The Pattern and Function of Vocalization and Gesture in Nigerian Mother-Infant Interaction

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The purpose of the study was to theorize on the ability of illiterate but experienced Igbo mothers to detect with accuracy infants’ social bids for appropriate care-giving. The study involved a participatory observation of two normal, full term infants, aged 0-3 months at different periods of their birth, by their mother-researcher. The social bids were food, sleep, comfort, and relief from pain. The period of observation for each infant was two months. The focus of observation was vocalization (distress and non-distress cry) and gestures (body movements and mouthing). The observations were recorded on daily basis in a journal for each period of observation. They were analyzed and compared to determine common features in the vocalizations, formal parameters of gestures, meaning of gestures, maternal response, and infants’ feedback. The findings revealed that vocalization served as automatic social arouser while the gestures encoded the social bids which the mother interpreted to provide appropriate care-giving. The study concluded that experienced but illiterate Igbo mothers relied on their interpretation of the formal parameters of the infants’ gestures to provide appropriate care-giving during the prelinguistic stage of the infant. Vocalization served as social arouser.

Keywords:
Vocalization, gesture, infants, mothers, interaction
INTRODUCTION

Normal, full term Nigerian infants, aged 0-3 months, communicate to their mothers their need for food, sleep, comfort, and relief through vocalization and gesturing. The communicative acts which form the infant-mother interaction are patterned and functional. Mothers respond to the infants' communicative acts by providing appropriate care-giving as decoded for them by their information processor—a term borrowed from the implication of Cognitive Information Processing Theory which states that information made available by the environment is processed by a series of processing systems (e.g., attention, awareness, and short-term memory). Attention and short-term memory are implicated in the concept of information processor as used in this study. See Robinson (2005) for a discussion on attention and short-term memory. The dominant vocalization of the infants at the age under study is distress and non-distress cry. Distress cry is one that invokes pain and discomfort while non-distress cry does not. Gestures are characterized by body manipulation and mouthing. The components of the interactive arts are, therefore, vocalization, gestures, and maternal response. These terms have been given adequate attention in the literature of infants' prelinguistic development.

Vocalization has been examined from such perspectives as type, function, development, and contribution to speech development. The following types of vocalizations have been identified: cries (Prescott, 1975); cooing (Stark, 1978); laughter (Nwokah et al., 1996); and grunts (McCune et al., 1996). Non-distress cry has also been categorized. Bloom (1988) classifies it into syllabic and vocalic. Examining it from the perspective of speech quality, Hsu et al. (2000) divides it into speech-like vocalization and non-speech-like vocalization – each of which is subcategorized into simple and complex. Functions of vocalization have been studied. Two functions are relevant to the present study. First, Hsu’s et al. (2003) claim that vocalization encodes the information that prompts maternal response. This study appears to have some reservation on this view based on the behavior of the subjects of the study. Second, it is generally accepted that vocalization, among other functions, serves as a social signal which control maternal behavior (Keller and Scholmerich, 1987; Zeskind and Collins, 1987; Bornstein et al., 1992; Papousek, 1995; Owings and Morton, 1997, 1998; Barr et al., 2000; Hsu et al., 2003; Goldstein and Bornstein, 2009). This view needs to be re-visited because it is implied that vocalization encodes messages from the infant and prompts maternal response. Vocal development has also attracted research interest. Studies on vocal development claim that it is conditioned by biological development actualized in age of the infant. For instance, babbling begins at ten months. Because its emergence is age-related, its occurrence is not affected by conditions of birth—full term or preterm (Eilers et al., 1993); economic status (Eilers et al., 1993); nationality (Oller et al., 1992); down syndrome effect (Smith and Oller, 1981; Lynch et al., 1990; Oller et al., 1994). The relationship of maternal response and non-cry vocalization forms the concern of Beckwith and Rodning (1996), Murray et al. (1990), and Goldstein and Bornstein (2009). Of special interest to the present study are on some of the studies on distressed infant cry. For instance, the present study shares the findings of Boukydis and Burgess (1982) and Zeskind and Collins (1987) that infant distress cries prompt automatic arousal in care-giver. However, the present study extends this function to all manners of cry. Its position is that cries are gradable in intensity. The intensity of the arousal is proportionate to the intensity of the cry. The study, however, rejects Solis’ (2004) position that distress cry prompts parental care. This study appears to assign this function to some other element in the interactive pattern. Other studies on distress cry are Morsbach et al. (1986) whose study shows that listening to infants’ cries adversely affects performance on simple tasks, and Parson et al. (2011) who reveal that distress cry leads to improvement in speed and accuracy in the provision of care-giving for the infant. The foregoing review of literature has provided the state-of-the-art on vocalization. The present study examines the role of vocalization (distress and non-distress cry) in the interaction between normal, full term infants, aged 0 – 3 months, and their mother as they bid for food, sleep, comfort, and relief from pain from their mothers and mothers’ response to each social bid.

Gestures are operationalized to include manipulations (Bernadis et al., 2008; Ruff, 1984) and mouthing (Fagan and Iverson, 2007). Manipulations, in the context of this study, represent the infants’ various patterns of body movement—legs, arms, lips, eyes. This study describes the formal parameters of these patterns of infants' body movement as observed by their mother-researcher and attempts to provide meaning to each pattern. Manipulations are studied in the literature from other perspectives especially speech development. For instance, Bernadis et al. (2008) correlate manual activity with speech development. In their study, Iverson and Thelen (1999) associate rhythmic hand movement with canonical babbling in infants, aged 6-8 months. Similarly, Caselli et al. (1995) observe a similar development of spoken language and manual gestures in infants, aged 8-11 months. The study by Valtorta et al. (2005) reveal that, although age marks the beginning of word recognition, infants’ ability to recognize words correlates with their ability to participate in games involving exploring and manipulating objects. According to the study of Capirci et al. (2005), more involvement in games of exploring and manipulating objects signal the beginning of deictic gestures of requesting, giving, showing, and pointing. These gestures are used to draw attention to objects, locations, and events. The foregoing studies on body manipulations attest to the meaning bearing functions of gestures of infants especially those, aged 8-11 months. The present study extends this meaning bearing functions to those infants, aged 0-3 months, by hypothesizing that the body movements of infants, aged...
0-3 months, are meaning bearing. Because manual gestures are meaning bearing, it has also been hypothesized that spoken language originated from manual gestures (Gentilucci and Corballis, 2006; Bates and Dick, 2002; Corballis, 2000; Rizzolatti et al., 1998; Hewes, 1973). Although the focus of this study is on gestures in infants, it is relevant to the study to summarize the studies on adult gestures to reinforce the meaning-bearing function of gestures in infants as the antecedents of adult gestures. That gesture is meaning bearing has been recognized in gesture studies (Müller, 2013). In such studies, the hand has been given prominence. Methodologically, the mode of representation is observed in order to answer the following questions:

- What are the gestural hands doing?
- What are the ephemeral shapes, movements, objects that are created? (Müller, 2013:213).

Answers to such question will lead to the basic meaning of the gestures. Although emphasis in gestural studies on the hand, it has also been observed that gestures may be performed by the “head, the face, the eyes, the lips, the legs, and feet” (Müller, 2013:213). This observation is important to the present study because the gestural acts of the infants’ lips, legs, feet, eyes and, of course, the hands are observed and interpreted based on their formal parameters such as position, movement and shape (Kendon, 2004) cited in Müller (2013:213). It has also been noted that gestures perform the same function as language as each gestural act represent an aspect of the function of language. For instance, the following gestures represent the expressive function of language:

- Moving the fist forward to express anger.
- Raising the hands towards the sky to express happiness and joy,
- Covering the face to express sadness or grief (Müller, 2013:213).

Similarly, the following gestural acts denote the connotative function of language (Stubbs, 1995) of appealing, directing, and persuading:

- Moving both small hand downwards to calm a public
- Placing the extended index across the lips to say ‘be quiet’
- Waiving somebody to come near (Müller, 2013:213).

In the same vein, gestures perform the referential function of language, as in the following:

- Opening the hands as if opening an imaginary window
- Tracing the shape of a picture by using both extended index fingers like pencil
- Modeling objects such as boxes, bowls, building, balls, or picture frame
- Pointing with the hands, lips, or eyes to visible and invisible objects (Müller, 2013: 213).

These examples reveal that gestural acts are meaning-bearing and that there is one-to-one meaning/gesture relationship in adults’ gestures. The meaning-bearing function of gestures is important in this study because it supports the view expressed in this study that body movement of infants, aged 0-3 months, are meaning-bearing. They serve to signal social bids for care-giving. Each social bid has its formal parameter.

Mouthing, a subset of gestures, has been defined as contact of an object with the mouth, lips or tongue (Fagan and Iverson, 2007; Ruff et al., 1992; Rochat, 1989). Studies have shown that it is a common practice among infants (Belsky et al., 1981; Fenson et al., 1976; Kopp, 1976). It occurs during play (Belsky et al., 1981). However, the main research interest in mouthing is on mouthing behavior and consonant production. Rochat (1989) and Spencer et al., (2000) have shown that mouthing behavior changes between the age of 6 and 9 months, that mouthing begin early in infants and increases between 15 and 20 weeks. That mouthing begins as early as 15 and 20 weeks is very relevant to this study as it confirms the observation made in this study that mouthing occurs in infants, aged 0-3 months. Mouthing has been found to be at its peak between 6 and 9 months and decreases between 9.5 and 15.5 months. Mouthing is replaced by explorative and manipulative activities with objects (Whyte et al., 1994; Ruff et al., 1992; Palmer, 1989; Rochat, 1989; Belsky et al., 1981; McCaill, 1974). Studies in consonant production reveal that the period 6-9 months sits changes in consonant production. There is increase in consonant variation within the period (Holmgren et al., 1986; Fagan and Iverson, 2007). Similarly, the period witnesses repetition of consonants and vowels (Fagan, 2005). Elbers (1982) and Fagan and Iverson (2007) have identical focus. Both deal with the mouthing episode of infants within the ages of 6-12 and 6-9 months respectively. Elbers (1982) deals with the observation of the mouthing episode of her son, aged 6-12 months and the interpretation given to the episode while Fagan and Iverson (2007) observe the mouthing characteristics of infants, aged 6-9 months. The present study is like Elbers’ in that it deals with a mother’s observation of the communicative acts of her two infants. Similarly, Elbers (1982), Fagan and Iverson (2007) and the present study observe and interpret mouthing episode in infants.

Maternal response has also been studied from different perspectives. It has been operationalized to mean a new action drawn from a mother’s behavioral repertoire to respond to infant’s social signal (Hsu et al., 2003). The new action may be additive in the sense that a new act was performed or deletive in the sense that an on-going action was eliminated or adjustive also in the sense that an adjustment was made on an on-going action in terms of form, location, and timing (Keller and Scholmerich, 1987). These changes are prompted by maternal assessment of infant’s social signal (Hsu et al., 2003). Although Hsu et al. (2003) make reference to maternal assessment; they failed to describe its processes of maternal assessment. The present study attempts to reveal the nature of the process of maternal assessment. Research on maternal response has
focused on its effect on the development of the infant in various domains. Blehar et al. (1977) study maternal response on infant’s attention span, play, and language comprehension. The role of maternal response on infant’s effect has been variously studied by Tamis-LeMonda et al. (2001); Nicely et al. (1999a); Nicely et al. (1999b) and Papousek et al. (1989). These studies distinguish between coherent and non-coherent maternal response and show that coherent maternal response to infant expression tends to influence the infant’s language development and expressive ability more than does non-coherent maternal response. Variations in maternal response are the subject of Hsu et al. (2003). According to their study, three factors prompt maternal response. These are: type of infant’s signal, content of the maternal response and coherence (matching between infant signal and maternal response). These prompts promote variations in maternal response. For instance, responsiveness to infant’s attention to objects matches infants’ explorative activities. Similarly, responsiveness to infants’ social bids is associated with infants’ social looks. Type of maternal response is the focus of Beebe and Gerstman (1984) and Koeste et al. (1989). They reveal that maternal response may be vocal, or non-vocal (facial and touch actions). The present study is concerned with non-vocal responses in the form of touch action that provide appropriate care-giving.

Based on the foregoing sample studies on vocalization, gestures, and maternal response, the broad goal of the present study is to describe the formal parameters of the gestures used by the infants under study and the type of vocalization used in order to demonstrate how these communicative acts could be used by a care-giver to provide appropriate care-giving. In other words, the study answers the question: How does a mother interpret the communicative signals of her infant to enable her to provide appropriate response to the infant’s social bids? Thus, the present study is about appropriateness of maternal response as interpreted from the infants’ communicative signals. It does not concern itself with contingency of response as appropriateness and contingency are considered independent maternal social behavior (Keller et al., 1999).

To understand the motive for this study, it is necessary to provide ethnographic information on care-giving of infants, aged 0-3 months, among the Igbo of Nigeria, where the study is situated.

Ethnographic background of the study

The Igbo ethnic group is one of the major ethnic groups in Nigeria. Others are the Yorubas in the West, and the Hausa-Fulani in the North. The Igbo are in the East. Polygamy is practiced in all parts of Nigeria. Although the incidence has dropped tremendously as a result of Christian religion and Western education, it is still practiced among the Moslems in all parts of Nigeria. Procreation is essentially the motive behind all contracted marriages. When daughters are given in marriage, mothers are anxious to be blessed with grand-children. When the expected infant arrives, mother-in-law goes to the son-in-law’s home to serve as care-giver for the first three months of the birth of the new infant. Within this period, mothers teach their daughters, who are now young mothers, the art of motherhood—giving the infant a bath, breastfeeding, dressing, cleaning when wet or soiled, and picking up the infant. It is common knowledge that uneducated grand-mothers could detect with accuracy the various social bids of the infant in their care at the signal of a cry and provide appropriate care. The first month of the arrival of the infant is for the young mother to observe her mother provide appropriate motherly care for the infant. In the next two months, the young mother practices care-giving under the supervision of her mother. My mother gave me the tutorials on motherhood at the arrival of my first baby girl. Surprisingly, her skill in detecting, with accuracy, the various social bids of the infant at the mere sound of a cry remained a mystery. Thus, this study was motivated by the need to discover how experienced but illiterate Igbo mothers are able to detect the infants’ social bids during the pre-linguistic stage at the sound of a cry in order to provide appropriate care-giving.

METHOD

The subjects of this study were two normal, full terms infants of the same parents, aged 0-3 months, – a girl and a boy with three-year age differential. They were born into an upper class Nigerian family where both parents have earned the PhD degrees and teach in the University of Nigeria. The two infants were fed exclusively on breast milk for the first six months. Their mother was aged 28 at the birth of the first infant, a girl. She played the dual role of a care-giver and a researcher in this research. The subjects belonged to the Igbo ethnic group and spoke a dialect of Igbo known as Ngwa dialect which is spoken in the southern part of Abia State of Nigeria. Abia State is one of the five States comprising the South-east geopolitical zone of Nigeria. Ngwa dialect is marked by heavy aspiration in addition to tonal and lexical variations. Although the Igbo language is characterized by three tones – high /‘/ , step /‘/ and low /‘/, there is no step tone in Ngwa dialect.

The study was conducted in two phases. The first phase was the observation of the infant girl at the signal of a cry (distress and non-distress) to note the formal parameters of the infant’s gestures at each sound of a cry and to read meaning to the gestural patterns—meanings which were tested out on the infant to determine its response. The various patterns of body movements were observed as they related to various social bids of the infant. The observations, which began during the second month of birth, were recorded on a daily basis in a journal. The journal entry contained the following information:

- Date of observation
- Time when cry was heard
- Observation of infant’s gestures for ten minutes
- Hypothesizing the formal parameters of the gestures
- Maternal action
- Infant’s response
At the end of the third month, the journal entries were analyzed for the following purposes:

- To identify each social bid
- To identify the type of vocalization and gestural patterns that characterize each social bid
- To hypothesize the functions of vocalization and gestures in each social bid
- To describe maternal action based on her hypothesis
- To describe infant's response to maternal action. See Appendix B for the analysis.

The second phase, which was a replication of the first phase three years later, occurred at the birth of a baby boy. The journal entries, the analysis (See Appendix C), follow the same pattern as in the first phase. Finally, the two analyses were compared to determine their underlying features in order to construct a model for the function of vocalization and gestures in the interaction between mother and infant, aged 0-3 months, for the provision of appropriate maternal care. This model may possibly explain how experienced Igbo mothers are able to detect the social bids of their infants for appropriate maternal care. Further research with enhanced population is needed to ensure generalization in this regard.

**FINDINGS**

A comparative study of the analyses of the two journal entries for the two infants (Appendix B & C) revealed that the dominant vocalization of the infants as observed were distress and non-distress cry. Distress cry was used when the infants were either soiled, wet or in pain. On the other hand, non-distress cry was used when the infants needed food or sleep. Although the infants slept most of the time within the period under study, occasions arose when they needed to sleep after being awake for some time. In addition to vocalization, it was found that the infants gestured as they cried. These gestures were in the form of various patterns of body manipulations and mouthing. These manipulations and mouthing, as the case may be, varied from infant to infant. They also varied according to social bid. Each social bid had its own pattern of manipulations or mouthing except in the case of pain where it was found that the manipulations were identical in the infants observed. In terms of functional roles, vocalization (distress and non-distress cry) was stable in function in all aspects of the infants' social bid in the sense that each type of vocalization for this study was responsible for arousal (Boukydis and Burgess, 1982; Zeskind and Collins, 1987). Arousal activated the information processor to enable the mother to notice the infants' gestures. The gestures encode the specific social bid of the infants through patterns of manipulations or mouthing or both. The encoded messages in the gestures are decoded by the information processor. Appropriate care-giving is dependent on maternal sensitivity to the promptings of the information processor. The care-giving is in the form of non-vocal, additive repertoire of touch actions. This means that vocalization and gestures play complementary roles in the communicative act by serving as prompts to appropriate maternal response. Against the above background, the model below is proposed.
The theoretical framework for the model is informed by the behaviorist paradigm of stimulus—response. Thus, the model has two components. While the infants’ acts serve as the stimulus, the mother’s acts serve as the corresponding response. The underlying assumption that informs the model is that Nigerian infants, aged 0-3 months, perform gestural acts that are meaning loaded. Consequently, the infants perform two communicative acts which are complementary functionally. These are vocalization (distress and non-distress cry) and gestures (body manipulations and mouthing). Because the functions are automatic and synchronous, both acts are inter-connected. Vocalization has two mutually exclusive sub-sets – distress and non-distress cries. It is generally accepted that vocalization stimulates automatic arousal (Burgess et al., 1982; Zeskind and Collins, 1987); but the position of this study is that vocalization (distress and non-distress cries) automatically arouses the information processor of the mother to notice the pattern of the infants’ gestures, to hypothesize the meaning of the gestural pattern, and to test it out on the infants by providing care. The validity of the mother’s test is determined by whether or not the care provided is appropriate. These series of maternal actions serve as initial responses to the infants’ stimulus. Gestures, on their part, comprise optionally co-occurring sub-sets—body manipulations and mouthing. They encode the infants’ social bids at a given time. Mother’s second response to the stimulus from the infants is that the information processor automatically and simultaneously processes the social bid and prompts appropriate care, which comprises non-verbal, touch actions (Beebe and Gerstman, 1984; Koester et al., 1989).

Appropriate care is dependent on the form and type of message the information processor prompts the mother to respond to. This is the stage of the mother’s hypothesizing the meaning of the gestural acts. The processing of the social bid by the information processor and its attendant prompting of the mother to provide appropriate care is, in the view of this study, what Hsu et al. (2003) referred to as maternal assessment of infants’ social signals. By their study, Hsu et al. (2003) imply social signal to mean the infants social bids which, according to them, is encoded in vocalization. This study rejects such a view based on the behavior of the subjects of this study. Like in infants’ communicative acts, information processor and appropriate care-giving are inter-connected. The actions are automatic, (unconsciously performed) and synchronous. This concept is borrowed from the theory of automaticity (Segalowitz, 2005).

The model, as described, reveals that vocalization (distress and non-distress cries) is an
activator while gestures encode the social bid and, therefore, perform the primary function of prompting maternal care if appropriately decoded by the information processor. Appendices B & C are provided to justify the postulations of the model by describing the components of each social bid and the maternal response. Each social bid is referred to as episode.

The food episode consisted of a combination of non-distress cry and gestures. The gestures varied in the two infants. For the girl, it was body manipulation in the form of lip sucking while for the boy, it was mouthing—sucking the thumb. The prompt for maternal response was lip sucking for the girl and thumb sucking for the boy. The care provided was non-verbal, touch actions of picking up the infants and breast feeding. The infants’ response to maternal action was zero crying and sucking mother’s breast ravenously.

The description conforms to the model. The infants’ communicative acts comprised vocalization, in this case, non-distress cry. This is why the model describes the two sub-sets of vocalizations as mutually exclusive. The other is gestures, which varied in the two infants and consisted of either body manipulations or mouthing. Non-distress cry served as an activator of the information processor to make the mother pay attention and notice the infants’ gestural acts. The information processor decoded the social bid in the gestures and prompted appropriate maternal care as described above.

The sleep episode also comprised non-distress cry and gestures. For the girl, it was body manipulations—moving the two hands across the two eyes and nose. The boy adopted both body manipulations and mouthing. He blinked his eyes (body manipulations) and sucked his fore finger (mouthing). Of the two gestures for the boy, the primary gesture was eye blinking while mouthing (sucking the fore finger) reinforced the social bid. This means that there were instances when a given social bid featured two gestures—one primary and the other secondary. The primary gesture predicted the social bid while the secondary reinforced it. The information processor decoded the primary gesture to represent sleepiness and prompts maternal care in the form of non-verbal, touch actions involving picking up the infants, cuddling, and massaging to put the infants to sleep. The infant responded by sleeping.

The sleep episode also conforms to the model. The significant feature of the sleep episode is that it justifies the categorization of the sub-sets of gestures (body manipulations and mouthing) as optionally co-occurring. All the other parameters of the model are in place in this episode.

The comfort episode is associated with the infants’ need to be cleaned and dressed when wet and soiled. The episode is characterized by distress cry and gestures. The gestures varied in the two infants. For instance, the girl had her feet raised (body manipulation) while the boy moved his buttocks rhythmically sideways (body manipulations). These body manipulations encoded the social bid and were thus interpreted and acted upon to provide appropriate care. The care was non-verbal, touch actions (cleaning and dressing the infants). The infant responded with zero crying.

As in other episodes, all the parameters of the model are in place in this episode. The communicative acts of the infants are not complex in this episode. A distress cry and gestures without primary and secondary sub-sets were noted. The mother’s actions consisted of two additive touch actions—cleaning and dressing. All the actions are non-verbal.

Finally, the pain episode was the most tasking of the episodes because Nigerian infants, aged 0-3 months, undergo three types of pains during this period. It requires the intuitive skill of an experienced mother to detect not only the presence of pain, but also the type of pain and respond appropriately (Celeste et al., 1986). Three types of pains have been identified. They are navel, belching, and immunization pains. Navel pain is associated with the healing of the umbilicus after the umbilical cord has disengaged from the umbilicus. Belching pain is a chest pain which occurs as a result of the accumulated gas in the stomach as infants breastfeed in a ravenous state. Finally, immunization pain is the post-immunization pain of fever and headache. Celeste et al. (1986) studied immunization pain at the moment of immunization. Consequently, the pain episode in the present study is different from that of Celeste et al. (1986). A common feature of these categories of pain is the presence of distress cry and patterns of body manipulations which were stable for the two infants. For instance, navel pain consisted of a combination of distress cry and stretched arms and feet for the two infants. Belching pain was characterized by distress cry and hands on the stomach for the two infants. Finally, post-immunization pain comprised distress cry and flapping of arms. In all of these instances, body manipulations as described encoded the social bid and served as prompt for maternal response in the form of non-verbal, touch actions that varied according to pain-type. For instance, navel pain involved picking up, administration of medicine, cuddling, and massaging the back. Belching pain consisted of picking up, resting the infant on the mother’s laps, and massaging the chest while post-immunization pain was in the form of picking up, administration of medicine, cuddling, and massaging the back. Navel and post-immunization pains had identical maternal responses. Infants’ response to maternal care in all of these types of pain episode is zero distress cry.

As in the other episodes, the pain episode, in spite of its gestural variations, conformed to all the parameters of the model as described above.

**DISCUSSION**

The mother/ researcher’s observation has revealed that infants, aged 0-3 months, vocalize and gesture. Vocalization is an activator of the information processor to enable maternal attention and noticing of the infants’ gestures, which are meaning-bearing. The information processor decodes the message encoded in the infants’ gestures to prompt appropriate maternal care. This view raises doubt on the generally held position that
vocalization serves as a social signal, among other functions, which determine maternal response (Bornstein et al., 1992; Papousek, 1995; Owing et al., 1997, 1998; Barr et al., 2000; Hsu et al., 2003; Bornstein, 2009). It also raises doubt on Hsu et al. (2003) claim that vocalization encodes the message that prompt maternal response.

Gesture studies (Müller, 2013) have demonstrated the meaning bearing function of gestures, especially the hand in performing such language functions as expressive, connotative, and referential. It has also been revealed that gestures are not restricted to the hand. Other parts of the body perform gestural acts (Kendon, 2004). Such a view has been affirmed by studies on body manipulations and mouthing of infants above the age of three months (Hewes, 1973; Rizzolatti et al., 1998; Corballis, 2000; Gentilucci and Corballis, 2006) for body manipulations and (Elbers, 1982; Hsu et al., 2003) for mouthing. Based on these studies, it is, therefore, hypothesized that infants, aged 0-3 months, gesture.

It is observed that gesturing, except in the case of pain episode, varied in the two subjects of the study. Gender distinguishes the two subjects—one male, the other female. Consequently, it is possible to hypothesize that the variation in gestural pattern, as observed in this study, is gender induced. This variation makes it difficult to chart a one-to-one correlation between gestures and social bids as noted in gesture studies (Müller, 2013). In spite of this lack, it is common knowledge in Igbo culture that experienced but illiterate Igbo mothers have the ability to detect with precision the needs of the infants in their care before the onset of linguistic development at the instance of a cry. This feat goes beyond reliance on vocalization as clue. It ventures intuitively into the area of gestures to find the clue, especially as gestures have been demonstrated to be meaning bearing. Because the feat is associated with experience in motherhood, it is postulated that the skill is innate and develops with age—the older the more the chances of predicting with accuracy the social bid of an infant before the onset of linguistic development at the instance of a cry (distress/non-distress).

CONCLUSION

From the foregoing, the study logically concluded that experienced but illiterate Igbo mothers rely on the infants’ gestures, as decoded for them by their information processor, to provide appropriate caregiving before the onset of linguistic development. Vocalization serves to arouse the care-giver to notice the formal parameters of the infants’ gestures.

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**APPENDIX A**

Analysis of Journal Entries for the Infant Girl

| Social Bid          | Arouser         | Gestural parameters                  | Interpretation of gestures | Maternal Response                          | Infant Response                              |
|---------------------|-----------------|--------------------------------------|-----------------------------|--------------------------------------------|----------------------------------------------|
| Food                | Non-distress cry| Body movement (sucking of lips)      | I need food                 | Non-verbal touch action (picking up, breastfeeding) | Zero crying and breast sucking with feeling of happiness |
| Sleep               | Non-distress cry| Body movement (moving the two hands across the eyes and nose) | I’m sleepy                  | Non-verbal touch action (picking up, cuddling, massaging the infant to sleep) | Infant went to sleep                           |
| Comfort             | Distress cry    | Body movement (feet raised)          | I’m wet                     | Non-verbal touch action (picking up, cleaning and dressing up the infant) | Zero distress cry with a feeling of happiness |
| Pain: navel post-immunization | Distress cry | Body movement (stretched arms and feet) | I’m hurting                 | Non-verbal touch action (picking up, administration of medicine, cuddling, massaging the back) | Zero distress cry with a feeling of relief |
| belching            | Distress cry    | Body movement (hands on the chest)   | I want to belch             | Non-verbal touch action (picking up, to rest on the mother’s laps, massaging the chest) | Zero distress cry and the infant belched       |
|                     |                 |                                      | I have acute pain          | Non-verbal touch action (picking up, administration of medicine, cuddling, massaging the back) | Zero distress cry with a feeling of relief |
### APPENDIX B

Analysis of Journal Entries for the Infant Boy

| Social bid     | Arouser           | Gestural parameters                                      | Interpretation of gestures  | Maternal response                                      | Infant response                                      |
|----------------|-------------------|----------------------------------------------------------|----------------------------|---------------------------------------------------------|-------------------------------------------------------|
| Food           | Non-distress cry  | Mouthing (sucking the thumb)                             | I need food                 | Non-verbal, touch action (picking up, breastfeeding)    | Zero non-distress cry with a feeling of happiness     |
|                |                   | Body movement/mouthing (blinking of eyes, sucking the fore-finger) | I'm sleepy                  | Non-verbal, touch action (picking up, cuddling and massaging the infant) | Infant went to sleep                                  |
| Sleep          | Non-distress cry  | Body movement/mouthing (stretched arms and feet)         | I'm wet                     | Non-verbal, touch action (picking up, cleaning and dressing up the infant) | Zero distress cry with a feeling of happiness         |
| Comfort        | Distress cry      | Body movement/mouthing (hands on the chest)              | I'm hurting                 | Non-verbal, touch action (picking up, administration of medicine, cuddling and massaging the back) | Zero distress cry with a feeling of relief            |
| Pain: navel    | Distress cry      | Body movement/mouthing (stretched arms and feet)         | I have acute pain           | Non-verbal, touch action (picking up, administration of medicine, cuddling and massaging the back) | Zero distress cry infant belched                      |
| belching       | Distress cry      | Body movement/mouthing (flapping of arms)                | I want to belch             | Non-verbal, touch action (picking up, resting the infant on mother’s lap, massaging the back) | Zero distress cry with a feeling of relief            |
| post-immunization | Distress cry  | Body movement/mouthing (stretched arms and feet)         | I have acute pain           | Non-verbal, touch action (picking up, administration of medicine, cuddling and massaging the back) | Zero distress cry with a feeling of relief            |