DOCUMENT RESUME

ED 112 557 EC 073 744

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TITLE The Relationship Between Affective and Cognitive Development in Down's Syndrome Infants.
PUB DATE Apr 75
NOTE 14p.; Paper presented at the Biennial Meeting of the Society for Research in Child Development (Denver, Colorado, April 10-13, 1975)

EDRS PRICE MF-$0.76 HC-$1.58 Plus Postage
DESCRIPTORS *Affective Behavior; *Cognitive Development; Emotional Development; Exceptional Child Research; *Infancy; Mentally Handicapped; *Mongolism

ABSTRACT

Examined was the association between affective and cognitive development in 14 Down's Syndrome infants (4- to 8-months-old). Mothers administered a series of 30 laughter items each month, and experimenters gave the Uzgiris-Hunt scales of cognitive development at 13 and 16 months, and the Bayley scales and Infant Behavior Record at 16 months. Available data indicated that Ss lagged well behind normal infants in onset of laughter and smiling although they followed the order of laughter items category by category (laughing first at auditory and tactile items and then at more cognitively complicated social and visual items). Results also demonstrated a clear relationship between cognitive and affective development, especially with regard to stages of object permanence and operational causality. (CL)

The Relationship Between Affective and Cognitive Development in Down's Syndrome Infants

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Paper presented at the Society for Research in Child Development Convention in Denver, Colorado, April 11, 1975.

Introduction

In previous research with several samples of normal infants between four and twelve months of age, changes in laughter were found which were associated with cognitive development (Sroufe and Wunsch, 1972). Infants in the first half year laughed primarily in situations which were physically intense or vigorous (auditory and tactile stimulation). Increasingly during the second half year, however, infants laughed at progressively more subtle and complex social and visual stimulation, while laughter at simple stimuli abated. For example, younger infants laughed at being kissed on the stomach, popping sounds of the lips, and bouncing on the knee, while only older infants laughed consistently at mother sucking on the baby's bottle, crawling on the floor, or covering her face with a mask. These findings suggest that later laughter is related to developmental changes in available schemata.

Accordingly, a subsequent study of infants with Down's syndrome was conducted to extend and elaborate the reported association between affective and cognitive development. If affective development is a function of cognitive development and not merely a function of chronological age, then the sequence of affective stages should occur at a rate corresponding to the degree of cognitive retardation of the child. Since items such as mother hiding behind a human mask elicit laughter when the normal infant has achieved the appropriate cognitive developmental level (eg. stage 4 object permanence), such affective and cognitive occurrences should also appear concurrently in the retardate, although they will be delayed until a later age.

Methodology

Subjects. Fourteen Down's syndrome infants between the ages of four and eight months are participating in an intensive longitudinal study until they become twenty-four months. The oldest infants are now eighteen months.

Procedure. All infants are administered a series of 30 laughter items each month (see Table 1), using their mothers as the stimulus agent. Each baby received the items in a different random order, usually across two forty-five minute sessions in their homes. An item was presented up to six times, but it was discontinued if it elicited crying. Mothers were blind to any experimental hypotheses. Smiling, laughter, overt behavior, and attention were coded by two or three independent observers, with reliabilities always in the high .90's.

In addition, the Uzgiris-Hunt scales of cognitive development were administered at thirteen months and at sixteen months and will also be given at nineteen and twenty-four months. The Bayley Mental and Motor

scales of development and the Bayley Infant Behavior Record were given at sixteen months and will also be administered at nineteen and twenty-four months. All of these assessments occurred in the infants home environment. The persons who did the infant testing were neither cognizant of any experimental hypotheses, nor were they aware of how the infants had performed on the affective items.

Results

Data are not completely collected, but all infants are now older than the oldest normal babies studied, and some clear findings have emerged. Infants with Down's syndrome, especially the most markedly hypotonic babies, lag well behind the normal infants in onset of laughter and laugh rarely (see Figure 1). However, the laughter items are ordered as they were for normal infants, category by category, and, in the main, item by item. Down's syndrome babies laugh first to auditory and tactile items, and then to the more cognitively complicated social and visual items. It was also found that in these infants laughter was delayed even to the less complicated items (modal age of onset 9 months versus 4 months for normal infants). That is, the Down's syndrome infants do not track the normal babies even through the stage of reflexive laughter. Moreover, the latency between item presentation and laughter was found to be greatly increased in the Down's syndrome infants (4-5 seconds as compared with immediate or anticipatory laughter in normal infants).

In addition, an analysis of smile data produced a pattern of results parallelling that for laughter. That is, developmental changes in the nature of items eliciting smiling are parallel to those of normal infants' laughter, though the whole process is delayed (see Figures 2a and 2b).

Based on the thirteen month and sixteen month data, there is also a clear relationship between cognitive developmental status and affective development, especially with regard to the object permanence and operational causality scales of the Uzgiris-Hunt. For example, no infant smiled or laughed to an item which assumed that stage 4 object permanence was a requisite (eg., mother-approach with a human mask) who did not attain this stage 4 level of object permanence on the Uzgiris-Hunt. Moreover, those babies who laughed or smiled earliest to these items had higher scores on the Uzgiris-Hunt scale of object permanence.

Similarly, infants who smiled or laughed to the more complex, subtle, sophisticated items (such as mother crawling like a baby or mother sucking baby's bottle) achieved higher levels of performance on the Uzgiris-Hunt scale of operational causality than did those infants

who did not. Moreover, those infants who laughed or smiled to these items earliest attained higher scores on the Uzgiris-Hunt operational causality scale than did those infants who laughed or smiled to them later.

An analysis of our smile data revealed that, as a group, smiling in eighteen month-old Downs syndrome infants very closely approximated laughter in eight month-old normal infants. We have collected data on twenty-five normal infants on the Uzgiris-Hunt and, interestingly, the sixteen month Uzgiris-Hunt scores for the Down's syndrome infants very closely parallel those of our eight-month old normals.

In addition, based on the 16 month data, there is also a clear relationship between affective developmental status and cognitive development as assessed by the Bayley Mental Scale. That is, those babies who smiled or laughed to the most complicated items had higher Bayley Mental quotients than those babies who did not. As with our Uzgiris-Hunt data, those infants who smiled or laughed earliest to the items had higher Bayley Mental quotients than did those infants who smiled or laughed to them later.

It is also interesting that some of these infants show extreme abnormalities in muscle tension and that this relates to laughter. The three most markedly hypotonic* infants in our sample did not laugh at all up to age 13 months and then very rarely, even though performance on the Uzgiris-Hunt and Bayley scales placed them not nearly so far behind the other infants in terms of cognitive development.

Finally, as in normal infants' laughter, smiling to the less complex items abated whenever the Down's syndrome infants began to smile consistently to the more subtle, complex stimuli.

Discussion

The finding that the Down's syndrome infants passed through the same affective stages as did the normal infants suggests that the behavior of Down's syndrome babies is also highly organized, adaptive, and functionally significant. Moreover, it was found that the level of cognitive development as measured by performance on the thirteen and sixteen month Uzgiris-Hunt scales of object permanence and operational causality and by the sixteen month Bayley Mental scale parallelled the level of affective development as measured by our thirty items. Thus, the earlier suggested association between affective and cognitive development (Sroufe and Wunsch, 1972) appears to be a valid relationship. This is in keeping

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*= Degree of hypotonicity was assessed by independent raters who were blind to any experimental hypotheses and by Bayley Motor quotients.

with Piaget (1951) who felt that affect was the "force" behind cognitive development. It seems clear to us that cognitive and social-emotional aspects of development are inextricably intertwined. Perhaps we should also speak of "sensory-affective" development in infancy, and no longer address ourselves exclusively to "sensorimotor" intelligence.

The finding that the Down's syndrome infants were delayed in their onset of smiling and laughing to even the least complex items (auditory and tactile stimulation) suggests that these items are also heavily laden with a cognitive component and depend upon cognitive growth. Thus, it may be overly simplistic to view affective responses to these items as being merely "reflexive". In an effort to elucidate the cortical nature of our items, we are currently also looking at microcephalic infants and other infants with chromosomal anomalies.

Down's syndrome infants lag considerably behind normal infants in laughter, although, eventually, those who laugh to the items do so in the same order reported by Sroufe and Wunsch (1972) for normal infants. Also, they will frequently smile at situations eliciting laughter in non-retarded infants. Our view is that, especially with the more cognitively sophisticated items, Down's syndrome infants cannot process the incongruity of the items with sufficient speed to produce the "tension lag" required for laughter. This contention is buttressed by the longer latencies to smiling and, especially, to laughing found in these infants. Moreover, those infants who were the most flaccid neuromuscularly hardly ever laughed. Apparently, even when Down's syndrome infants attend carefully to the presentations and smile differentially to the items, insufficient cognitive tension is generated to produce laughter.

In an effort to subject this hypothesis to empirical test, we are currently looking at the psychophysiological correlates of laughter and smiling in normal and Down's syndrome infants. Heart rate, respiration, and two EMG channels are being monitored in an attempt to elucidate the important role these autonomic indices, particularly EMG, play in affective expression.

Another interesting finding which has emerged from our data is that fear is rarely observed in Down's syndrome infants. Sroufe and Wunsch (1972) and Sroufe et al. (1974) found that situations previously shown to produce fear (eg. intense stimulation, loud sounds, loss of balance) were most potent for producing laughter, and that, by varying context, the same situation could produce laughter or fear. Interestingly, only the infants with the highest scores on the Uzgiris-Hunt and Bayley scales showed fear to any of our items. Currently, we are also investi-

gating other situations which have been found to elicit fear in normal infants (eg., "looming", visual cliff, stranger-approach, strange situation technique of Ainsworth and Wittig, dropping and catching of infant). To date, we have seen virtually no instances of fear to these procedures in our infants. The only exceptions, again, are in those infants who have higher test scores, both cognitively and affectively. Thus, it appears that fear-affect-and cognition are intimately related in Down's syndrome infants. Some recent biochemical evidence with the catecholamines norepinephrine and epinephrine lends support to our hypothesis. First, Axelrod (1974) has reported a finding that dopamine-beta-hydroxylase, an enzyme necessary for the conversion of dopamine into norepinephrine, is low in Down's syndrome children's blood. This suggests that there are deficiencies in the sympathetic nervous systems of Down's syndrome children (Cicchetti and Serafica, 1974; Serafica and Cicchetti, 1975). Second, there is also evidence that urinary epinephrine levels are low in children with Down's syndrome (Keele, et al, 1969). This finding could suggest that Down's syndrome children have immature adrenal systems. In keeping with the contention of Bronson (1965, 1968) and Hebb (1946), we feel that it is likely that there are developmental differences in the rates and levels of maturation in Down's syndrome infants' cortical and endocrinological systems which affect the emergence of fear behavior. Moreover, we contend that these differences have important genetic determinants. It appears that there is a close relationship between the constructs of fear and joy and between smiling and wary behaviors. (We are planning to pursue brain-behavior relationships in detail with Down's syndrome children).

Finally, it is suggested that affective expression may prove to be a viable diagnostic and, perhaps, prognostic indicator of degree of cognitive retardation. This should prove to be especially fruitful with Down's syndrome infants, since it is well documented that they lag greatly in expressive language production and in neuromuscular coordination, making it extremely difficult to get an accurate assessment of their intellectual functioning through conventional assessment techniques.

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Table 1*

Items presented to the infant by mother

Auditory

1. Lip Popping
2. Aah (Swelling, then cut off)
3. Boom, Boom, Boom
4. Synthesizer sound
5. Whispering in baby's ear
6. Squeaky Voices
7. Horse sound

Tactile

8. Blowing in hair
9. Kissing Stomach
10. Goochy-goo with soft object
11. Bouncing on knee (baby turned away)
12. Jiggling baby in front of you
13. Tickling under chin
14. Mouthing back of neck

Social

15. Peek-a-boo cardboard (No sound)
16. Playing tug (hand baby one end of yarn)
17. Put cloth in your mouth - let them pull it out
18. "I'm gonna get you" (I'm protracted)
19. Covering-uncovering baby's face (with cloth)
20. Stick out tongue - pull in when baby touches it

Visual

21. Covered face - approach to within one foot of baby (with cloth)
22. Disappearing-reappearing object (behind card)
23. Looking in mirror
24. Holding in air, looking down back
25. Sucking baby bottle (three pretend sucks)
26. Crawling on floor like baby
27. Walking like Charlie Chaplin
28. Shaking hair in baby's face - don't touch
29. Human mask - approach to within one foot of baby
30. Walking fingers

*= The interested reader is referred to Sroufe and Wunsch (1972) for a detailed description of these items and the administration procedure.

FIGURE 1

LAUGHTER IN DOWN'S SYNDROME INFANTS

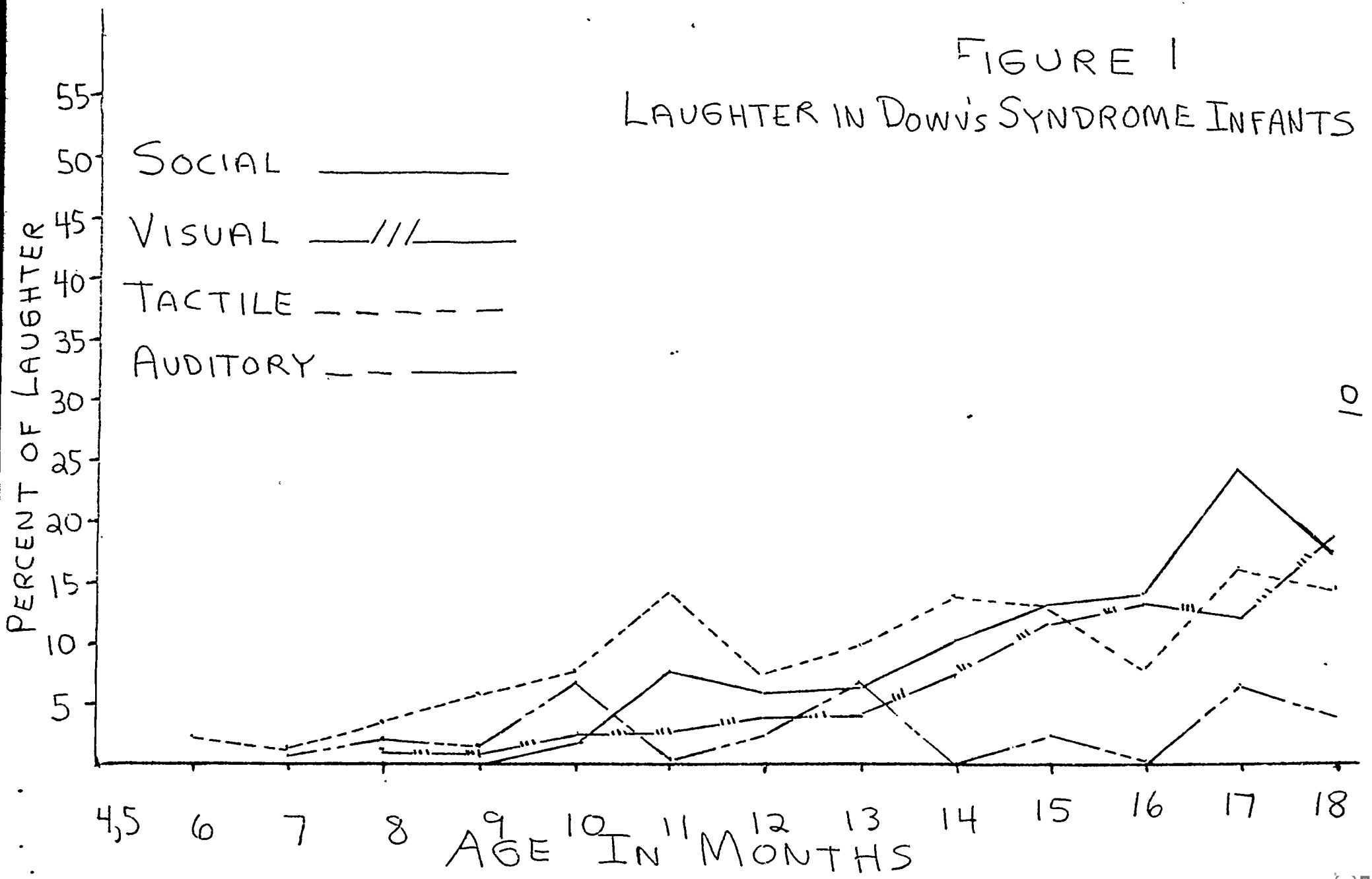


FIGURE 2a
SMILING IN DOWN'S SYNDROME INFANTS

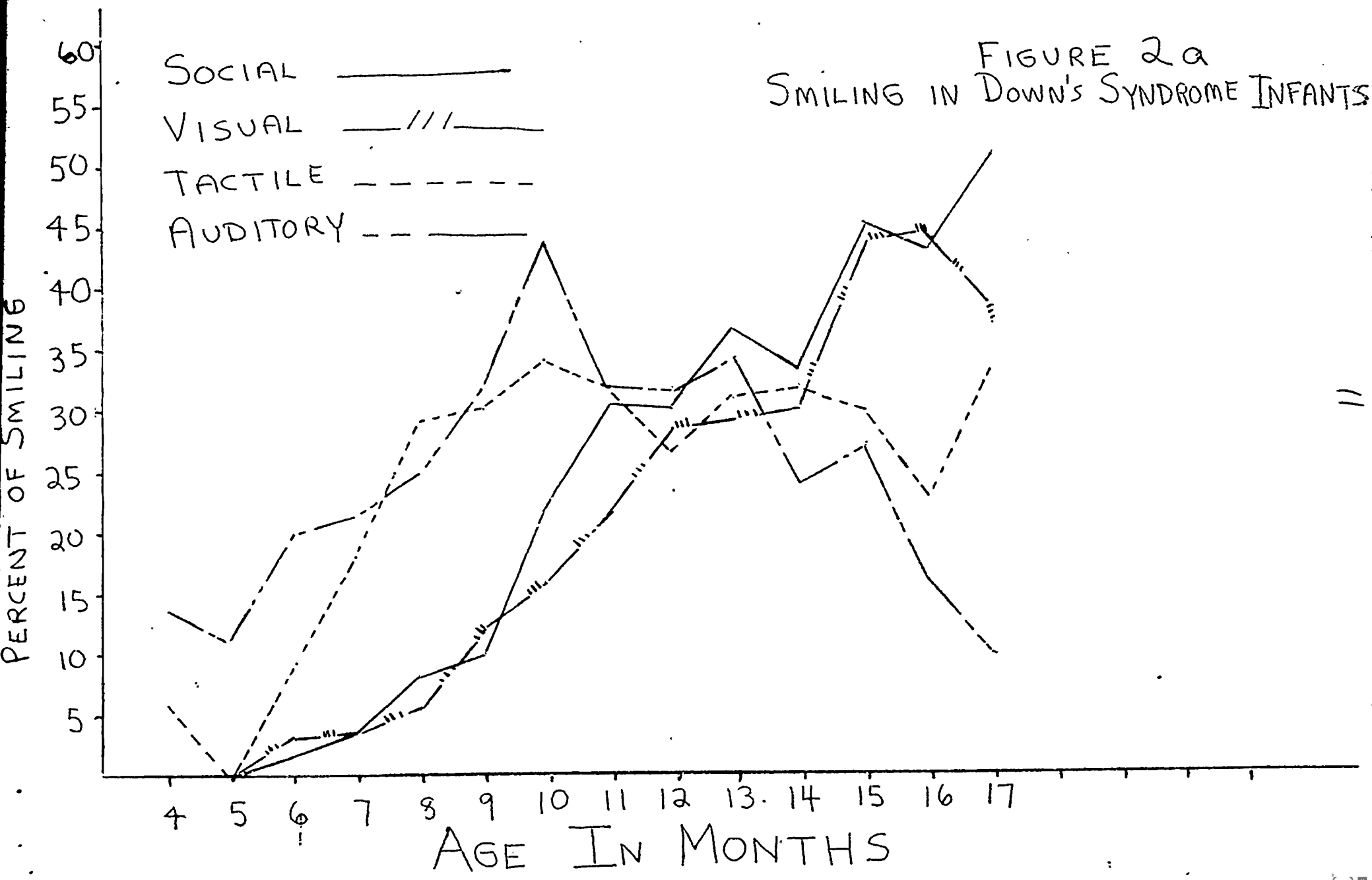
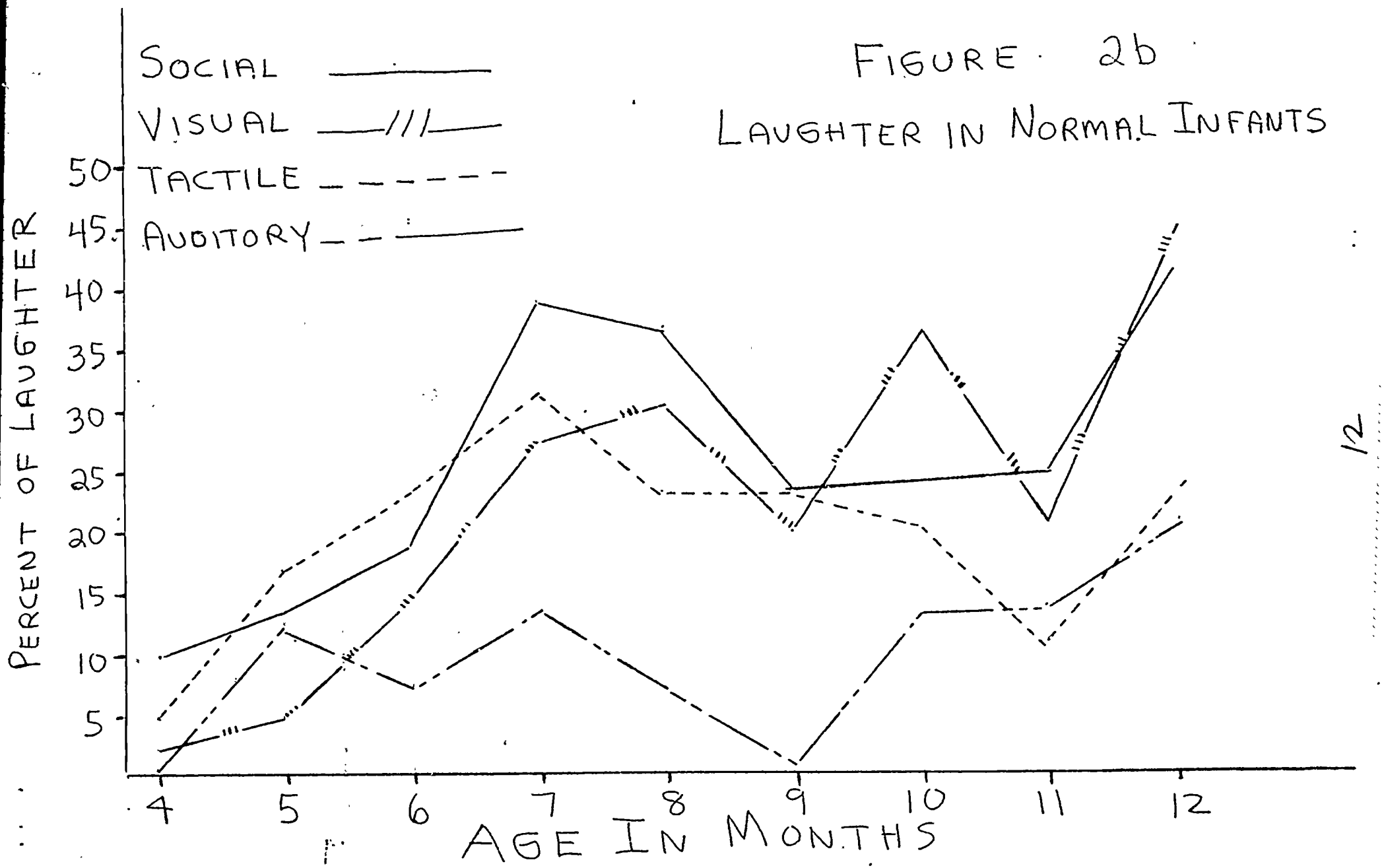


FIGURE 2b

LAUGHTER IN NORMAL INFANTS



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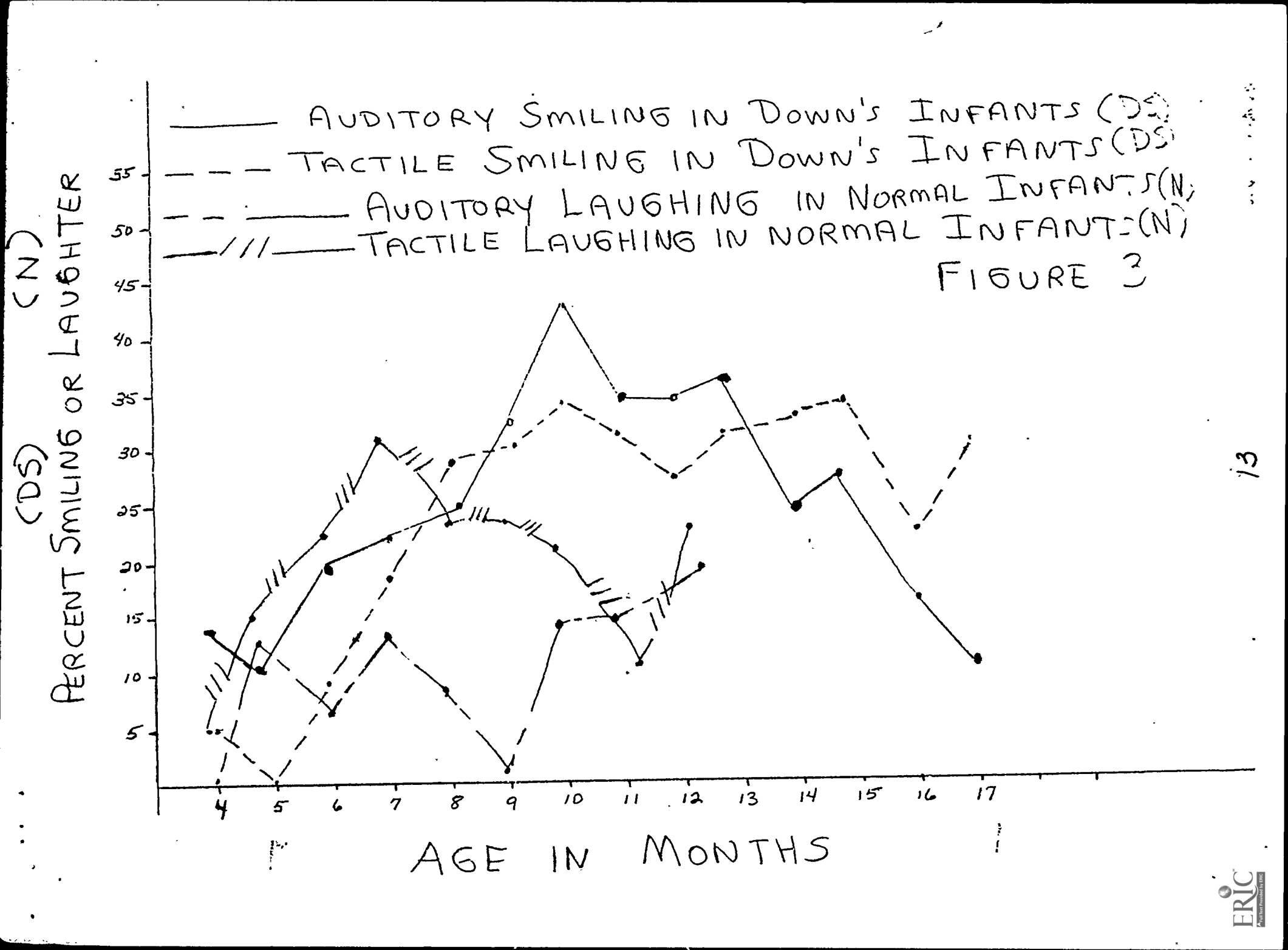
AUDITORY SMILING IN DOWN'S INFANTS (DS)
TACTILE SMILING IN DOWN'S INFANTS (DS)
AUDITORY LAUGHING IN NORMAL INFANTS (N)
TACTILE LAUGHING IN NORMAL INFANTS (N)
PERCENT SMILING OR LAUGHTER (DS) (N)
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AGE IN MONTHS

FIGURE 3

FIGURE 4

SMILING IN DOWN'S SYNDROME INFANTS V.S. LAUGHTER IN NORMAL INFANTS TO SOCIAL AND VISUAL ITEMS