Coded
1. Social interaction: Female examiner interacts with child for two minutes at the beginning and end of the test session	Child fixates examiner Child vocalizes Child smiles Child frets

2. Block episode: child is shown 8 repetitions of large 2-inch block, followed by 5 repetitions of discrepancy (1 1/2-inch block), followed by 3 repetitions of the original standard	Duration of each fixation of stimulus Duration of each vocalization Duration of fretting Duration of each smile Duration child leans toward or points to the stimulus Duration of arm wave Duration of twist of body Continuous heart rate
3. Auditory Episode I: child hears 12 repetitions of a particular meaningful phrase, followed by 5 repetitions of a nonsense phrase, followed by 3 repetitions of the original standard	Duration of each fixation of the speaker baffle Duration of head and eye searching movements Duration of vocalization Duration of each smile Duration of fret or cry Duration of lean toward or point to the speaker baffle Duration of arm wave Duration of body twist Continuous heart rate
4. Masks: child is shown a series of 4 different human masks (regular, scrambled, no eyes and blank) for a total of	Same variables as coded for the Block episode (No. 1)

two times in a random order for a 30 second presentation

5. Light episode: child is shown 10 repetitions of a sequence in which an examiner's hand moves an orange rod in a circular arc until it contacts a bank of three light bulbs which light upon contact, followed by 5 repetitions in which the hand touches the orange rod, but the rod does not move and the lights go on 4 seconds later, followed by 3 repetitions of the original standard

   Same variables coded for Block episode (No. 2)

6. Auditory episode II: Same as Auditory I except the child hears a different meaningful phrase for the initial 12 repetitions and the discrepant transformation involves 5 repetitions of another meaningful phrase

   Same variables as coded for Auditory I (No. 3)

7. Separation episode: Mother leaves child alone for a maximum of 2 minutes	Occurrence of fretting or crying Latency to the first fret or cry
8. Social interaction: Same as the initial social interaction	Same variables as coded for the first social interaction (No. 1)

Battery at 7 1/2 months

Episode	Variables Coded
1. Social interaction: Same as at 3 1/2 and 5 1/2 months	Same variables as coded at 3 1/2 and 5 1/2 months
2. Block episode: Same as at 3 1/2 and 5 1/2 months	Same variables as coded at 3 1/2 and 5 1/2 months
3. Auditory I: Same as at 3 1/2 and 5 1/2 months	Same variables as coded at 3 1/2 and 5 1/2 months
4. Light episode: Same as at 3 1/2 and 5 1/2 months	Same variables as coded at 3 1/2 and 5 1/2 months
5. Separation: Same as at 3 1/2 and 5 1/2 months	Same variables as coded at 3 1/2 and 5 1/2 months
6. Bayley Developmental Scale: child is administered items for the Bayley Developmental Scale in the standard way	Child's behavior scored as passing or failing each item
7. Social interaction: Same as at 3 1/2 and 5 1/2 months	Same variables as coded at 3 1/2 and 5 1/2 months

Battery at 9 1/2 months

	Episode	Variables Coded
1.	Social interaction: Same as at 3 1/2 and 5 1/2 months	Same variables as coded at 3 1/2 and 5 1/2 months
2.	Block episode: Same as at 3 1/2 and 5 1/2 months with the exception that the initial repetition of the standard is reduced to six trials and the number of discrepant transformation trials is reduced to 3	Same variables as coded at 3 1/2 and 5 1/2 months
3.	Auditory I: Same as at 3 1/2 and 5 1/2 months with the exception that the initial repetition of standard trials is reduced to 8 presentations	Same as at 3 1/2 and 5 1/2 months
4.	Masks: Same as at 3 1/2 and 5 1/2 months	Same as at 3 1/2 and 5 1/2 months
5.	Light episode: Same as at 3 1/2 and 5 1/2 months, with the exception that the initial repetition of the standard is reduced to 8 trials	Same as at 3 1/2 and 5 1/2 months

6. Auditory III: The child hears 8 repetitions of a meaningful phrase followed by 5 repetitions of the same words arranged in ungrammatical order, followed by 3 repetitions of the original standard	Same as Auditory I at 3 1/2 and 5 1/2 months
7. Car-Doll episode: child sees a small wooden car roll down an incline and strike a form which falls on contact. This event is repeated for 8 trials during which the car strikes the form but the form does not fall, followed by 3 repetitions of the original standard	Same variables as coded for the Block and Light episodes plus the addition of one extra variable: anticipatory fixation of the form during the early phases of the trial
8. Slides: child sees a set of 4 chromatic slides projected on a screen. In each set an object becomes gradually transformed into a second object (e.g., a dog gradually changes into a cat)	Same as for Block and Light

9.	Play: child plays with 2 pairs of toys for 2 successive 4 minute periods. The child is then shown a pair of toys, one of which is the old one he played with earlier, and one of which is new. We code the toy he looks at first, the one he chooses first to play with, and the one he plays with for the longest period of time	Duration of looking at mother Duration of smiling Duration of vocalization Duration of fretting or crying Duration proximal to mother Duration looking at old toy Duration looking at new toy Duration of play with each toy
10.	Separation: Same as at 3 1/2 and 5 1/2 months	Same as at 3 1/2 and 5 1/2 months
11.	Social interaction: Same as at 3 1/2 and 5 1/2 months	Same as at 3 1/2 and 5 1/2 months

Battery at 11 1/2 months

	Episode	Variables Coded
1.	Social interaction: Same as at 3 1/2 and 5 1/2 months	Same as at 3 1/2 and 5 1/2 months
2.	Block: Same as at 9 1/2 months	Same as at 3 1/2 and 5 1/2 months
3.	Auditory I: Same as at 9 1/2 months	Same as at 3 1/2 and 5 1/2 months
4.	Light: Same as at 9 1/2 months	Same as at 3 1/2 and 5 1/2 months
5.	Auditory III: Same as at 9 1/2 months	Same as at 9 1/2 months
	Car-Doll: Same as at 9 1/2 months	Same as at 9 1/2 months

7.	Slides: Same as at 9 1/2 months	Same as at 9 1/2 months
8.	Separation: Same as at 3 1/2 and 5 1/2 months	Same as at 3 1/2 and 5 1/2 months
9.	Social interaction: Same as at 3 1/2 and 5 1/2 months	Same as at 3 1/2 and 5 1/2 months

Battery at 13 1/2 months

	Episode	Variables Coded
1.	Social interaction: Same as at 3 1/2 and 5 1/2 months	Same as at 3 1/2 and 5 1/2 months
2.	Solitary Free Play: Child plays in a room with his mother and a set of age appropriate toys for 15 minutes	Duration of each attentional involvement with a toy Duration proximity to mother Duration looking at mother Duration of each smile Duration of vocalization Duration of fretting or crying
3.	Free Play with a Strange Peer: A stranger of same age and sex as the experimental child and his (her) mother is introduced into	Duration of each attentional involvement with a toy Duration proximal to strange mother Duration proximal to child's own mother

a new room with a new set of toys and the experimental child is allowed to play for 25 minutes	Duration touching strange peer Duration fretting Duration vocalization Duration child initiates social interaction with strange peer Duration child remains when peer initiates interaction with the child Child withdraws when peer initiates an interaction Duration look at strange peer Duration look at strange mother Duration look at own mother
4. Light episode (Variation II): Same as Light episode at 9 1/2 months for the initial 8 repetitions followed by a different transformation in which the rod moves across the circular arc without a hand being visible, touches the lights and returns again to its initial starting point.	Same as at 3 1/2 and 5 1/2 months

	When it returns to its initial starting point, the lights go on and after 4 seconds the examiner's hand appears contiguous with the lights and the lights go off.	
5.	Auditory III: Same as at 9 1/2 and 11 1/2 months	Same as at 9 1/2 and 11 1/2 months
6.	Masks: Same as at 3 1/2 and 5 1/2 months with the exception that each mask is only shown once	Same as at 3 1/2 and 5 1/2 months
7.	Car-Doll: Same as at 9 1/2 and 11 1/2 months	Same as at 9 1/2 and 11 1/2 months
8.	Bayley Scale: Items on the Bayley Scale administered in standard form	Child's behavior scored as passing or failing each item
9.	Separation: Same as at 3 1/2 and 5 1/2 months	Same as at 3 1/2 and 5 1/2 months
10.	Social interaction: Same as at 3 1/2 and 5 1/2 months	Same as at 3 1/2 and 5 1/2 months

Battery at 20 months

Episode	Variables Coded
Session I.	
1. Attachment: child is observed for 45 minutes in a room containing his mother, a strange woman he has never seen before, and his primary caretaker from the day care center (if he is a day care subject) or a close friend of the family for a control child	Duration proximity to each of the three adults Duration touching each of three adults Duration looking each of three adults Number of times child brings toy to each of three adults Number of times child smiles at each of three adults Duration vocalizing Duration fretting or crying
2. Light episode: Same as at 13 1/2 months with the exception that 6 standard and 3 transformation trials are given	Same as at 3 1/2 and 5 1/2 months
3. Auditory III: Same as at 13 1/2 months with the exception that only 6 standard and three transformation trials are presented	Same as at 9 1/2 and 11 1/2 months

4. Car-Doll: Same as at 13 1/2 months with the exception that 6 standards and 3 transformation trials are given	Same as at 9 1/2 and 11 1/2 months
5. Discrepant Chromatic Slides: Child sees a series of 14 chromatic slides one at a time. In this series, 5 of the slides depict discrepant events. (a man in a dress; a man with 4 arms)	Same as variables coded for Block episode at 3 1/2 and 5 1/2 months
6. Vocabulary Recognition: Child is shown sets of pictures of objects and asked to point to the object that the examiner names	Number correctly recognized

Session II

1. Solitary free play: Child is in room with his mother playing with a set of age appropriate toys for 21 minutes	Duration of attentional involvement with each toy Duration of time child relates 2 or more toys Duration looking at mother Duration proximal to mother Duration each smile Duration of vocalization Duration of fretting or crying

2. Peer Play: A strange peer of the same age and sex as the child and the strange peer's mothers enter the room and a new set of toys is brought in. The child's behavior is observed for an additional 21 minutes	Duration of involvement with each toy Duration of time relates 2 or more toys Number of times child initiates aggressive play with peer Number of times child initiates cooperative play with peer Number of times child stays when he is approached by same peer Number of times child withdraws when he is approached by strange peer Number of times child resists coercion or aggression by strange peer Duration proximal to mother Duration looking at strange peer Duration looking at his mother Duration of vocalization Duration of fretting or crying
3. Bayley Scale: Age appropriate items are administered	Child's behavior scored for passing or failing each item
4. Separation episode: Same as at 3 1/2 and 5 1/2 months	Same as a5 3 1/2 and 5 1/2 months

The 30 month battery is now being pretested and will be ready by late spring. The first child to reach 30 months -- who is also the first graduate of the program -- will be seen in early July. The 30 month battery will evaluate: social behavior with a strange peer, language competence with an emphasis on active use of concepts, memory, tempo and creativity in play, reaction to discrepant events.

Preliminary Analysis of Data

This section summarizes preliminary results based on data obtained from a normative, cross-sectional sample of infants who were administered part of the infant battery, as well as some infants in our experimental groups.

Interpretation of these normative data is based on the assumption of two important maturationally controlled processes that emerge between 2 and 12 months, each of which influences the child's reaction to a transformation of an habituated event (Kagan, 1970, 1972). At approximately 8 weeks of age the average American infant begins to show increased attention to an event that is a moderate discrepancy of an habituated standard in the visual mode. He is also likely, but with less consistency, to show a heart rate deceleration of five to fifteen beats (average of eight beats per minute) to the presentation of the discrepant event. In addition, infants who are temperamentally disposed to vocalize to a discrepant experience display increased babbling to the appearance of the discrepant event or the reappearance of the formerly

habituated standard. The increased vocalization, however, may be related to the sex of the child and to the way he has been handled during the prior months. For example, middle class American infants, who experience a great deal of verbal interaction from their parents, are more likely to vocalize to a discrepant event than Guatemalan Ladino or Indian infants raised in extremely isolated, rural, subsistence farming villages. The Guatemalan infants experience minimal vocal interaction from either parents or older siblings, and rarely vocalize to a discrepant event, although they show increased fixation time. Moreover, if permitted, they regularly select the discrepant member of a pair of objects, where one member is an habituated object and the second is a novel one.

In the auditory mode it is not possible to use orientation to the sound source with the interpretive confidence attributed to fixation time to visual events because the infant can process the auditory message without necessarily orienting to its source. Our normative data suggest that the tendency to orient to the source of a discrepant or novel sound decreases throughout the first year, while other indexes of reactivity have different age functions. It is as if the infant orients to the sound source if he wishes to determine where the information is coming from, but he may not orient if he is attempting to understand the information contained in the event.

Hence we rely on additional indexes of reactivity to auditory discrepancy--changes in heart rate (deceleration,

acceleration, or decreased variability), changes in vocalization during the presentation of the stimulus, as well as during the silent interstimulus period following termination of the event, and changes in coordinated movements of the eyes and head, which we believe reflect an alerting reaction to the information. The intercoder reliability for these variables is remarkably high, ranging from .85 to .95.

As indicated earlier, the 2 to 3 month old infant displays a sensitivity to moderate discrepancy, but if the discrepancy is too subtle he will show no reaction. For example, the normative data indicate that the majority of infants show increased fixation time at about 7 1/2 months when the repeated exposure of a 2-inch block is changed to the smaller block--a result caused by the marked habituation to the last three standards. However, reaction to the discrepancy in the light episode--as measured by an attenuation of the reduction in fixation--does not occur until 9 1/2 months. In a moment we shall describe these results in more detail.

The modal reactions to discrepancy during the period 2 to 8 months include increased fixation time, increased vocalization, and either cardiac deceleration or decreased variability of heart rate during the stimulus presentation. However, beginning at about 8 to 9 months, a second process, which also seems to be under partial maturational control, emerges. The infant now begins to activate cognitive structures--which we call hypotheses--to interpret discrepant events. 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.

The primary support for this idea comes from age changes in fixation time to the same set of events. In one series of studies, a set of four different human masks were shown to infants 4 through 36 months of age living in the United States, rural villages in Guatemala, and the Kalahari desert in Botswana. The masks were constructed to resemble the "ideal" male countenance for each of the three ethnic groups. In all three cultural settings there was a U-shaped relation between age and fixation time, with the trough in the curve always appearing at approximately 12 months of age.

This U-shaped relation between attention and age also holds for non-social stimuli, such as the block stimulus described earlier. Figure 1 shows the fixation time to the first three transformation trials (small block) for subjects 3 1/2 to 11 1/2 months of age.

Insert Figure 1 here

Since the reaction to discrepancy and the activation of hypotheses appear to be under the control of both maturation and environmental experience, longitudinal analyses of the child's reaction to our procedures should allow us to determine,

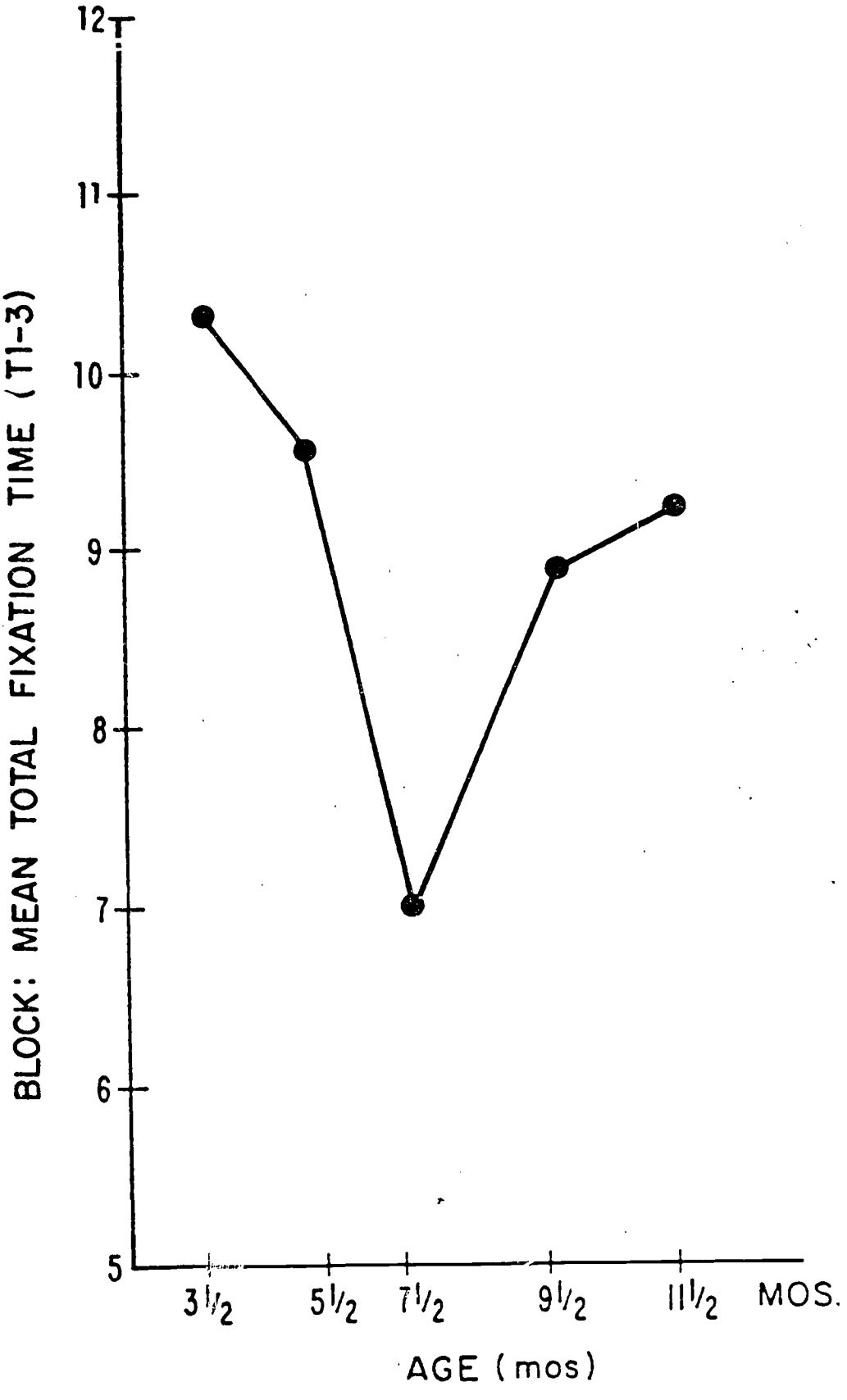

BLOCK: MEAN TOTAL FIXATION TIME (T1-3)
12
11
10
9
8
7
6
5
3 1/2
5 1/2
7 1/2
9 1/2
11 1/2
MOS.
AGE (mos)

FIG. 1

with some confidence, the relative developmental maturity of each infant. The infant who shows increased reactivity to a particular discrepant event - say the small block - at 7 1/2 months will be presumed to be cognitively advanced over the infant who does not show increased reactivity until 9 1/2 or 11 1/2 months of age.

The suggestion that activation of hypotheses to discrepancy emerges as a new competence toward the end of the first year gains support from the age patterning in heart rate changes to the same discrepancy for the normative infants. During the first 8 months the dominant reaction to a discrepancy is a cardiac deceleration. However, toward the end of the first year the preferred reaction to a transformation shifts to a cardiac acceleration. Figure 2 shows the percentage of heart rate accelerations to an auditory transformation with age. The likelihood of an acceleration is a monotonic function, increasing from about 22 percent at 5 1/2 months to about 62 percent at 11 1/2 months. Interpretation of this phenomenon is facilitated by the work of the Lacevs on the meaning of cardiac change. The Lacys (1963) have demonstrated that when an adult is doing active mental work his heart rate increases, in contrast to the typical decrease displayed when a subject is merely looking at or listening to an interesting event. Kagan and Rosman and, more recently, van Hover, have replicated this phenomenon in children 6 to 10 years

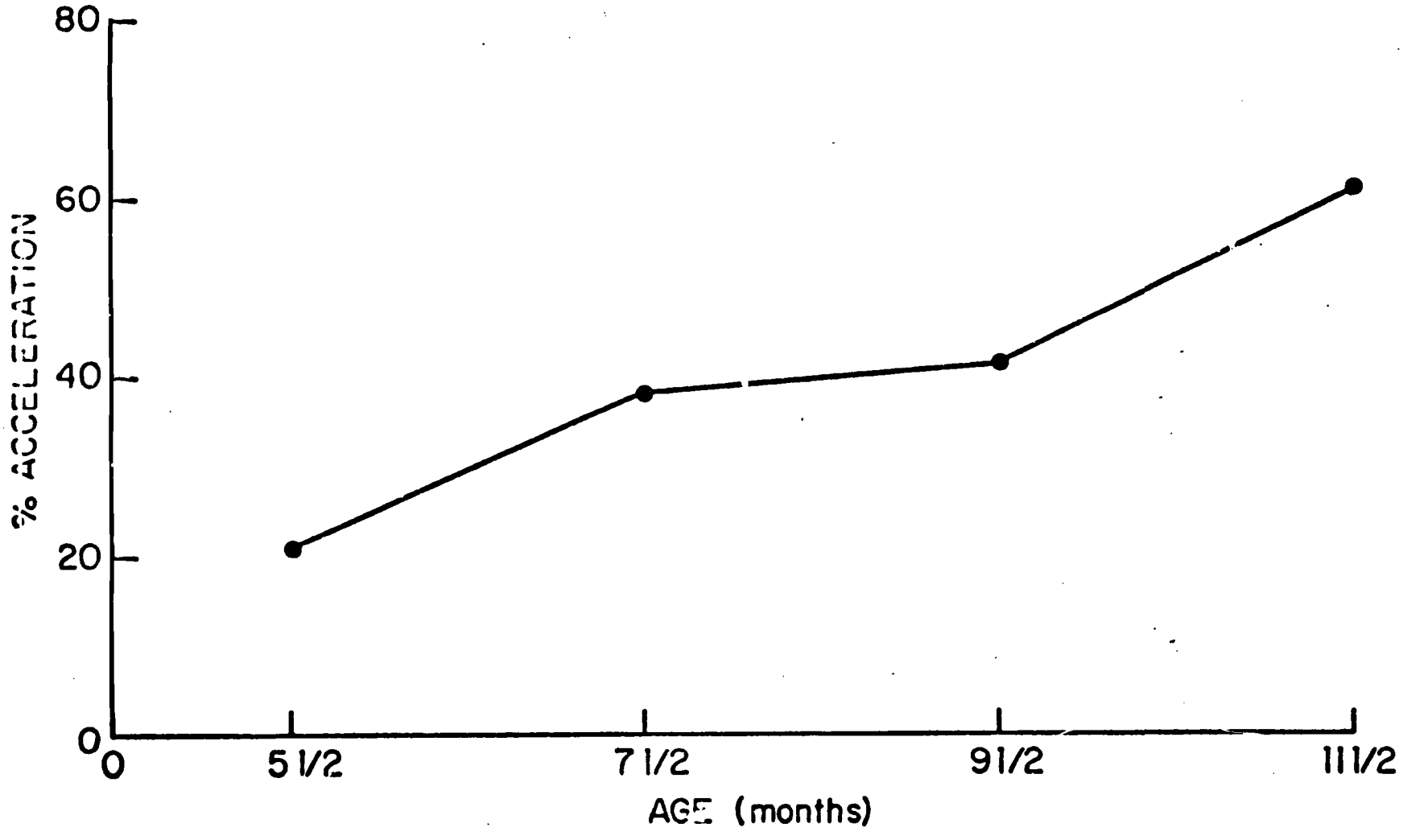
of age. Van Hover (1971) has shown that auditory or visual tasks that require orienting or search elicit cardiac deceleration in children; tasks requiring memory elicit acceleration. If this relation between the quality of cognitive process and direction of cardiac change is valid for infants, we should see cardiac acceleration toward the end of the first year when the infant activates hypotheses to aid interpretation of discrepant experience.

The data we have gathered lend some support to these hypotheses, for both cross-sectional and longitudinal analyses reveal that cardiac acceleration becomes a more regular phenomenon to discrepancy at 11 1/2 and 13 1/2 months, while cardiac deceleration is the more typical reaction to the same discrepancy at earlier ages. The shift to acceleration occurs at the same time that the infant shows increased fixation time to a discrepant event. To illustrate, Figures 3 and 4 show the fixation time and incidence of cardiac deceleration or acceleration for one of the day care subjects to the light episode. Note that the duration of attention to the first three transformation trials increases at 9 1/2 months, the age at which the first acceleration to a transformation occurred./ (See Figure 4.) Moreover the change from deceleration to acceleration with age is even more striking to the initial eight standard presentations, where the predominant reaction is deceleration at 7 1/2 months, but acceleration at 11 1/2 and 13 1/2 months.

Figure 5, which illustrates the proportion of a cross-sectional sample that showed a predominance of either deceleration or acceleration

FIGURE 2

PERCENTAGE HEART RATE ACCELERATION TO AUDITORY TRANSFORMATION



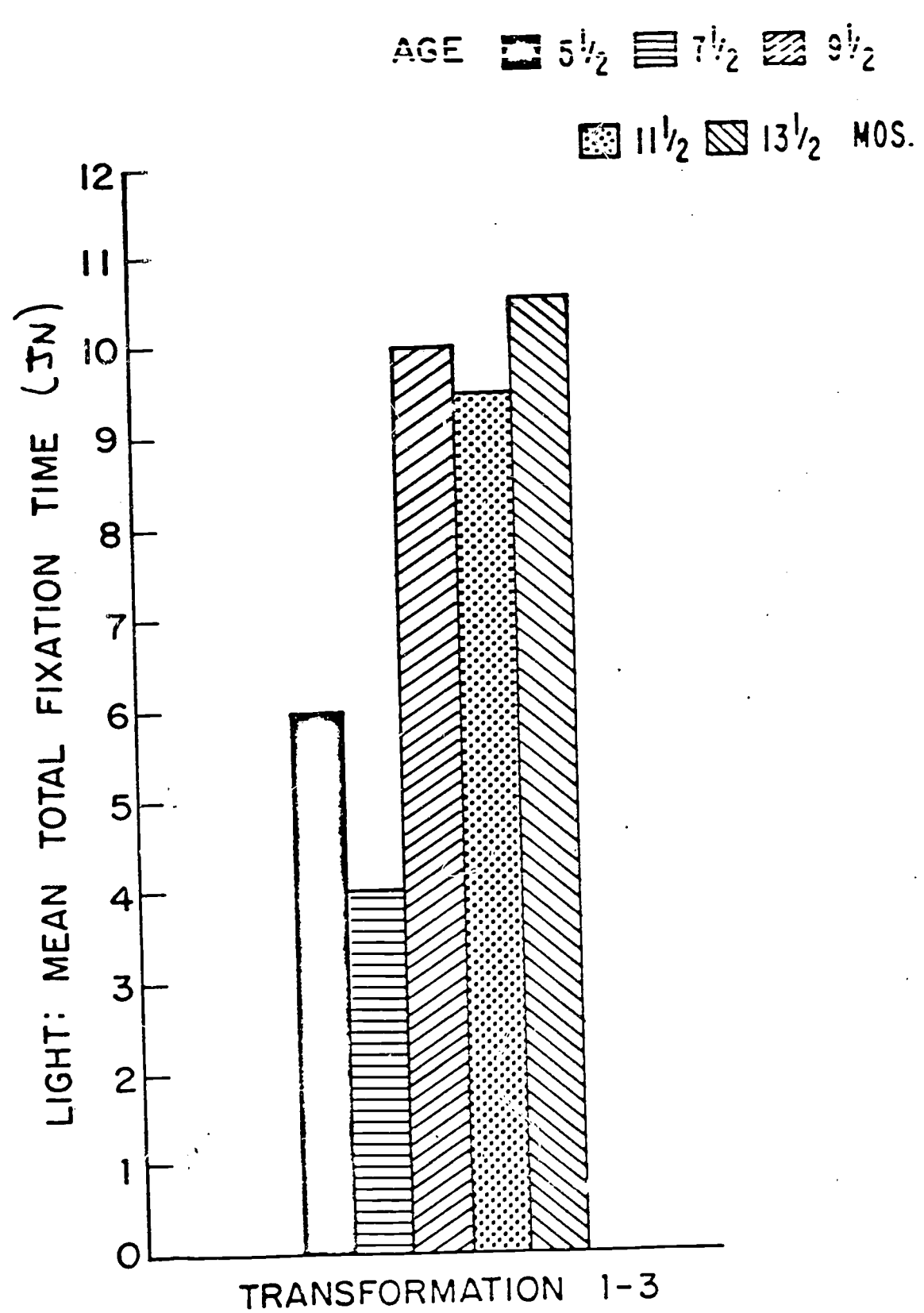

AGE 5½ 7½ 9½
11½ 13½ MOS.
LIGHT: MEAN TOTAL FIXATION TIME (JN)
0
1
2
3
4
5
6
7
8
9
10
11
12
TRANSFORMATION 1-3

FIG. 3

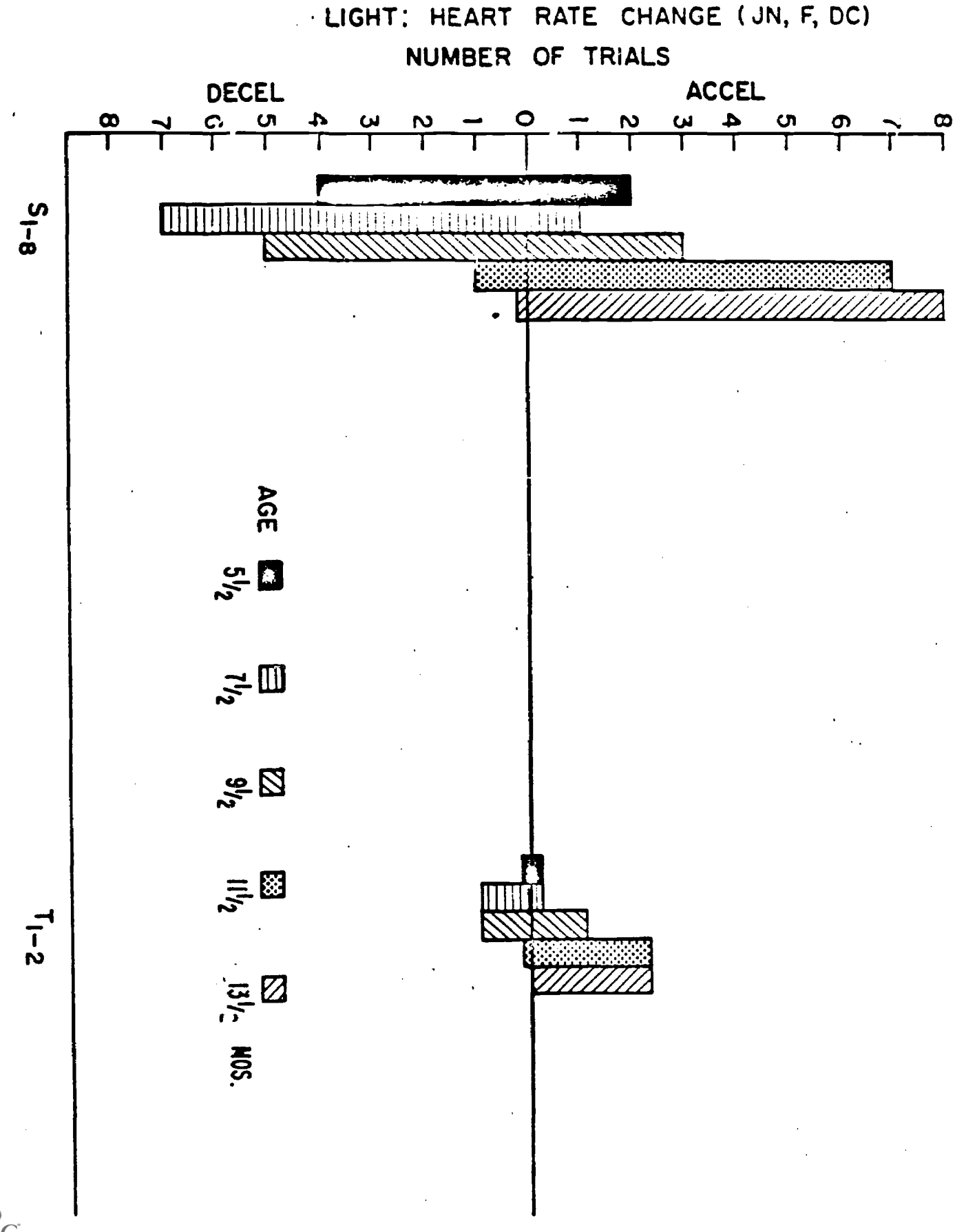

LIGHT: HEART RATE CHANGE (JN, F, DC)
NUMBER OF TRIALS
DECEL
ACCEL
8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8
S1-8
T1-2
AGE
5½
7½
9½
11½
13½
MOS.

FIG. 4

to the car-doll episode, reveals a sharp increase in occurrence of acceleration at 11 1/2 months of age.

Insert Figure 5 here

In sum, existing data imply that during the last half of the first year most infants pass a maturational frontier which allows them to attempt to interpret discrepant experience. There are, of course, individual differences among infants in the age at which they pass these milestones. Since it is reasonable to suppose that the time at which the new competence emerges is a joint function of both maturation and experience, we plan to assess the difference between experimental and control infants on this function.

Although the growth of cognitive functions is an important focus of interest, the interpersonal experiences in the day care center should affect the children's reactions toward adults and other children. We have noted minimal interest in or interaction with other infants under 8 months of age. Each of the young infants in our day care center spends most of his waking hours in a large carpeted area in the vicinity of fourteen other infants, yet he usually appears indifferent to his peers. He rarely attempts to play with them in even the most primitive manner. Instead, he divides his interest between the adult caretakers and the

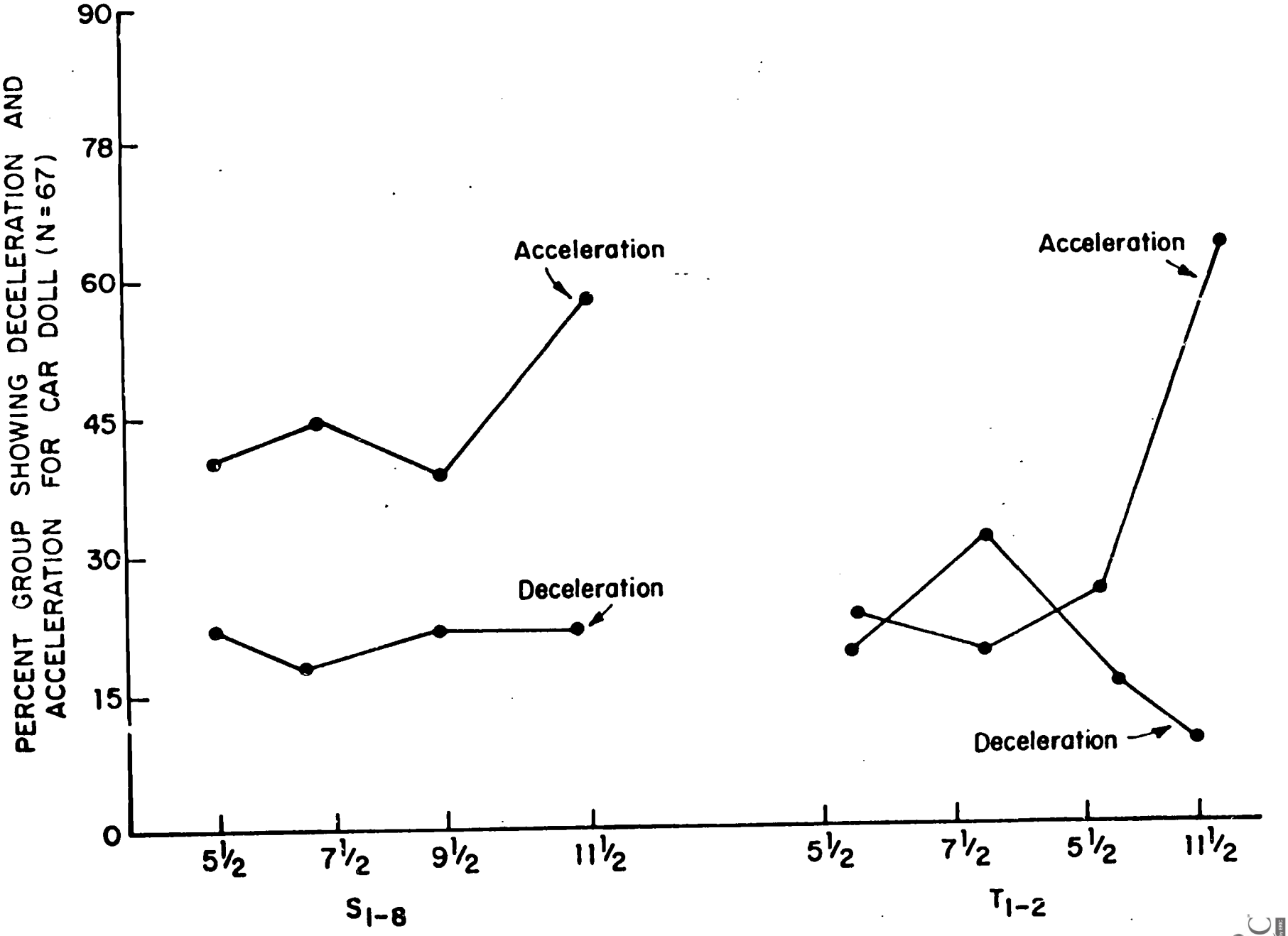

PERCENT GROUP SHOWING DECELERATION AND ACCELERATION FOR CAR DOLL (N=67)
90
78
60
45
30
15
0
Acceleration
Deceleration
Acceleration
Deceleration
5½
7½
9½
11½
5½
7½
5½
11½
S1-8
T1-2

FIG. 5

many attractive toys in the vicinity. However, as he approaches the last quarter of the first year tentative initiations are seen and the infant begins to explore the hair, face and hands of another. Occasionally, he will play (usually, but not always,parallel) in the exploration of a new toy. We have even observed a marked case of peer attachment. Two of the infants sharing the same teacher show mutual delight in the presence of the other, often playing hiding games in their cribs and exploring the nursery together.

Since home-reared infants are less likely to experience the presence of another infant for thirty hours a week it is reasonable to expect that behavior with a strange child will be different for experimental and control babies.

Stranger and Separation Anxiety

To our surprise, the frequency and intensity of stranger anxiety among the day care infants was remarkably similar to that of infants who remained at home all day. The existing literature has suggested that an infant exposed to many strangers on a regular basis should be less likely to manifest this developmental milestone. Apparently, the 8 month old infant is mature enough to have sufficiently articulated schemata for the 10 to 12 adults who typically enter the nursery so that he is able to detect one who is different. This fact suggests that we have underestimated the young infant's capacity to construct differentiated representations of many adults.

Second, most of our infants develop strong attachments to one, two, or, occasionally, three caretakers, while still displaying signs of attachment to the biological parent. Typically, each infant has a preferred caretaker to whom he orients or locomotes when in mild or moderate distress. If that woman is available the infant prefers her to anyone else. But if she is not present he will accept the next caretaker in his preference hierarchy. However, he does have a cut-off point and will not accept any caretaker in the center despite the fact that she may have been in the center for many months. Moreover, the range of variation in attachment and separation protest is as large as that observed in completely home reared infants. As indicated earlier the attachment to the mother does not seem seriously impaired for the infant normally greets the mother with smiling, excitement and rapid approach when she arrives in the late afternoon to pick up her child.

Analysis of the child's tendency to protest or cry following the mother's departure from a strange room -- the typical way of measuring separation anxiety -- showed no difference between day care and home-reared children. (See Figure 6). Moreover, the sharp rise in separation protest at 9 1/2 months of age is in perfect accord with independent data gathered on three other samples. These data suggest that occurrence of separation protest is controlled, in part, by maturational forces; and is not seriously affected by the difference in experiences between day care and home residence.

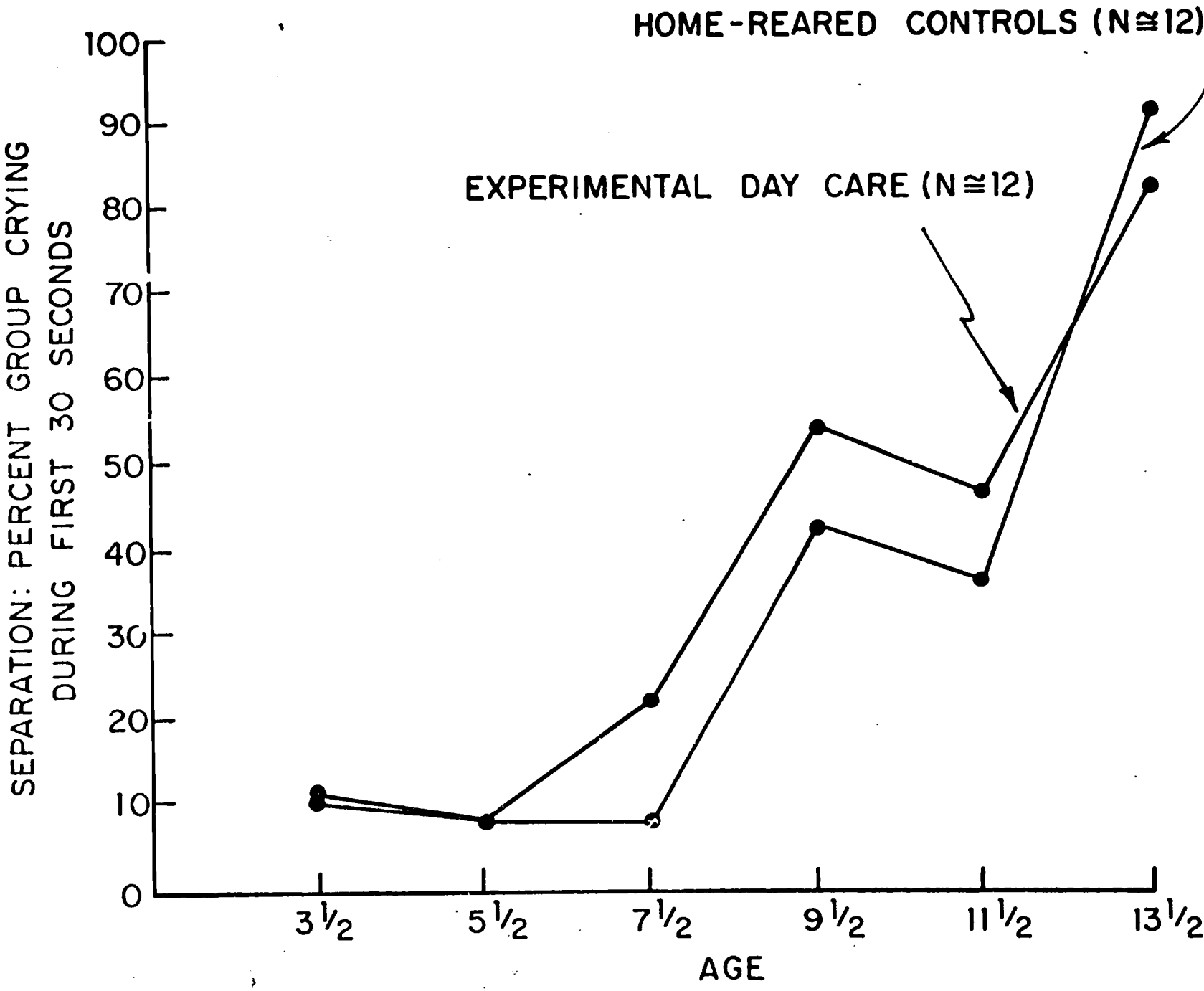

HOME-REARED CONTROLS (N≅12)
EXPERIMENTAL DAY CARE (N≅12)
SEPARATION: PERCENT GROUP CRYING DURING FIRST 30 SECONDS
100
90
80
70
60
50
40
30
20
10
0
3 1/2
5 1/2
7 1/2
9 1/2
11 1/2
13 1/2
AGE

FIG. 6

It appears that daily attendance at a day care center does not seriously retard or distort the universal affective milestones of stranger and separation protest or attachment to adults. This finding is significant, for many psychologists and parents have been apprehensive about the emotional sequellae of day care attendance. Although our more detailed analyses during the next two years may reveal more subtle effects, we can say with confidence at this time that the molar phenomena that are supposedly diagnostic of normal psychological development are not seriously altered in our day care sample.

Results of the normative sample of infants

Block episode. The normative cross sectional data support the prediction of a curvilinear relation between age and fixation time, for the 5 1/2 and 11 1/2 month old subjects show shallow habituation curves to the repetition of the standard, while the 7 1/2 and 9 1/2 month old infants show steep habituation. Fixation to the return of the original two-inch cube shows the curvilinear age pattern most clearly; longest fixations occur at 5 1/2 and 11 1/2 months and the shortest fixations occur at 7 1/2 and 9 1/2 months.

The sensitivity of vocalization as an index of reaction to the discrepant smaller block appears to be culturally determined, among girls. We have recently completed a study among isolated, rural Guatemalan infants 5 1/2 through 11 1/2 months. The increase in vocalization at 11 1/2 months to the transformation and return trials of the block episode was larger for boys than

for girls in these Guatemalan communities. In Cambridge the increased vocalization occurred more frequently for girls (Zelazo, Kagan & Hartmann, 1972). This cultural difference is best illustrated by the data for intertrial vocalization following the first transformation trial at 11 1/2 months of age. The American girls were more likely than boys to vocalize following the first discrepant stimulus. In Guatemala, the boys were more likely to show this reaction.

It should be noted that in these Guatemalan families the boys are spoken to more by adult caretakers than are girls. In the United States, especially in middle class homes, girls experience more distinctive vocalization from adults than boys. In addition, observations in an even more isolated Indian village in western Guatemala reveal that infants almost never vocalize to a discrepant event, neither boys nor girls, but react to discrepancy in other ways. The infants in these very poor Indian villages are spoken to by adults or children less than 8 percent of their waking hours, compared to 20-30 percent in middle class American homes. Hence the tendency to vocalize to a new experience in the visual mode seems to be partially controlled by verbal interaction at home and is not as valid an index of sensitivity to discrepancy as increased fixation time.

Light episode. The increase in attentiveness toward the end of the first year did not occur until 11 1/2 months for the light episode. This is not surprising since the transformation was the

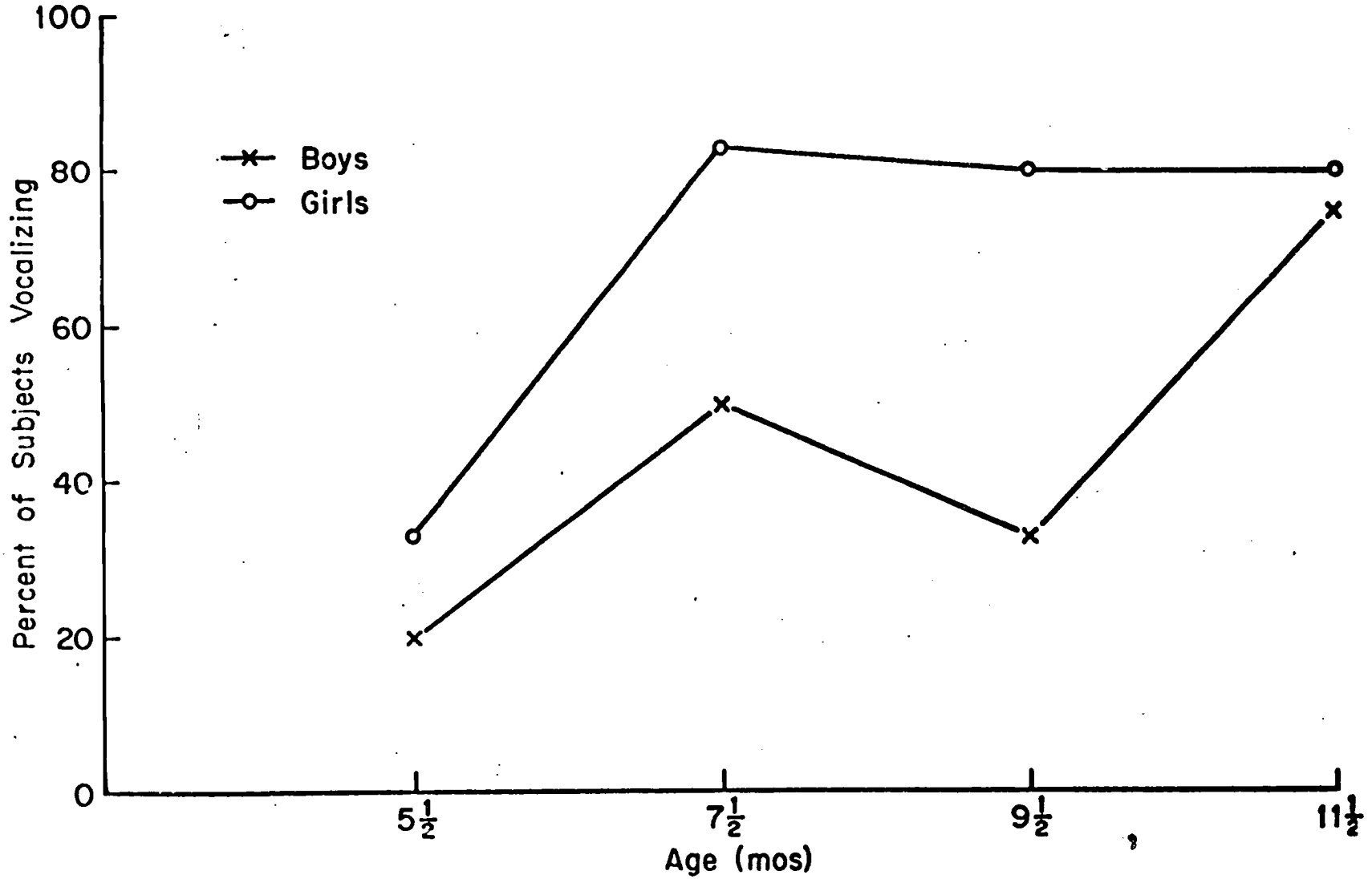
omission of a three-second movement sequence, rather than the substitution of a different dynamic event. During the light transformation nothing happened for three seconds and the child had to generate a representation of the event transformed. Since our theory of the first year implies that this competence does not emerge until the end of the first year it might be expected that the fixation time measure should not reflect sensitivity to this discrepancy until later in the year. Fixation to the return of the original sequence again revealed the greatest increases at 5 1/2 and 11 1/2 months and the smallest increases at 7 1/2 and 9 1/2 months.

Vocalization to the light was infrequent, but displayed its highest value at 11 1/2 months, especially to the transformations. There was no clear indication of an increase in vocalization to the transformation until 11 1/2 months of age, and that reaction occurred primarily among girls, who increased from essentially no vocalization on the last standard trial to a mean of greater than 1.0 second on the first transformation. Vocalization during the intertrial interval also displayed a linear increase with age and, as with vocalization during the stimulus presentation, the 11 1/2 month old girls showed a marked increase in intertrial vocalization following the first transformation.

Auditory episode I: meaning to nonsense. There was a linear decrease with age in the duration of orientation to the sound source during the transformations.

FIGURE 7

VOCALIZATION DURING INTERVAL FOR TRANSFORMATION (T_1-T_5 POOLED)
AUDITORY I (MEANING TO NONSENSE)
AMERICAN NORMS



this auditory episode at 9 1/2 months (this was not true for the two visual episodes), it is possible that this particular sex difference may have a biological origin.

Auditory II: meaning to meaning. As in the first auditory episode, orientation to the speaker decreased linearly with age supporting the earlier suggestion that this response reflects a disposition to locate the source of the sound. Unlike the first auditory episode, however, there was no large increase in orientation to the speaker during the transformation at 5 1/2 or 7 1/2 months. This suggests either that the "meaning to meaning" discrepancy was a more difficult discrimination to make or that the children had become so accustomed to the auditory event they were not motivated to search for the source of the sound. The first interpretation seems more likely, for the 9 1/2 and 11 1/2 month girls displayed a sharp increase in orientation to the sound source on the first two transformation trials.

As in the first auditory episode, vocalization during the trial was infrequent, though increasing with age. The joint appearance of sudden quieting and a sharp increase in orientation to the sound source among 9 1/2 month girls implies a definite reaction to the first transformation. This effect was less clear for boys. Vocalization following termination of the stimulus also increased with age, and 7 1/2 and 11 1/2 month old girls showed the clearest increase in reactivity to the transformations.

Visual discrepancy: car-doll episode. The infants showed prolonged attentiveness at all ages and minimal habituation to this interesting event. There was no increase in fixation time to the transformations because attention during the habituation series was high. Vocalization to the transformations increased with age for both sexes.

In sum, the results of the normative study suggest that the probability of a child reacting to a discrepancy is a function of the nature of the discrepant event. The infants gave their first clear reaction to the simple auditory transformation at 5 1/2 months, to the block transformation at 7 1/2, to the light and second auditory discrepancies at 9 1/2 and 11 1/2 months. The more subtle the transformation, the later the behavioral evidence of detection of that discrepancy.

We can now turn to the preliminary data generated by the subjects in the major project.

Preliminary results for day care versus home reared children

This summary of initial data is primarily for illustration rather than persuasion. It compares the behavior of several matched pairs of children -- one experimental and one home control -- to convey an impression of how the final analyses will proceed.

Pair #1 - JN Day Care vs. KL Home Control, middle class, Causasian females.

JN is an alert and precocious Caucasian female who has generated a positive halo among all of the day care staff. As an infant of seven months she was unique in her tendency to crawl off from the group and play for long periods of time with toys in an intense and prolonged aura of concentration. She was the first child to begin to use meaningful words and currently, at 24 months, has the richest language repertoire of any child in the Center. Her performance on our episodes during the first year was remarkably close to theoretical expectations. It is almost as if she had read our theoretical papers and was trying to be maximally obliging. KL is also a blond, first-born girl whose mother is in the same general social class and educational level as JN's parent.

Block Episode. JN showed the expected curvilinear relationship between attention and age (See Figure 8) with a trough at 7 1/2 months and an increased disposition to display cardiac acceleration towards the end of the first year (See Figure 9). At 5 1/2 months, there was no acceleration to any of the six repetitions of the standard, while at 11 1/2 months acceleration occurred on 5 of 6 presentations. At 11 1/2 months JN displayed acceleration on each of the first three transformation trials.

By contrast, KL did not show as clear a U-shaped function for attention distribution and showed decreasing attention with age to the transformation trials, suggesting that KL had not yet entered the stage of activation of hypotheses at 11 1/2 months. This suggestion is in accord with the fact that KL

did not display a notable increase in cardiac acceleration with age. At 11 1/2 months, she accelerated on only one of six standards and one of three transformations, while JN accelerated on 5 of 6 standards and all 3 transformations. (See Figures 10 and 11.)

Light Episode. As with Block, JN showed a clearer indication of the curvilinear function to the transformations than KL. JN showed a sharp increase in fixation time to the transformations at 9 1/2 and 11 1/2 months, whereas KL's attention remained low at these two ages. The heart rate data provided further support to JN's precocity, for she showed acceleration on most of the trials at 11 1/2 and 13 1/2 months of age (7 of 8 and 8 of 8) while KL's reactions were predominantly cardiac decelerations. (See Figures 3, 4, 12, and 13.)

In sum, the data on these two episodes for these two girls matched on ethnicity, ordinal position and social class suggest that JN, who was in the day care group, may have reached the stage of activation of hypotheses a little ahead of KL.

Pair #2. This analysis contrasts two first-born Chinese boys; SC who was in the day care group and SL who resided at home.

Block. Unlike the first pair, the boy in the day care center was not precocious to the one living at home. In the Block episode, SL showed prolonged attention to the standard and transformations at 7 1/2, 9 1/2 and 11 1/2 months. SC did not show the increase in attention until 11 1/2 months.

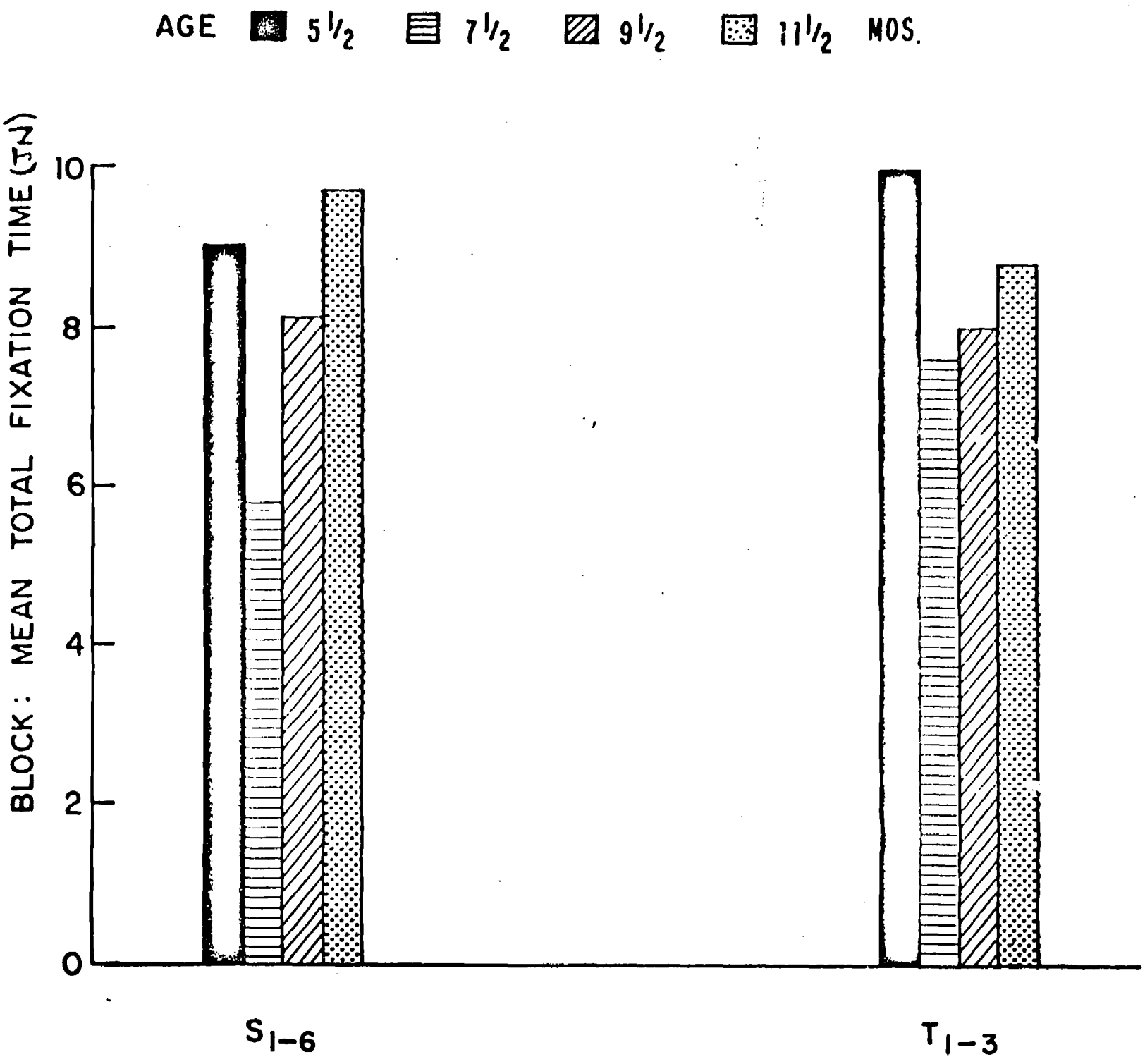

AGE 5 1/2 7 1/2 9 1/2 11 1/2 MOS.
BLOCK: MEAN TOTAL FIXATION TIME (TN)
10
8
6
4
2
0
S1-6
T1-3

FIG. 8

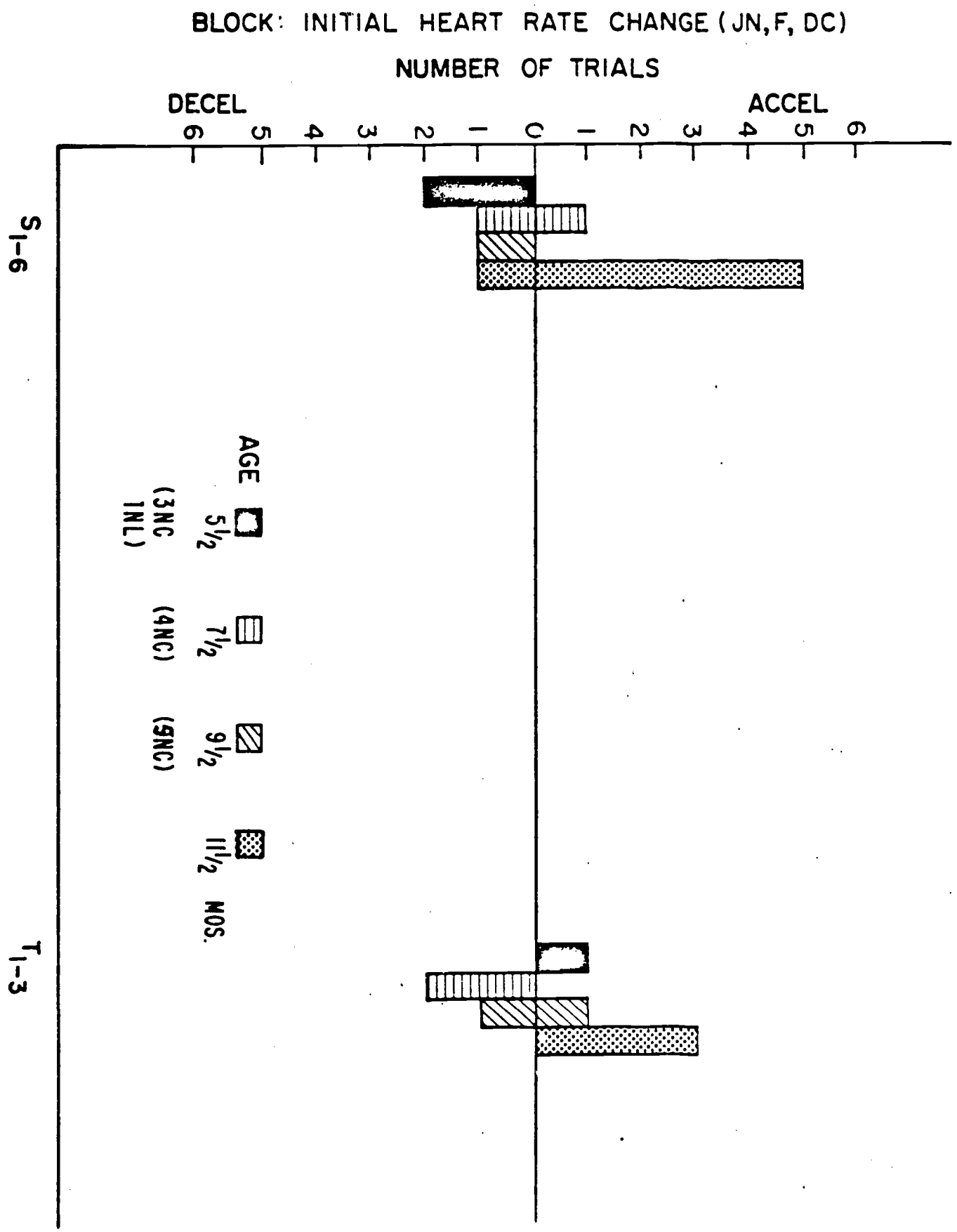

BLOCK: INITIAL HEART RATE CHANGE (JN, F, DC)
NUMBER OF TRIALS
DECEL
ACCEL
6 5 4 3 2 1 0 1 2 3 4 5 6
S1-6
T1-3
AGE
5½
7½
9½
11½ MOS.
(3NC 1NL)
(4NC)
(5NC)

FIG. 9

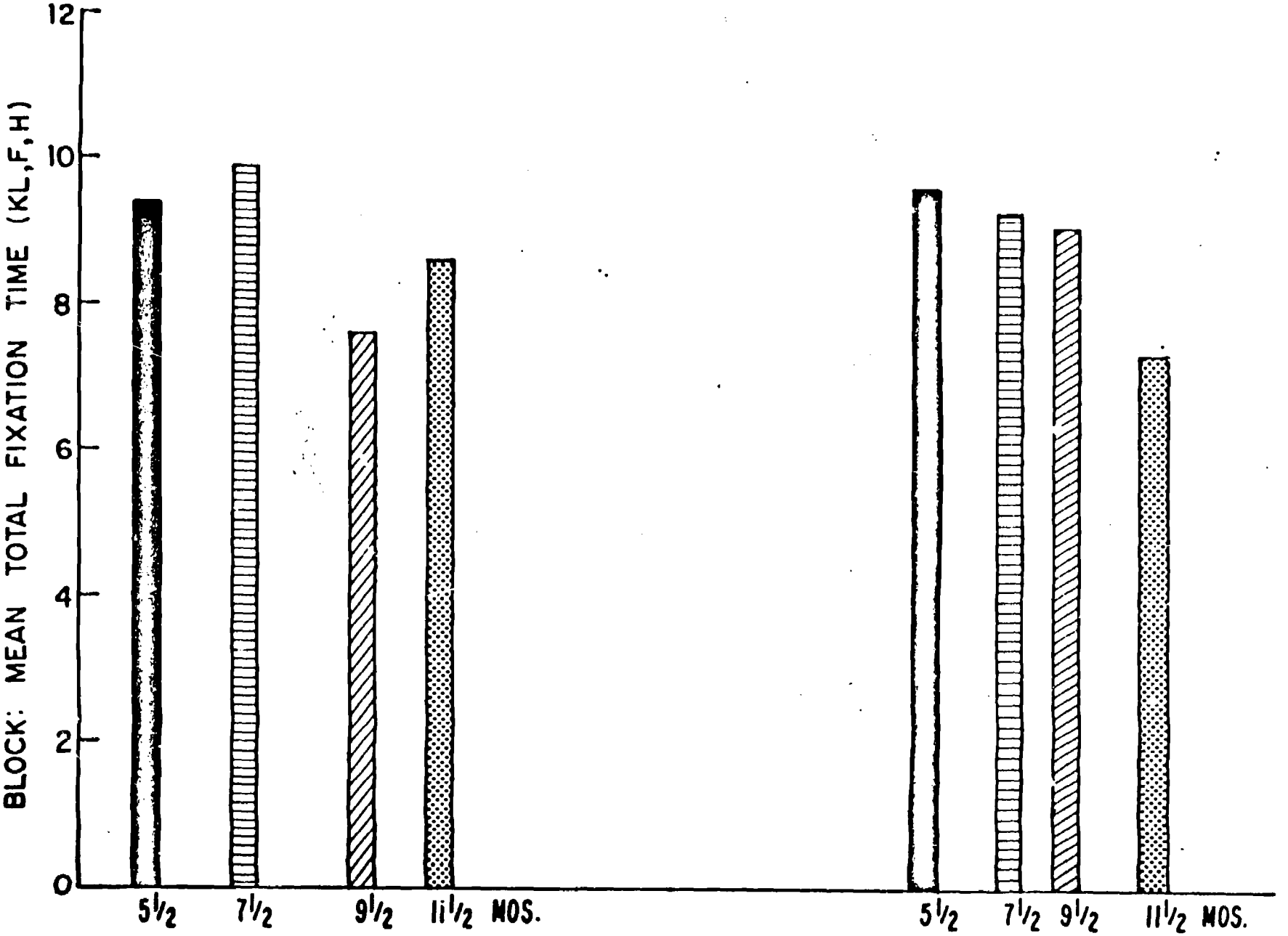

BLOCK: MEAN TOTAL FIXATION TIME (KL,F,H)
12
10
8
6
4
2
0
5½
7½
9½
11½ MOS.
AGE
S1-6
5½
7½
9½
11½ MOS.
AGE
T1-3

FIG. 10

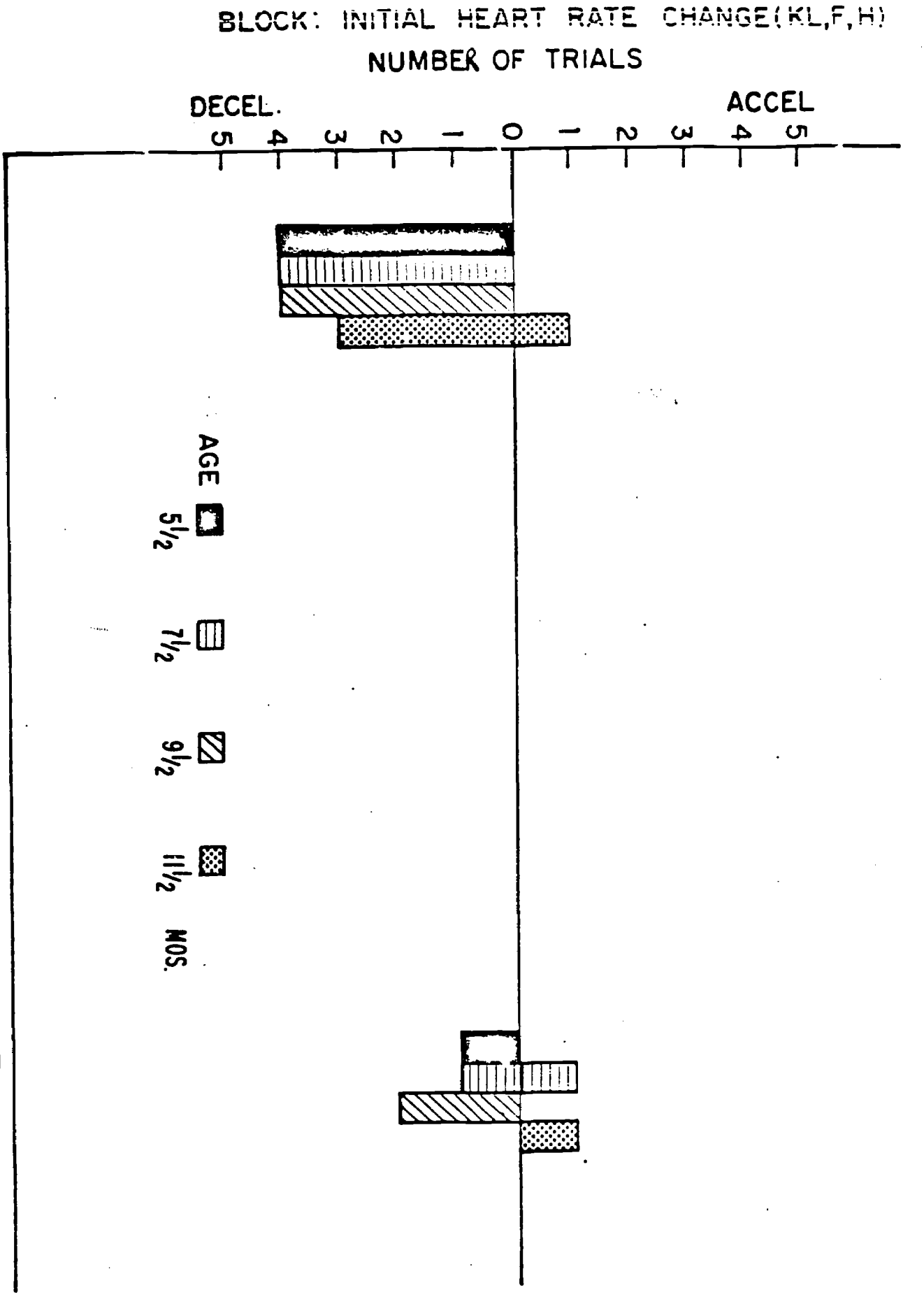

BLOCK: INITIAL HEART RATE CHANGE(KL,F,H)
NUMBER OF TRIALS
DECEL.
ACCEL
5 4 3 2 1 0 1 2 3 4 5
S1-6
T1-3
AGE
5½
7½
9½
11½
MOS.

FIG. 11

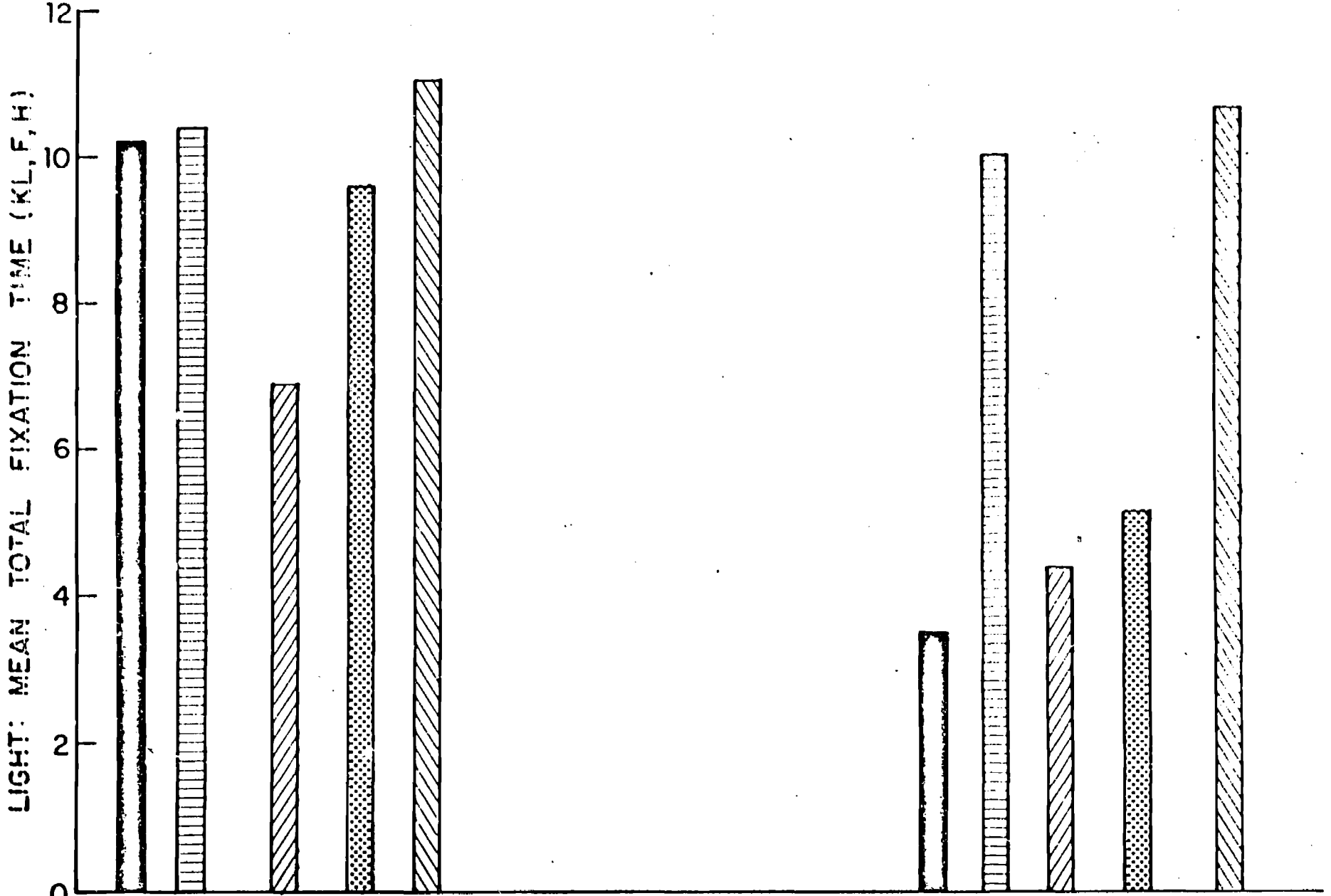

LIGHT: MEAN TOTAL FIXATION TIME (KL, F, H)
12
10
8
6
4
2
0
5½ 7½ 9½ 11½ 13½ MOS.
AGE
S1-8
5½ 7½ 9½ 11½ 13½ MOS.
AGE
T1-3

FIG. 12

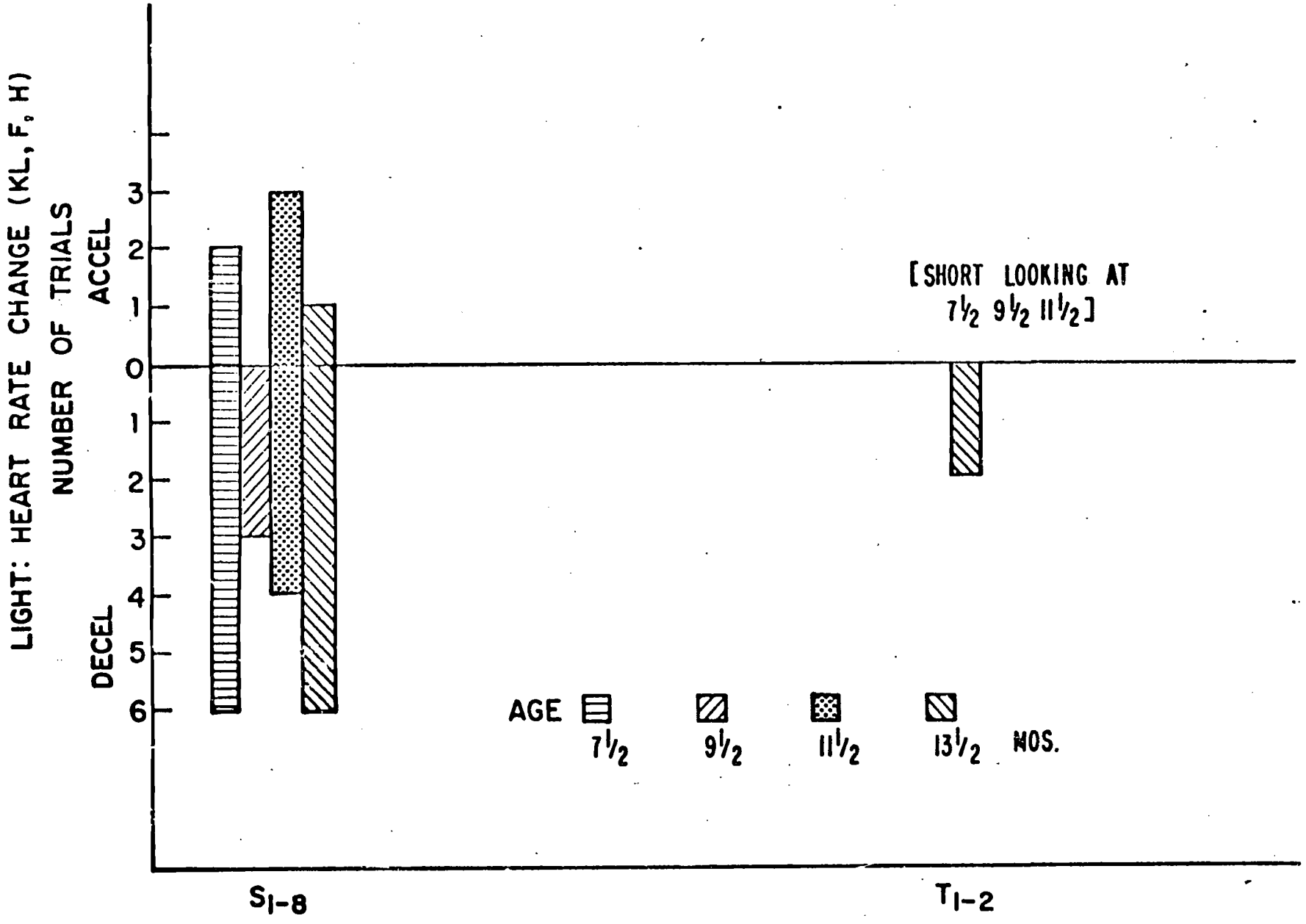
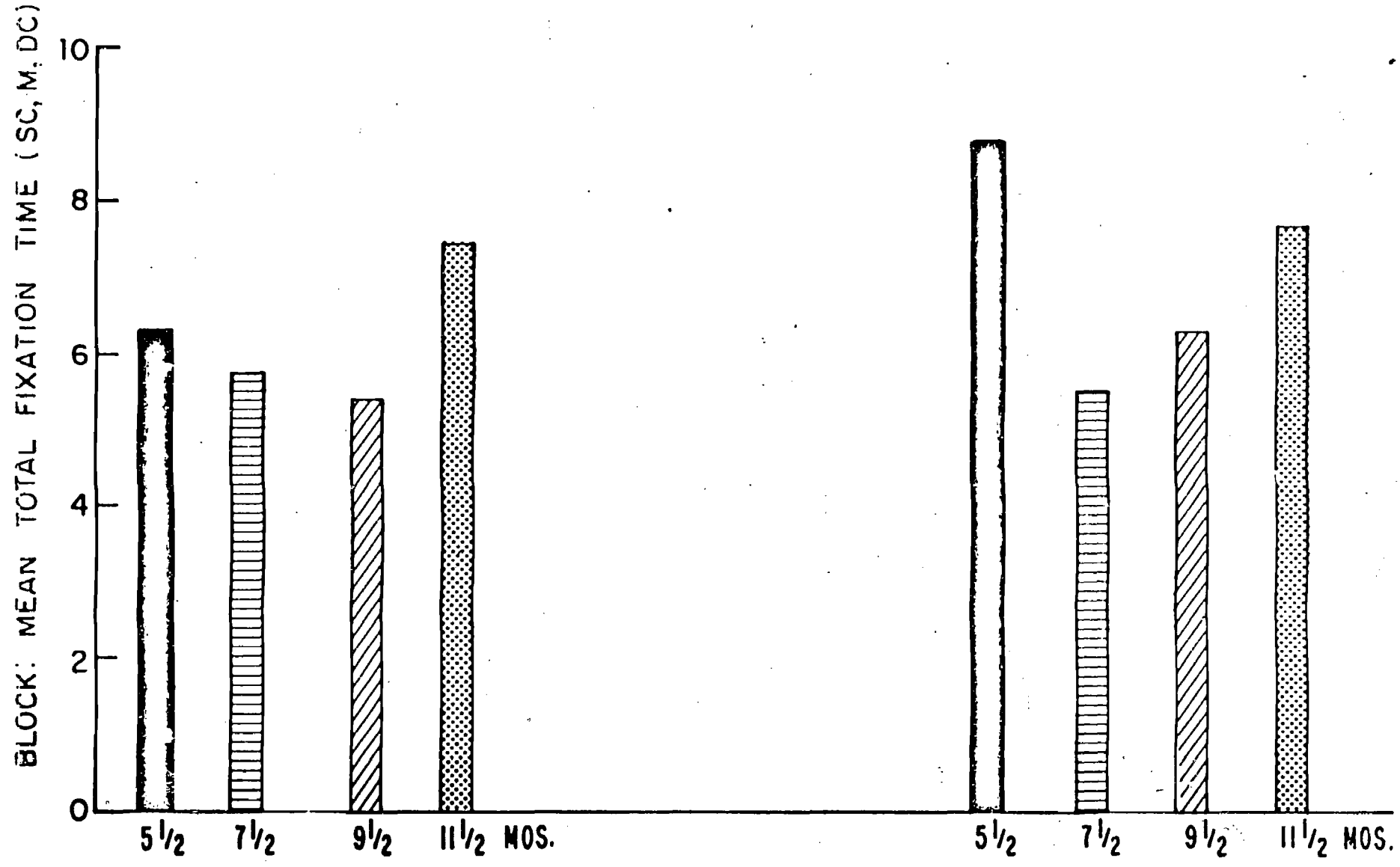

LIGHT: HEART RATE CHANGE (KL, F, H)
NUMBER OF TRIALS
ACCEL
DECEL
3
2
1
0
1
2
3
4
5
6
[SHORT LOOKING AT
7½ 9½ 11½]
AGE
7½
9½
11½
13½
MOS.
S1-8
T1-2

FIG. 13



S_{1-6} FIG. 14 T_{1-3}

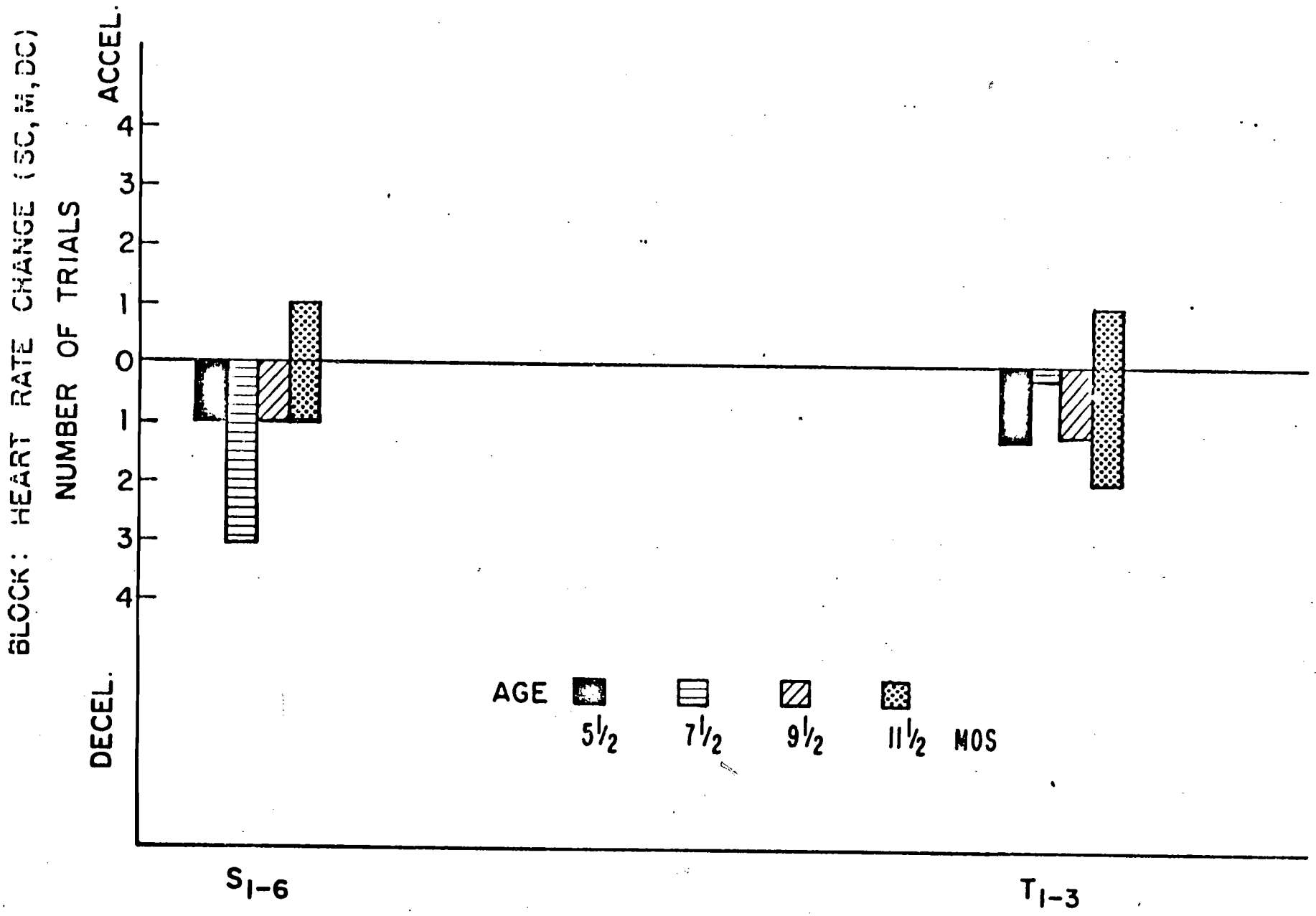

BLOCK: HEART RATE CHANGE (SC, M, DC)
NUMBER OF TRIALS
ACCEL.
DECEL.
4
3
2
1
0
1
2
3
4
AGE
5½
7½
9½
11½ MOS
S1-6
T1-3

FIG. 15

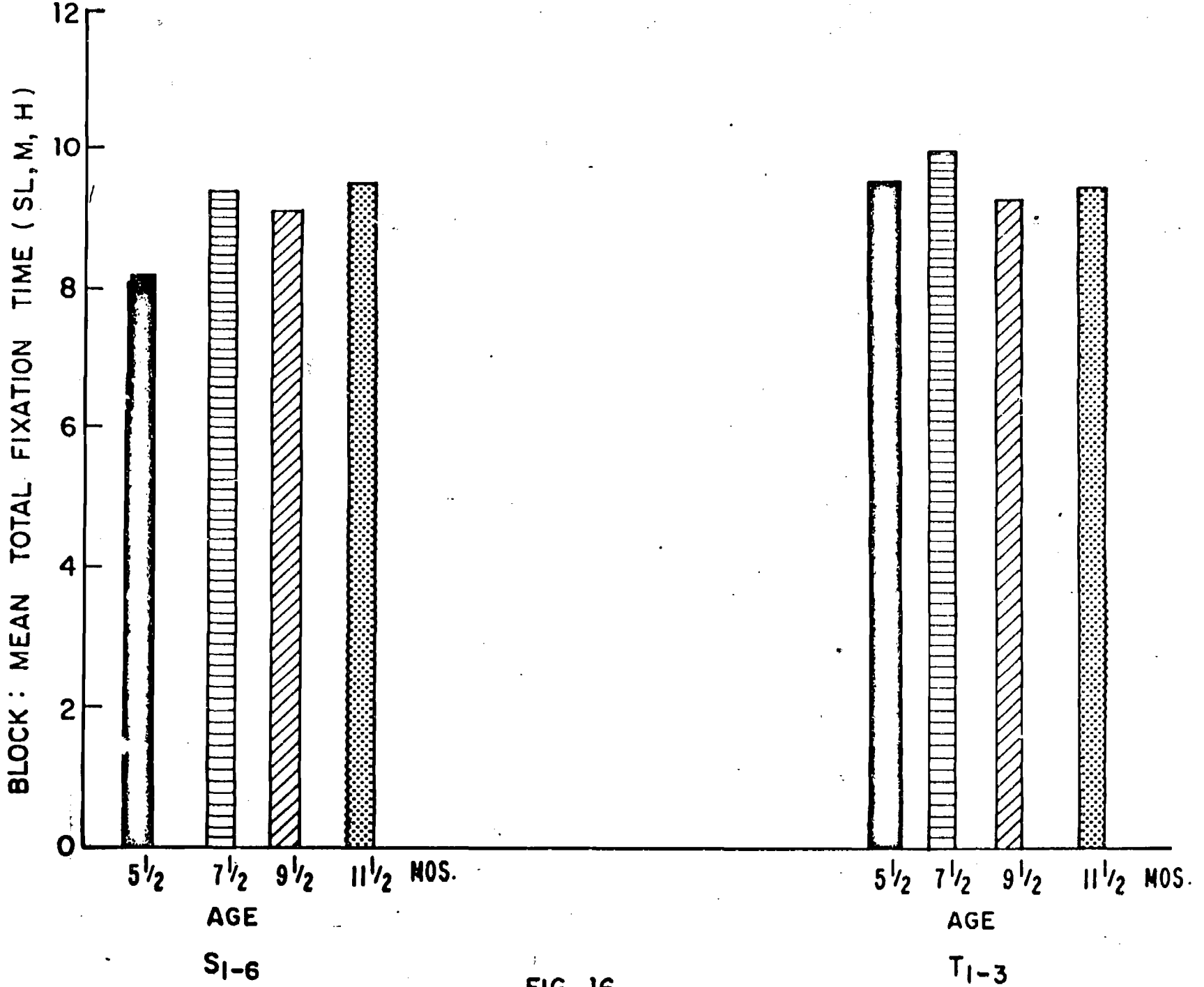

BLOCK : MEAN TOTAL FIXATION TIME (SL, M, H)
12
10
8
6
4
2
0
5½ 7½ 9½ 11½ MOS.
AGE
S1-6
5½ 7½ 9½ 11½ MOS.
AGE
T1-3

FIG. 16

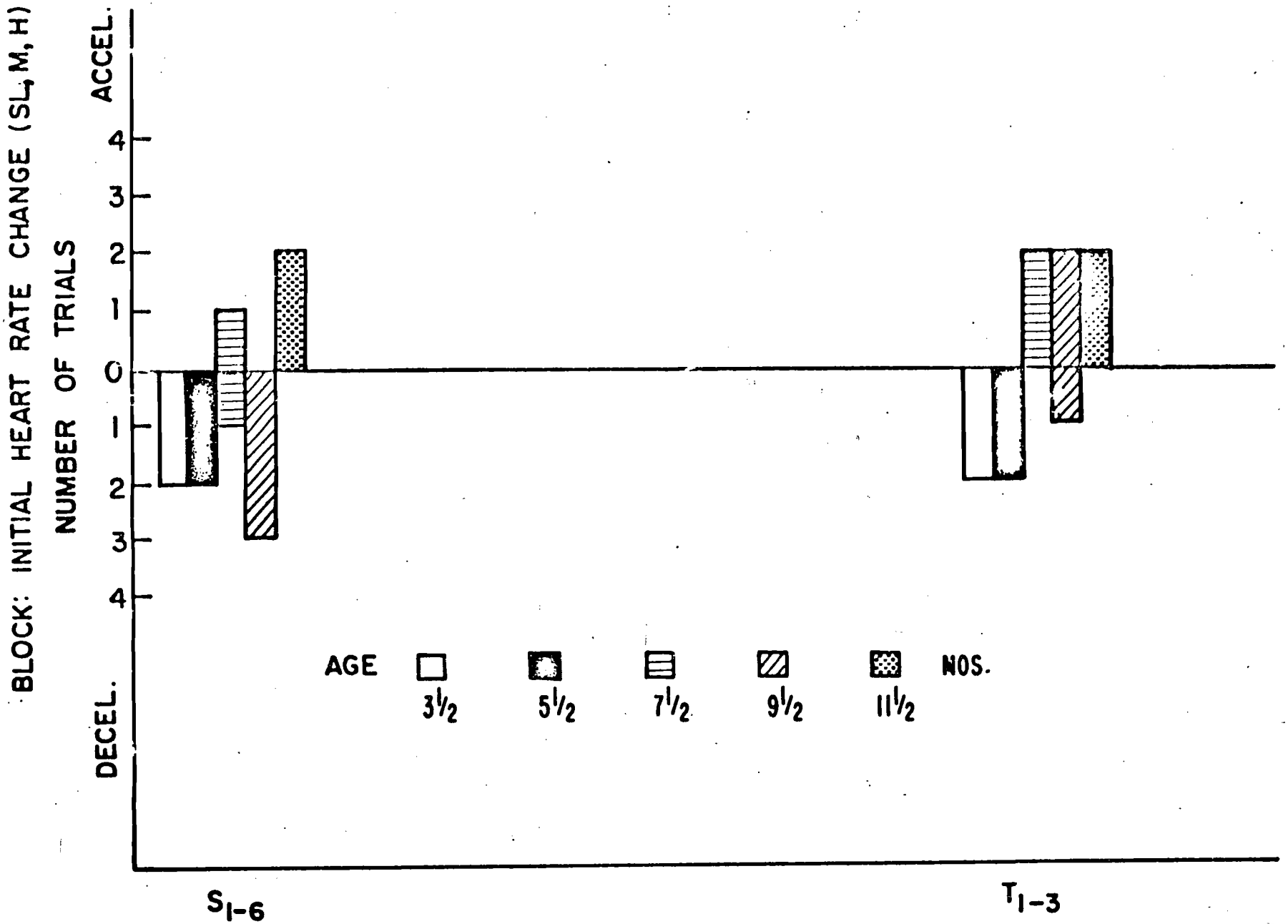

BLOCK: INITIAL HEART RATE CHANGE (SL, M, H)
NUMBER OF TRIALS
ACCEL.
DECEL.
4
3
2
1
0
1
2
3
4
AGE
3½
5½
7½
9½
11½
NOS.
S1-6
T1-3

FIG. 17

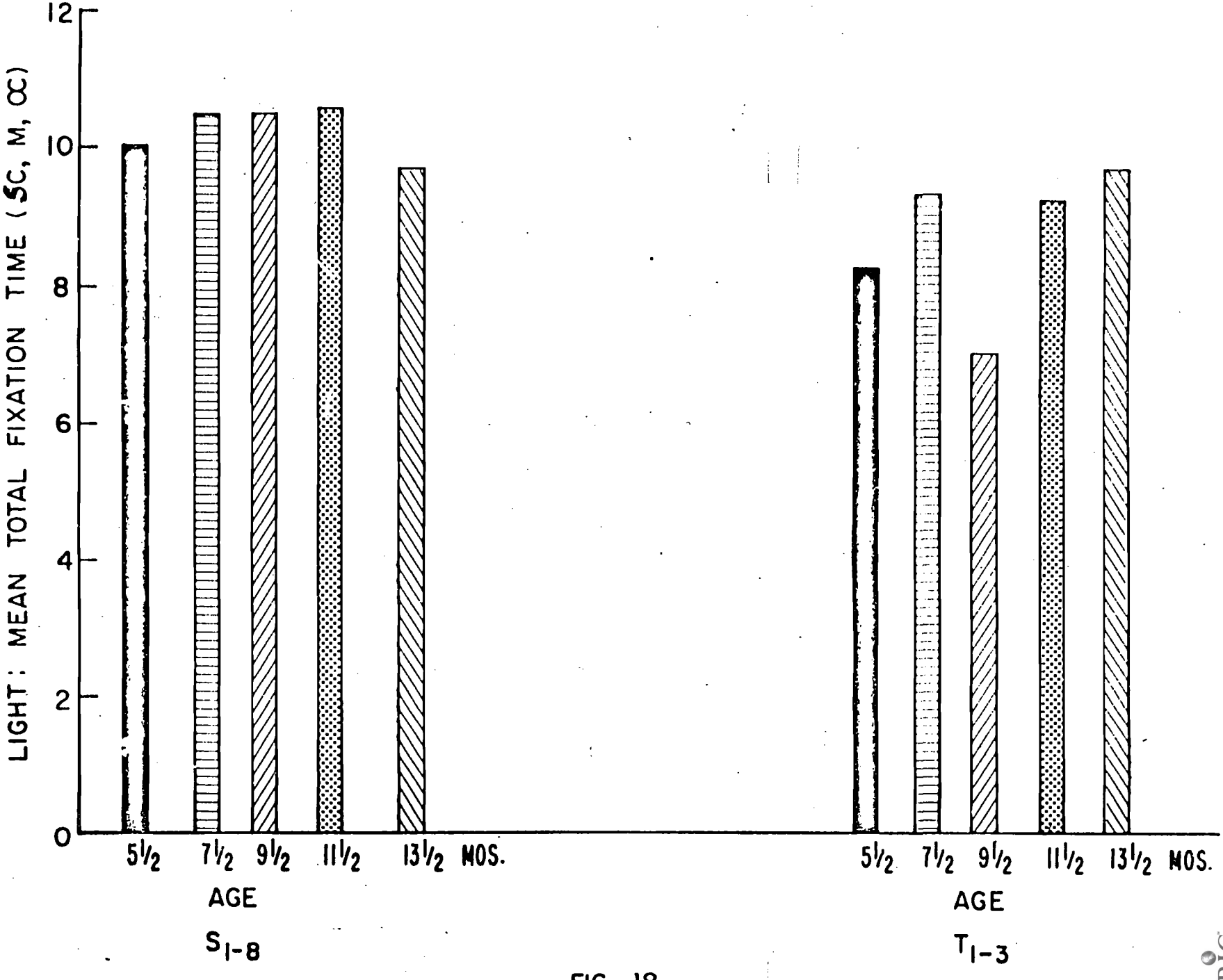

LIGHT: MEAN TOTAL FIXATION TIME (SC, M, CC)
12
10
8
6
4
2
0
5½ 7½ 9½ 11½ 13½ MOS.
AGE
S1-8
5½ 7½ 9½ 11½ 13½ MOS.
AGE
T1-3

FIG. 18

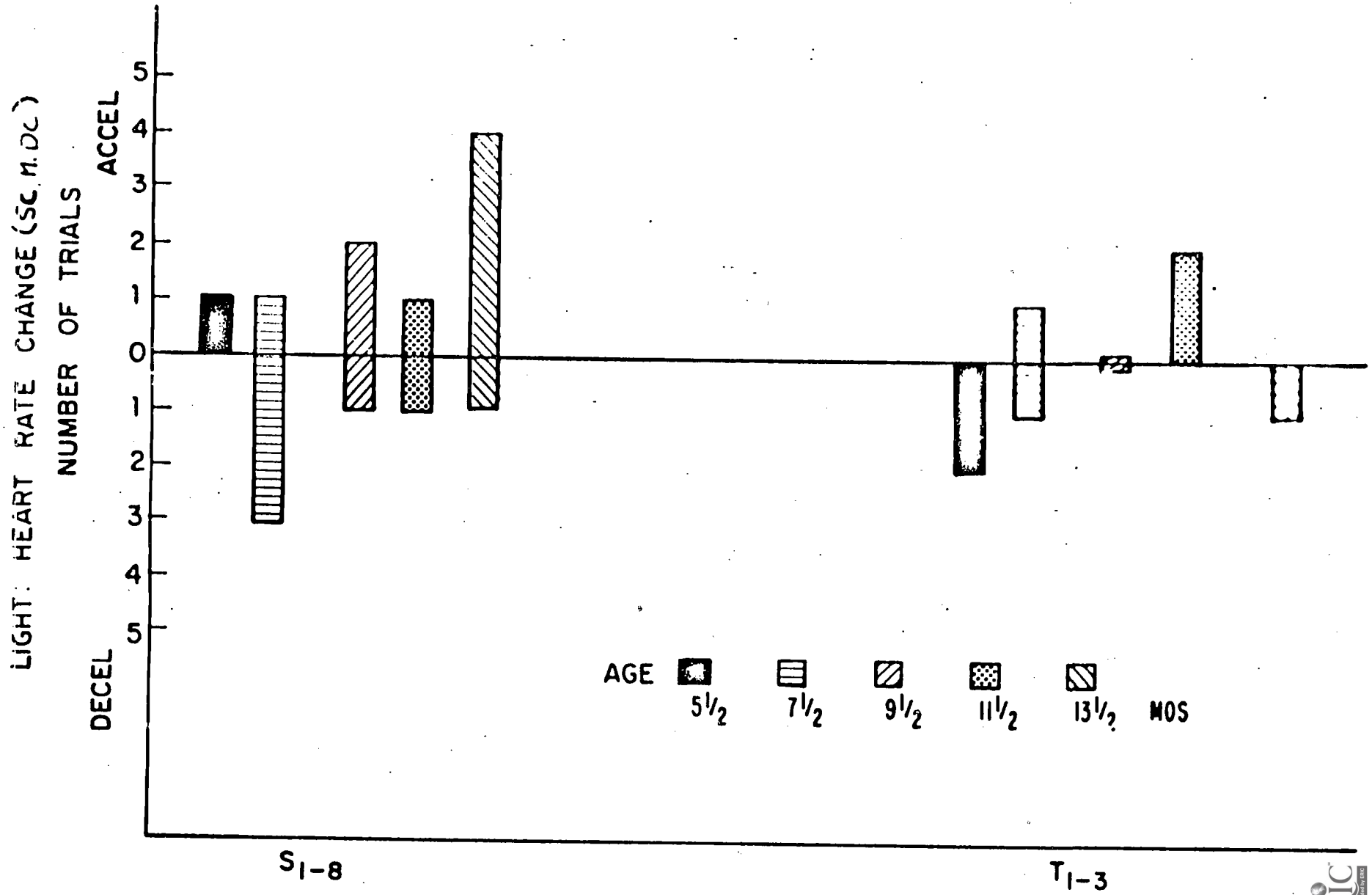

LIGHT: HEART RATE CHANGE (SC. M.DC.)
NUMBER OF TRIALS
ACCEL
DECEL
5
4
3
2
1
0
1
2
3
4
5
AGE
5 1/2
7 1/2
9 1/2
11 1/2
13 1/2
MOS
S1-8
T1-3

FIG. 19

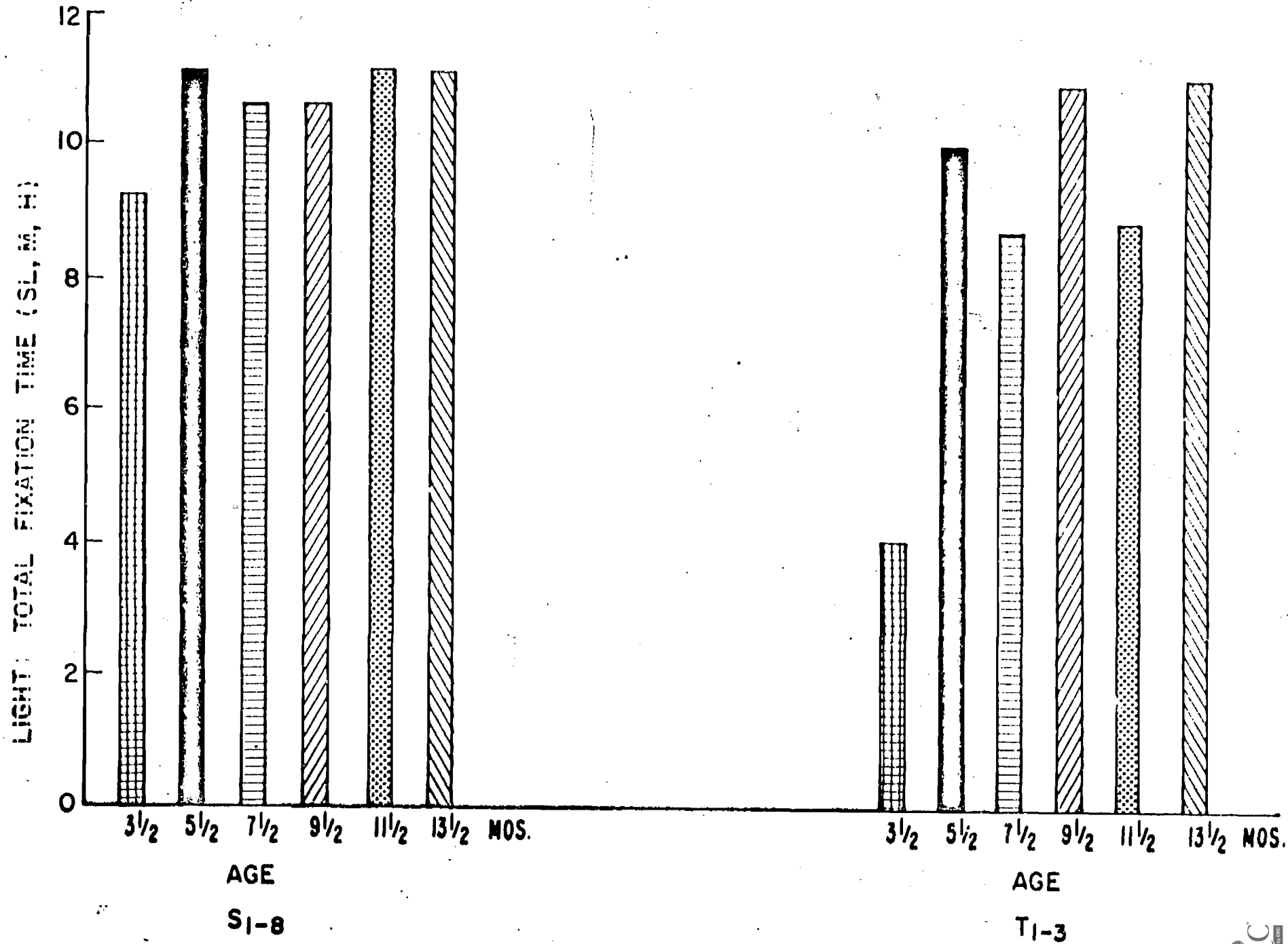

LIGHT TOTAL FIXATION TIME (SL, M, H)
12
10
8
6
4
2
0
3½ 5½ 7½ 9½ 11½ 13½ MOS.
AGE
S1-8
3½ 5½ 7½ 9½ 11½ 13½ MOS.
AGE
T1-3

FIG. 20

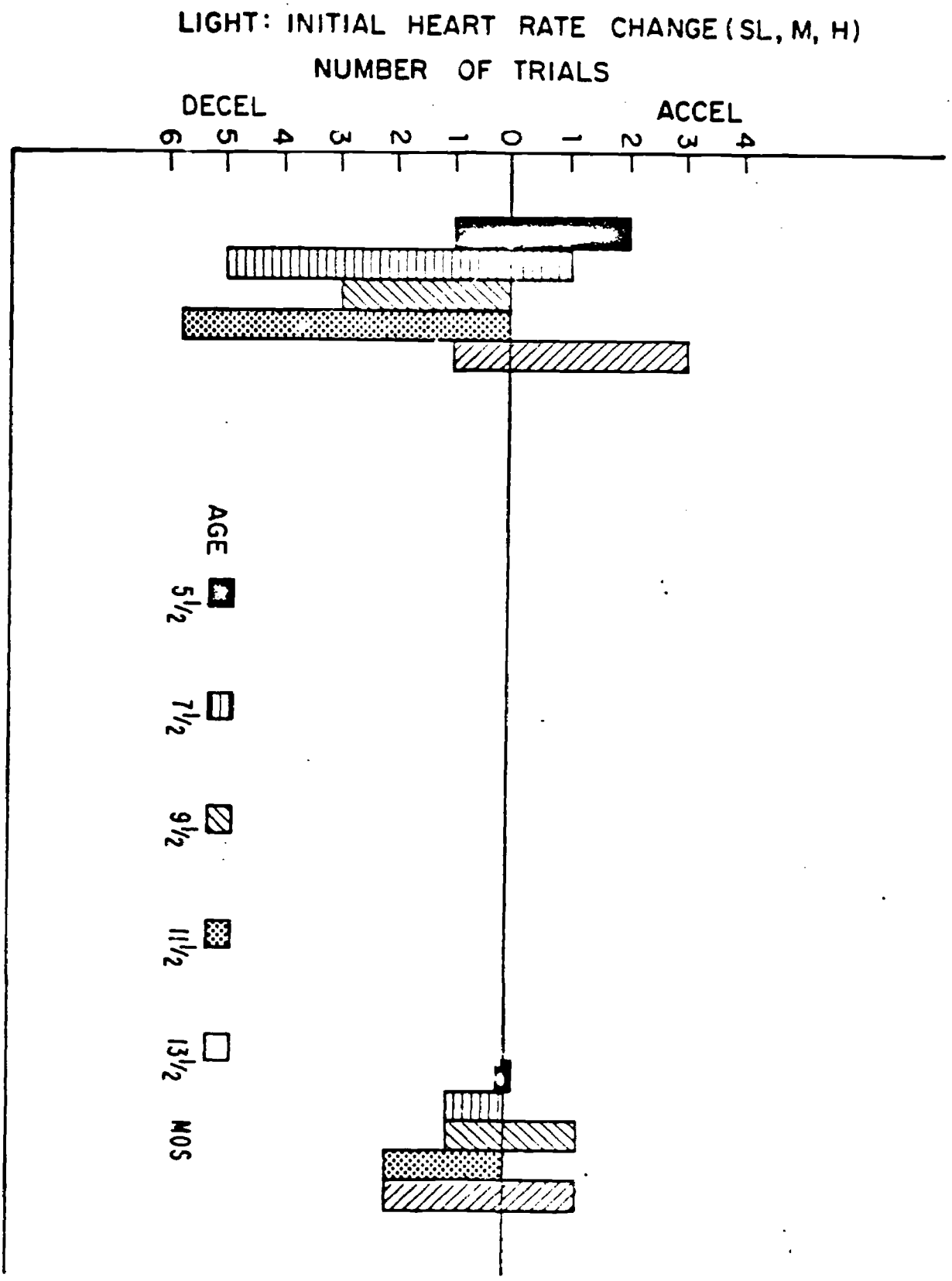

LIGHT: INITIAL HEART RATE CHANGE (SL, M, H)
NUMBER OF TRIALS
DECEL
ACCEL
6 5 4 3 2 1 0 1 2 3 4
S1-8
T1-3
AGE
5½
7½
9½
11½
13½
MOS

FIG. 21

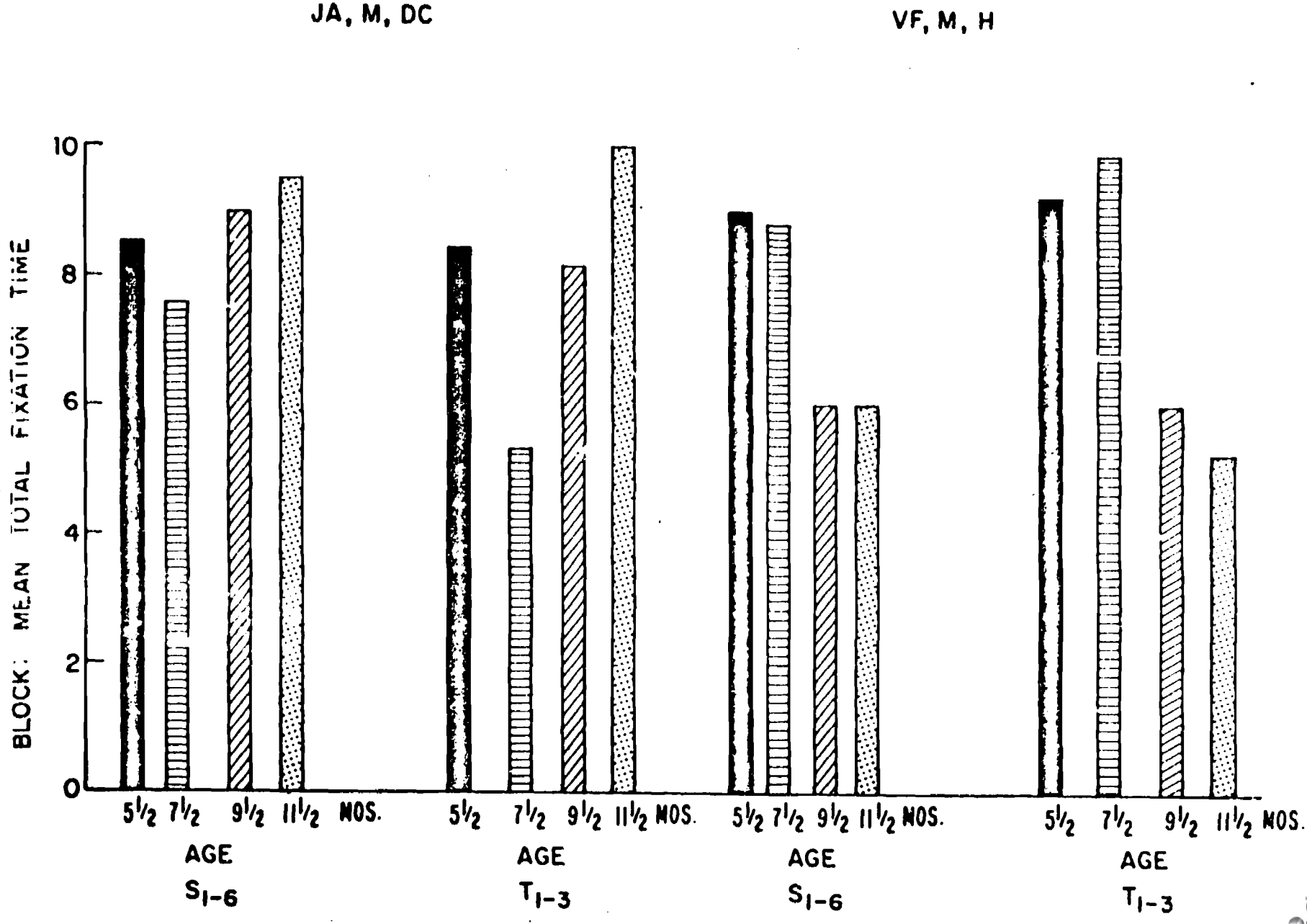

JA, M, DC
VF, M, H
BLOCK: MEAN TOTAL FIXATION TIME
0
2
4
6
8
10
5½ 7½ 9½ 11½ MOS.
AGE
S1-6
5½ 7½ 9½ 11½ MOS.
AGE
T1-3
5½ 7½ 9½ 11½ MOS.
AGE
S1-6
5½ 7½ 9½ 11½ MOS.
AGE
T1-3

FIG. 22

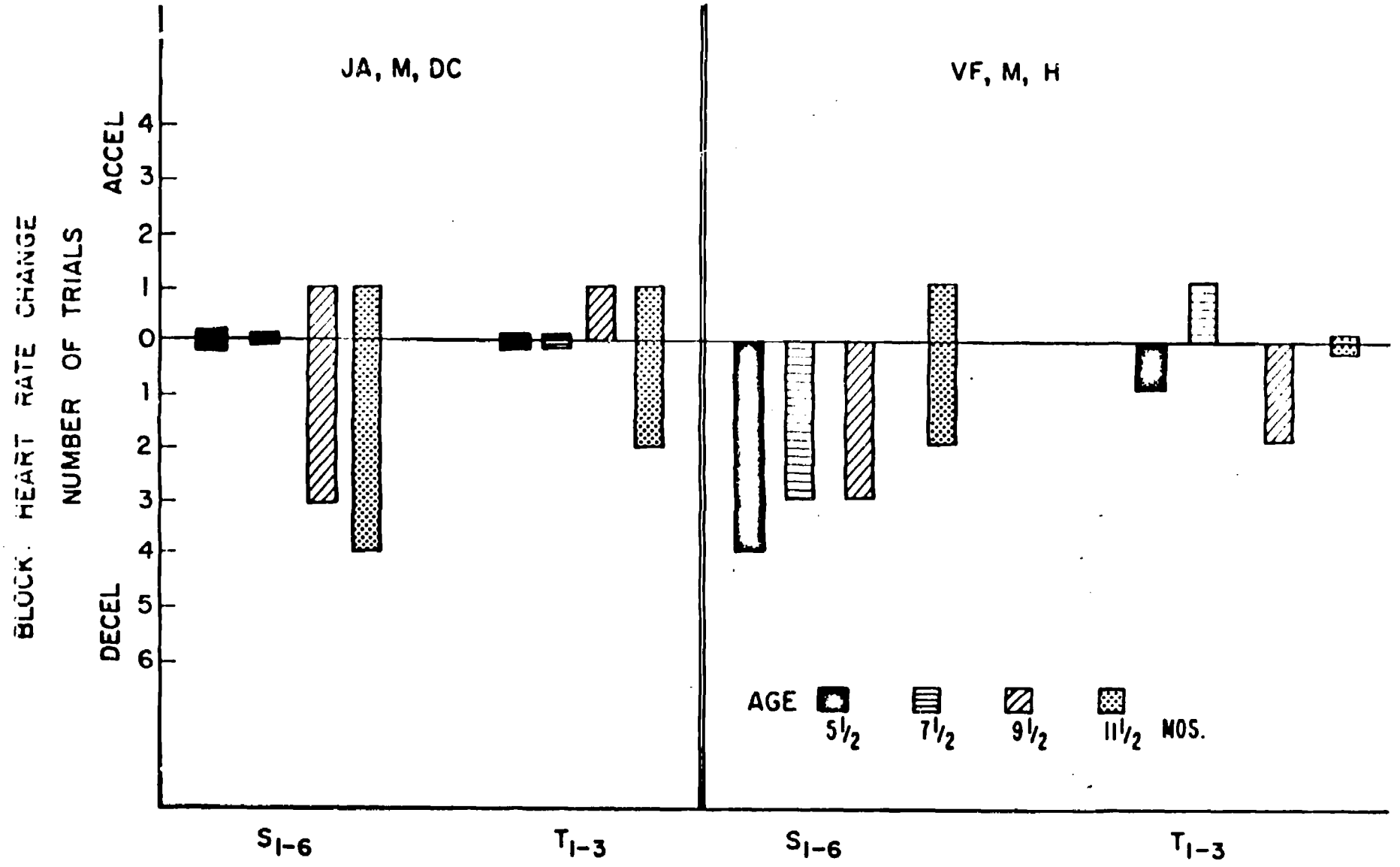

JA, M, DC
VF, M, H
BLOCK. HEART RATE CHANGE
NUMBER OF TRIALS
ACCEL
DECEL
1
2
3
4
5
6
0
1
2
3
4
AGE
5½
7½
9½
11½ MOS.
S1-6
T1-3
S1-6
T1-3

FIG. 23

JA accelerated on all 8 of the standard presentations and 4 out of 5 of the transformations; while VF failed to show any acceleration at 13 1/2 months (see Figures 24 and 25).

Figure 26 shows the patterns of cardiac reaction to the Car-Doll episode, which we have not discussed up to now. As with Light, JA showed acceleration on all 8 standard repetitions at 11 1/2 and 13 1/2 months, while VF accelerated on less than half the trials (Figure 26). These three pairs of children hopefully provide an initial indication of the kinds of analyses to be performed on the final data. In addition, we shall be examining social and free play variables which we have not considered in this preliminary summary.

More subjective analyses of the control children matched with the day care infants on sex, ordinal position, social class and ethnicity suggests that a temperamental dimension, which may be correlated with ethnicity, is influencing reactivity to our episodes. The Chinese infants, whether in day care or home, for example, are less vocal and less excitable than the Caucasians. It is not clear whether this Chinese/Caucasian difference is due to differential treatment at home or to biological factors. During the coming year, as the continued analysis of the data proceeds, we will be able to make more definitive statements.

We believe that the strategy of comparing growth functions among the three groups of children should allow us to assess the profile of differences that covary with the three classes of experience. The matching of experimental

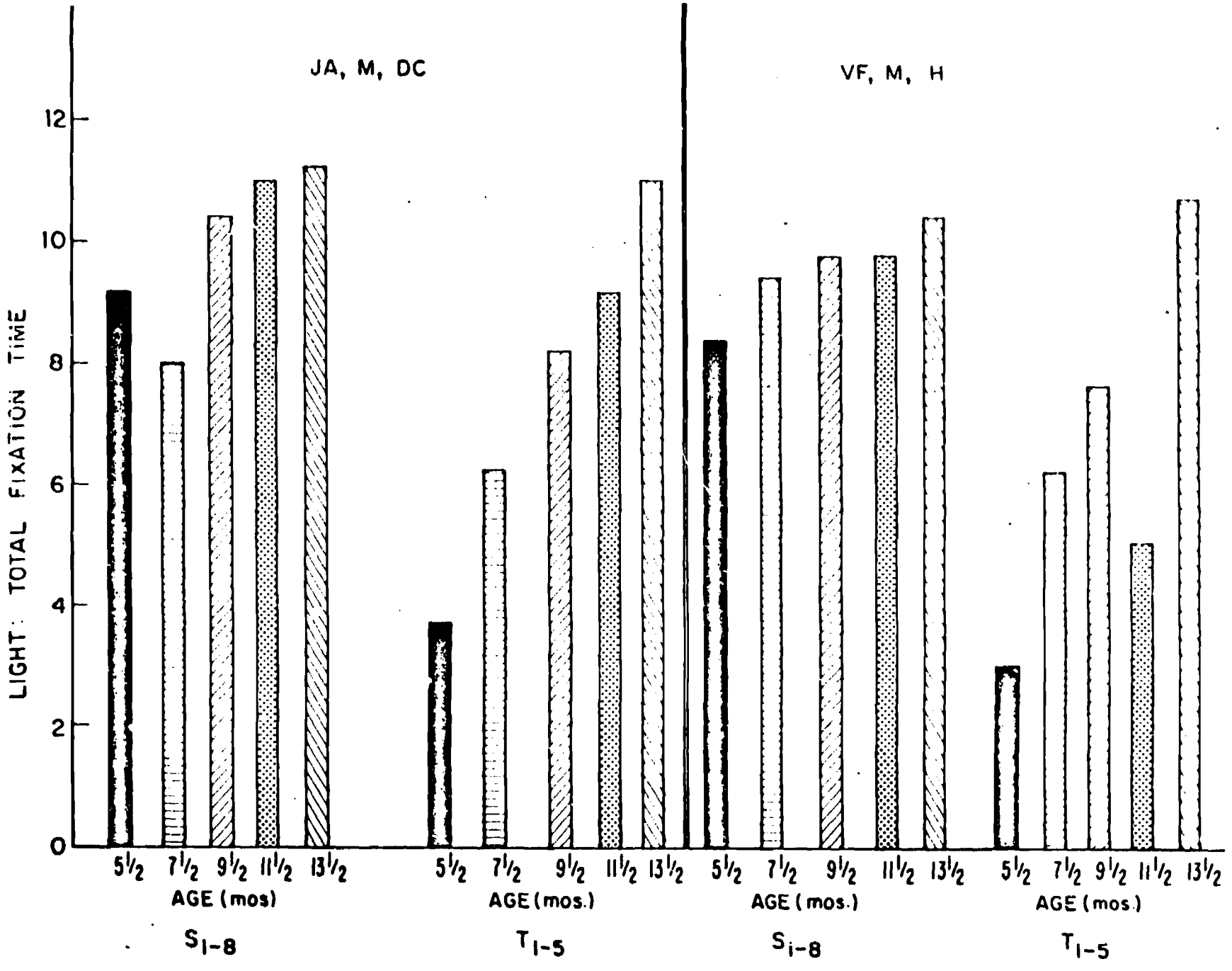

JA, M, DC
VF, M, H
LIGHT: TOTAL FIXATION TIME
0
2
4
6
8
10
12
5½ 7½ 9½ 11½ 13½
AGE (mos)
AGE (mos.)
AGE (mos.)
AGE (mos.)
S1-8
T1-5
Si-8
T1-5

FIG. 24

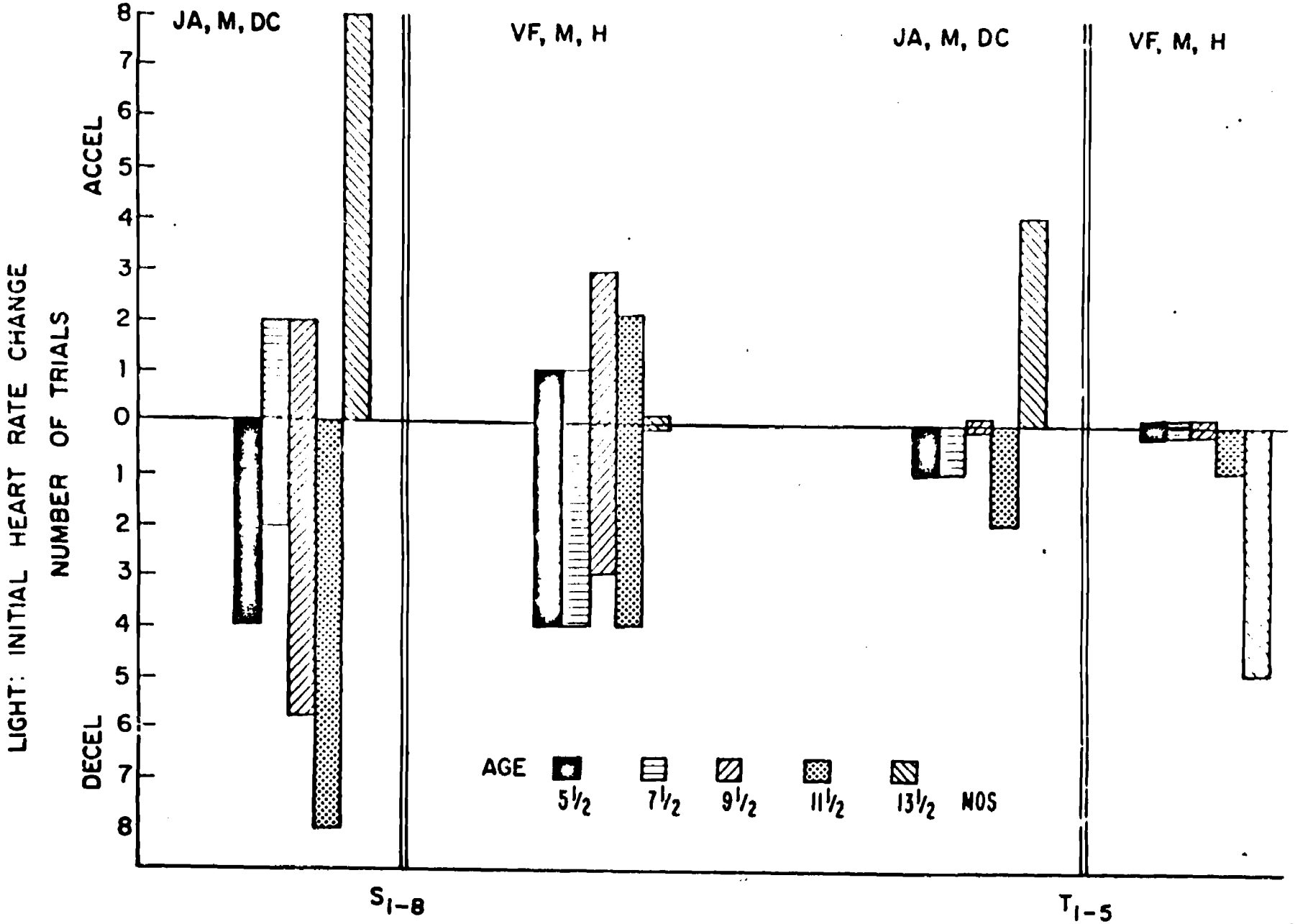

JA, M, DC
VF, M, H
JA, M, DC
VF, M, H
LIGHT: INITIAL HEART RATE CHANGE
NUMBER OF TRIALS
ACCEL
DECEL
8
7
6
5
4
3
2
1
0
1
2
3
4
5
6
7
8
AGE
5½
7½
9½
11½
13½
MOS
S1-8
T1-5

FIG. 25

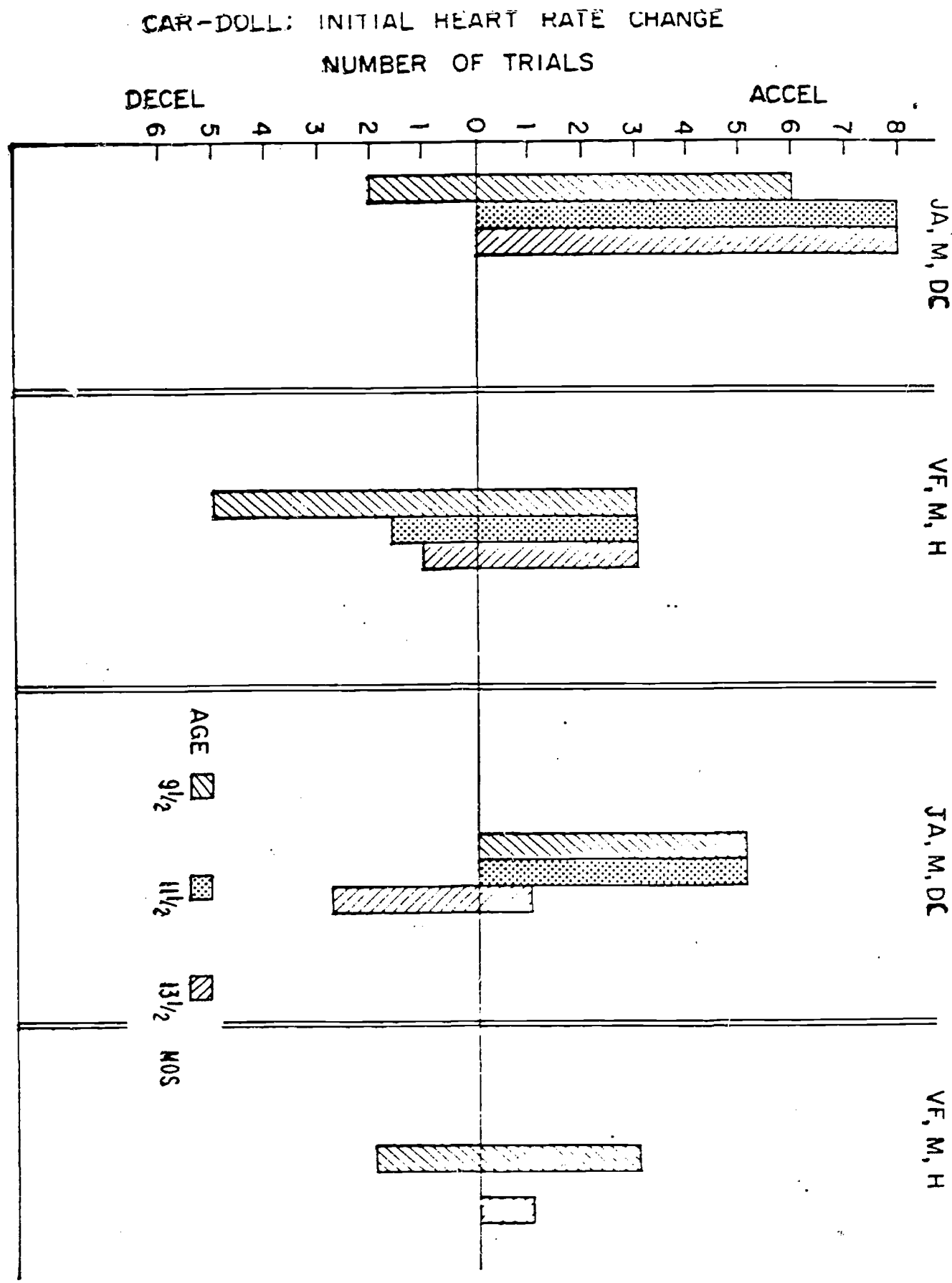

CAR-DOLL: INITIAL HEART RATE CHANGE
NUMBER OF TRIALS
DECEL
ACCEL
6 5 4 3 2 1 0 1 2 3 4 5 6 7 8
JA, M, DC
VF, M, H
JA, M, DC
VF, M, H
S1-8
T1-5
AGE
9½
11½
13½
MOS

FIG. 26

and control children on ethnicity, as well as sex and ordinal position, should permit separate evaluation of the potential influence of ethnic background and day care on psychological growth. Finally, we believe that the decision to quantify separate dimensions in cognitive, affective and social development, rather than rely on instruments designed to yield a general developmental quotient -- or IQ -- will provide more valid answers to the theoretical and practical questions that have been generated by the increase in day care for young children.

Future Analyses

A brief description of the planned analyses will be grouped by major category -- cognitive, social, and affective.

A. Cognitive Variables

1. Age at which the child enters the stage of "activation of hypotheses." A series of studies over the last few years have suggested that most infants enter a special stage of cognitive development between 7 and 12 months which we have called "activation of hypotheses." During the earlier period, from about 8 weeks to 7 months, the child merely assimilates (or fails to assimilate) a discrepant event to his schema for that event. During the later period he not only attempts to assimilate the event, but also tries to interpret it, to transform the discrepant stimulus to his schema for the class to which that external event belongs. The postulation of this stage of cognitive functioning is based on the replicated discovery of a curvilinear relation between age and duration

of fixation to the same set of discrepant stimuli across the period 4 through 36 months. The trough in that function typically occurs between 7 and 12 months of age. There is, in addition, an increased probability of cardiac acceleration to these discrepant events, as opposed to cardiac deceleration, as the child enters the last third of the first year.

Since all of the subjects are exposed to the same set of episodes across the first year (block, light, auditory, and car-doll) it should be possible to determine when each child enters this stage. We will designate a priori criteria for the presence of this stage of functioning using fixation time and cardiac acceleration as the primary indexes. We will assign each infant an age value on the basis of his data, indicating the age when he presumably enters the stage of "activation of hypotheses." This assessment will be made for each of the episodes. The statistical analyses will ask whether the distribution of these ages is different among the three experimental groups.

2. Reaction to discrepancy. Infants react to the presentation of a transformation with increased fixation time, as well as changes in vocalization, cardiac rate, cardiac variability, posture, smiling, and irritability. We will determine if the sensitivity to discrepancy (as indexed by these variables) is different across the three groups. The typical statistical analysis will compare the child's reactivity to the last three standards with the first three transformations. We will also compare the child's behavior to the last standard trial with his reaction to the first transformation trial for each of the major dependent variables. For example, we shall compare, for each child at each age, the difference in total fixation

time between the last three standards of the Block episode and the first three transformation trials. This distribution of differences will comprise the scores for an analysis of variance in which the three experimental groups will be the independent factors. We shall, of course, examine the effect of social class, ethnicity, and sex on these dependent variables.

Additionally, we shall perform time trend analyses to determine if the pattern of changes in reaction to discrepancy across the first year is different among the three experimental groups. It is our expectation, at the moment, that the children in day care (Group I) will show a greater reaction to discrepancy than the other two groups during the first year. They may also show a greater increase in reactivity to discrepancy between 3 1/2 and 7 1/2 months of age than the subjects in Groups II and III.

3. Vocalization to speech. Previous research (Kagan, J., Change and Continuity in Infancy, New York: John Wiley, 1971) has suggested that vocalization during the silent intertrial interval following a four-second presentation of human speech reflects an excitement generated by the attempt to assimilate the discrepant event, expecially at 7 1/2 and 9 1/2 months of age. We have noted the expected increase in vocalization during the intertrial periods from 3 1/2 to 9 1/2 months and shall examine the data to see if there is any difference across the three groups in the amount of vocalization to our two auditory episodes. We shall also look for signs of increased vocalization when we compare the last three standards with the first three transformation trials.

4. Searching movements to the auditory presentation of human speech. During the auditory episode, infants often showed searching movement of the head and eyes which seem to reflect vigilance and an attempt to assimilate the event. These head and eye movements tend to increase with age, and we shall compare the pattern of these searching movements over age among the three experimental groups.

5. Tempo of play. Previous work has suggested that tempo of play, defined in terms of the length of sustained directed attentional involvement the child invests in an object, is predictive of the reflection-impulsivity dimension during the early preschool years. We have coded duration of each attentional epoch with a particular toy in our free play sessions at 9 1/2 and 13 1/2 months. We shall examine the distribution of each sustained directed activity for each child (in seconds), cast these values into a frequency distribution, and use the Q2 and Q3 values as the primary indexes of tempo. We shall also use the number of sustained directed activities greater than two minutes in duration as a third index of tempo of play. Selection of these three variables is based on the fact that they were sensitive in previous work. We shall determine if these measures of tempo differ across the three expreimental groups. It is possible that the Group I day care children, who are allowed long periods of solitary play with a rich set of toys, will display a slower tempo of play than children in the other two groups.

6. Patterns of reactivity to discrepancy. Thus far we have considered single variables. Previous research

B. Social Interaction Variables

1. Social interaction with the experimenter. At every age, from 3 1/2 to 13 1/2 months of age, the test session is bracketed by two minutes of fixed social interaction in which one of the female experimenters interacts with the child for two minutes prior to the beginning of the session and for two minutes after the session is completed. The behavior of the experimenter is programmed and we code the child's social responsiveness; namely, vocalization, smiling, and irritability. We shall examine these data to see if the social interaction and changes in interaction over the first year are different among the three experimental groups.

2. Reactivity to a peer. At 13 1/2 months of age each child is placed with his mother in a room with a strange peer of the same age and sex and the peer's mother. The variables coded include; proximity to and touching the peer and the mo as well as vocal and behavioral overtures to each person. These data, coded on Esterline Angus chart paper, are discrete and will be analyzed for both frequency and duration. We shall examine these data to see if the patterns of interaction with the strange mother and peer are different across the three experimental groups. Preliminary observations suggest that the day care children are initially more wary with the strange peer than children reared at home. Our preliminary interpretation is that the child in the day care center has

such a firm schema for his own peers at the center that a strange child is a discrepant event. Hence, he is initially more vigilant than a one-year-old living at home who does not play regularly with a large group of same sex peers. The initial wariness of the day care child may be the result of a more finely articulated schema for children his own age.

3. Separation Anxiety. Finally, a separate protest episode occurs at the end of every session. The mother leaves the child in a room and we code differences in crying, latency to crying, and the occurrence of behaviors aimed at gaining the the mother. Preliminary analysis of data from 12 day care and 12 home reared children indicates no important differences in separation protest between these groups. Both groups show a dramatic increase in separation protest between 7 1/2 and 9 1/2 months. These age values correspond to age norms found in other investigations, suggesting that this phenomenon is, in part, maturational.

C. Affective Development

The primary measures of affectivity are the frequency of smiling and vocalization during the perceptual and play episodes. There is enormous variability among the children in the disposition to smile, laugh, and vocalize. Although this variability seems to be primarily temperamental in origin, it is possible that the day care experience is exerting some effect on these variables. We shall analyze these data to

see if our groups differ in frequency of smiling and vocalization to each of the major episodes.

Secondary Aims of the Study

A second purpose of this research, in addition to the primary goal of assessing the effect of the day care setting, is to learn more about basic aspects of cognitive and social development during the first year. There are several discrete corpuses of information contained in the project data which, in and of themselves, address important developmental issues. We hope that these data can inform major themes in human development.

1. Activation of hypotheses. The postulation of the stage of activation of hypotheses toward the last third of the first year is of potential significance for explaining object permanence, separation and stranger anxiety, and increase in planfulness in play. Data from an earlier cross-sectional study of children 5 1/2 to 11 1/2 months of age (using many of the episodes contained in this investigation) revealed an increasing probability of cardiac acceleration to the discrepant events with age. The current longitudinal data, which extend from 3 1/2 to 29 months, will permit a richer analysis of this phenomenon. If the longitudinal data affirm the suggestion contained in the cross-sectional data, we will have greater faith in the suggestion that this age brackets an important change in cognitive functioning.

2. Ethnic differences. We have been struck with the differences in vocalization, smiling, and motoricity between the Chinese and non-Chinese infants. These observations are consonant with the recent findings of Daniel Freedman that newborn Chinese children from middle class Chinese-American families are less irritable and more placid than newborn Caucasian children. We know of no systematic research on Chinese - non-Chinese differences during the first two years of life. Should these ethnic differences be affirmed by the statistical analyses to be performed, they could be of significance for a greater understanding of the relations between biological and psychological aspects of early development.

3. Peer play. There has been little research on a child's reaction to a peer during the first years of life, for most of the research has been on preschool children. The 13 1/2 and 20 month olds' behavior with a strange peer will provide data on this issue. Preliminary observations suggest that there is minimal interactive play in this situation at 13 1/2 months. The one year old treats the other peer as an interesting object which he initially studies and explores, as he would an attractive toy. After the initial exploratory period is over, children typically play by themselves. Since we also have a peer play episode at 20 months, it will be of interest to study the change in peer play across the second year of life.

4. The predictability of speech. Since all children will have some expressive and comprehensive language by 20 and 29

months, the collection of these longitudinal data from 3 1/2 through 13 1/2 months will allow us to make some statements about those variables that are most predictive of language competence at 20 and 29 months of age. At the moment we have no strong hypotheses. The degree of vocalization during the first year does not seem to be a strong antecedent of early language. We shall examine tempo of play, age at which activation of hypotheses appeared, reaction to discrepancy, and sociability during the first year to see if these variables are predictive of language competence at 20 and 29 months.

5. Continuity of temperament. An issue of interest to those concerned with the ontogeny of personality revolves around those temperamental dimensions most likely to be stable during the opening years of life. Some of these continuities involve irritability, passivity, and motoricity. The work of Chess, Thomas and Birch, based primarily on interviews, suggests continuity for dimensions closely related to those we are coding. The corpus of data we have gathered should add, in a considerable way, to better understanding of this important question.

References

Kagan, J. Attention and psychological change in the young child. Science, 1970, 170, 826-832.

Kagan, J. Do infants think? Scientific American, 1972, 226, 74-82.

Lacey, J. I., Kagan, J., Lacey, B. & Moss, H. A. The visceral level: situational determinants and behavioral correlates of autonomic response patterns. In P. H. Knapp (Ed.) Expressions of the Emotions in Man. New York: International Universities Press, 1963, 161-196.

van Hover, K. A developmental study of three components of attention. Unpublished doctoral dissertation, Harvard University, 1971.

Zelazo, P. R., Kagan, J. & Hartmann, R. Excitement and boredom as determinants of vocalization in infants. Unpublished manuscript, Harvard University, 1972.

Figure Captions

1. Mean total fixation time to the first three transformations of the block episode for a cross-sectional sample.
2. Percentage of heart-rate accelerations to an auditory transformation for a cross-sectional sample.
3. Mean total fixation time to the light for a female subject at day care center.
4. The number of trials of cardiac acceleration or deceleration to the light for a female subject at day care center.
5. Percent of cross-sectional groups showing deceleration or acceleration to the car-doll episode.
6. Percent of group displaying separation protest during the first 30 seconds, comparison of day care versus home reared controls.
7. Percent of cross-sectional group vocalizing during the inter-trial interval for the transformation trials to an auditory episode.
8. Mean total fixation time to the block episode for a female in day care center.
9. Number of trials in which female subject in day care sample shows cardiac acceleration or deceleration to the block episode.
10. Mean total fixation time to the block episode for the female home control.
11. Number of trials in which female home control subject shows cardiac deceleration or acceleration to the block episode.

12. Mean total fixation time to the light episode for female home control.
13. Number or trials in which female home control subject shows cardiac deceleration or acceleration to the light episode.
14. Mean total fixation time to the block episode for a male subject at day care center.
15. Number of trials of cardiac deceleration or acceleration to the block episode for male subject from day care sample.
16. Mean total fixation time to block episode for male subject from home control group.
17. Number of trials of cardiac deceleration or acceleration to the block episode for male subject from home control group.
18. Mean total fixation time to light episode for male subject from day care sample.
19. Number of trials of cardiac deceleration or acceleration to light episode for male subject from day care sample.
20. Mean total fixation time to light episode for male subject from home control group.
21. Number of trials of cardiac deceleration or acceleration to light episode for male subject from home control group.
22. Mean total fixation time to block episode for pair of subjects, one from day care center, one home control.
23. Number of trials of cardiac deceleration or acceleration to block episode for pair of male subjects, one from day care center, one from home control group.

Mean total fixation time to light episode for pair of

male subjects, one from day care sample, one from control group.

25. Number of trials of cardiac deceleration or acceleration to light episode for pair of subjects, one from day care sample, one from home control group.

26. Number of trials of cardiac deceleration or acceleration to car-doll episode, to pair of subjects, one from day care center, one from home control group.

Publications Supported in Part

by Grant # 722-7031, Office of Child Development

Kagan, J. Cross-cultural perspectives in early development. American Psychologist, (in press).

Kagan, J., Klein, R.E., Haith, M.M., and Morrison, F.J. Memory and meaning in two cultures. Child Development, 1973, 44, 221-223.

Spelke, E., Zelazo, P., Kagan, J., Kotelchuck, M., Father interaction and separation protest. Developmental Psychology. (in press).