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ABSTRACT

A study examined patterns of development in spoken interaction and types of causal thought that might reflect the human capacity to displace, that is, to shift reference from the present moment to another moment in time. Participants were four infants and their parents, who came to a laboratory for one-half hour every 2 weeks from the child's fifth and one-half month until the ninth month. Cognitive tasks for auditory memory, for causality, and for ends/means relationship were administered during each session. Free interaction was videotaped for 12 to 15 minutes. Results showed that three of the infants inhibited parent vocalization for 4 to 10 seconds after their own vocalization, from the age of seven and one-half months to nine months. Parents decreased mean utterances to 7 seconds or less by the infants' ninth month. There was no apparent direction of relationship between interactive speech and some types of causal thought. Although interactive speech changed between five and one-half and nine months toward increased infant influence and, at the same time, causal thought accomplishments also increased, there was no clear direction indicated for the relationship between interactive speech and causal thought. (Extensive tables of data are appended.) (FL)

Developmental Patterns in Spoken Language and Causal Though+

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Developmental Patterns in Spoken Language and Causal Thought

Introduction

The recognized relationship between cognitive development and human communication development has led to speculation about the nature of that link (Fisher and Corrigan, 1980; Kagan, 1971; Zelazo, 1972). Two general descriptions of that relationship between thought and language have emerged. One assumes that the abilities develop in sequence with language following social cognition; Piaget was the most recognized proponent of this view. The other proposes that language and thought are parallel in their development. Vygotsky (1962) suggested parallel, independent early development of thought and language up to the stage of symbolization (18-24 months).

In the last ten years, the Piagetian assumption has been challenged. Fisher and Corrigan (1980) describe language and cognition as a set of overlapping skills. Vygotsky's proposition that thought and language merge and become interdependent is being pushed back to account for relationships apparent prior to symbolic communication (Bates,1979; Ferguson, 1978). The purpose of this study is to examine patterns of development in spoken interaction and types of causal thought that may reflect the human capacity to displace.

Infant Speech Patterns

A common observation of infant vocalizations concerns the shift from solely vocalic sounds to true speech,[1] consisting of consonantal as well as vocalic sounds. Bever suggests that the early period reflects subcortical reflex control, whereas after four months of age, the brain shifts to cortical control which is more voluntary (McCaffrey,1976). The effects of this move to voluntary control are observable first in the expansion of vocalization types (four to six months) used playfully and then, suddenly, in a shift to reduplicated syllables (seven to ten months). Infants will often use one particular syllable type for long periods in strings of repetitions (Oller, 1980).

Elbers suggests that infants cognitively "grasp" articulatory contrasts and then vary those dimensions of articulation in babbling. She also notes that first words tend to fit the existing babbling patterns very well (1982). Thus, available speech sounds are manipulated by the infant with increasing control.

Babbling may even be used meaningfully prior to the acquisition of language words. The child's first meaningful speech sounds may consist, according to Ferguson, of repeated vowels, syllabic consonants and other babbled speech that does not bear a clear resemblance to adult speech; that is, the child makes "active use of sound-meaning correspondences of his (her) own" prior to language onset (Ferguson, 1978).

The ability ot contrast sounds is a prerequisite for combination; one cannot purposefully combine two items unless a distinction between the two is perceivable. Once the contrast is distinct, an ability to recall past sounds is necessary for variation; the sound being produced may be contrasted with a similar sound produced in the past only if one can recall the original sound. Memory stretches with longer strings of babble variations until "favorite" sounds can be recalled and varied without long, continuous series of sounds.

In the first phase of the research program being presented, Yingling found that when infants speak by themselves, they decrease and stabilize their mean speech durations from 5½ to 8½ months of age. They also decreased the number of utterances repeated in a series after an initial increase. That is, sounds are repeated in long strings at first capability, for practice and variety, then the individual appears to become more selective. Memory may come to serve the speaker so that long repetitions are unnecessary (Yingling, 1981).

Displacement and Memory Development

One cognitive capacity that appears to be uniquely human is displacement, or the ability to shift reference from the present moment to another moment in time.[2] Speech helps the child create a time field and, according to Vygotsky, leads to the construction of memory (Vygotsky, 1978). Combining elements of past experience with the present one facilitates this memory stretch that builds the capacity for displacement.

Based upon Fraisse' observation that a sense of time emerges from "the experience of successions," (1963, p.1) this writer has suggested that the individual must be able to "recall the experience of successions in relation to oneself."(Yingling, p.174) The voluntary nature of the speech act is critical to the awareness implied by displacement. The individual endures, as a distinct self, while producing series of patterned acts that may be held in memory. When one is capable of recalling one's situation in past patterned acts, it becomes possible to situate oneself in time. In addition, temporal displacement allows the segmentation of experience such that perceptions may be mapped onto speech patterns.

Memory, specifically recall, appears to be critical to displacement. The literature suggests that infants are capable of recognition memory in the first several days of life (Kail, 1979, p.64), however, recall memory increases observably in the second half-year of life. The older infant is better able to "retrieve schema of prior events." (Kagan, 1979, p. 17) One explanation of interest to communication scholars is that the infant is increasingly able to use control processes like attention, rehearsal or symbolic labeling to increase memory duration (Brody, 1981, p.249).

Most research on infant memory relies on visual attention, but very few have used auditory attention (upon which symbolic labeling primarily depends). The role of speech in these control processes has yet to be examined adequately.

Conditioning paradigms (habituation and conjugate reinforcement) have been traditionally employed to test recognition memory (for example, see Lamb and Campos, 1982, pp. 111-113), however they tend to be confounded with novelty preference and limited to recognition memory (Sophian, 1980). Sophian suggests object permanence tasks to determine non-recognitory forms of memory. Memory in the absence of the remembered object reflects both object permanence and ability to recall, as both require an "internal representation of the object that is independent of his or her actions with respect to that object." (Sophian, p.252) Such an "internal representation" may first be formed in a sequence of actions with the object, which, when the infant has had the opportunity to observe the results of those acts (in feedback), becomes available for anticipation (feedforward) of the same results.

Bruner hypothesizes that the infant reorganizes these successful patterns, based on the feedforward loop, toward mastery and eventually, toward a higher order pattern (Bruner, 1973). Speech may be viewed as a series of skilled acts requiring such "reorganization" in order to be useful for language. Stark (1980) observed similarities between infant speech manipulation (repetitive babbling) and secondary circular reactions;[3] the infant repeats familiar sequences while increasing frequency and duration of preferred sounds.

If speech is indeed manipulated by the infant in a series of skilled acts, then a comparison may be made between several types of secondary circular reactions. Categorizing these behaviors according to sensory mode (visual and auditory) may suggest a pattern of modal acquisition for self-regulating skilled acts.

Measures for many types of visual secondary circular reactions have been developed (Uzgiris and Hunt, 1975). The usefulness of one type, object-permanence tasks, has been questioned in the past decade particularly for studying relationships between language and cognitive development (Gratch, 1975). Corrigan noted, among other difficulties, that object-permanence appears to be very dependent upon given task factors (1979) and is not related to all language development (1977).

Abilities to differentiate and adapt to means-ends relations appear to be more clearly related to speech and the auditory mode than do object-permanence tasks. The development of means-ends differentiation was significantly and negatively affected in language-disabled subjects, whereas object-permanence was not (Snyder, 1978). The speech/hearing complex seems to be closely related to the development of the ability to act such that self is an agent (means) in a series of acts to obtain a desired end.

Some early speech patterns appear to mirror this type of causal thought. Does speech foster the cognitive abili+y, reflect is, or follow it? In any case, the memory-stretching necessary for displacement seems to become probable with secondary circular reactions, or self-regulated sequences of acts.

Adult-Infant Communication Patterns

Although developing patterns of infant speech may be related to developing cognitive abilities, the infant does not develop in a vacuum. Questions arise concerning the effects of interaction on speech and cognition. Are infant speech patterns developing in the same manner, whether used interactively or alone? If different, are they performing different functions for the infant?

A number of scholars have examined the rhythmicity of infant behavior. Results from the study of subjects in the first few months of life indicate that the infant tends to synchronize vocal productions with movement (Lar, 1976), and movement with adult speech productions (Condon and Sander, 1974). General interdependency of rhythm appears to be the rule at very early stages of infant-caregiver interaction (Brazelton, Koslowski and Main, 1974).

Stern found that in dyads comprised of mother and her three or four month old infant, the infant most often initiated and terminated mutual gaze, while mother used facial and vocal behaviors to regulate social contact. He suggested a "discrepancy principle" to explain infant attention in interaction. As the stimulus distribution varies moderately from the one anticipated by the "schema," attention increases compared to an indentical or totally novel distribution (Stern, 1974, p. 206).

Infants appear to be attending, then, to patterns of stimuli that are recognizable as patterns, but vary. Stern examined vocalization alone in similar dyads and found that mothers' influence determined the dyadic vocalization when the infant was in his/her third month of life. The dyadic patterns were categorized as either coactive (vocalizing at the same time) or alternating (taking turns). The coaction pattern appeared twice as frequently as the alternating pattern, although all dyads appeared able to perform both. Stern speculates that the alternating pattern would dominate interaction in the second year of life (Stern, 1975, p. 96).

In adapting Stern's discrepancy-arousal hypothesis, Cappella and Greene replace the term "schema" with "expectation." Both imply "a cognitive representation familiar enough to the individual to be a standard against which current and future environmental states can be compared." (Cappella and Greene, 1982, p.97)

If, in the fourth month of life, the infant begins to switch from reflex control to more voluntary control (McCaffrey), then the infants in Stern's studies were probably functioning at the subcortical level; that is, the "expectation" or "familiar cognitive representation" will have been a conditioned standard. Although the infant may continue to respond to interaction on the same cognitive basis even into adulthood (Cappella and Greene, 1982, p.126), the development of more voluntary control in later months may have an effect on the manner in which the "expectation" is stored and utilized. Although the individual's "standard" expectation in interaction may indeed be "automatic" (and so account for the fast reaction times of influence at all ages), an additional set of abilities must account for the changes in interaction after the infant's sixth month.

Older infants (9½ to 11½ months) smile when they successfully match an external stimulus to an internal representation (Zelazo, 1972). Apparently, they have achieved appropriate recall of a past stimulus similar to the present one (whether social or not). The achievement seems purposeful rather than automatic. The internal representation persists as a specific long term memory rather than a standard of expectation for complexity of stimuli.

The infant changes a great deal from three to ten months. Not only does articulate speech become available, but the speech produced may be regulated by means of feedback. Physiological changes include the eruption of first teeth and achievement of upright posture.

Cognitively, the infant begins to see objects as permanent, recognizes people and objects, matches body movements to familiar gestures, differentiates familiar and unfamiliar people and things, and learns to use objects to attain goals (Alexander, 1980).

Interaction patterns may be expected to change during this period when speech and cognition change. Are the changes inter-related, and if so, how? What is the role of spoken interaction in the development of individual displacement?

Methods and Procedures

Participants and Design

The pilot study was planned to explore the legitimacy of interfacing cognitive measures and observational data, and to practice time series analysis to locate trends. The time series consisted of biweekly observations over a period of three and one-half months. Participants were four infants and their parents who were colleagues at the University. All were unpaid volunteers who agreed to participate in the longitudinal study by coming into the laboratory for one-half hour every two weeks, from the child's fifth and one-half month to the ninth. One infant (B) started the study at six months and another (C) missed one session because of illness.

Tasks and Interaction

Three types of cognition tasks were adminstered during each session: for auditory memory (toy in the box), for causality, and for means-ends relationships. Free interaction was videotaped for twelve to fifteen minutes.

The measure for auditory memory was devised by the researcher to test infant's memory for a link between visual experience and the spoken response to that experience (appendix A). A toy was placed in a darkened box and the infant was seated three to four feet in front of it in a darkened room. A tape recorder was activated simultaneously with a light inside the box which illuminated the toy. Most often, the child would produce speech. In two trials, one five minutes later and one twenty minutes later, the tape was replayed in the presence of the infant and darkened box.

Causality measures were adapted from Mehrabian to reflect Piagetian stages four and five (appendix B, Harding and Golinkoff, p.36). Means-ends relationships were measured by means of a series of trials devised by Uzgiris and Hunt (appendix C, 1975).

Videotaping began by seating the infant on a table facing the parent, who was then told to interact freely for fifteen minutes. Two cameras recorded a split-screen image of parent and child for at least twelve and up to fifteen minutes.

Causality measures were applied after the first auditory memory trial, videotaping followed. Then means-ends relationships were tested and finally, the second auditory memory trial was run.

Coding and Treatment

The toy-in-the-box memory test was coded by gaze response and vocalization response. Gaze responses included: to parent or researcher (0), to the tape recorder or cause (1), and to the box or cued recall object (2). Vocal responses included: no vocalization (0), different vocalization or conversation (1), and similar vocalization or possible recognition (2).

Causality measures were coded by response to chair movement and response to hair blowing. Responses to chair movement included: none or no interest (0), startle or repetitive behavior (1), and looks behind or in front of seat (2). Responses to hair blowing included: none or no interest (0), touches parent's mouth or repetitive behavior (1), and makes eye contact or waits expectantly (2). Codes of (1) for both measures were scored as stage four, mixed codes (1&2 or 2&1) as transitional, and codes of (2) for both as stage five (Mehrabian used Piagetian stages as categories). Zero codes reflect a null trial, or no response.

The series of trials for means-ends relationships were coded similarly, although accomplishment of progressive trials supposed more advanced ages. Responses included: losing interest or other play (0), display of interest and/or unsuccessful attempt to get toy (1), and successful use of means (2).

Each videotape was coded four times by trained graduate students using the OS-3 event recorder, a hand-held device with a numerical keyboard. The OS-3 provides a sequential record of code and duration of code.

Results

Reliability

The measures used in the laboratory were not tested for interobserver reliability because the investigator was most often collecting data alone. (The pilot study was not funded.) The auditory memory test, then is as yet untested.

Measures for causal thought and means-ends relationships already had been tested for reliability. Harding and Golinkoff report interobserver reliability on causal measures (along with intentional vocalization measures they used) ranging from r=.86 to r=1.00 (1979, p.36).

For the means-ends measures, Uzgiris and Hunt report interobserver agreement from 93.7% to 100% for the four tests in the series.

Coding from videotape for vocalization was checked in the present study. Two graduate assistants each coded one dyadic session for infant vocalization and a different session for mother vocalization. Vocalization codes were considered on a second-by-second basis, with one second leeway allowed for varying response times. Coders agreed on mother vocalization durations 95% of the time and on infant vocalization durations 90% of the time.

Coding for movement from the videotapes did not reach adequate agreement levels after several additional training sessions, so nonvocal data will be submitted to recoding at a later date.

Descriptive Results

Figures 1 and 2 display results of the cognitive measures. All infants achieved means-ends relations by session six (eight months of age), and one achieved as early as session three (six and one-half months).

Auditory memory results are difficult to assess because the instrument has not been tested for reliability or validity. With this rather severe limitation, the earliest"short term cued recall" appeared at six months for one infant and another did not accomplish the task in any session. "Long term cued recall appeared first at seven and one-half months and not at all for one infant. Earliest "short term recognition" appeared at five and one-half months, and all accomplished this task by the final session (nine months). The first "long term recognition" occurred at seven months and the last at nine months.

Figure 3 demonstrates frequency of utterance over sessions for parent speaking singly, infant speaking singly, the total of the two single scores, and for simultaneous speech. Parents' speech frequency appeared to most closely shadow the combine scores (parent spoke most often) while infant frequencies shadowed simultaneous speech (infant spoke alone in proportion to the amount s/he spoke simultaeously with parent).

Figure 4 displays mean durations of parents' and infants' utterances. Parents decreased durations over all session, reaching a mean duration in the last session of very small range (4.29-6.25 seconds).

Lag Sequential Analysis

Vocalization data were analyzed using Lag Sequential Analysis (Sackett, 1978a). This program measures the number of times a behavior of interest follows a selected behavior at various lag steps removed in the ordered data a compares it with the number of occurrences of the behavior of interest in the data as a whole.

Lags in this study are defined as the number of time units between sequential events. The event was the utterance and the time interval employed was one second.

Behaviors lagged from are termed criterion categories. Behaviors looked for at lagged steps from the criterion are called matching categories. In this study, infant's vocalization was the criterion and parent's vocalization was assessed for matching up to a time lag of thirty seconds. Parent vocalization was also used as criterion, matching infant vocalization to thirty lags.

Time lags were calculated from every unit (second) of the criterion (vocalization). This "level lagging" assesses the

probability that a matching behavior will follow every second of the criterion up to thirty seconds, regardless of when the criterion began or ended or how long it lasted (Sackett, 1978b).

Frequency data were transformed into lag conditional probabilities by dividing each matching frequency by the total number of occurrences of the criterion at each lag. Statistical significance is assessed by testing conditional lag probabilities against unconditional probabilities, under the null hypothesis that matching behaviors will follow a criterion randomly. A nonchance relationship would be assumed if a Z score was significant using the unconditional probability as the expected value and the conditional probability as the observed (Sackett, 1980).

If parent influences infant vocalization, Z scores for lags where parent is the criterion will be significant. If infant influences parent, Z scores for lags where infant is the criterion will be significant.

For figures 5 through 8, the vertical axis reports Z scores, while the horizontal axis reports time lags. A score above or below 2.72 ($p \leq .01$) shows that the criterion individual's vocalization significantly increases the probability of the other vocalizing at that lag.

Discussion

Each subject's lag probabilities were computed separately, so it would be premature to comment on general trends. There were several clear individual trends. Infant C influenced parent vocalizations positively in the first two sessions. While his parent influenced him positively during sessions 2, 5, 7 and 8. Infant B, on the other hand, inhibited parent vocalizations from session 3 to 8, while parent did the same. Dyad C may be taking short turns, while dyad B is taking much longer ones (see mean durations of vocalizations compared to lag time).

Three infants (A, B and D) inhibited parent vocalizations in the first four to ten lags of session 5. That is, they are beginning to influence the parent to listen while they take a short turn. In session 6, no significant effect emerged in the early lags, but the effect again appears in session 7 for infants B and D. Note that parents' mean durations decrease to the last session. The infant seems to be influencing the parent to "take turns" at this briefer duration (closer to the infant's average turn throughout).

The beginning of the early lag effect (infant suppresses parent within the first ten lags) emerges one session after means-ends achievement for A and D, and one session before B's achievement. "Cued recall" was accomplished two sessions after the effect begins, in session 7 (either short or long term recall) for all three subjects who demonstrated the effect.

Although the interaction pattern found does not appear to be prior to means-ends relationships, it does appear in these cases within a month of that cognitive achievement. The results from causal thought measures were so varied (subject D remained in transition from stage four and five, while subject B achieved stage five in the fourth session) that no claim can be made about a relationship to interaction patterns.

The kind of memory critical to means-ends relationships (a type of causal thought) appears to be functional in the period studied, but no clear relationship to interactive speech may be claimed at this stage of the research program. The study is limited by small sample size, the use of an untested measure, and cognitive measures that may incur practice effects.

Further treatment of the pilot data is planned, including extension of lags to sixty seconds (some significant z scores were found at or near lag 30), recoding and analysis of nonvocal data, and trend analysis of descriptive data.

The next phase of research will test the measure and expand sample size. Infants' vocalization patterns when alone will be examined in relation to cognition. The first study in this program (Yingling, 1981) described changes in speech patterns when infant babbled alone (not interactively). Utterance durations decreased (from 5½ to 8 months) within an overall pattern to increase in the first year of life (Delack, 1978). The data presented in the present study however, reflect increased durations for three of four subjects with low points at sessions four or six (figure 4). Different change patterns for speech alone and interactive speech may indicate differential use of speech for control of self and control of other.

Conclusion

Three of the four infants studied inhibited parent vocalization for four to ten seconds after their own vocalization, from the age of seven and one-half months to nine months. Parents decreased mean utterance to seven seconds or less by the infants' ninth month. There is not apparent direction of relationship between interactive speech and some types of causal thought.

Although interactive speech changes between five and one-half and nine months toward increased infant influence and, at the same time, causal thought accomplishments also increase, there is no clear direction indicated for the relationship between interactive speech and causal thought.

means-ends: top line (blue)
causality: bottom line (red)

2=behaved at top accomplishment
1=behaved at simpler level
0=did not respond

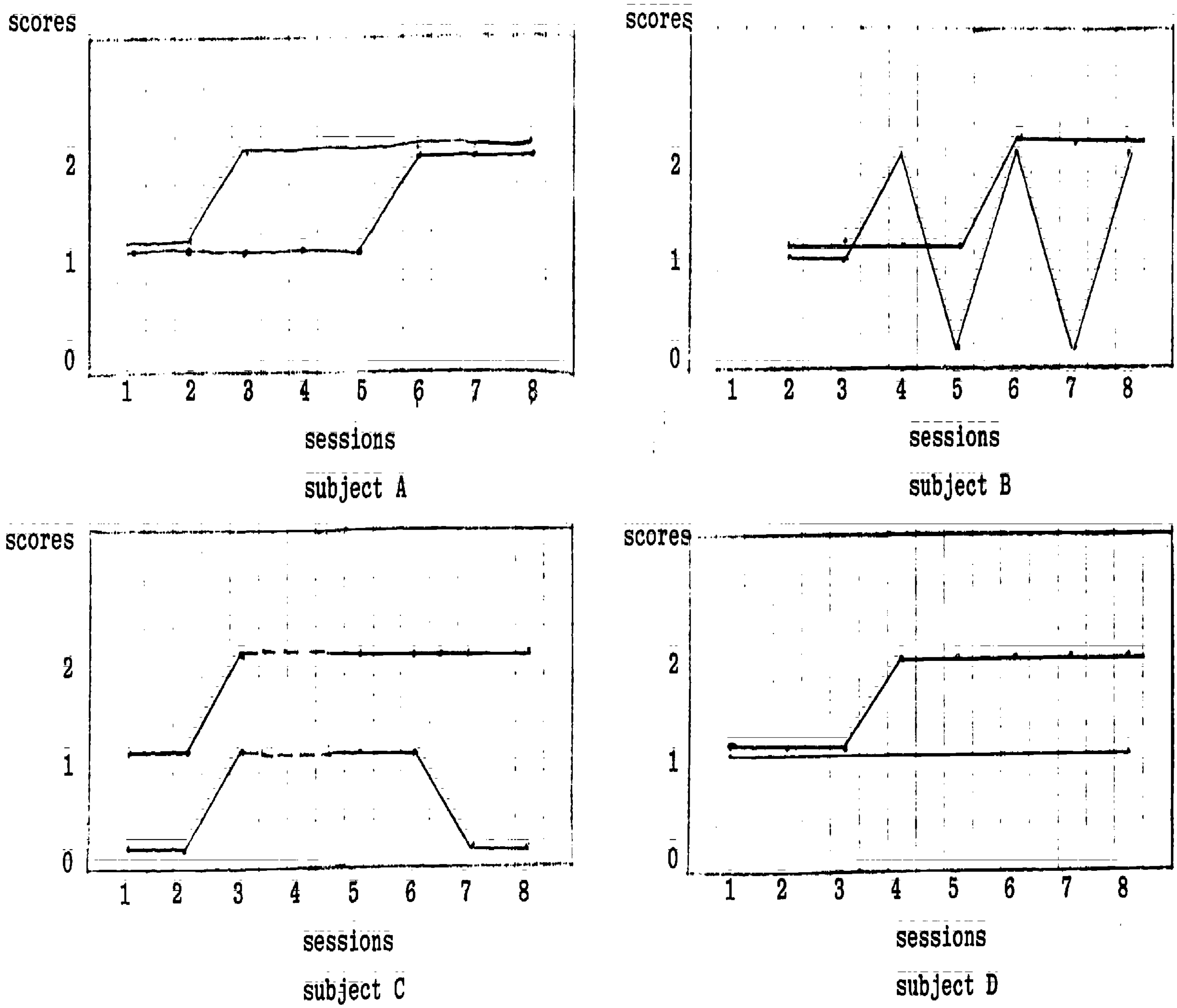


Figure 1: Cognitive Measures

G=gaze 0=elsewhere, 1=to recorder, 2=to box ("cued recall")

V=vocalization 0=none, 1=different, 2=same ("recognition")

*means-ends achievemer

Replay:

		1	2	3	4*	5	6	7	8
Long Delay (15")	G	0	0	0	1	0	0	1	0
	V	0	1	0	0	1	0	1	2
Short Delay (3-5")	G	1	2	1	1	1	0	2	1
	V	0	1	0	1	0	0	2	2

sessions

subject A

Replay:

		1	2	3	4	5	6*	7	8
Long Delay (15")	G		1	0	0	0	0	0	2
	V		1	0	2	0	0	0	2
Short Delay (3-5")	G		0	0	0	0	0	2	1
	V		2	1	0	0	0	0	2

sessions

subject B

Replay:

		1	2	3*	4	5	6	7	8
Long Delay (15")	G	0	0	1		2	2	2	0
	V	0	0	1		1	2	2	0
Short Delay (3-5")	G	1	1	1		2	2	2	2
	V	2	2	1		2	2	2	2

sessions

subject C

Replay:

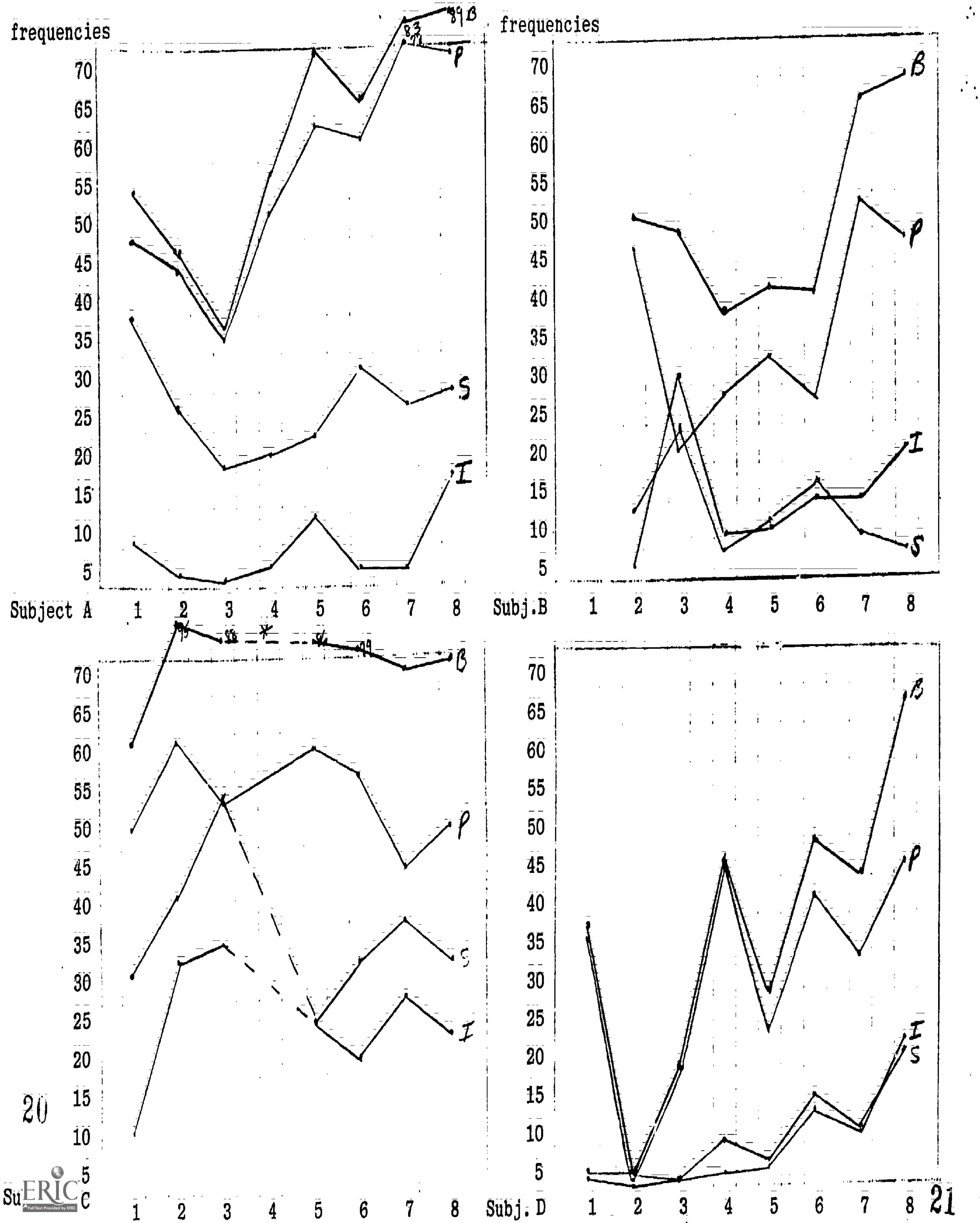
		1	2	3	4*	5	6	7	8
Long Delay (15")	G	0	0	0	0	0	0	2	0
	V	0	0	0	0	0	0	0	2
Short Delay (3-5")	G	0	0	0	0	0	0	1	1
	V	0	0	0	0	0	0	0	2

sessions

subject D

Figure 2: "Auditory Memory"

B=total parent and infant vocalizations, P=parent vocs., I=infant vocs., S=simultaeous vocs.



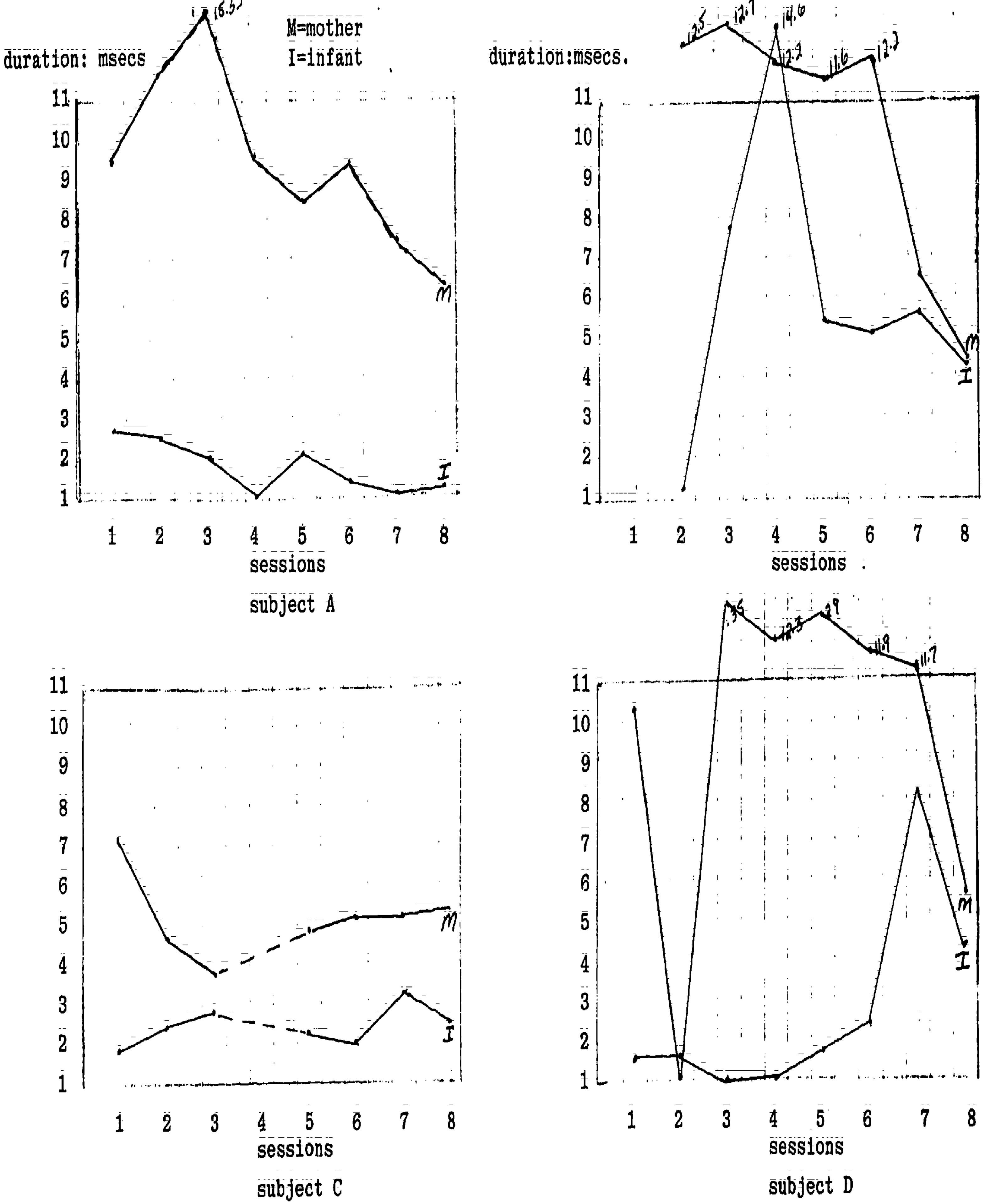


Figure 4: Mean Durations of Utterances

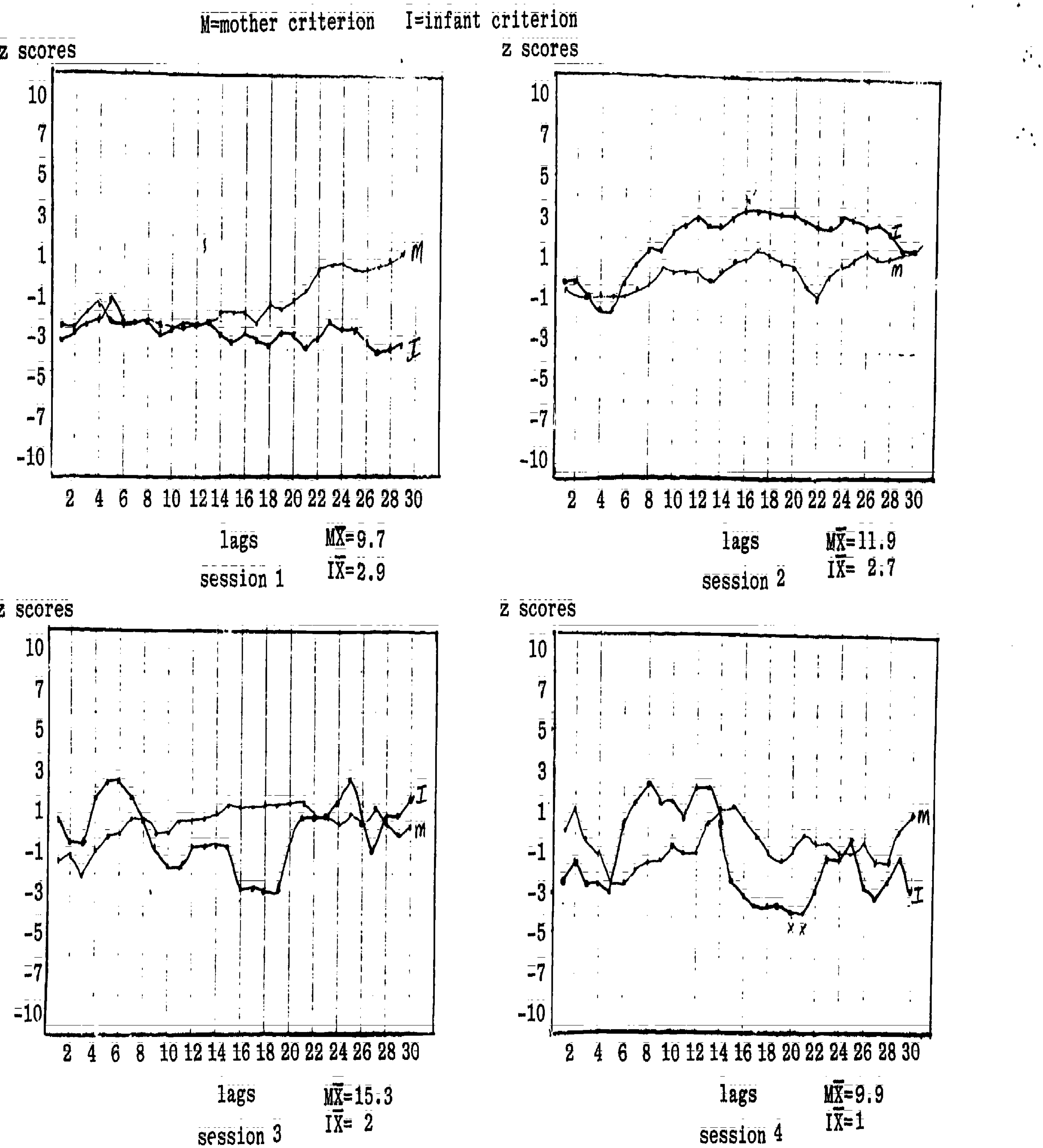


Figure 5: Dyad A

MX=mother mean duration
IX=infant mean duration

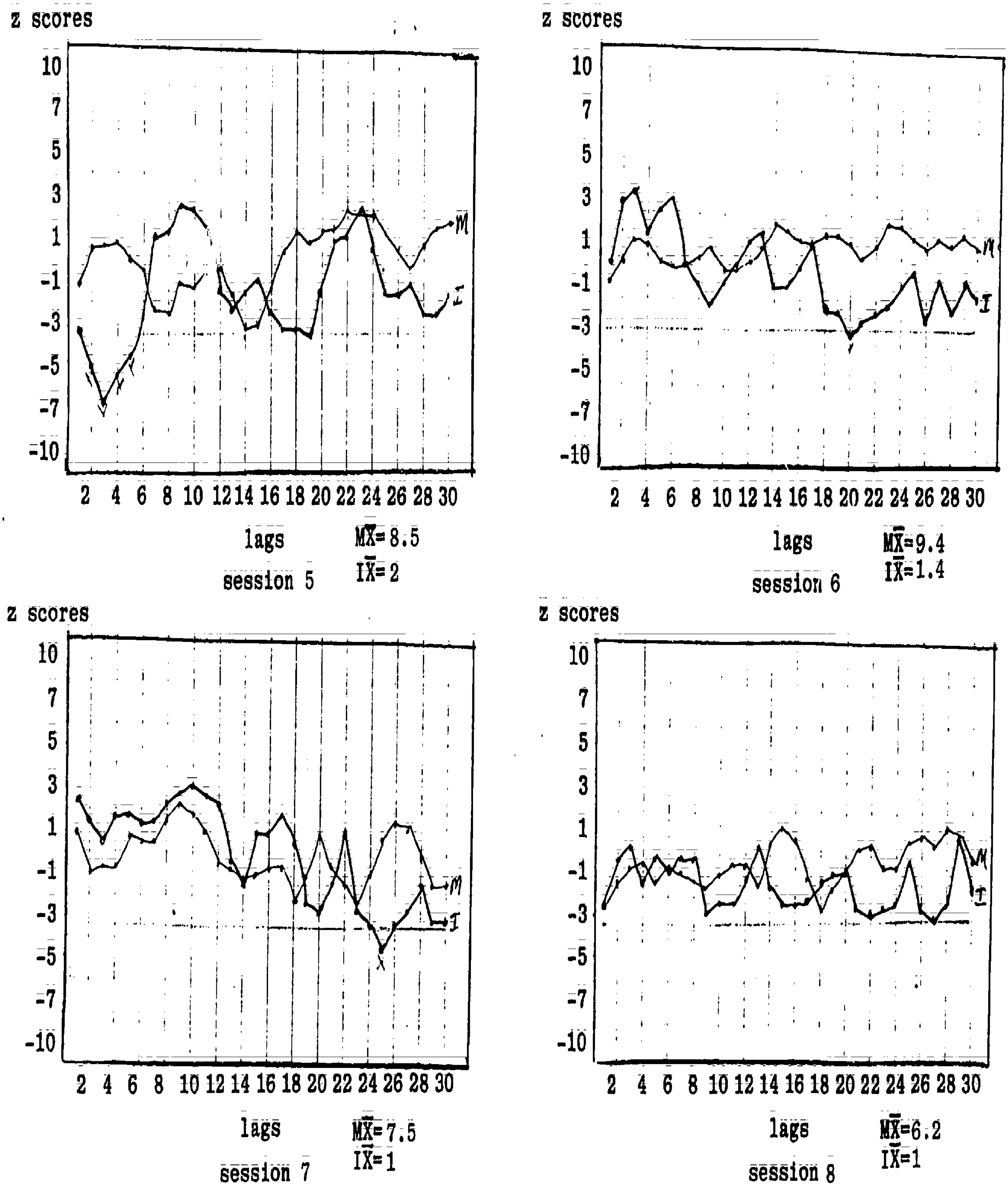


Figure 5: Dyad A

MX=mother mean duration
IX=infant mean duration

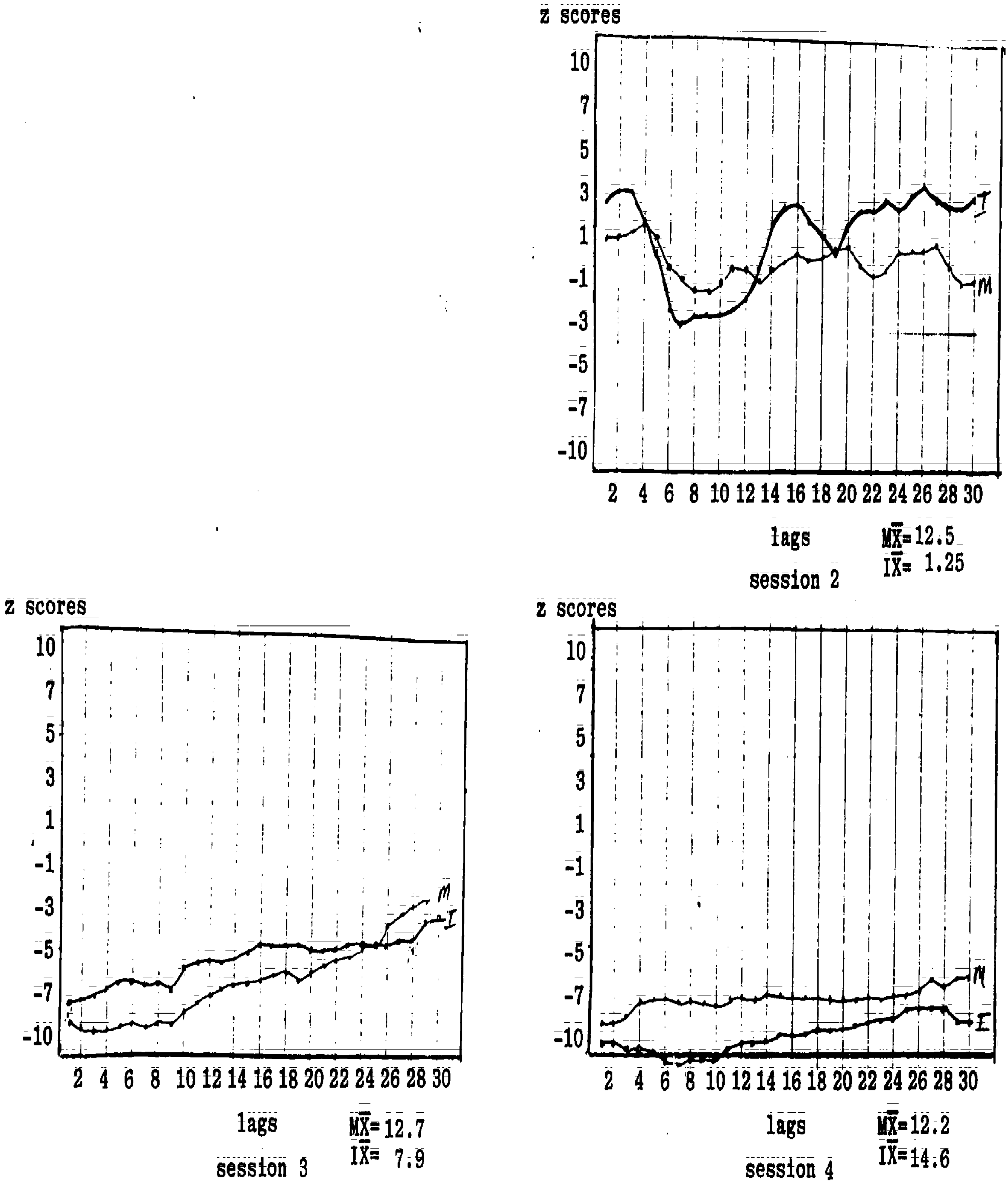


Figure 6: Dyad B

MX=mother mean duration
IX=infant mean duration

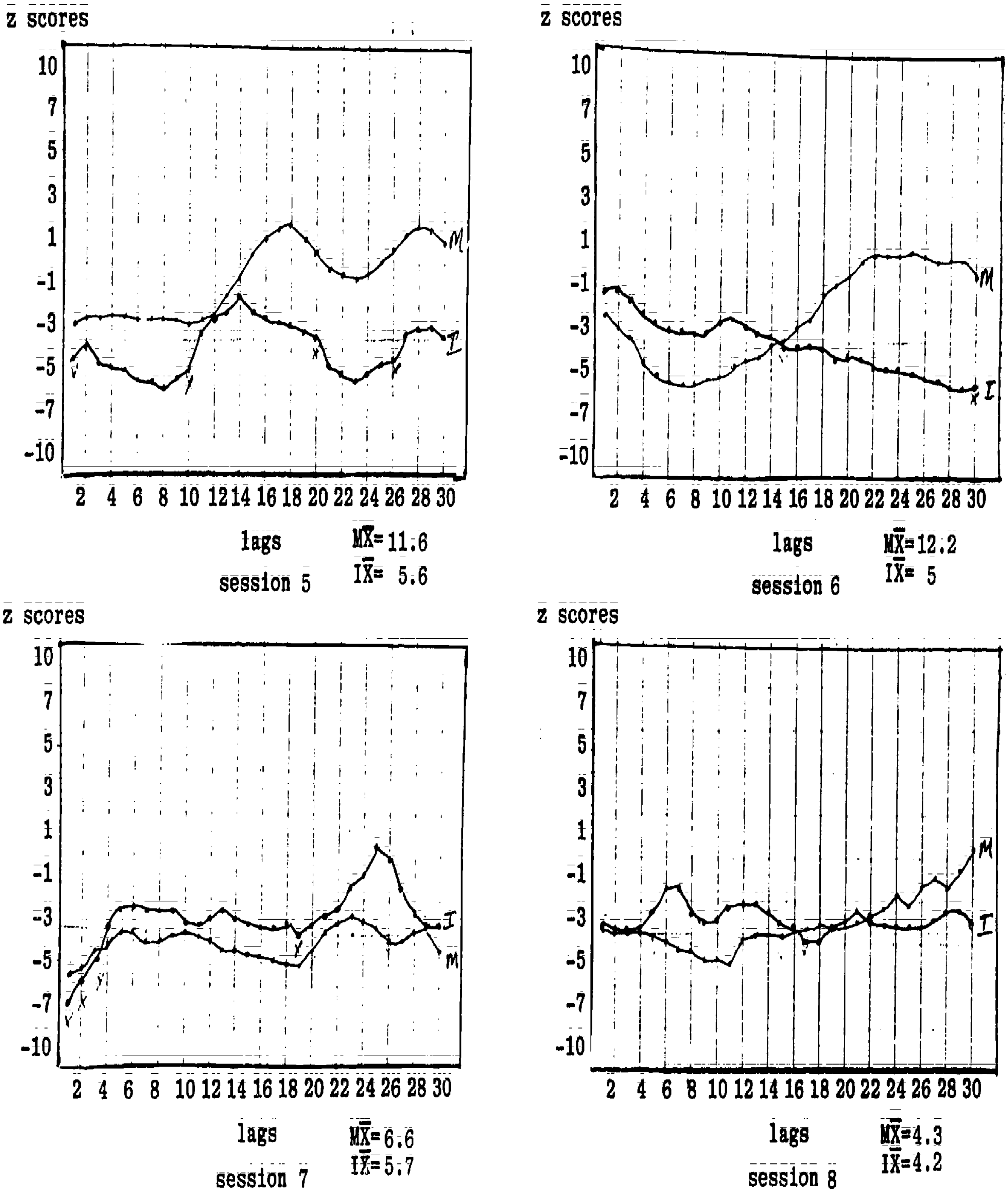
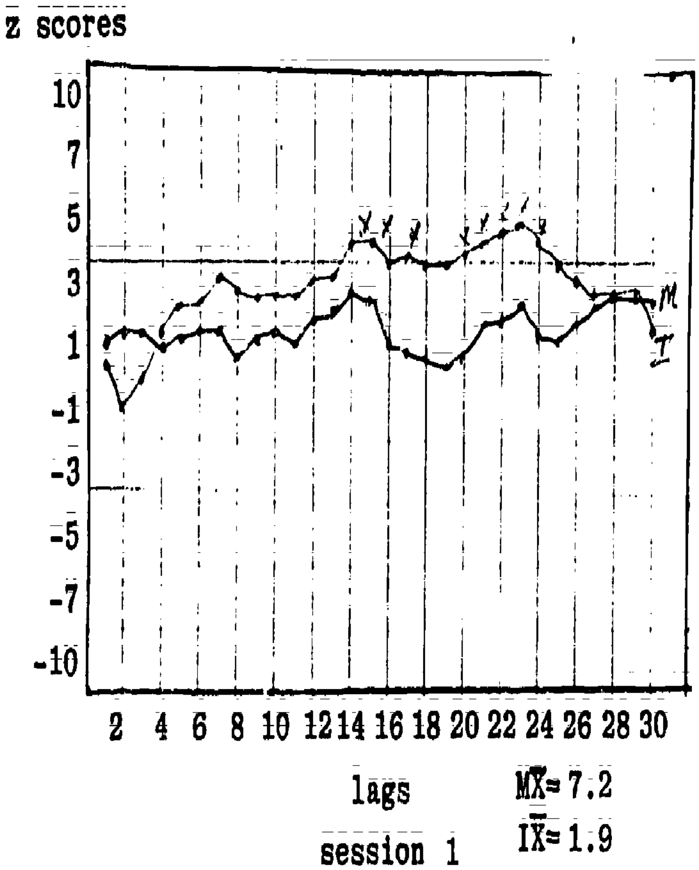
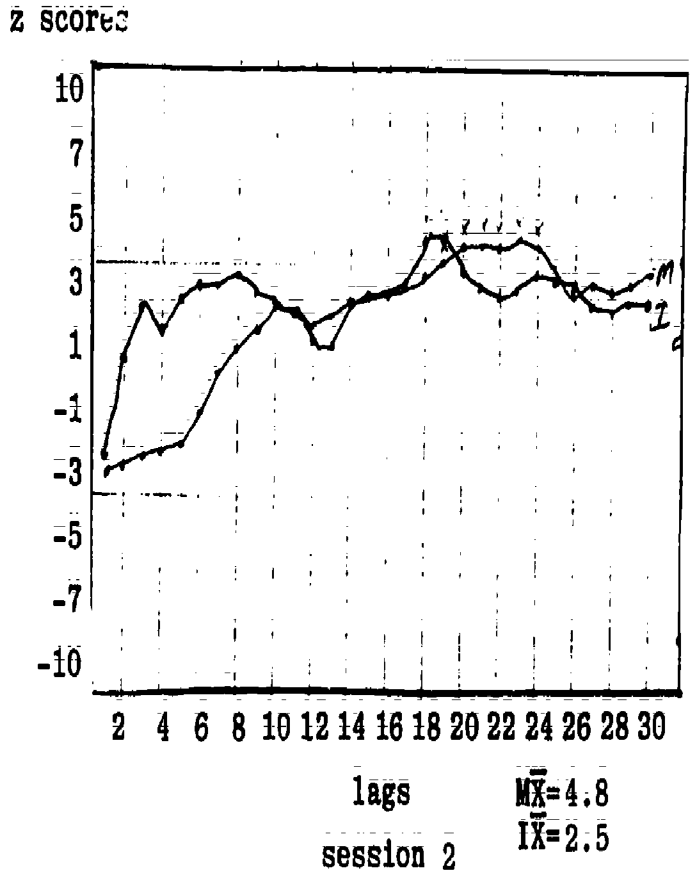


Figure 6: Dyad B

MX=mother mean duration
IX=infant mean duration





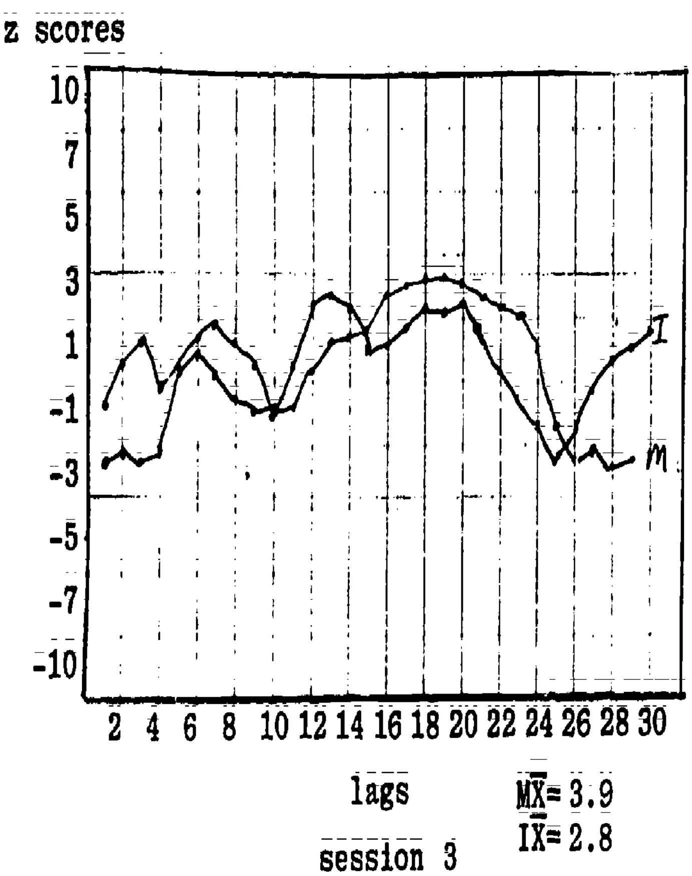


Figure 7: Dyad C

MX=mother mean duration
IX=infant mean duration

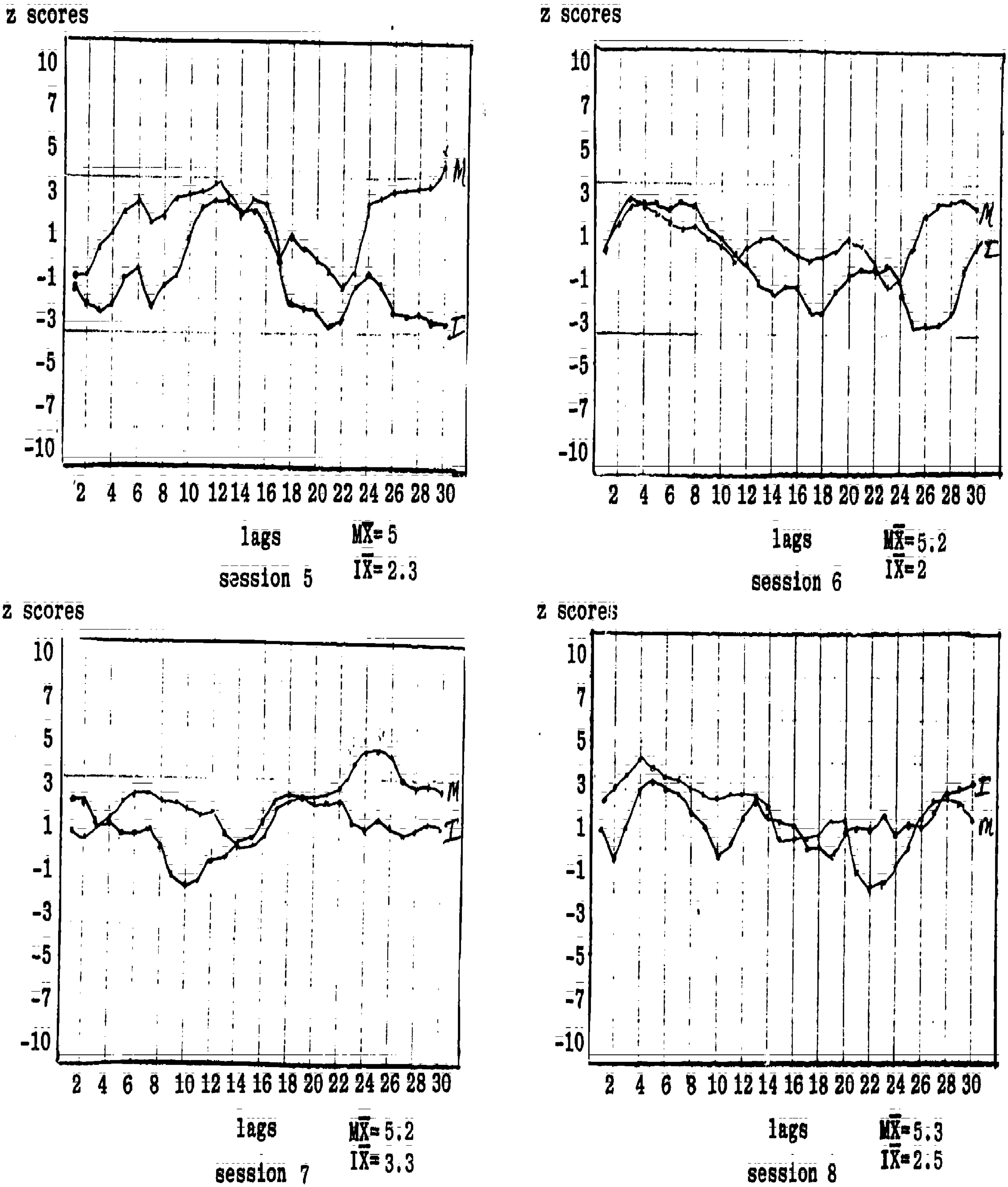


Figure 7: Dyad C

MX=mother mean duration
IX=infant mean duration

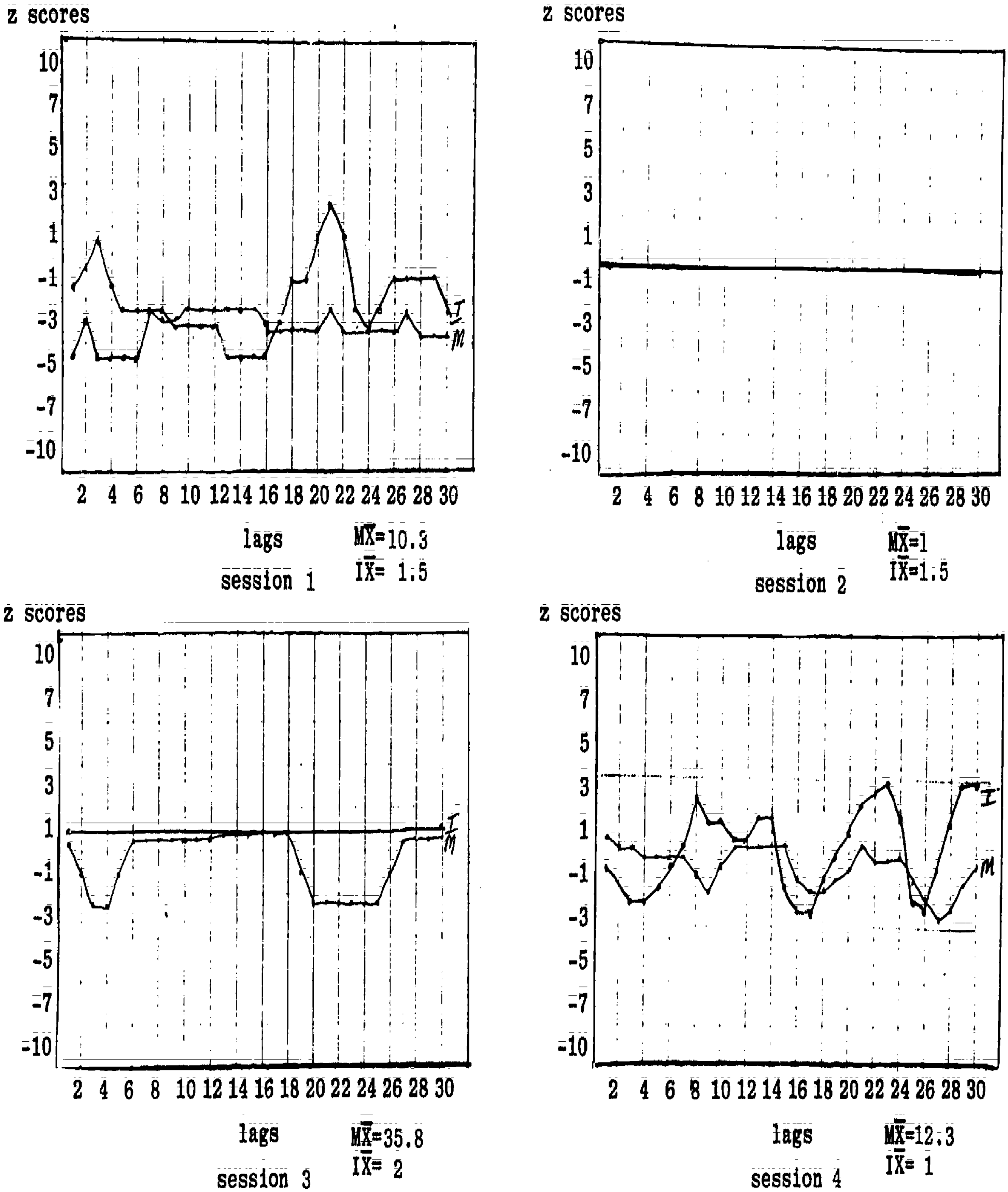


Figure 8: Dyad D

MX=mother mean duration
IX=infant mean duration

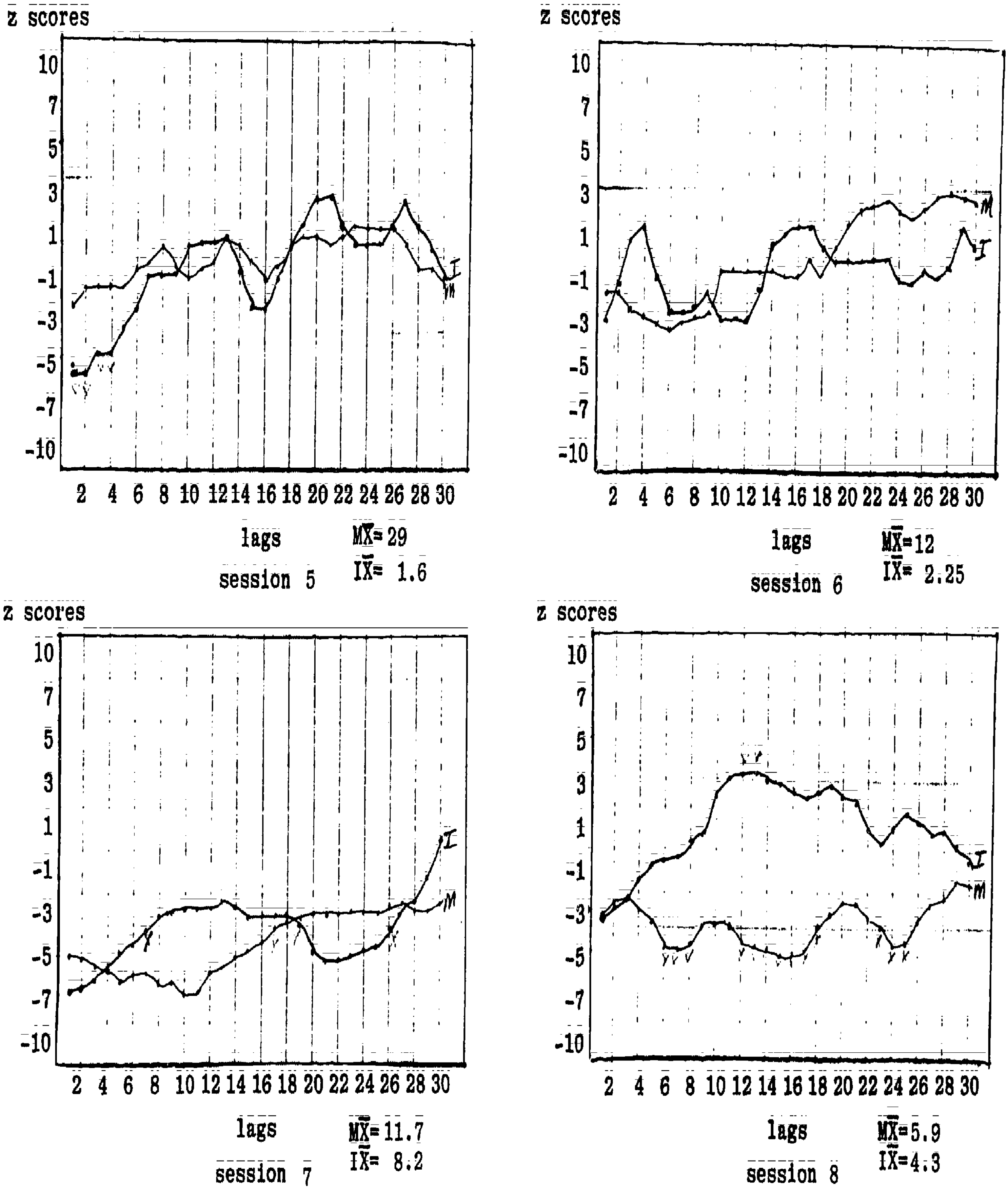


Figure 8: Dyad D

MX=mother mean duration
IX=infant mean duration

Notes

1. Dance has defined speech as "the human genetically determined, species-specific individual activity consisting of the voluntary production of phonated, articulated sound through the interaction and coordination of peripheral effector organs as a group as well as the speech-specific neural structures and pathways." (Dance, 1982, p. 126)

2. The ability to shift reference from the present moment to another moment in time has also been called temporal decentering; see Harner, p. 158. A distinction between decentering and displacement has been stated as that between 1) self/outside of self and 2) time/space; see Dance, 1979, p.2.

3. Piaget described secondary circular reactions as motor skills in which one object conditions the next such that a sequence is set up in which the individual is an active agent (Piaget, 1954, pp. 321, 330 and 348).

References

Bates, E., The emergence of symbols: ontogeny and phylogeny. In W.A. Collins (Ed.), Children's language and communication. New Jersey: Lawrence Erlbaum Associates, Publishers, 1979.

Beebe, B, Stern, D. and Jaffe, J. The kinesic rhythm of mother-infant interactions. In A.W. Siegman and S. Feldstein (Eds.), Of speech and time: temporal speech patterns in interpersonal contexts. New Jersey: Larence Erlbaum Associates, Publishers, 1979.

Brazelton, T.B., Koslowski, B. and Main, M. The origins of reciprocity: the early mother-infant interaction. In M. Lewis and L.A. Rosenblum (Eds.), The effect of the infant on its caregiver. New York: John Wiley and Sons, 1974.

Brody, L.R. Visual shrot-term cued recall memory in infancy. Child Development, 1981, 52, 242-250.

Bruner, J.S. Organization of early skilled action. Child Development, 1973, 44, 1-11.

Cappella, J.N. Mutual influence in expressive behavior: adult-adult and infant-adult dyadic communication. Psychological Bulletin, 1981, 89, 101-132.

Cappella, J.N. and Greene, J.O. A discrepancy-arousal explanation of mutual influence in expressive behavior for adult and infant-adult interaction. Communication Monographs, 1982, 49.

Condon, W.S. and Sander, L.W. Neonate movement is synchronized with adult speech. Science, 1974, 183.

Corrigan, R. Language development as related to stage 6 object permanence development. Journal of Child Language, 1978, 5, 173-189.

Corrigan, R. Cognitive correlates of language:differential criteria yield differential results. Child Development, 1979, 50, 617-631.

Dance, F.E.X. The acoustic trigger to conceptualization: a hypothesis concerning the role of the spoken word in the development of higher mental processes. Health Communications and Informatics, 1979, 5, 203-213.

Dance, F.E.X. A speech theory of human communication. In F.E.X. Dance (Ed.), Human communication theory. New York: Harper and Row, 1982.

Delack, J. Aspects of infant speech development in the first year of life. In L. Bloom (Ed.), Readings in language development. New York: John Wiley and Sons, 1978.

Elbers, L. Operating principles in repetitive babbling: a cognitive continuity approach. Cognition. 1982, 12, 45-63.

Ferguson, C.A. Learning to pronounce: the earliest stages of phonological development in the child. In F.D. Minifie and L.L.Lloyd (Eds.), Communicative and cognitive abilities: early behavioral assessment. Baltimore: University Park Press, 1978.

Fischer, K.W. and Corrigan, R. A skill approach to language development. In R. Stark (Ed.), Language behavior in infancy and early childhood. Amsterdam: Elsevier North Holland, 1981.

Fraisse, P. The psychology of time. New York: Harper and Row, 1963.

Freedle, R. and Lewis, M. Prelinguistic conversations. In M. Lewis and L. Rosenblum (Eds.), Interaction, conversation and the development of langauge. New York: John Wiley and Sons, 1977.

Harding, C.G. and Golinkoff, R.M. The origins of intentional vocalizations in prelinguistic infants. Child Development, 1979, 50, 33-40.

Harner, L. Talking about the past and future. In W.J. Friedman (Ed.), The developmental psychology of time. New York: Academic Press, 1982.

Hildebrandt, K.A. Factors influencing the regulation of gazing, smiling, and vocalizing between parents and their 3-month old infants. Dissertation Abstracts International, Michigan State University,1978.

Kagan, J. Change and continuity in infancy. New York: John Wiley and Sons, 1971.

Kagan, J. Overview: perspectives on human infancy. In J.D. Osofsky (Ed.), Handbook of infant development. New York: John Wiley and Sons, 1979.

Kail, R. The development of memory in children. San Francisco: W.H. Freeman and Co., 1979.

Lamb, M. and Campos, J.J. Development in infancy. New York: Random House, 1982.

Lar, R. Movement Behaviour and preverbalization of five infants in a cross-cultural setting. In W. von Raffler-Engel and Y. Lebrun (Eds.), Baby talk and infant speech. Neurolinguistics 5. Amsterdam: Swets and Zeitlinger B.V., 1976.

McCaffrey, A. Asymmetry, asynchrony and discontinuity. In W. von Raffler-Engel and Y. Lebrun (Eds.), Baby talk and infant speech. Neurolinguistics 5. Amsterdam: Swets and Zeitlinger, B.V., 1976.

Mehrabian, A. and Williams, M. Piagetian measures of cognitive development for children up to age two. Journal of Psycholinguistic Research, 1971, 1.

Oller, D.K. The emergence of the sounds of speech in infancy. In G.H. Yeni-Komshian, J.F. Kavanagh and C.A. Ferguson (Eds.), Child Phonology, Volume I: Production. New York: Academic Press, 1980.

Piaget, J. The construction of reality in the child. New York: Basic Books, Inc., 1954.

Rose, S. Developmental changes in infants' retention of visual stimuli. Child Development, 1981, 52, 227-233.

Sackett, G.P. Measurement in observational research. In G.P. Sackett (Ed.), Observing behavior. Volume II: Data collection and analysis methods. Baltimore: University Park Press, 1978a.

Sackett, G.P. The lag sequential analysis of contingency and cyclicity in behavioral interaction research. In J.D. Osofsky (Ed.), Handbook of infant development. New York: John Wiley and Sons, 1978b.

Sackett, G.P. Lag sequential analysis as a data reduction technique in social interaction research. In D.B. Sawin (ed.), Exceptional infant 4: Psychosocial risks in infant environmental transactions. New York: Brunner/Mazel, Inc., 1980.

Sander, L.W. The regulation of exchange in the infant-caretaker system and some aspects of the context-content relationship. In M. Lewis and L. Rosenblum (Eds.), Interaction, conversation and the development of language. New York: John Wiley and Sons, 1977.

Snyder, L.S. Communicative and cognitive abilities. Merrill-Palmer Quarterly, 1978, 24.

Sophian, C. Habituation is not enough: novelty preferences, search, and memory in infancy. Merrill-Palmer Quarterly, 1980, 26, 239-258.

Stark, R.E. Stages of speech development in the first year of life. In G.H. Yeni-Komshian, J.F. Kavanagh and C.A. Ferguson (Eds.), Child Phonology, Volume I: Production. New York: Academic Press, 1980.

Stern, D.N. A micro-analysis of mother-infant interaction. American Academy of Child Psychiatry Journal, 1971, 10, 501-517.

Stern, D.N. Mother and infant at play: the dyadic interaction involving facila, vocal and gaze behaviors. In M. Lewis and L. Rosenblum (Eds.), The effect of the infant on its caregiver. New York: John Wiley and Sons, 1974.

Stern, D.N., Jaffe, J., Beebe, B. and Bennett, S.L. Vocalizing in unison and in alternation: two modes of communication within the mother-infant dyad. Annals: New York Academy of Sciences, 1975,263.

Street, R. Noncontent speech convergence and divergence in adult-child interactions. Paper presented at the convention of the International Communication Association, May 1983.

Uzgiris, U.C. and Hunt, J.McV. Assessment in infancy: ordinal scales of psychological development. Urbana: University of Illinois Press, 1975.

Vygotsky, L.S. Thought and language. Cambridge: The M.I.T. Press, 1962.

Vygotsky, L.S. Mind in society: the development of higher mental processes. In M. Cole, V. John-Steiner, S. Scribner and E. Souberman (Eds.). Cambridge: Harvard University Press, 1978.

Zachry, W. Ordinality and interdependence of representation and language development in infancy. Child Development, 1978, 49, 681-687.

Zelazo, P.R. Smiling and vocalizing: a cognitive emphasis. Merrill-Palmer Quarterly, 1972, 18, 349-365.

Zelazo, P.R., Kagan, J. and Hartmann, R. Excitement and boredom as determinants of vocalization in infants. The Journal of Genetic Psychology, 1975, 126, 107-117.

APPENDIX A

Toy in a Box Scoresheet

Name____________________

Date____________________

1. Which toy was used?

2. Trial #1
   a. Did the infant look to the box when the light was turned on?
      yes______ no__________
   b. Did the infant vocalize when the light was turned on?
      yes_______ no_________

3. Trial #2
   a. When speech was replayed, where did the infant look?
      i. to parent
      ii. to the box
      iii. to researcher
      iv. elsewhere __________________
   b. Did the infant vocalize again upon tape replay?
      i. during replay?
      ii. after replay?
      iii. the same vocalization?
      iv. a different vocalization?_______________________

4. Trial #3 (after videotaping)
   a. When speech was replayed, where did the infant look?
      i. to parent
      ii. to the box
      iii. to researcher
      iv. elsewhere _____________________
   b. Did the infant vocalize again upon tape replay?
      i. during replay?
      ii. after replay?
      iii. same vocalization?
      iv. different vocalization?____________________

APPENDIX B

Causality Scoresheet

Name________________

Date________________

A. Infant's response to abruptly moving chair forward:

1. no reaction
   startle response
   repetitive behavior (e.g. bang on seat)
2. looks behind seat
   looks in front of seat

B. Infant's response to hair blowing pattern:

1. touches parent's mouth
   repetitive behavior (e.g. bang on seat)
2. makes eye contact with parent
   waits expectantly in front of parent.

APPENDIX C

Piaget/Means-Ends Relationships Scoresheets

Name________________________

Date________________________

A. Means-Ends--Locomotion

Means and Ends—Locomotion as Means (Sets III and IV)

While the infant is engaged in play requiring more than one object (e.g., putting blocks into cup), take the object most essential for the play activity and place it at a distance from the infant, so that he would have to move in order to retrieve it.

Loses interest in toy____

Reacts to loss, but does not move to retrieve toy____

Moves to retrieve toy____

Other (specify):

B. Means-Ends--Support

. *Means and Ends—Support* (Sets III, IV, and V)

a. Seat the infant next to a table and after getting him interested in some toy, take the toy and place it on a pillow located on the table in such a way that the toy would be out of the infant's reach, but a corner of the pillow would be within reach.

Loses interest in toy____

Reaches for toy and shows unhappiness____

Tries to climb onto table to obtain toy____

Appeals to E or mother____

Pulls the pillow and obtains toy____

Other (specify):

b. If the infant *does not* use the pillow as a support, demonstrate that moving the pillow back and forth also moves the object, and observe again.

Loses interest in toy____

Reaches for toy and shows unhappiness____

Tries to climb onto table to obtain toy____

Appeals to E or mother____

Pulls the pillow to obtain toy____

Other (specify):

c. If the infant *does* use the pillow as a support, on one trial hold the object a few inches above the pillow and observe whether the infant will still pull the pillow.

Pulls pillow____

Reaches for toy directly____

Other (specify):

C. Means-Ends--String

Means and Ends—String (Sets IV and V)

a. Seat the infant next tc a table and, after getting him interested in some toy, tie a string around the toy and place it on the table so that it is outside the infant's reach, but stretch the string out from the toy to the infant's hands.

Loses interest in toy____
Plays with the string instead____
Reaches for toy and shows unhappiness____
Tries to climb onto table to obtain toy____
Appeals to E or mother____
Pulls string and obtains toy____
Other (specify):

b. If the infant *does not* use the string to obtain the toy, demonstrate that pulling the string brings the toy closer, and again observe his behavior.

Loses interest in toy____
Plays with the string instead____
Reaches for toy and shows unhappiness____
Tries to climb onto table to obtain toy____
Appeals to E or mother____
Pulls string and obtains toy____
Other (specify):

c. If the infant *does* use the string to obtain the toy, lower the toy to the floor and stretch the string up, placing it close to his hands.

Loses interest in toy____
Looks down searching for toy____
Throws down string and cries for toy____
Plays with string instead____
Pulls string, but not enough to get toy____
Pulls string and obtains toy____
Other (specify):

d. If the infant *does not* obtain the toy from the floor by means of the string, demonstrate that raising and lowering the string moves the toy up and down.

Loses interest in toy____
Looks down searching for toy____
Throws down string and cries for toy____
Plays with string instead____
Pulls string, but not enough to get toy____

Pulls string and obtains toy____
Other (specify):