

MATERNAL LANGUAGE: INFANT
GENDER AND PACING EFFECTS

By

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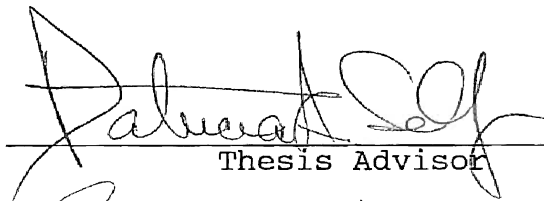
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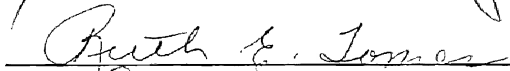
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Thanks to the parents who brought their infants into lab for videotaping. Without their willingness to come into the lab, it never would have been completed.

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CHAPTER I

INTRODUCTION

Past research studies have examined various facets of maternal vocalizations to infants (Snow, 1977b). Of particular interest have been characteristics of mother and infants that alter the language environment. This study proposes to examine two aspects which are likely to change maternal language behavior; infant gender and alterations in maternal-infant interaction.

Theories of early language development include learning, cognitive, dialectic, and systems theory. The current research emanates from the theories of Vygotsky (1962), and Fogel and Thelen (1987).

Alterations in mother-infant interaction have been researched by Arco and McCluskey (1981), Field (1977), and Symons and Moran (1987). Acceleration or deceleration of maternal interaction seem to elicit the following changes in maternal speech. Mothers vocalized more in the accelerated phase (63.78 sec./2 min.) and less in the decelerated phase (50.44 sec./2 min.).

Infant gender has also been noted to elicit differential language behavior. Shafaie, Noble, and Self

(1982) found sons to receive more imperative utterances and daughters to receive more declarative utterances from their mothers.

The current study briefly reviews the theoretical perspectives in early language, particularly those focusing on receptive language. Research literature on the effects of infant gender, measures of early language environment (and the developmental changes), the impact of alterations of maternal language behavior are then reviewed. These sections are followed by the statement of the problem and hypotheses, as well as the methodology, results and discussion of the current research study.

CHAPTER II

LITERATURE AND RESEARCH REVIEW

Vygotsky's (1962) theory on language and cognitive development is that speech and thought develop separately; but at times the development of one will influence the development of the other. Vygotsky (1962) believed that in word meaning, thought and speech came together into verbal thought. He explained the development of language as a combination of the development of verbal thought and the sociocultural experiences of the child. He believed that the child's intellectual growth was based on his or her mastering of language, the social means of thought. According to Vygotsky (1962), a close relationship existed between language and logical thinking. As more advanced levels of speech were obtained, so were more advanced levels of thought.

In developing language, the infant uses both internal and external components. The internal components are the developing of thought and language (Vygotsky, 1962) and sociability of the infant. The external factors are environmental, the most significant external factor being the parent.

Vygotsky (1962) has four stages of speech development. The first stage is the 'Primitive' or 'Natural' stage. This stage consists of preintellectual speech and preverbal thought. The second stage is 'Naive Psychology' with 'Naive Physics'. In this stage, the child becomes aware of the objects in his/her environment. The child begins to use the correct grammatical forms and structures of speech, but does not have an understanding of the logic behind them. The third stage is external signs and external operations. The child begins to use external objects to aid in the solution of internal problems. S/he could use her/his fingers to count. The fourth stage is the 'Ingrowth' stage. The child no longer needs to use his/her fingers to count. Instead the child is able to count in her/his head. This study will focus on Vygotsky's first stage of speech development.

The theme of Dynamic Systems theory proposed by Fogel and Thelen (1987) is that a set of components, some coming from the individual and some from the context can be integrated so that the behavior that develops is the systems product of the components. The development of these behaviors is contingent upon the experiences and the maturational status of the child, and the current context of the action. The fundamental characteristics of these components are stability and change.

In systems theories, behavior is predicted to maintain a dynamic stability, that is, a focus on the task orientation, with resistance to small disturbances. Language development occurs with the assistance of environmental feedback. When this is lacking, the development is impaired or non-existent. Language development of the infant is able to adjust to minor disruptions without damaging effects.

According to Fogel and Thelen (1987), adults can temporarily enhance the infant's performance beyond what s/he is capable of doing alone. The adult supplies the support the infant needs to develop his/her incomplete behavioral patterns into well functioning systems. One of these support systems is the conversational model used by mothers to facilitate their infant's contribution to the interaction (Mayer & Tronick, 1985). The use of a monologue mode during mother-infant interaction is almost nonexistent (Snow, 1977a). Mothers' vocal interactions with their infants are conversational, they expect a response. The mothers perceive the interaction time as a reciprocal situation and work to provide their infants with the appropriate number of turn yielding cues for the infant's current interactive capabilities (Mayer & Tronick, 1985).

In order for the child to develop understanding and to communicate, his or her experiences must be generalized and

simplified to a level that s/he comprehends; so that the experience becomes meaningful to him/her (Vygotsky, 1962). Maternal vocalizations fit into this category. Maternal speech is simplistic (Phillips, 1973; Snow, 1972), and pertains to items in the child's immediate environment (Bloom, 1974). Fernald (1985) found that four month old infants prefer to listen to infant-directed speech (motherese) rather than adult-directed speech. No sex differences were found. The listening preference of infants to infant-directed speech may be due to the fact that infant directed speech is produced at a higher pitch (Fernald & Kuhl, 1987).

Maternal Linguistic Features

Snow (1977b) felt that the central theme of early mothers' speech research was the relevance of mothers' speech to language acquisition. Maternal caretaking behaviors observed during mother infant interaction provide tactile, visual, vocal, kinesthetic, and proprioceptive stimulations (Moss, 1967). These face-to-face interactions provide the basis for the development of the infant's communication skills. Therefore Field (1977) believed that these first few months are a crucial time in the beginning development of communication skills. Fry (1966) believed that as early as one month of age, the amount of speech the infant hears has a positive effect on the future

development of his or her speech. Proctor (1984, p.4) stated that one of the main aspects of socially oriented behaviors between mother and infant in the "process of bonding and subsequent attachment" is the maternal vocalizations.

A number of measures have been utilized in the examination of maternal speech to infants. Snow (1977b) divides the variables of maternal speech into three categories: 1) Prosody, 2) Grammatical Complexity, and 3) Redundancy. Prosodic features consist of the rate of speech, the ease of segmentation, disfluencies, pitch, and pitch range. Features of grammatical complexity are mean length of utterance, number of utterances, and grammatical sentence type. Redundancy is the amount of repetition from one utterance to the next.

One of the prosodic features is the rate of speech (Snow, 1977b). In a review of language universals of adult speech to young children, Ferguson (1978) found that adults speak slower (Kaye, 1982; Stern, 1974) and have longer pauses between their sentences. Fernald and Simon (1984); Papousek, Papousek, and Bornstein (1985); and Snow (1972), found parents to have slower articulation rates (Kaye, 1982) and longer pauses when talking to infants. Stern (1974) argues that the reason for the mother's slowed speech is that she is trying to more closely match the

infant's perceptual capabilities and speech production abilities.

Fernald and Simon (1984) found maternal speech to restless infants to be characterized by longer utterances, shorter pauses and slower articulation rates in comparison to maternal speech to drowsy, alert, or quiet infants. In the Wasserman and Lewis (1985) study when mothers were asked not to interact with their infants, they still responded vocally to the infant's social behavior.

The most common measure for categorizing maternal speech is the mean length of utterance (MLU) (Snow, 1977b). Snow (1977a) defined the MLU as the average number of words per utterance. Proctor (1984) substituted mean length of response (MLR) which was an average number of words per utterance for MLU. The MLU or MLR are figured by dividing the total number of words by the total number of utterances. Mayer and Tronick (1985) defined an utterance as speech surrounded by pauses of 1-2 seconds. Schaffer and Crook (1979) defined utterances as speech phrases set off by changes in inflection or pauses. Stern, Spieker, and MacKain (1982) defined utterances as vocalizations surrounded by pauses greater than 300 msec.

Sentences to infants and young children are shorter than sentences to adults (Ferguson, 1978; Fernald & Simon, 1984; Morikawa, Shand, & Kosawa, 1988; Papousek et al., 1985; Snow, 1972). The MLU varies depending upon the study

and the age of the children. Stern, Spieker, Barnett, & MacKain, (1983) found the MLU for mother speaking to her: neonate was 3.12, 4-month-old was 4.00, 12-month-old 3.60, and 24-month-old 4.58. When speaking to another adult her MLU was 8.16 (Stern et al., 1983). In the study by Fernald and Mazzie (1991) infant-directed utterances contained fewer words ($M=4.76$) than did adult-directed utterances ($M=7.59$). Kaye (1982) in looking at maternal vocalizations to infants between the ages of six and twenty-six weeks found the MLU to be 2.76. Papousek, Papousek, and Haekel (1987) reported a MLU of 2.8 for mothers speaking to their 3-month-old infants. Newport, Gleitman, and Gleitman (1977) gave the MLU for mothers speaking to their young children to be 4.24. Rheingold and Adams (1980) found the MLU of hospital staff to newborns to be 4.85. Mayer and Tronick (1985) did not find the number of maternal utterances produced to change significantly as the infant aged from 2 to 5 months.

In Kaye's (1982) study, the maternal utterance rate was twenty-one utterances per minute. Papousek et al. (1987) reported 200 maternal utterances for the six minute session. These utterances averaged about 1.1 seconds and were surrounded by pauses of about .7 seconds. Papousek and Papousek (In Papousek et al., 1985) reported that mothers talked to their 3-month-old infants at an average rate of 35.15 ($SD=5.89$) utterances per minute during two

minute face-to-face interaction. Mayer and Tronick (1985) found that mothers produce an average of 75 utterances per three minute session when talking to their infants at the ages of 2, 3, and 5 months. Fogel, Toda, and Kawai (1988) reported mothers in Japan and America vocalized to their 3 month infants about 80% of the time in the 2 minute session.

Grammatical sentence types are divided into four categories: interrogative, declarative, imperative, and 'contentless' utterances (Snow, 1977a) or moodless utterances (Sinclair & Coulthard, 1975). Shafaie et al. (1982) used entertaining utterances as one of their categories. This category consisted of clicks or whistles. Stern, Spieker, and MacKain (1982) included meaningful communication like oh, ooh, uh oh, hum, and shh; but excluded nonverbal sounds (kisses and laughter) and routines (songs and nursery rhymes) from their classification of maternal utterances. Interrogatives are utterances containing a subject-verb inversion or having a questioning or rising intonation (Proctor, 1984; Snow, 1977a). They request a response (Sinclair & Coulthard, 1975). They are questions (Proctor, 1984; Schaffer & Crook, 1978). Interrogatives include "wh" questions (Newport et al., 1977; Snow, 1977b; Stern et al., 1982) and yes/no questions (Proctor, 1984; Stern et al., 1982). "Wh" questions are those beginning with words in which the first

two letters are "wh" like "what" or "why". Declaratives give information and point out observations made (Proctor, 1984; Schaffer & Crook, 1978; Sinclair & Coulthard, 1975).

Imperatives are commands (Schaffer & Crook, 1978).

'Contentless' utterances are those consisting of imitations of the infant's babbles, songs, and verses (Snow, 1977a).

Moodless utterances are those without a verb (Sinclair & Coulthard, 1975).

Utterances made to infants and young children contain many questions/interrogatives (Ferguson, 1978; Morikawa et al., 1988; Snow, 1977a) and imperatives (Snow 1977b). Shafaie et al. (1982) reported that multiparous and first-time mothers, in controlling their newborn male infants' attention, used significantly more imperative forms of utterances than declarative, interrogative, or entertaining utterances (clicking or whistling). Multiparous mothers used more entertaining utterances with their sons than with their daughters. The number of imperative utterances used with male infants were almost three times more than those used with female infants. These mothers were found to use more declarative statements with their newborn daughters. They reported that declarative statements were more complex and thus cognitively more demanding. Snow, Arlman-Rupp, Hassing, Jobse, Joosten, and Vorster (1976) reported that imperatives, in general, are very simple in form.

Mayer and Tronick (1985) did not find significant differences in the number of interrogatives, declarative, and command utterances. Papousek and Papousek (Cited in Papousek et al., 1985) reported that 62.4% of maternal utterances to their 3-month-old infant had no distinguishable syntactic structure.

Rheingold and Adams (1980) analyzed the speech of the hospital staff in the newborn nursery. They found that 87% of the utterances were sentences. The other 13% consisted of single words, sounds, and incomplete utterances. Forty percent of the sentences were declarative sentences, twenty-three percent were interrogative sentences, fourteen percent were commands, two percent were exclamations, and the remaining eight percent were greetings, appellations, and conventional phrases. Papousek et al. (1987) broke maternal utterances down into these percentages: fragments of speech 62.6%, statements 13.9%, directives 9.8%, Yes/No questions 7.6% and "Wh" questions 6%.

Newport et al. (1977) in comparing mother to young child utterances to mother to adult utterances found that mother to child utterances contained 30% declaratives, 18% imperatives, 44% questions ("Wh" questions 15%, Yes/No questions 21%, Deictic questions 8%). Mother to adult utterances contained 87% declaratives, 2% imperatives, 9% questions ("Wh" questions 1%, Yes/No questions 8%). Deictic questions are ones which name a referent by means

of a variable whose identification depends on the speakers and their situations, e.g., "There is a ball".

Snow et al. (1976) looked at speech characteristics of mothers from three social classes to their 2-year-old children. The three social classes used were unskilled and semiskilled working class (WC), skilled lower middle class (LMC), and academic middle class (AMC). Significantly more imperatives were used by WC mothers. Significantly more interrogatives were used by LMC mothers.

Proctor (1984) in comparing the grammatical function (syntax) of a mother suspected of neglecting (MSN) her infant to a mother with a medically ill (MMI) infant found that 45% of the MSN's sentences were commands while the MMI had 0% commands. 24% of the MSN's sentences and 33% of the MMI's sentences were exclamations. Ten percent of the MSN's sentences were declarative as were 29% of the MMI's sentences. Ten percent of the MSN's and 38% of the MMI's sentences were questions. The author did not report if any of these results were significant.

Snow (1977a) did not find that mothers waited until they expected verbal responses or comprehension of speech from their infants to use interrogatives. She found a high usage of interrogatives in both of the infants at the age of 3 months. There was no change in the mother's speech with regard to the use of declaratives, interrogatives, imperatives, contentless utterances, and temporal

references as the infant's linguistic abilities grew. The utterances to the infant changed from being infant centered to focusing on the environment between the ages of 3 months to 18 months.

Francis, Self, and Noble (1982) reported a clear relationship between the visual context (mutual gaze or visual co-orientation) and the mothers' use of different types of control methods with their 2-4 month old infants. The infants were exposed to different types of linguistic information depending on the context of the situation. In co-orientation, the focus was on some object. In mutual gaze, the primary emphasis is on the mother and infant. In comparing infant gaze and maternal utterances, Morikawa et al. (1988) found American mothers produced 53% of the total utterances when their infants were looking at them; Japanese mothers produced 46%. American mothers' action eliciting utterances were more often produced while the infant was gazing away from them; Japanese mothers did so when their infant was looking at them.

Significant differences were found by Phillips (1973) when she examined adult speech to the child versus adult to adult speech. The speech to the child was syntactically less complex (Phillips, 1973; Snow, 1972). The vocabulary is less varied and more concrete. Snow (1972) found that the speech of adults to 10-year-olds was more complex than speech to 2-year-olds.

When speaking to an infant or young child, the adult's speech is often focused on the here and now and contains few past tenses (Ferguson, 1978; Snow, 1977b). Bloom (1974) found that parental speech to children pertained to events in the immediate environment.

Adult speech to children is often redundant (Snow, 1972, 1977b). Kaye (1982) reported that 16% of maternal utterances to their infants were exact replications of the proceeding utterance. Those utterances with fewer words were most likely to be repeated. The mother was more apt to repeat a noun rather than substitute a pronoun for a noun when speaking to 2-year-olds (Snow, 1972). Papousek et al. (1987) found that 17.7% of the utterances were exact repetitions. Snow et al. (1976) reported that mothers repeated 5% of their own utterances exactly, and 13% partially. In Rheingold and Adams' (1980) study only 6% of the utterances were exact repetitions. This could be due to the fact that the purpose of the interaction was not for play. Newport et al. (1977) reported that 23% of maternal utterances to young children involved some sort of repetition. Snow (1972) feels that the repetition of sentences increases the child's chances of successfully processing the sentence.

Stern et al. (1983) found the peak amount of repetition to be when the infant was 4-months-old and that the amount of repetition declined over the next two years.

When adults were speaking to 4-month-old infants, they immediately repeated 26% of their utterances. When speaking to other adults, only 5% of the utterances were immediately repeated. Sentence repetition was about four times more frequent for 2-year-olds than for 10-year-olds (Snow, 1972).

Moss (1967) reported that mothers of daughters were more likely to imitate their daughters vocalizations than the mother's of sons. The mothers were found to reinforce the behavior differently based on the sex of the infant.

Mothers vocal interactions are conversational with their infants. They expect a response. When interacting with their infants, the mothers speak to their infants as if they were able to respond verbally. The use of a monologue mode when interacting with her infant is almost nonexistent (Snow, 1977a).

Gender Differences

A review by Maccoby and Jacklin (1974) reported that female superiority on verbal tasks is one of the most solidly established generalizations in the field of gender differences. Differences in verbal skills between boys and girls were found to occur before the age of three and after the age of eleven. Between these ages, girls and boys were fairly equal on verbalization skills. They did not find mothers to provide more verbal stimulation to daughters

than sons. Girls were not found to be more "social" than boys.

They also found parents to treat boys and girls basically the same, suggesting that there are not many biologically based behavioral differences that would elicit different reactions from caregivers. These results are questionable due to later studies.

In a study by Lewis and Cherry (1977) looking at maternal interaction with their 2-year-old children, more maternal utterances and MLU's were directed toward the girls than the boys. In play, the girls were found to remain closer to their mothers than the boys did. Mothers were found to use more conversation-maintaining devices when interacting with their 2-year-old daughters than with their 2-year-old sons (Lewis & Cherry, 1977). Questions, maternal acknowledgments of children's answers and mother turns, and maternal other repetitions are types of conversation-maintaining devices.

A study by Rubin, Provenzano, and Luria (1974) looked at parental descriptions of their newborn infants. Fathers were found to give more stereotypical responses when describing their newborns. Sons were more frequently described as big. Adjectives frequently used to describe daughters were little, beautiful, pretty, and cute.

Will, Self, and Datan (1976) looked at maternal differences toward a six month old male dressed as a female

for six of the mothers and as a male for five of the mothers. They found that mothers smile more when they think the infant is a female rather than a male. This provides the females with more social stimulation.

Culp, Cook and Housley (1983) looked at parental differences toward a six month old (\pm two weeks) female dressed as a female for half of the mother-father pairs and as a male for the other half. They found that when the infant was dressed as a female; she received more verbal interaction and more interaction without gaze. When she was dressed as a male, she received more direct gaze.

Moss (1974) found that when mothers and fathers were asked to get their infants to vocalize, they spent significantly more time with daughters than sons. No differences were found in the performance level of the infants (male or female).

Will et al. (1976) reported that gender did not influence the frequency of utterances. Garrity (1979) found that at 26, 52, and 78 weeks of age mothers vocalized more to their daughters than to their sons. She did not find any differences in the amount of infant vocalizations at these ages. Wasserman and Lewis (1985) also found mothers to vocalize more to their one year old daughters than to their sons. Schaffer and Crook (1979) found that mothers of females (15 and 24 months old) provided more verbal utterances than did mothers of males. Goldberg and

Lewis (1969) found that mothers of 6 month old infants significantly touched, talked to, and handled their daughters more than their sons. When these infants were 13 months old, the girls touched and talked to their mothers more than the boys did (Goldberg & Lewis, 1969).

Gunner and Donahue (1980) in a cross-sectional study of mother-infant interaction at 6, 9, and 12 months found that maternal behavior in regard to initiating interaction with her infant did not vary with either the age or sex of the infant. The infant behaviors did however differ. The number of infant initiations increased with age. Girls initiated more interactions than did boys. Girls were also found to be more responsive to vocal initiations than boys were. A review by Garai and Scheinfeld (1968), concluded that female infants are more interested in people and facial features.

Although Maccoby and Jacklins' (1974) review of the literature failed to find consistently significant differences in the amount of verbal stimulation received, later studies do propose differences. These later findings suggest that further studies are relevant to see if differences exist in the amount of verbal stimulation and the type of information the infant receives changes based on the infant's gender.

Shafaie et al. (1982) reported differences in grammatical sentence type based on the infant's gender.

These investigators found that mothers used more declaratives with daughters.

In looking at maternal behaviors, Clarke-Stewart (1973) found verbal stimulation to be the most highly related to children's competence. The child's intellectual development was significantly influenced by the amount of verbal stimulation directed toward him/her, specifically affecting the child's ability to comprehend and express language. Nonresponsive maternal speech was not found to be correlated to competence in the child. This suggests that the quantity of speech is not as important as the quality. The results indicate that a relationship between the content of maternal speech and children's early vocabularies may exist. Girls and their mothers were particularly prone to interact in a verbal-social mode.

Rheingold, Gerwartz, and Ross (1959) looked at vocalization behavior in three month old infants. They found that experimenter social reinforcement (broad smile, three "tsk" sounds, and a light touch to the abdomen) increased the infants' vocalizations 39% the first day and 34% the second day. After two days without reinforcement, the infants' vocalizations had returned to baseline.

In Moss and Robson (1968) a significant correlation was obtained between Total Fixation Time for the social stimuli and vis-a-vis at three months for females, but not for males. Females were more socially responsive. They

also found more mutual gaze at 3 months than at 1 month between mother and infant.

Pacing

Arco (1983) reports that most of the data on temporal patterns of communication between mothers and infants has been collected from naturalistic observations or used very small samples. To find out if timing is important, she suggests more precise, probing communication modification through experimentation. Arco and McCluskey (1981) found that the tempo of the interaction did affect both the mother's and the infant's interaction patterns.

Arco and McCluskey (1981) reported differences in mean phase levels depending on the tempo of the interaction. Mothers were found to vocalize significantly more in the fast play phase than in the natural or slow play phases. Vocalizations in the natural temporal patterning, slow temporal patterning, return-to-natural temporal patterning, and fast temporal patterning were reported at 56.81, 50.44, 55.73, and 63.78 seconds for each two minute session. The infant was found to prefer the fast-paced play period over the slow-paced play period. The rate of these utterances was unaffected by the gender of the infant.

A study by Field (1977) found that infants were more likely to gaze avert in attention getting (when the mother was most active) and least during imitation (when the

mother was least active). She felt that the mother's slowed-down, exaggerated imitations sustained the infant's attention.

Field (1979) compared the heart rate during interaction of 12 high risk infants and 12 normal term infants, and their mothers. The infants were about four months (corrected age) at the time of the study. In the attention getting situation where mothers were asked to keep their infant's looking at them, she reported increased maternal activity and heart rate for both groups. Both groups of infants had higher heart rates and increased gaze aversion.

A follow-up study (Field, 1979) looked at the relationship between early measures of mother-infant interaction (at four months) and later communication patterns (at 2 years). The sample was composed of 20 high risk mother/infant pairs and 20 normal mother/infant pairs who had participated in the longitudinal study. A breakdown of maternal speech showed that mothers of normal toddlers had an average of 36.85% statements, 14.75% imperatives and 45.12% questions. Mothers of high risk toddlers had an average of 26.88% statements, 25.46% imperatives, and 43.75% questions. Greater amounts of mother imitations and infant attentiveness were correlated with a larger infant working vocabulary at 2 years. When the infant was 2, the number of mother imperatives was

negatively correlated to the infant's working vocabulary and MLU.

When looking at the theories of Vygotsky, and Fogel and Thelen, one can see that both internal and external components significantly contribute to the development of language in the child. The focus of this study was to examine the external characteristic of maternal grammatical sentence type and see if maternal speech varied based on the sex of the child. This study also looked to see if maternal utterances varied based upon the pace of play. In slower paced play, the mother was expected to decrease her utterances.

Hypotheses

Numerous questions remain concerning maternal vocal behaviors with their three month old infants. The present study explored several aspects of a changing vocal environment for the infant. Particularly of interest was the impact of infant gender and pacing on the maternal language environment. The measures of maternal vocalizations examined included the number of utterances, MLU's, the number of repetitions of utterances, and grammatical sentence type. The impact of mutual gaze on grammatical sentence type was also examined.

In order to assure that the mothers followed the directions, a preliminary examination of number of

utterances was done. The number of utterances were anticipated to be significantly lower in the second phase (H1).

The first set of hypotheses dealt with the effects of infant gender across all three phases. First, over all phases female infants will receive a greater number of utterances (H2), and longer MLU's (H3). Gender will have no effect on the number of repetitions (H4).

The second set of hypotheses concerned the effects of phase on the variables. As such, a significant effect of phase is expected for the length of MLU's (H5), and the number of repetitions (H6).

The third set of hypotheses concerned the interaction of gender and phase and various dependent variables. First, there will be significant differences in the number of utterances to daughters and sons in the second phase (H7). Second, there will be significant differences in the MLU's to daughters and sons in the second phase (H8).

The fourth set of hypotheses concerned the effects of gender across phases for sentence types. Female infants will receive more declarative utterances (H9). Male infants will receive more imperatives and entertaining utterances (H10). There will be significant interaction of gender by phase for all sentence types (H11).

The fifth set of hypotheses concerned the effects of mutual gaze across phases for sentence types. Significant

differences in the number of imperatives, meaningful utterances, and entertaining utterances will be found with more occurring when the pair is not in mutual gaze (H12). Significant differences in the number of declaratives and interrogatives will be found with more occurring during mutual gaze (H13).

CHAPTER III

METHOD

Subjects

Subjects were 32 mother-infant pairs (16 males and 16 females). Names were obtained from the birth announcements of the local paper. The mean age of the infant was 12 weeks \pm 1 week. The families contacted were from a medium size midwestern town.

An additional 23 subjects were tested but excluded due to fussiness (9 females, 5 males), use of toys (1 male), experimenter error (4 females, 1 male), and equipment failure (2 female, 2 males). A break between sessions was needed for three females and two males. Eight females and three males became fussy in either session two or three. Sessions for three females were restarted due to fussiness.

Procedures

Sessions took place in a private room at the Oklahoma State University Child Development Laboratories. The baby was placed in an infant seat on a table top. The mother was seated next to the infant so that they were in a face-to-face position. Two color video cameras, a split screen

editor, time-date generator, and a video recorder were used. One of the cameras was set up in the room; this camera videotaped the infant. The other camera was behind a one-way mirror and recorded the mother's behavior.

The procedure was reviewed with the mother. She was told that if she felt that the infant was becoming distressed, she could remove him or her from the infant seat. The mothers were asked to engage in the following 3-minute temporal episodes: (1) natural temporal patterning (phase 1); (2) slow temporal patterning (phase 2); (3) return to natural temporal patterning (phase 3).

Before phase 1, the graduate assistant instructed the mother to play with her infant as she normally does at home, but not to use toys or any other items to assist her in playing with the infant. The mother was told that after approximately three minutes a short break would be taken and she would be given further instructions about changing the tempo of her interaction. After a three minute session, all mothers were asked to slow down their play behaviors. Following another three minute session, mothers were asked to return to their normal play patterns. The graduate assistant left the room before each session began so that the infant and mother could play in privacy.

At the end of phases one and two, the graduate assistant went back into the room and asked the mother if she and the infant were ready to go on to the next phase.

If either the mother or the infant was not ready, a short break would be taken. When the subjects were ready, the next phase was explained to the mother.

At the end of phase 3, the graduate assistant went back into the room and concluded the session by thanking the mother and giving the infant a toy. The mother was asked if she had any questions about the study. She was told that the study was looking at how both the infants and the mothers reacted when the pace or rate of play was slowed down.

Analysis

Maternal utterances were coded using number of utterances, mean length of utterance (MLU), grammatical sentence type, and number of repetitions. Infant gaze and sentence type were also recorded to see if the mother varied her grammatical sentence type according to whether or not the infant was looking at her.

Videotapes were transcribed by two observers who transcribed the maternal utterances together. One observer typed in the maternal utterances while the other watched the mother's mouth for utterances that were barely audible and ran the video cassette recorder. From the transcriptions, the number of utterances, the number of words, MLU, and the number of repetitions were scored. Grammatical sentence type was scored from the transcripts

and video tapes. In addition, two observers reviewed the videotapes together and coded mutual gaze. One observer scored mutual gaze while the other marked the transcripts.

Maternal utterances were divided into five categories: interrogative, declarative, imperative, meaningful, and entertaining. Interrogatives were utterances that had a questioning or rising intonation (Proctor, 1984; Snow 1977a). Declaratives were utterances that gave information and pointed out observations made (Proctor, 1984; Schaffer & Crook, 1978; Sinclair & Coulthard, 1975). Imperatives were commands (Schaffer & Crook, 1978). Meaningful utterances were those without a verb (Sinclair & Coulthard, 1975). They consisted of songs and versus (Snow, 1977a). They could also be forms of meaningful communication like "oh", "uh oh", "hmm", and "shh" (Stern et al., 1983). Entertaining utterances consisted of clicks and whistles (Shafaie et al., 1982). They could also be imitations of infant's babbles (Snow, 1977a). Due to the difficulty in transcribing entertaining utterances, they were excluded from the analysis on mean length of utterance and number of repetitions. Entertaining utterances were difficult to code because they were often multiple repetitions of consonant sounds, vowel sounds, and combinations of the two. Examples would be consecutive runs of "ta", "da", or "tke".

MLU was found by dividing the total number of words by the total number of utterances. Entertaining utterances were excluded from both categories.

Number of repetitions included exact and partial repetitions. Only immediate repetitions were counted. In partial repetitions, at least half of the phrase was repeated, and it was in the same order as the wording in the preceding utterance.

Mutual gaze was scored if both the infant and the mother were looking at each other during the start of the maternal utterance. Mutual gaze started at the middle or end of the utterances was not included in the category of mutual gaze for this study.

Inter-observer reliability was calculated by dividing the total number of agreements by the total number of agreements and disagreements for number of utterances; number of words; number of repetitions; grammatical sentence types; and mutual gaze during maternal vocalizations and then multiplying by 100%. A subset (3) of the maternal utterances was transcribed by one of the initial observers and another observer who had not previously viewed the video tapes. Agreement on the number of utterances was 95.40%, and on the number of words 98.23%. A subset (3) of the number of repetitions was coded separately from the transcripts by two observers. Agreement on the number of repetitions was 92.05%. A

subset (3) of grammatical utterance was coded separately by two observers using the video tapes and transcripts. Overall agreement on grammatical utterance type was 91.87%. A break down of agreement on grammatical utterance type revealed agreements of 89.73% on entertaining utterances; 89.54% on declarative utterances; 96.30% on questions; 91.72% on commands, and 88.43% on meaningful utterances. A subset (3) was also coded for mutual gaze; overall agreement for the occurrence/nonoccurrence of mutual gaze during vocalization was 86.01%.

CHAPTER IV

RESULTS

The analyses will examine the effect of gender and phase upon the number of maternal utterances, MLU, sentence type, repetition of utterances. In addition, mutual gaze, gender, and phase will be analyzed for impact on maternal utterances. First, a 2 (gender) x 3 (phase) repeated measures analysis of variance assessed the effects of the experimental instructions on the number of utterances. Second, two, 2 (gender) x 3 (phase) repeated measures analysis of variance were run to see the effects of gender and phase on the mean length of utterance, and number of repetitions. Third, a 2 (gender) x 3 (phase) multivariate analysis of variance assessed the effects of gender and phase on maternal sentence type. Follow-up 2 (gender) x 3 (phase) repeated measures analyses of variance were run on sentence types. Finally, a 2 (gaze) x 3 (phase) x 2 (gaze vs nongaze) multivariate analysis of variance assessed the effects on sentence types.

Preliminary Analysis

Initially, a repeated measures analysis of variance was run to check the effectiveness of the experimental

instructions in asking the mother to slow down her pace of play. A significant effect ($F=35.57, p<.001$) was found for the number of utterances by phase. The mean number of utterances for phase 1 was 91.91, for phase 2 was 65.19, and for phase 3 was 92.53. Scheffe tests applied to the means indicated that phase 2 was found to be different from phases 1 and 3 ($p<.05$), but that differences between phases 1 and 3 were not significant. No significant gender effect was found for the number of utterances ($F=0.03, p<.867$). Table I shows the means for this analysis, Table II show the results of the ANOVA. Tables are at the end of the chapter.

Primary Analyses

In the analysis of the effects of gender, phase, and their interaction as denoted in the first, second, and third set of hypotheses, two repeated measures analyses of variance with gender and phase as independent variables were run with mean length of utterance (MLU), and number of repetitions as dependent variables. No significant gender effects were found for MLU ($F=0.69, p<.413$) or the number of repetitions ($F=0.73, p<.399$). No significant phase effect was found for MLU ($F=0.85, p<.431$). A significant phase effect was found for the number of repetitions ($F=7.55, p<.001$). Scheffe tests applied to the means for number of repetitions by phase was not significant ($p<.05$),

although the means for phase 2 were lower than phases 1 or 3. Phase x gender results approached significance for MLU ($F=1.87$, $p<.163$); but not for number of repetitions ($F=0.19$, $p<.824$). Table III shows the results for the means of these analyses, and Table IV shows the results for MLU and number of repetitions for ANOVA's. Tables are at the end of the chapter.

In analyzing the fourth set of hypotheses, a multivariate analyses of variance with gender and phase as independent variables and types of sentence utterance as dependent variables was performed. The overall MANOVA F for sex(phase) was not significant ($F=.9473$, $p<.512$) by the Wilks' Lambda Criterion. However, the overall MANOVA F for phase was significant ($F=.4.0092$, $p<.001$). Additional repeated measures analysis of variance were run for sentence types in order to test a priori hypotheses. The hypothesis stated that female infants would receive more declarative utterances and male infants would receive more imperatives and entertaining utterances. No significant gender effects were found for declaratives ($F=0.00$, $p<.950$), imperatives ($F=0.03$, $p<.858$), or entertaining utterances ($F=0.23$, $p<.635$). Interaction effects between gender and phase were found not to be significant for declaratives ($F=0.29$, $p<.751$); imperatives ($F=0.12$, $p<.887$); entertaining ($F=0.07$, $p<.933$); meaningful ($F=0.55$, $p<.580$); or interrogatives ($F=0.19$, $p<.826$). Table V shows

the means for sentence types by phase and gender, Figures 1-6 show graphs of sentence type by gender, and Table VI shows the ANOVA results for sentence types. Tables and Figures are at the end of the chapter.

In analyzing the fifth set of hypotheses, a multivariate analysis of variance with mutual gaze as well as gender and phase as independent variable and types of sentence utterance as dependent variables was performed. The overall MANOVA F for visual(phase) was significant ($F=2.31$, $p<.0003$) by the Wilks' Lambda Criterion. Significant differences were found for non-mutual gaze with declarative utterances ($F=11.63$, $p<.001$), interrogative utterances ($F=13.32$, $p<.001$), imperative utterances ($F=4.20$, $p<.042$), and meaningful utterances ($F=12.85$, $p<.001$). Significance was not found for gaze with entertaining utterances ($F=0.86$, $p<.354$). Scheffe tests applied to the means indicated that mutual gaze (visual 1) was found to be significantly different from non-mutual gaze (visual 2) ($p<.05$) for declarative utterances, imperative utterances, interrogative utterances, and meaningful utterances; but not for entertaining utterances. Table VII shows the means for sentence type by gaze, Figures 6-10 show graphs of sentence type by gaze, and phase, and Table VIII shows the MANOVA results for sentence types. Tables and Figures are at the end of the chapter.

TABLE I
 MEANS AND STANDARD DEVIATIONS FOR UTTERANCES
 BY PHASE AND GENDER

Source	Phase 1		Phase 2		Phase 3	
	Mean	SD	Mean	SD	Mean	SD
Female	90.69	28.25	66.75	34.55	94.13	29.30
Male	93.13	12.56	63.63	21.15	90.94	14.96
Mean	91.91	21.54	65.19	28.23	92.53	22.94

TABLE II
 ANALYSIS OF VARIANCE RESULTS FOR UTTERANCES

Source	df	Mean Square	F	p
Gender	1	40.04	0.03	.867
Phase	2	7797.14	35.57	.001
Phase x Gender	2	83.45	0.38	.685

TABLE III
 AVERAGE MEAN LENGTH OF UTTERANCE
 AND NUMBER OF REPETITIONS

Source	Phase 1		Phase 2		Phase 3	
	Mean	SD	Mean	SD	Mean	SD
Mean Length of Utterance						
Female	0.33	0.08	0.34	0.07	0.34	0.08
Male	0.32	0.08	0.33	0.09	0.30	0.06
Mean	0.32	0.08	0.33	0.08	0.32	0.07
Repetitions						
Female	16.56	8.53	11.63	8.75	16.06	10.50
Male	20.13	11.48	14.13	8.83	17.81	10.49
Mean	18.34	10.11	12.88	8.77	16.96	10.36

TABLE IV
 REPEATED MEASURES ANOVA RESULTS FOR
 MLU AND NUMBER OF REPETITIONS

Source	df	Mean Square	F	p
Mean Length of Utterance				
Gender	1	0.01	0.69	.413
Phase	2	0.01	0.85	.431
Phase x Gender	2	0.01	1.87	.163
Number of Repetitions				
Gender	1	162.76	0.73	.399
Phase	2	258.07	7.55	.001
Phase x Gender	2	6.64	0.19	.824

TABLE V
AVERAGE NUMBER OF SENTENCE TYPES

Source	Phase 1		Phase 2		Phase 3	
	Mean	SD	Mean	SD	Mean	SD
Declaratives						
Female	12.94	7.14	10.75	6.69	12.19	7.96
Male	13.00	8.60	9.44	7.25	13.06	6.38
Mean	12.97	7.77	10.09	6.89	12.63	7.11
Imperatives						
Female	11.57	14.25	6.56	5.91	8.50	9.34
Male	10.13	10.64	6.31	8.40	8.50	10.75
Mean	10.84	12.39	6.44	7.15	8.50	9.91
Entertaining						
Female	18.94	12.66	10.81	8.87	27.13	16.14
Male	21.31	10.41	12.56	12.51	27.69	11.57
Mean	20.13	11.46	11.69	10.70	27.41	13.82
Meaningful						
Female	19.13	11.74	19.44	14.47	22.50	12.35
Male	14.44	7.33	11.06	7.09	14.19	6.87
Mean	16.78	9.92	15.25	11.99	18.34	10.70
Interrogatives						
Female	28.06	13.55	19.19	12.98	23.81	15.00
Male	34.25	13.07	24.25	11.67	27.44	14.25
Mean	31.16	13.47	21.72	12.41	25.63	14.51

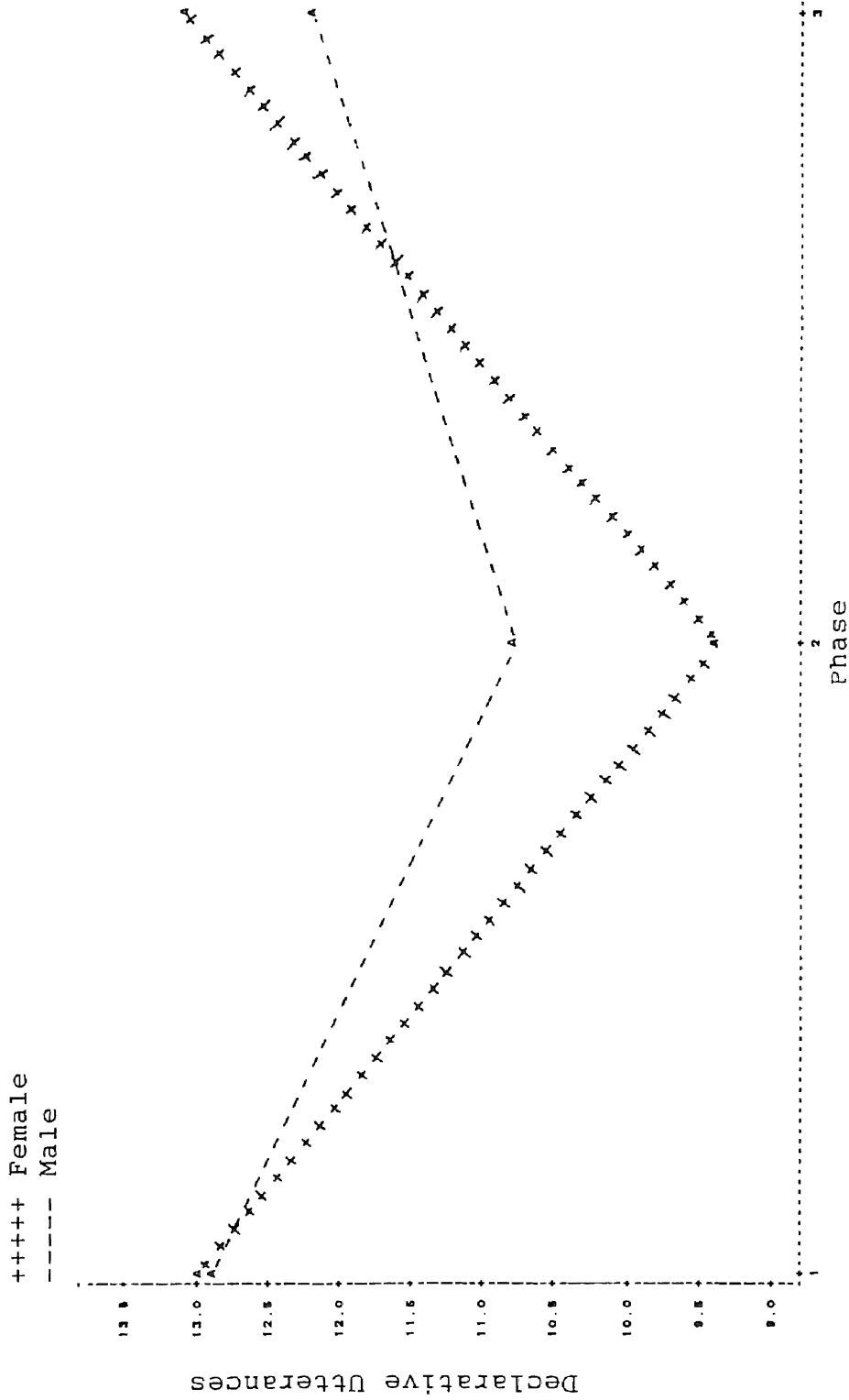


Figure 1. Average Number of Declarative Utterances by Gender

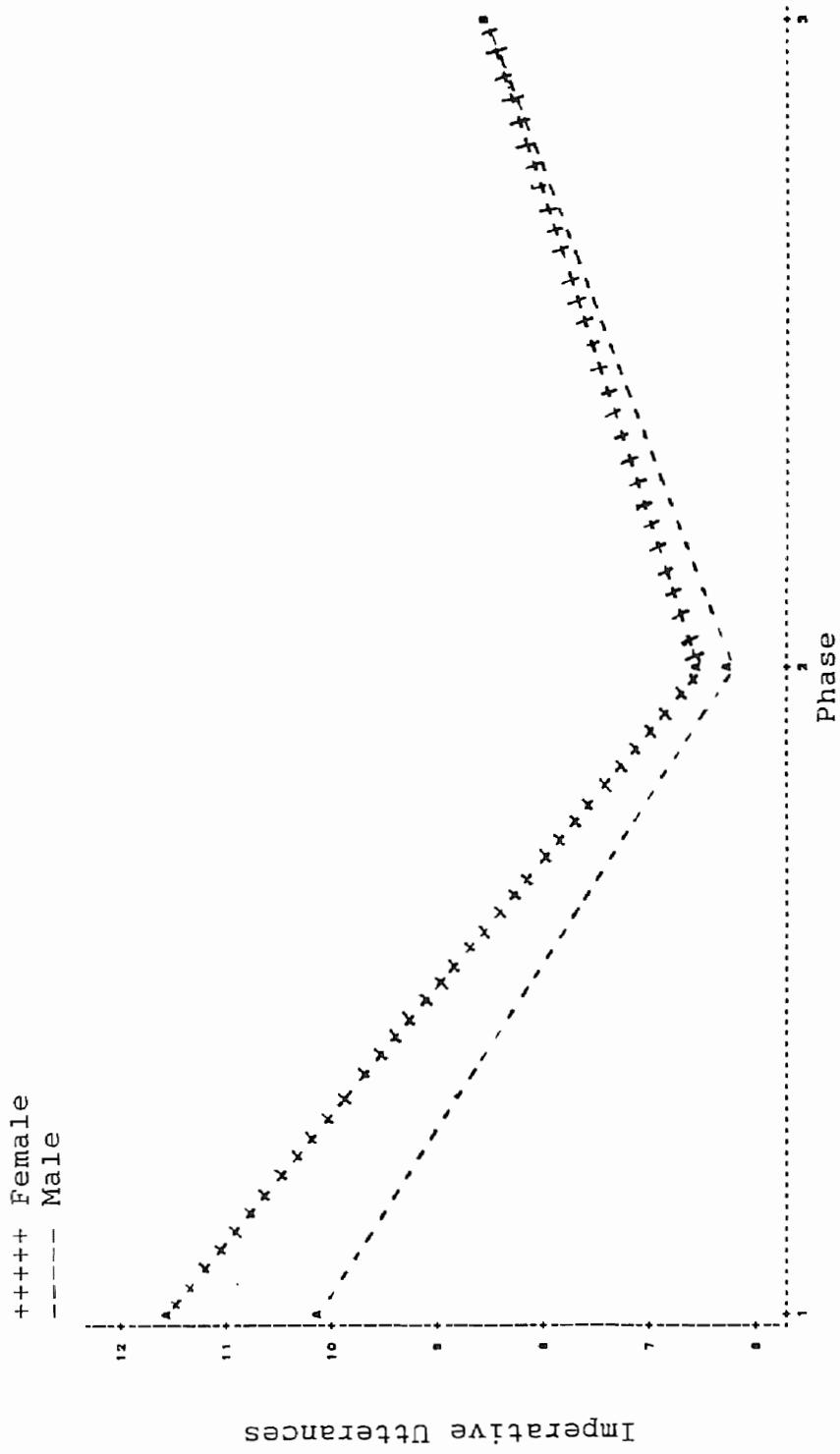


Figure 2. Average Number of Imperative Utterances by Gender

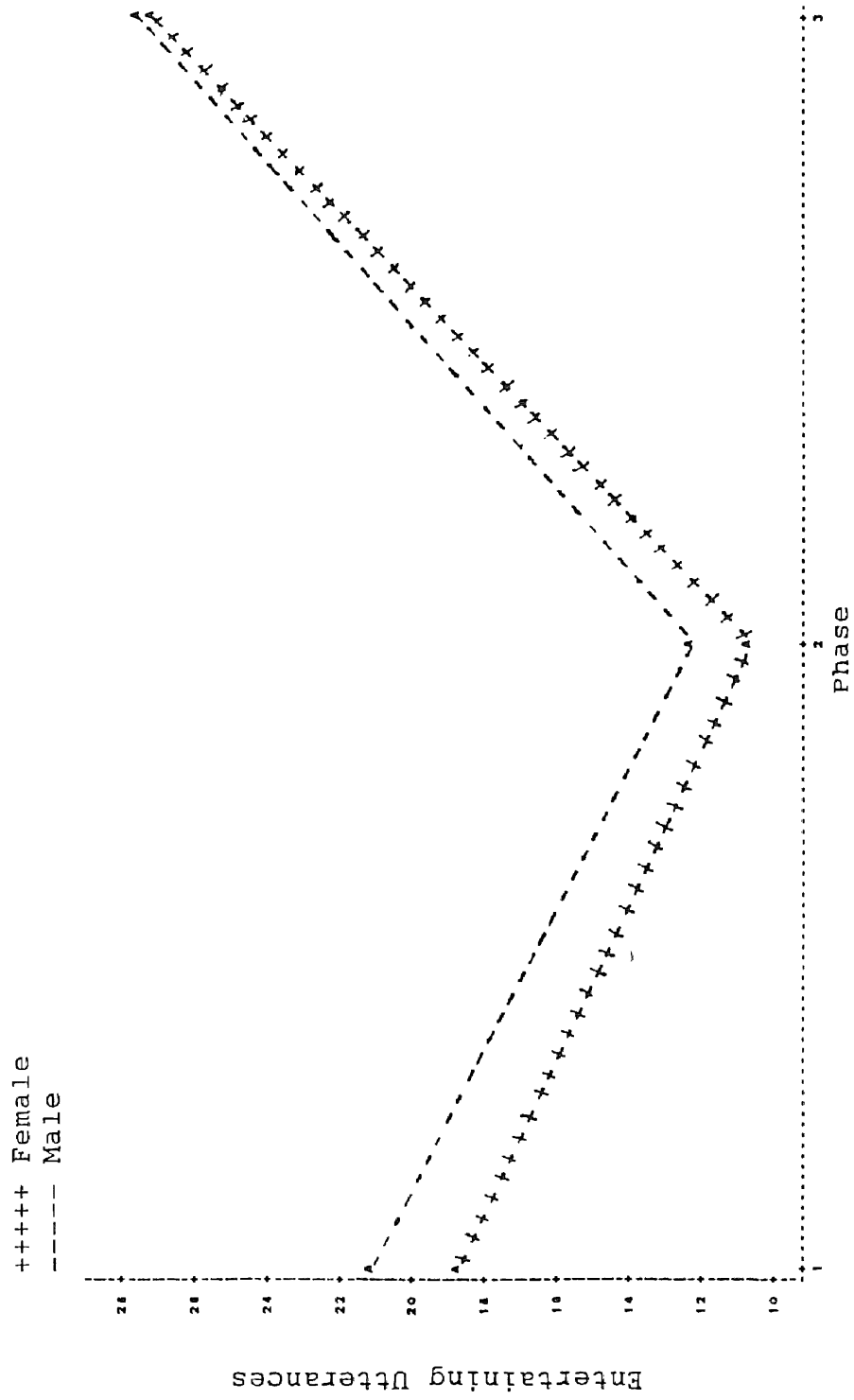


Figure 3. Average Number of Entertaining Utterances by Gender

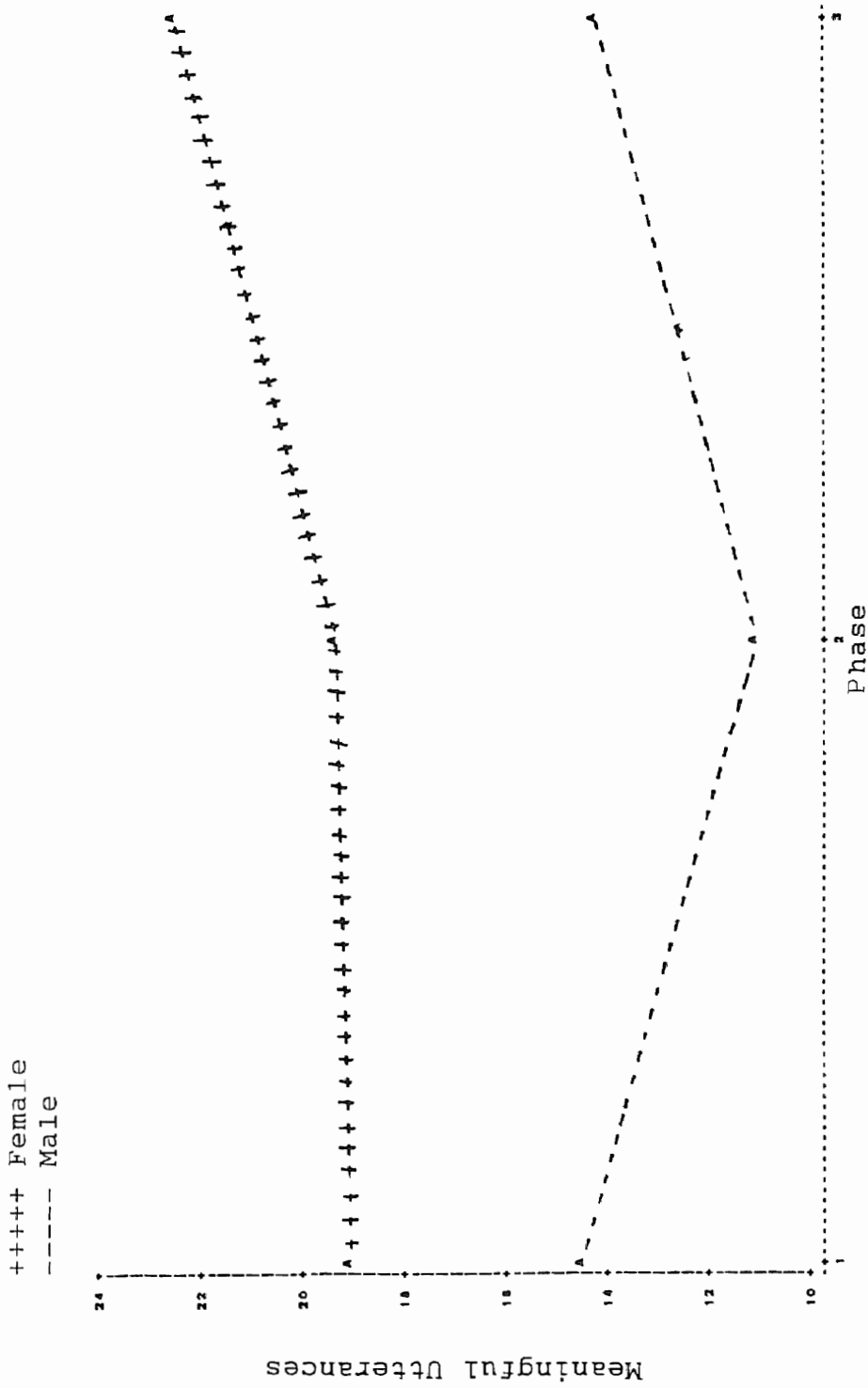


Figure 4. Average Number of Meaningful Utterances by Gender

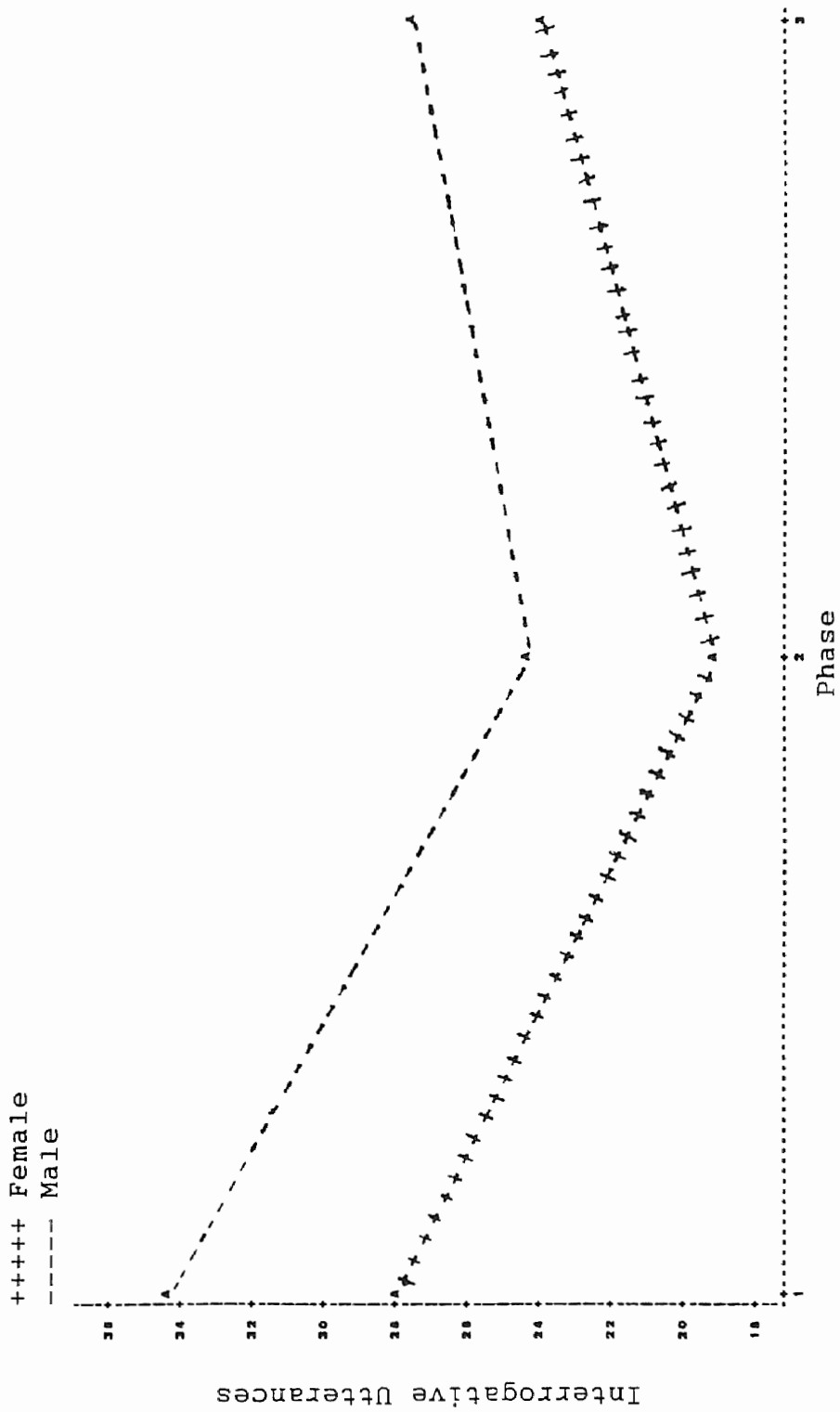


Figure 5. Average Number of Interrogative Utterances by Gender

TABLE VI
ANOVA RESULTS FOR SENTENCE TYPES

Source	df	Mean Square	F	p
Declaratives				
Gender	1	0.38	0.00	.950
Phase	2	78.89	2.32	.107
Phase*Gender	2	9.78	0.29	.751
Imperatives				
Gender	1	7.59	0.03	.858
Phase	2	155.53	3.96	.024
Phase*Gender	2	4.72	0.12	.887
Entertaining				
Gender	1	58.59	0.23	.635
Phase	2	1980.20	20.40	.001
Phase*Gender	2	6.78	0.07	.933
Meaningful				
Gender	1	1218.38	6.23	.018
Phase	2	76.57	1.18	.314
Phase*Gender	2	35.66	0.55	.580
Interrogatives				
Gender	1	590.04	1.45	.237
Phase	2	719.57	10.44	.001
Phase*Gender	2	13.20	0.19	.826

TABLE VII

AVERAGE NUMBER OF SENTENCE TYPES BY GAZE AND PHASE

Source	Phase 1		Phase 2		Phase 3	
	Mean	SD	Mean	SD	Mean	SD
Declaratives						
Mutual	5.75	5.75	3.81	4.65	4.13	4.22
Non-mutual	7.22	7.08	6.28	5.26	8.50	6.24
Mean	6.48	6.45	5.05	5.08	6.31	5.72
Imperatives						
Mutual	4.50	8.66	2.59	4.42	2.88	5.75
Nonmutual	6.34	7.79	3.84	5.18	5.63	6.71
Mean	5.42	8.22	3.22	4.82	4.25	6.35
Entertaining						
Mutual	10.75	9.46	5.09	8.02	11.75	12.84
Nonmutual	9.38	8.55	6.59	6.02	15.66	10.81
Mean	10.06	8.97	5.84	7.07	13.70	11.94
Meaningful						
Mutual	7.88	7.88	5.31	9.19	5.31	5.30
Non-mutual	8.91	9.09	9.94	8.71	13.03	10.39
Mean	8.39	8.45	7.63	9.18	9.17	9.06
Interrogatives						
Mutual	14.53	11.64	7.94	8.29	8.00	10.01
Non-mutual	16.63	11.90	13.78	9.68	17.63	13.40
Mean	15.58	11.72	10.86	9.41	12.81	6.35

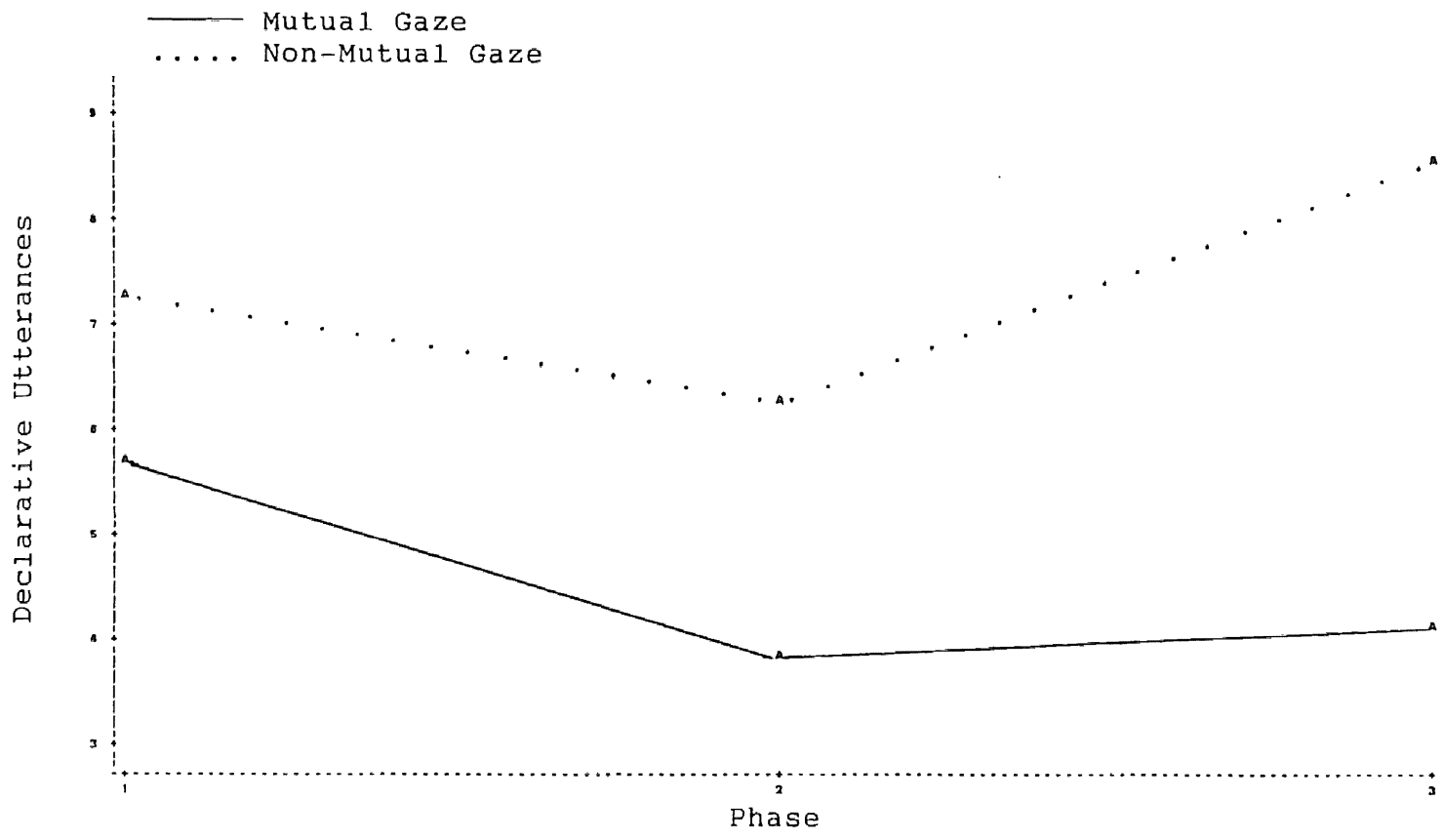


Figure 6. Average Number of Declarative Utterances by Gaze

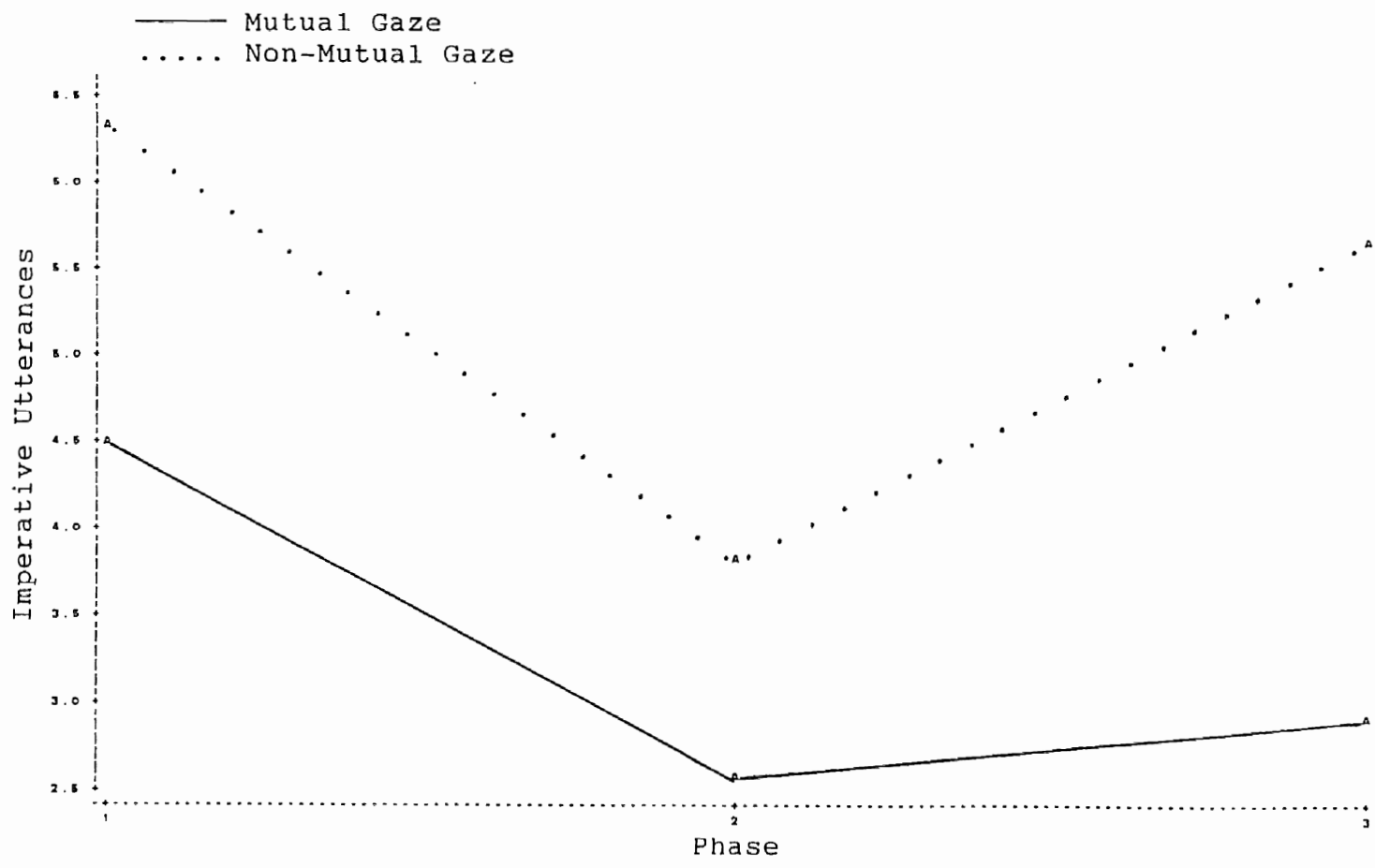


Figure 7. Average Number of Imperative Utterances by Gaze

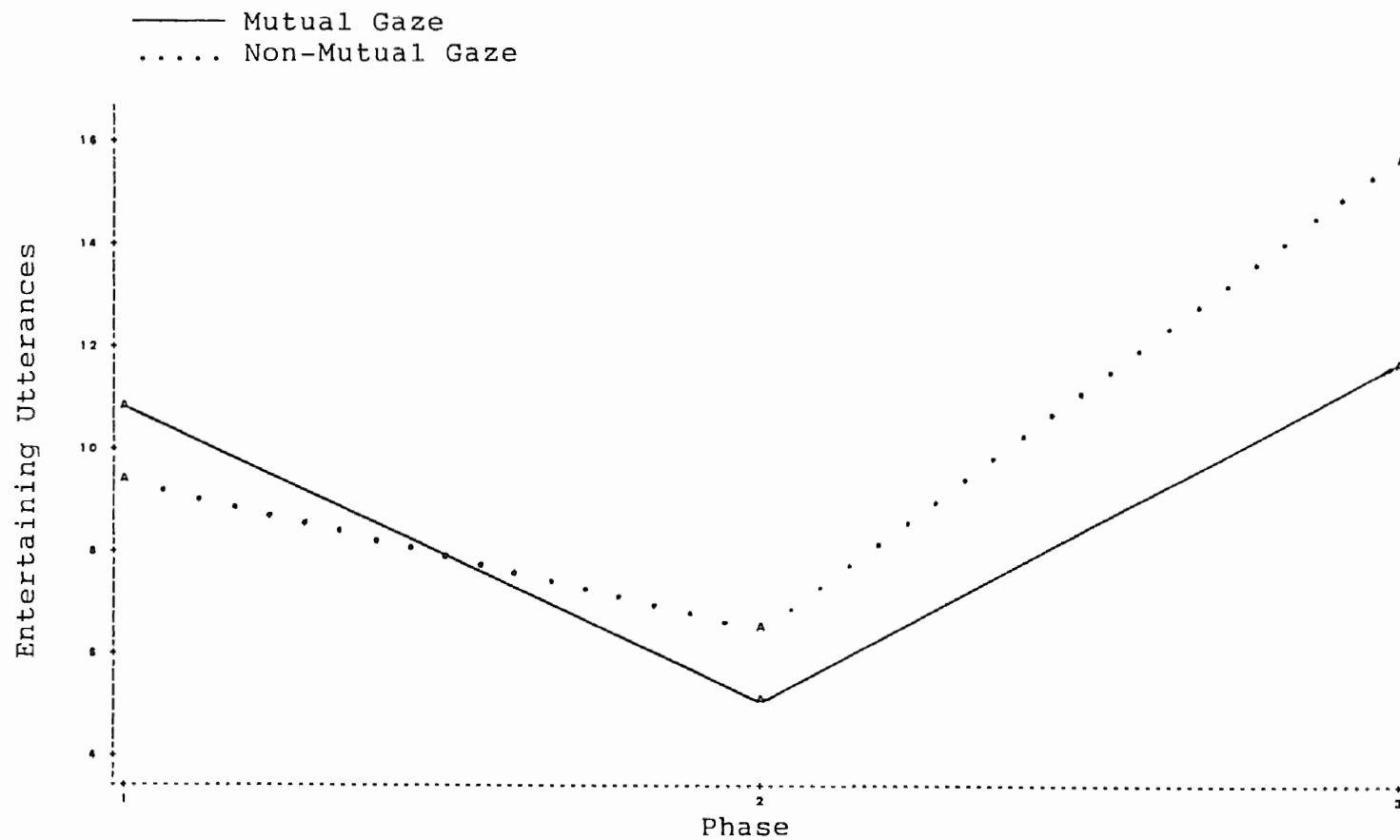


Figure 8. Average Number of Entertaining Utterances by Gaze

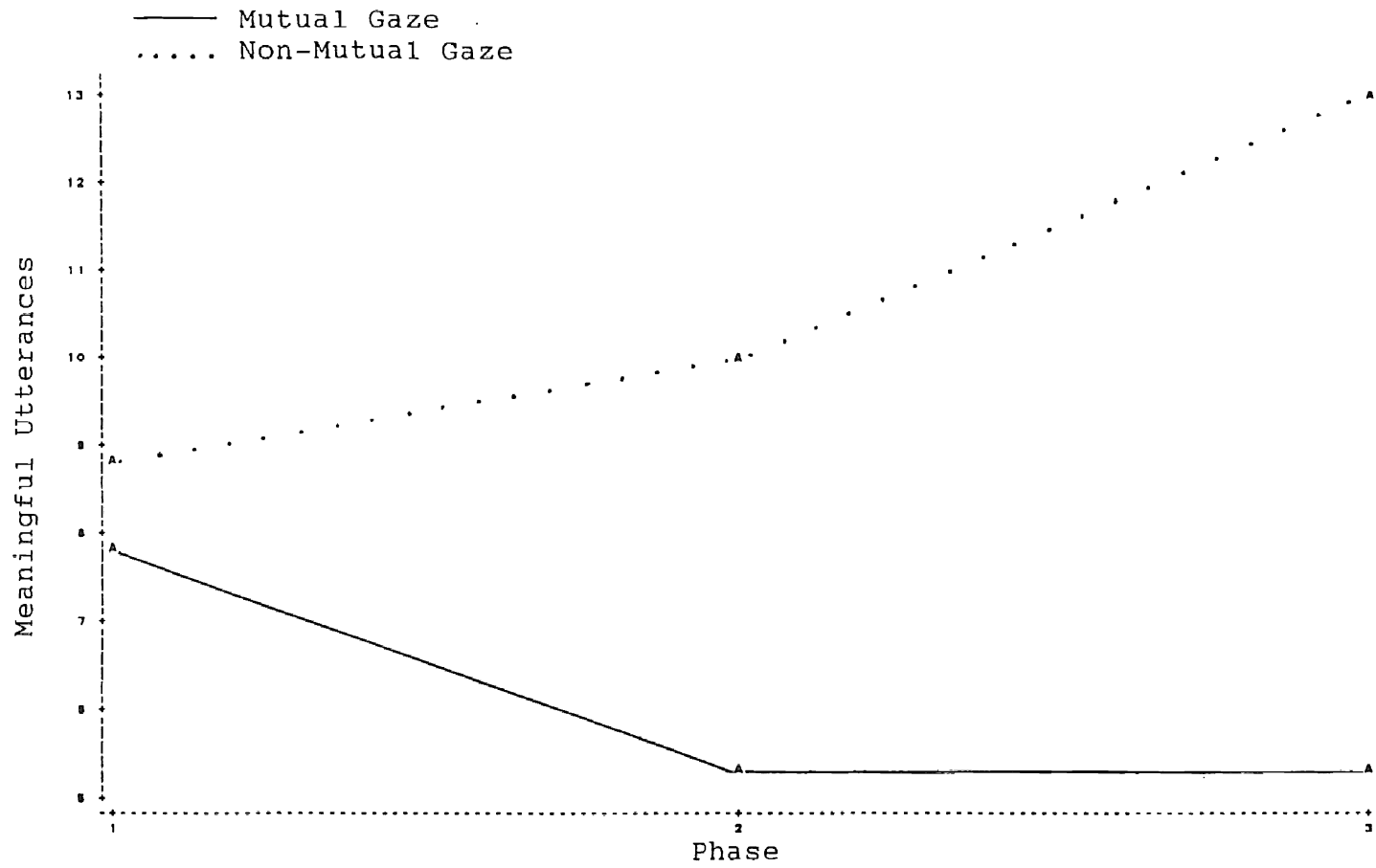


Figure 9. Average Number of Meaningful Utterances by Gaze

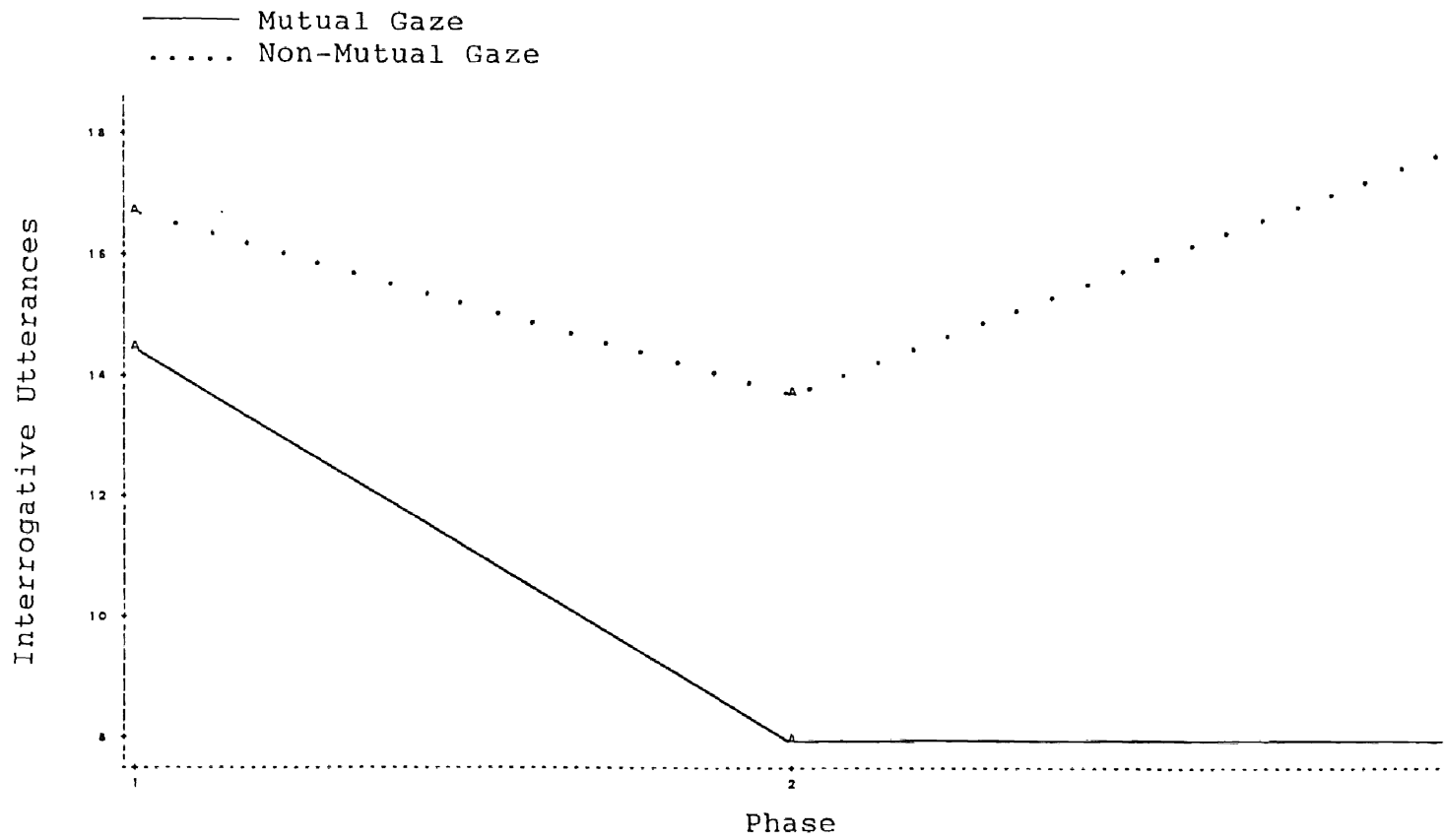


Figure 10. Average Number of Interrogative Utterances by Gaze

TABLE VIII
ANOVA RESULTS FOR SENTENCE TYPES BY GAZE

Source	df	Mean Square	F	p
Declaratives				
Gaze	1	368.52	11.63	.001
Phase	2	39.44	1.18	.309
Gaze(Phase)	2	103.43	3.28	.007
Imperative				
Gaze	1	182.13	4.20	.042
Phase	2	77.77	1.78	.172
Gaze(Phase)	2	71.18	1.64	.151
Entertaining				
Gaze	1	86.67	0.86	.354
Phase	2	990.10	10.88	.001
Gaze(Phase)	2	458.12	5.05	.001
Meaningful				
Gaze	1	954.08	12.85	.001
Phase	2	38.29	0.48	.618
Gaze(Phase)	2	277.82	3.78	.003
Interrogatives				
Gaze	1	1645.02	13.32	.001
Phase	2	359.79	2.79	.064
Gaze(Phase)	2	563.67	4.70	.001

CHAPTER V

DISCUSSION

This study examined the effects of infant gender and pace of play on maternal language behaviors. The experimental instructions were found to be effective in that mothers were found to decrease the number of utterances when asked to slow down the pace of play. The experimental manipulation and gender of the infant were expected to affect the mother's utterances by varying the number of sentences, the type of sentence, and when the sentence types were used. The number of repetitions was found to vary across phases; but no gender differences were found. Meaningful utterances were the only sentence type found to be significant for gender effects. Finally, more meaningful utterances were found to be uttered during non-mutual gaze than during mutual gaze.

The specific hypotheses are now discussed. First, the data supported the first hypothesis, that the number of utterances would be significantly lower in the second phase. Instructing the mother to slow down her pace of play, decreased her utterance number. Data did not support that female infants would receive a greater number of

utterances (H2) and longer MLU's (H3). No significant differences were found between males and females on the number of utterances received or the length of MLU's across phases. Significant differences were not found across phases between males and females which supported H4, that gender would not have an effect on the number of repetitions.

In the third set of hypotheses, support for H5 (phase will effect length of MLU) was not found, but support for H6 (phase will have a significant effect on MLU) was found. As such, phase had no effect on the length of MLU's (H5) but did on the number of repetitions (H6). In the third set of hypotheses, neither of the hypotheses H7 or H8 were supported. Significant differences were not found in the number of utterances (H7) or MLU (H8) to the daughters and sons in the second phase.

In the fourth set of hypotheses, support was not found for any of the hypotheses. Female infants did not receive more declaratives (H9). Male infants were not found to receive more imperatives or entertaining utterances (H10). No significant interaction effects were found for gender by phase for sentence types (H11).

In the fifth set of hypotheses, none of the hypotheses were fully supported. Significant differences were found for meaningful and imperative utterances; but not for entertaining utterances during non-mutual gaze. Some

support was thus found for H12 which stated that significant differences would be found in the number of imperatives, meaningful utterances, and entertaining utterances with more occurring when the pair is not in mutual gaze. Support was not found for H13 in which significant differences would be found in the number of declaratives and interrogatives with more occurring during mutual gaze. Just the opposite was found. Significant differences were found for declaratives and interrogatives with non-mutual gaze instead of with mutual gaze.

Previously cited studies are reviewed to compare the results of earlier research to the results of the current study. The areas to be focused on are those concerning pacing, gender, sentence type, and mutual gaze.

This study found results similar to those found in an earlier study done by Arco and McCluskey (1981). Maternal temporal patterns were altered by the experimental manipulation. In the current study, the experimental manipulation resulted in fewer utterances in the second phase, as well as an alteration in the types of utterances.

In regard to gender, the results of this study support those found by Will et al. (1976) in which gender did not influence the frequency of utterances. Support was not found for Garrity (1979); in that study

mothers were found to vocalize more to their daughters than their sons. Similarly, the findings of this study did not support the earlier study done by Shafaie et al. (1982) in which more declarative utterances were found to be used with daughters, and more entertaining and imperative utterances were used with sons. In the present study, sentence type was not differentiated by gender. Since Shafaie et al. (1982) used newborns and the present study examined dyads with three month olds, the type of sentence used by mothers may vary depending on the age of the child. A longitudinal study would provide a more comprehensive picture of maternal language patterns. In contrast to Shafaie et al. (1982) the only significant gender difference found in this study for sentence types was with meaningful utterances. More meaningful utterances in the current study were directed to females.

An interesting note is that subject loss for females compared to males due to fussiness was almost 2 to 1. The majority of these females were lost in the second session when they became extremely fussy. This suggests that females are more sensitive to changes in the interaction patterns. Gender effects may have thus influenced the results prior to data collection and analysis.

In analyzing the speech of the mothers to young children, Newport et al. (1977) found maternal utterances to be 30% declaratives, 18% imperatives, and 44% questions. The current study found maternal utterances to consist of 20% meaningful utterances, 14% declarative utterances, 10% imperative utterances, 24% entertaining utterances, and 32% interrogative utterances. As in earlier studies by Ferguson (1978), Morikawa et al. (1988), and Snow (1972) questions were found to be a large proportion of maternal utterances.

Morikawa et al. (1988) found that American mothers produced 53% of their total utterances when their infants were looking at them. In the current study, the percentage of utterances produced during mutual gaze (beginning of the utterance) was 47% for phase 1: 38% for phase 2; and 35% for phase 3. Entertaining utterances are the only ones to recover from the experimental manipulation. In all of the other sentence types, there was a failure for language during mutual gaze to return to pre-experimental levels. This lack of recovery may be due to the infants inability to respond to the temporal pattern change to a slower pace. The utterances of the mothers were essential to maintaining the responsiveness of the infant. When the maternal utterances decreased; mutual gaze between the infant and mother also decreased. The only sentence

type that went back to pre-experimental mutual gaze levels was entertaining utterances. With declarative utterances, interrogative utterances, meaningful utterances, and imperative utterances mutual gaze was found to decrease with the experimental manipulation and not recover even in the final phase.

The experimental interactions had a significant impact on the social relationship between the mother and the infant. From the means, it appears that the mothers used more meaningful and entertaining utterances in the final phase to try and regain their infants' mutual gaze. The number of imperative and interrogative utterances decreased slightly. The extended impact of the experimental manipulations upon the social interaction (language and mutual gaze) was surprising and merits further experimental attention.

The results of this study seem to fit best into the Dynamic Systems perspective. In this view, the development of language is a systems product of the components and based more upon the communication patterns of the individuals. Behavior in systems theories is predicted to maintain a dynamic stability and be responsive to small disturbances. From these results, alterations in the pacing of maternal stimulation have been shown to have a significant impact on the communication system of the mother-infant

dyad. Unfortunately, the length of the study was not long enough to measure the magnitude of this impact.

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