

## **OPERANT, RESPONDENT, AND UNCONDITIONED REFLEX RESPONSES IN LANGUAGE ACQUISITION**

### **OPERANTES, RESPONDIENTES Y RESPUESTAS INCONDICIONADAS EN LA ADQUISICIÓN DEL LENGUAJE**

**VÍCTOR M. ALCARAZ, REGINA MARTÍNEZ-CASAS,  
ANTONIA PADILLA, AND LUCÍA PUGA<sup>1</sup>**  
UNIVERSITY OF GUADALAJARA

#### **ABSTRACT**

This paper presents a functional approach to the early acquisition of language. We proposed that language arises from a shaping process of reflex responses that change into operants and respondents during mother-child interaction. In support of this, we present an analysis of six mother-child dyads videotaped from birth to 12 months of age. The children related with the predominant interactive pattern of their mothers, whose communicative style could be characterized in two ways: Either a style based predominantly on the use of mands or one based on social communication rather than controlling their children's behavior.

Key words: language acquisition, operant conditioning, classical conditioning, mother-child-interactions

#### **RESUMEN**

Este trabajo presenta, a partir de una perspectiva funcional, algunos de los mecanismos responsables de la adquisición del lenguaje. Se plantea que el lenguaje

---

<sup>1</sup> This work was possible thanks to the research grant number 400312-5H of the National Council of Science and Technology of Mexico. The authors would like to thank Andy Lattal and Martha Peláez for their critical comments, reviews, and editorial improvements on the manuscript, translated from Spanish. Correspondence of this article should be addressed to the first author at: Instituto de Neurociencias, Universidad de Guadalajara, Rayo No. 2611, C.P. 44520, Jardines del Bosque, Guadalajara, Jal., México.

The first author is at the Instituto de Neurociencias de la Universidad de Guadalajara and at the Facultad de Psicología de la Universidad Nacional Autónoma de México. The second author is at the CIESAS-Occidente. The third author is at the Centro de Estudios e Investigaciones en Comportamiento de la Universidad de Guadalajara, and the last author is at the Instituto de Neurociencias de la Universidad de Guadalajara.

surge por un proceso de moldeamiento de respuestas incondicionadas, las cuales, en el curso de la interacción madre-hijo, se convierten en operantes y respondientes orientadas a la interacción comunicativa. Se muestran los resultados del análisis de seis diadas madre-hijo observadas desde el momento del nacimiento del niño, hasta los doce meses de edad. Se identifican dos grupos de niños, claramente diferenciados y correlacionados con el tipo de patrón de interacción predominante de sus madres. Un primer grupo está compuesto por hijos de madres que utilizan los mandos y el segundo grupo, por hijos de madres que utilizan comunicación social en lugar de controlar el comportamiento de sus hijos.

Palabras clave: adquisición del lenguaje, condicionamiento operante, condicionamiento clásico, interacciones madre-hijo.

---

### **Pavlovian and Skinnerian Approaches to Language**

An important avenue for language study was opened by Pavlov when he explained language as a system of signals used by humans to refer to reality and to assure anticipatory responses that allow better adaptation to the environment. Skinner (1957) proffered new resources for the understanding of language when he defined it as a social interaction by which reinforcers accrued through other persons. He proposed that interactions had a predominantly verbal character and were composed of three classes of responses: Tacts or verbal references made to stimuli, mands which changed listener behavior and which were determined by deprivation conditions or aversive stimuli affecting the speaker, and intraverbals, including the autoclitic, which allowed organization and composition of verbal behavior sequences.

For Pavlov, language responses are evoked by associative processes and composed of two elements: An auditory stimulus and a proprioceptive stimulus in the phonation apparatus. Both stimuli associated to an external stimulus acquire a signal function of the external one.

According to Skinner (1957), language consists of emitted responses reinforced by the verbal community. The speaker's verbal repertoire is established by environmental contingencies. Mands receive direct reinforcement because the behavior aroused in the listener supplies the stimulus deprived by the speaker or eliminates the aversive stimulus that disturbs him. The stimulus evoking the tact may be considered a discriminative stimulus. Verbal operants are discriminative stimuli for autoclitics. As a result, the language community then establishes particular reinforcement contingencies for the whole verbal behavior.

Both Pavlovian and Skinnerian approaches supply elements for the understanding of language, but they leave out many aspects of the linguistic

interaction. Language consists of not only verbal behavior, as Skinner (1957) noted. In spite of the introductory clarification he made concerning this latter point, Skinner's work was mainly centered in verbal behavior. Here, we will define language as a set of responses involving the entire organism which allows the speaker and the listener to mutually adjust to gain reinforcement. Some of these reinforcements are supplied simply by the interaction. Establishing contact reinforces the speaker as well as the listener. In other instances external reinforcements accrue as a result of the vocalizations of the speaker, accompanied by some gestures that will guide the listener to accomplish cooperative behaviors.

### **Operants and Respondents**

Responses of the entire body are to be found in linguistic interactions. Some responses will be acquired as respondents and others will be established as operants, through response-reinforcement relations. Operants and respondents therefore will appear interwoven in verbal behavior.

Earlier Alcaraz (1979, 1980) criticized the operant-respondent distinction established by Skinner (1937/1972). He proposed that this distinction was an artificial product of the recording techniques in laboratory conditions. Respondents occur in the period between the appearance of a stimulus and the presentation of reinforcement. Operants appear in the period preceding reinforcement. Thus, we have here not two different response mechanisms, but two different times of observation. Traditionally, respondents were classified as responses of the smooth muscle under the control of autonomous nervous system and operants as emitted responses mediated by the skeletal muscle system under the control of the nervous system. The two kinds of responses, according to this view, could be considered as reactions correlated with different biological functions. Respondents are related to the regulation of the inner milieu of the organism and operants are responses that maintain interaction with the external world. If the distinction is limited in this way, then, it is not necessary to talk about different conditioning mechanisms.

Most classifications of responses represent an attempt to explain a multiform reality where it is not always possible to establish dividing lines. Thus, the previously described classification omits a number of responses. For example, a respondent may occur as an anticipatory reaction in the muscle skeletal system and an operant may appear as a response of the smooth muscle, depending on the reinforcing conditions. For this reason, and to avoid confusion, we define respondents for the present purposes as responses primarily with visceral components or as undifferentiated motor activations of the smooth muscle responses--the continuance of which depends on the

maintenance of visceral activation. We consider operants as those responses of the striate muscle with their rates determined by the rate of reinforcement. For example, anticipatory crying may be a respondent, as when it increases as a product of activation of the sympathetic nervous system, or may be an operant, when it is shaped by environmental contingencies.

The preceding definitions permit differentiation between response types without overly forcing classifications. For example, a response labeled as classically conditioned may be considered an operant if we observe its appearance before the reinforcement and ignore the stimulus that evoked it. Respondent crying may be interpreted as operant if the evoking stimulus is unknown and only the reinforcements received afterwards are observed. However, it is difficult to maintain operants based on smooth muscle movements under ratio schedules. Salivation starts but it tends to stop if there is no immediate reinforcement. By contrast, a muscle-skeletal operant is more likely to be maintained during ratio schedules. Of course, counter examples may be found. The cry of a baby may be respondent and last until aversive conditions are withdrawn, but its continuance is due to the presence of the aversive condition.

In Pavlovian conditioning, conditioned responses arise from a transfer of evoking properties of an unconditioned stimulus to a conditioned stimulus. In other words, the reflex response linked to a stimulus is detached from its unconditioned excitant and is associated with a different stimulus to function as a conditioned response. Salivation linked to the excitation of the buccal mucous is separated from the original eliciting stimulus to be associated with stimuli affecting other sensory modalities. Likewise, operants tend to separate from their unconditioned reinforcement and come under the control of vicarious reinforcement. In the final analysis, learning is a successive detachment from pure reactive conditions.

Behavior is a continuous interaction between unconditioned reflexes, operants, and respondents. No successive alternations are detected in the human organism in which, at a certain moment, it will only respond to internal stimulus, while in other circumstances it responds only to external stimulus. Sometimes internal stimuli trigger responses directed externally and, on other occasions, external stimuli may evoke internal responses. An operant, as well as a respondent, are the result of the sum of internal and external stimuli. Only under special conditions do respondents occur without an operant counterpart. Operants always are accompanied by respondents in that any muscular contraction demands increased blood flow to the activated muscle, which in turn may affect changes in respiratory rhythm and even changes in other systems, such as hormonal secretion.

There is little doubt that analysis of the behavior would be enhanced by taking into account reflex reactions as well as respondent and operant processes, rather than reducing the scope of study to only one kind of response. Such a multiple-system approach is critical to understanding language learning, because verbal behavior, as we shall see, is the product of complex operant-respondent interactions, and the genesis of these is in turn reflex reactions.

### Functions of Language

We will elaborate this multiple-system approach by using it to analyze the functions of language. We already have noted that language represents a group of reciprocal adjustments by participants within a social interaction and that such adjustments involve the whole body. These adjustments are respondents and operants, visceral changes as well as skeletal muscular changes. The most important activities of the latter occur in the vocal articulatory apparatus.

Visceral responses may evoke operants in the vocal articulatory apparatus, they may appear as a consequence of such operants, or they may occur concomitantly with them. Respondents evoking verbal operants are generally activities of a visceral nature that originate verbal designation responses, for example, saying "I have a headache" when an elongation of the walls of blood vessels irrigating the encephalic zone occurs, or saying "I am hungry" in conjunction with an increase in intestinal peristalsis.

Verbal operants, on the other hand, may initiate or elicit respondents, as in the word "lemon" eliciting a salivary response. Lastly, operants and respondents may occur simultaneously when language is produced. An analysis of any verbal statement may serve as an example. Thus, when a sentence is emitted, there is an operant component constituted by movements of the tongue, lips, and palate, and a respondent component formed by vocal cord tension and the different openings of the buccal cavity, which, in the beginning, before children learn the language, only integrate the cry-reflex responses. In both adults and children who have already learned to speak, that respondent component is the basis of crying and also of prosody, that is, the language melody expressing emotional conditions.

A continuous interaction between respondents and operants occurs in the process of speech acquisition, which allows language to facilitate human interaction. Language gains its role as a behavior guide primarily because words are converted in signs and substitutes for stimuli. Thus, an individual does not need to face an evoking stimulus of a response to modify the behavior; sometimes the substituting verbal stimulus is sufficient. In the

following experiment, we attempted to demonstrate how the interaction of reflex responses, operants and respondents form the matrix of language.

## METHOD

Six dyad interactions between mothers and their infants were videotaped under different circumstances: Feeding, cleaning, and playing. Each recorded session lasted 15 min. Sessions occurred fortnightly for 1 year starting 10 days after birth. Once the videotapes were transcribed, behaviors were analyzed and classified under two broad categories, which were in turn subdivided into several subcategories as follows:

(a) Reflex responses formed by crying vocal emissions.

(b) Respondents constituted by motor agitations as a product of a strong excitement originated by reinforcement or by its anticipation.

(c) Operant responses integrated by:

(1) Preverbal vocal or motor responses. Vocal responses were all of those voice emissions that appeared in children before referential behaviors emerged and that would be produced facing stimulative situations indicating reinforcement deliveries, or that were shaped and reinforced and hence, increased in rate of occurrence. Motor responses were movements in search of maternal contact either by touching or by fixation of sight.

(2) Verbal responses were those constituted by mother's language and by the child's first words with referential function, that is, the first verbal tacts in Skinner's (1957) terminology. The mother's language was categorized according to the language functional frame proposed by Jakobson (1963) and modified by us (Alcaraz & Martínez-Casas, 1994).

Both respondents and operant vocalizations were in turn subdivided according to their function, yielding the following functional response subcategories:

(1) Motor agitation respondents composed of arms and legs generalized movements, culturally interpreted as a child's "satisfaction" condition or "pleasant state" (Mar).

(2) Cry reflexes (Cr).

(3) Physical contact operants, child's approximation movements to the mother (Pco).

(4) Eye movements in search of the mother, which we have designated visual contact operants (Vco).

(5) Calling vocal operants, composed of groans similar to crying, but a product of the mother's shaping of what was originally reflex crying (Cvo).

(6) Upholding attention vocal operants, constituted of sounds emitted by the child that were reinforced by the mother's attention (Uavo).

(7) Discriminated vocal operants formed by voice emissions of the child in response to verbalizations of the mother and that integrated a sort of protodialogue in which the mother spoke and the child responded with murmurs (Dvo).

(8) Referential verbal behavior (Skinner's tacts). Children's first words and mother's language aimed to designate objects or persons (Rvb).

(9) Emotive-expressive verbal behavior, that is, mother's emotional exclamations with either positive or negative character (eev+ and eev- respectively).

(10) Mother's language classified as conative because it was addressed to give an order to the child and operant command behaviors in the child which made the mother pay attention to her child to satisfy a necessity. The mother's verbal conative behavior was divided into imperative conative (C) and dialogic conative (Dc), the latter qualified with formulas such as "please" or petition or plead expressions. We named the child's demands "command operants" and the mother's verbalizations "conative responses" to differentiate preverbal from verbal behavior.

(11) Phatic verbal behavior, which we divided into attention-directing phatic (Adp), ritualized phatic (Rp), turn specifying phatic (Tsp), and referential phatic to the interlocutor (Rpi). The attention-directing phatic behavior was composed of calls for the child to pay attention to the mother and signaling for the child to notice a particular stimulus. The ritualized phatic was integrated by salutation-type formulas and the turn-specifying phatic was mainly composed of verbal questions which started at early stages before the child emitted its first words. Inducing the child to answer a mother's verbal behavior also was classified as a turn-specifying phatic. The referential phatic to the interlocutor was formed by appearance references to the child, such as "how pretty" or "how smart," etc. We also included in the mother's verbal behavior such paraverbal behaviors as physical and visual operant contacts. We identified phatic behaviors with the mother to emphasize that they already formed part of the language system and were not, like those of the child, directed operants leading to tangible reinforcement.

(12) Conative behavior proto-referential to language that was the mother's request to the child to emit certain sounds like "say<sub>gu</sub>" and which was used to stimulate its vocalizations.

(13) Conative behavior referential to language conformed by the same kind of requests as the above, but now directed to child emissions resembling words shaped by the mother.

A cumulative record of the different types of verbalizations, both the mother and the child was kept, and this allowed observation of the evolution of the child's verbalization during its ontogenetic development. The functional

category of particular verbalizations was established based on their context. The simple cumulative record was converted to percentages to allow the ranking of each category in each session and in each quarter of the study. Behavior classifications were made independently by different members of the working group. These then were discussed to confirm their reliability. Agreement among the investigators was > 90%.

## RESULTS

Two different types of children and two different types of mothers were found. Some children showed fast language learning. We will refer to them as members of Group A, while members of the other type, which we will refer to as Group B, showed slower learning of language. Mothers of fast-language learning children were more referential and phatic, while mothers with children who learned language more slowly were predominantly conative. We will refer to these two types of mothers respectively as conative and phatic-referential.

Phatic-referential mothers started making references beginning in the first quarter of life, that is, during the first three months following the birth of their child, and 7.1% of their behavior during that time was composed by this kind of verbal behavior. Their referential behavior dropped to 3.6% during the second quarter (months 4-6) in the course of their dyad interaction, increased to 11.4% during the third quarter (months 7-9) and to 19% during the fourth quarter (months 10-12) of life of their children. In addition, these phatic-referential mothers showed a progressively-increasing conative behavior referential to language, that is, they promoted childhood verbalizations, shaping and inducing their occurrences. Consequently, their conative behavior referential to language during the first quarter was 0.7%, 7.9% during the second quarter, 6.2% during the third quarter and a decrease to 3.7% during the fourth quarter when integrated bucophonatory patterns had been established in their children which allowed production of the first words. Something similar occurred with their conative behavior proto-referential to language in which vocal emissions of their children were encouraged, in spite of the different pronunciation of the adult. In this case, during the second quarter 6.5% of such behavior was shown; it decreased to 3.6% during the third quarter, and it practically disappeared during the fourth quarter when their children's vocalizations started forming words.

Phatic mothers presented more phatic-referential behavior than conative mothers: 20% vs. 16.2% during the first quarter, 11.5% vs. 5.1% during the second quarter, and 3.6% vs. 0.9% during the third quarter. This trend was reversed during the fourth quarter, where conative mothers showed a greater



percentage of this type of behavior, that is, 8.3% vs. 4.2% of phatic-referential mothers. Phatic-turn specifying behavior occurred early in both phatic-referential and conative mothers. During the first quarter, phatic referential mothers presented 23.5% turn-specifying verbalizations, while conative mothers used them only 15.4% of the time. Such behavior dropped in the second quarter to 11.5% in phatic-referential and 14.2% in conative mothers. Here we see that the most important decrease is that of the phatic-referentials. During the third and fourth quarters the drop continued in the conative mothers (6.6 and 6.1% respectively) while a progressive increase occurred with the phatic-referential mothers (11 and 18.6% respectively).

Conative mothers expressed less search of physical contact operants than phatic-referential mothers during the second quarter (4.5 vs. 7.2% of their counterparts) and greater search of visual contact (5.7 vs. 3.9%) This latter relation was maintained during the third quarter with 5.7% of search of visual contact in conative mothers and 2.5% in phatic-referential ones. Also, conative mothers tended to exhibit ritualized phatic behavior, that is, their language had more ready made formulas than phatic referential mothers: 2.9% vs. none during the first quarter, 6.2% vs. 3.6% during the second quarter, 7.6 % vs. 5.1% during the third quarter, and 6.6% vs. 2.6% during the last quarter.

As already noted, conative mothers presented a greater number of orders or commands than phatic-referential mothers. We recorded 13.3% dialogic conative responses by conative mothers during the first quarter vs. 6.4% for the other mothers and 13.1% vs. 8.6% during the second quarter. During the third quarter, both, phatic referential and conative mothers received a similar number of dialogic conative responses and during the fourth quarter phatic-referential mothers exceeded conative ones (20.7 vs. 14.5%). Imperative conative responses to conative mothers were proportionally greater during the second, third and fourth quarters than those to referential mothers (13.7 vs. 4.3, 11.4 vs. 2.9, and 11.9 vs. 3.1%) (See Table 1 and Figures 1-4.)

The children in Group A exhibited more motor agitation respondents than did children in Group B during the first quarter (34.3% vs. 24.6%). During the second and third quarters the proportions were 14.2% versus 18% and 11.2% versus 9.6% for Groups A and B respectively. The largest drop was for the Group B children. During the last quarter the proportion of these motor agitation behaviors was minimal for both groups. Cry reflex responses of children in Group B were higher than those of Group A during the second quarter: 39.7% versus 20.9% respectively, even though the proportions were similar in both groups during the first quarter. An increase in such reactions by Group A children relative to those of Group B children occurred in the last quarter: 8.1% vs. 1.6%.

Table 1. Mother's language recorded during the mother-child interaction in weekly samples along the first year of life. ee+: positive emotive expressive verbal behavior; ee-: negative emotive expressive verbal behavior; C: Conative behavior; Dc: Dialogic conative behavior; Adp: Attention directing phatic; Pco: Physical contact operants; Vco: Visual contact phatic; Tsp: Turn specifying phatic; Rp: Ritualized phatic; Rpi: Referential phatic to the interlocutor; R: Referential verbal behavior, CPR: Conative behavior protoreferential to language; CRL: Conative verbal behavior referential to language.

Mothers R	ee+	ee-	C	Dc	Adp	Pco
0-3 Months	1.7	0.3	4.2	6.4	22.5	9.6
Mothers C	ee+	ee-	C	Dc	Adp	Pco
0-3 Months	1.2	0	4.5	13.3	21.6	8.7
Mothers R	ee+	ee-	C	Dc	Adp	Pco
4-6 months	1.8	0.3	4.3	8.6	28.6	7.2
Mothers C	ee+	ee-	C	Dc	Adp	Pco
4-6 months	0	0.5	13.7	13.1	29.7	4.5
Mothers R	ee+	ee-	C	Dc	Adp	Pco
7-9 months	0.3	0.7	2.9	20.2	29.1	2.5
Mothers C	ee+	ee-	C	Dc	Adp	Pco
7-9 months	1.9	3.3	11.4	21	21.5	2.3
Mothers R	ee+	ee-	C	Dc	Adp	Pco
10-12 months	0	4.7	3.1	20.7	18.6	1
Mothers C	ee+	ee-	C	Dc	Adp	Pco
10-12 months	0.9	0.9	11.9	14.5	27.3	3

Mothers R	Vco	Tsp	Rp	Rpi	R	CPR	CRL
0-3 Months	3.5	23.5	0	20	7.1	0	0.7
Mothers C	Vco	Tsp	Rp	Rpi	R	CPR	CRL
0-3 Months	6.3	15.4	2.9	16.2	2.5	3.7	1.2
Mothers R	Vco	Tsp	Rp	Rpi	R	CPR	CRL
4-6 months	3.9	11.5	3.6	11.5	3.6	6.5	7.9
Mothers C	Vco	Tsp	Rp	Rpi	R	CPR	CRL
4-6 months	5.7	14.2	6.2	5.1	1.1	0	5.7
Mothers R	Vco	Tsp	Rp	Rpi	R	CPR	CRL
7-9 months	2.5	11	5.1	3.6	11.4	3.6	6.2
Mothers C	Vco	Tsp	Rp	Rpi	R	CPR	CRL
7-9 months	5.7	6.6	7.6	0.9	9.5	2.3	5.2
Mothers R	Vco	Tsp	Rp	Rpi	R	CPR	CRL
10-12 months	2.1	18.6	2.6	4.2	19.1	1	3.7
Mothers C	Vco	Tsp	Rp	Rpi	R	CPR	CRL
10-12 months	2.3	6.1	6.6	8.3	10.7	2.1	4.7

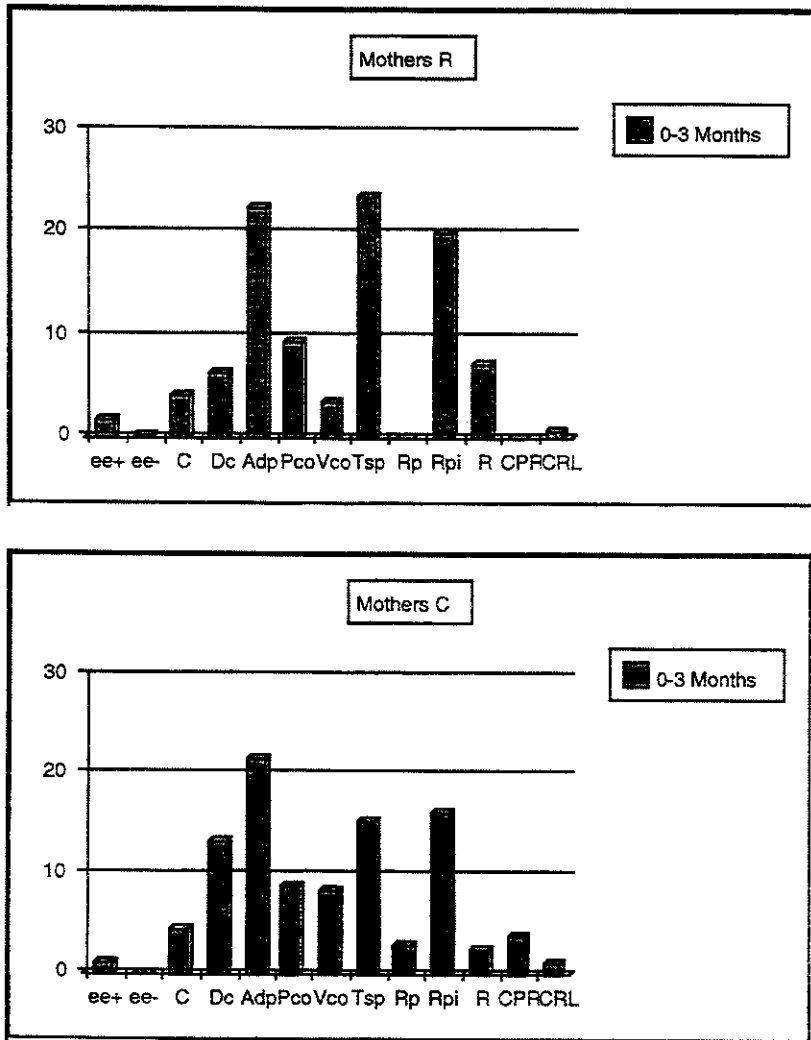


Figure 1. Mother's language recorded during mother-child interaction in the course of weekly samples along the first three months of life. We can see clear differences between conative and referential mothers. (ee +: positive emotive expressive verbal behavior; ee -: negative emotive expressive verbal behavior; C: Conative behavior; Dc: Dialogic conative behavior; Adp: Attention directing phatic; Pco: Physical contact operants; Vco: Visual contact phatic; Tsp: Turn specifying phatic; Rp: Ritualized phatic; Rpi: Referential phatic to the interlocutor; R: Referential verbal behavior, CPR: Conative behavior protoreferential to language; CRL: Conative verbal behavior referential to language).

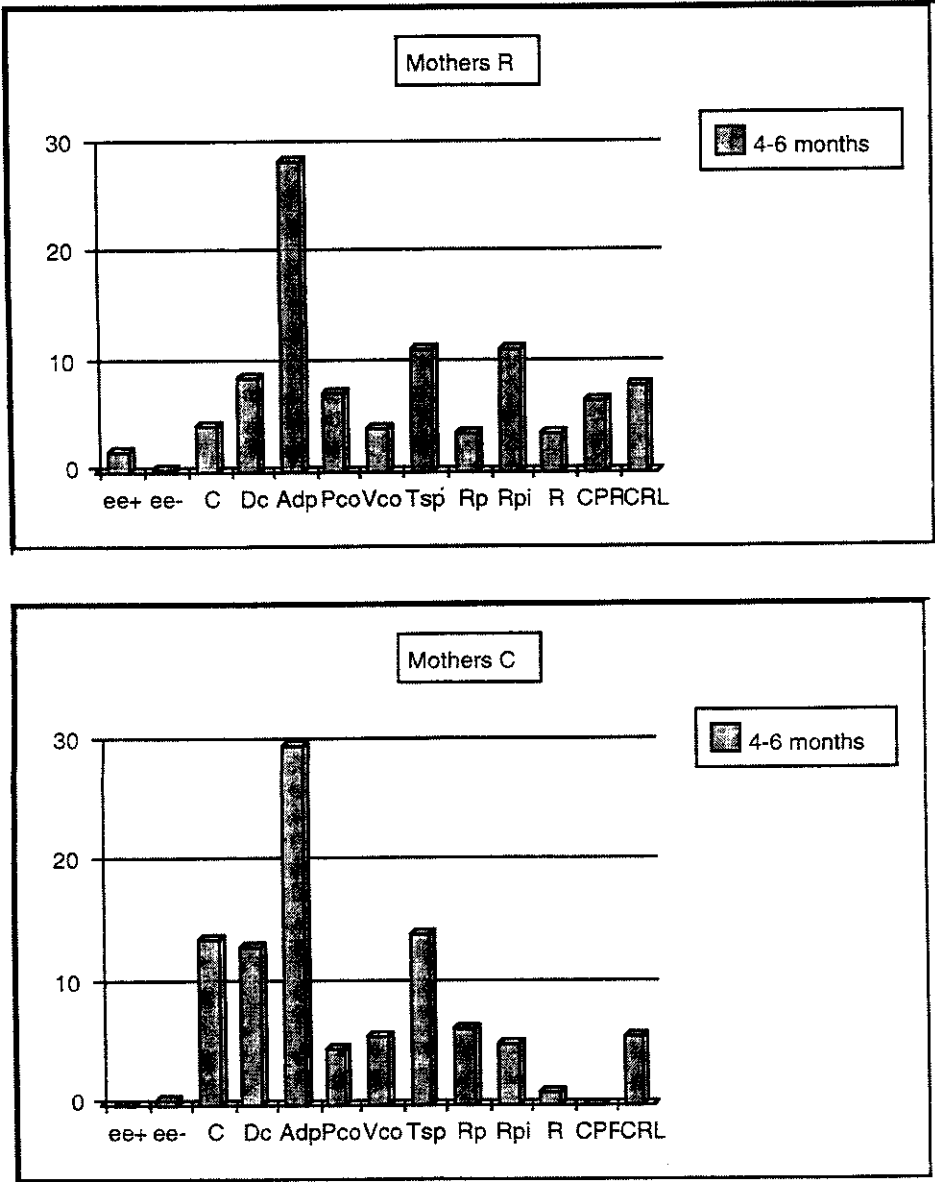


Figure 2. Mother's language recorded during mother-child interaction in the course of weekly samples along the second quarter of life.

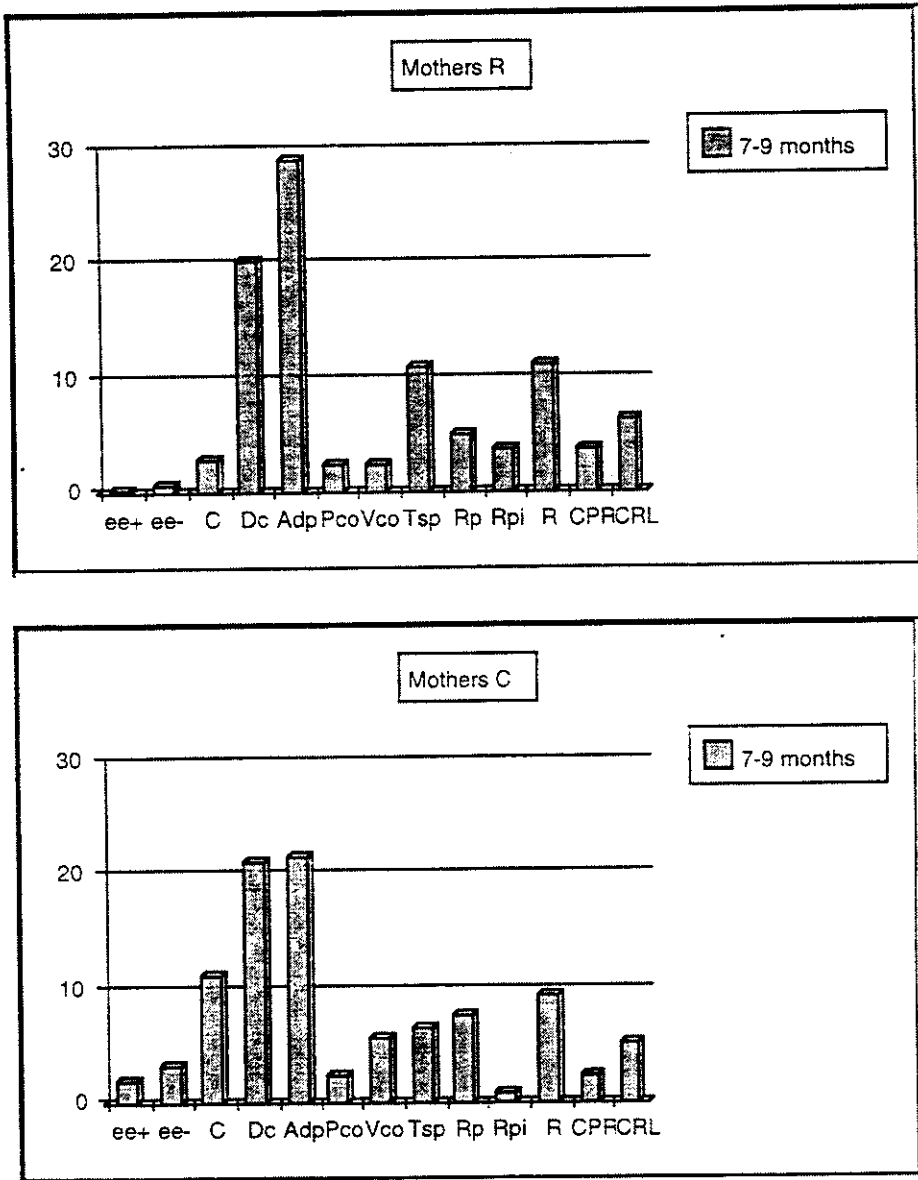


Figure 3. Mother's language recorded during mother-child interaction in the course of weekly samples along the third quarter of life.

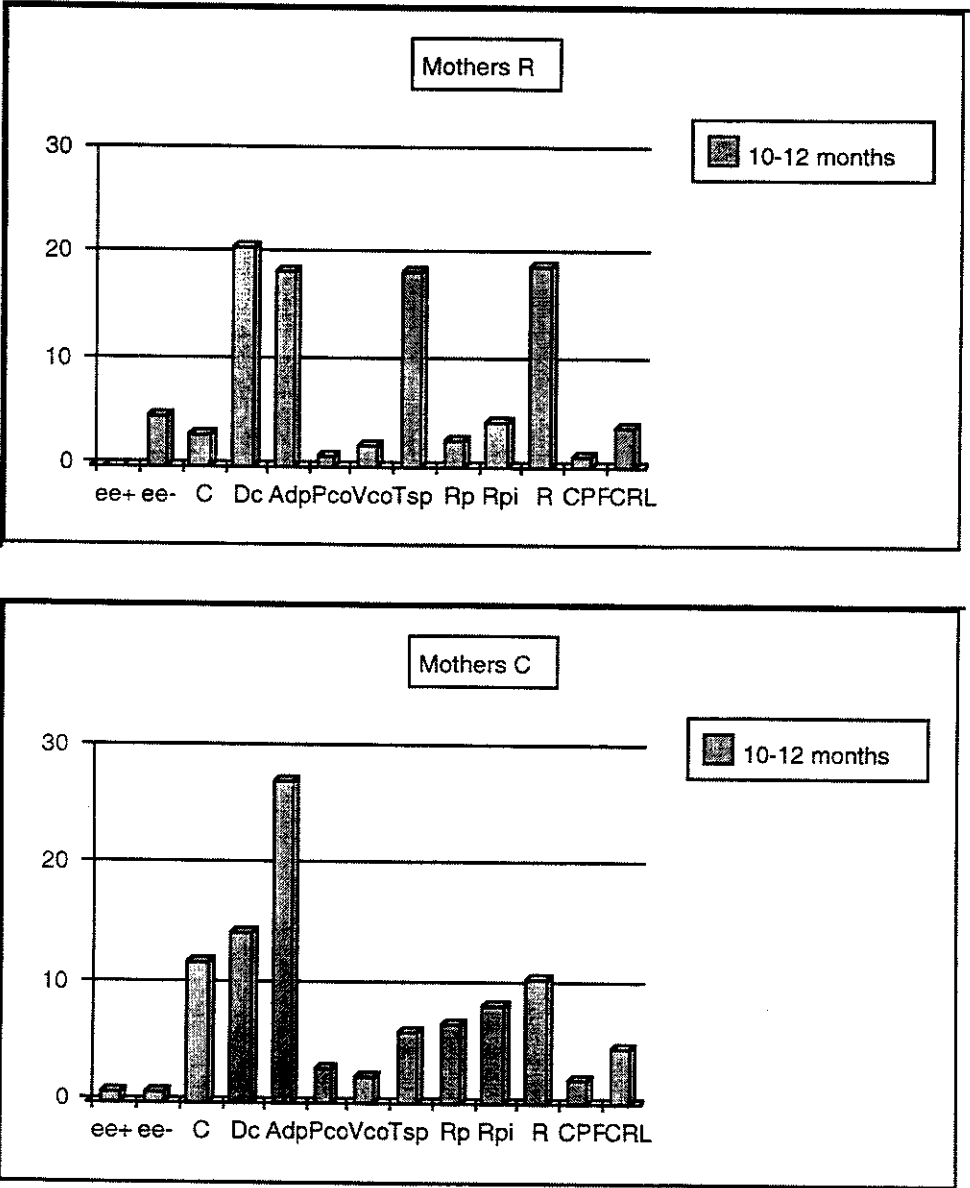


Figure 4. Mother's language recorded during mother-child interaction in the course of weekly samples along the fourth quarter of life.

The overall responses, reflex, respondents and operants showed a special evolution in both groups. During the first two quarters of the year, reflex and elicited responses predominated: 50.6 and 57.7% for Group B, and 60.5 and 35.1% for Group A. Operants represented a greater proportion in the sampled behavior during the last two quarters: 75.5% during the third quarter and 91.5% during the fourth quarter for Group A and, for Group B, 82.5% and 96.2% respectively for the third and fourth quarters. The fact that reflex and respondents responses in Group B maintained practically the same proportion during the first half of the year and then abruptly dropped during the second half attracted our attention. Group A showed a progressive increase of operant behavior between the second and last quarters. Cry reflex responses and motor agitation respondents were less in Group B during the first quarter. However, an analysis of operant responses reveals transitional behavior: The physical contact operant. We consider it transitional because it results in tangible reinforcement: the cutaneous stimulus. It does not look like other operants such as the fixation of sight, attention maintenance, discriminative operants, and referential verbalizations, in which reinforcement is the mother's look, or other verbal responses or attention-getting responses. The physical contact search transitional operant was found during the first quarter of life in greater proportions in Group B members. It appears that members of Group A tend to free themselves from tangible reinforcers while members in Group B continue to depend on such reinforcers. Summing reflex cry, respondents, and operants with tangible reinforcements leads to the conclusion that Group A and Group B are similar during the first quarter with 63.5% and 60.7% of these behaviors respectively.

Visual-contact search operants were higher in Group B children during the first and third quarters (24.6% vs. 14.1% in children of Group A and 16.3% vs. 10.4%). During the second and fourth quarters children in Group A emitted more visual contact operants than did children in Group B (13.3% vs. 10.8% and 4.5% vs. 2.7%). Command operants appeared during the third and fourth quarters in a greater proportion in children of Group A than those in Group B (3.2% vs. 0% in the third quarter and 5.4% vs. 4.3% in the fourth quarter).

*Discriminated operants*, that is, vocalizations emitted as an answer to mother's verbal behavior, were more frequent in Group B than in Group A children during the first quarter (8% vs. 6%). In the second quarter, both Groups were even in this respect (21.6% vs. 20.9%). During the third quarter Group B children were higher than Group A children by 27.8% vs. 23%. This difference continued during the last quarter, where the proportions were 21.4% vs. 18.1% for children in Groups B and A respectively.

The calling operant was greater in children in Group A during the first three quarters (16.1% vs. 2.8% in the first quarter, 22.8% vs. 9.6% during the second quarter, and 33% vs. 26.9% in the third quarter). This ratio reversed during the fourth quarter, where Group B children showed 51% in calling behavior vs. 32.7% in children in Group A. During the last quarter, referential behavior occurred in Group A children in a more marked way (26.3% vs. 8.7% in Group B). Responses addressed to maintain attention of interlocutor (uvo) occurred mainly in Group B children during the last quarter, but percentages varied considerably between the Groups from quarter to quarter: 2.8% in Group B vs. 0% in Group A during the first quarter; 6.6% and 8.8% during the second and third quarters in Group A vs. 0% and 6.7% in group B during these quarters and 2.7% in Group A vs. 7.1% in Group B during the fourth quarter. (See Table 2 and Figures 5-9).

Table 2. Percentage of child's reflex, respondent and operant responses recorded during the mother-child interaction in weekly samples along the first year of life. Mar: Motor agitation responses; Cr: Cry reflex; Mo: Mand operants; Pco: Physical contact operants; Vco: Visual contact operants; Cvo: Calling verbal operants; Uav: Upholding attention vocal operants; Dvo: Discriminated vocal operants; R: verbal referentials.

0-3	Mar	Cr	Pco	Vco	Cvo	Uav	Dvo
A	34.3	26.2	3	14.1	16.1	0	6.06
B	24.6	26	10.1	24.6	2.8	2.8	8.6

7-9	Mar	Cr	Mo	Pco	Vco	Cvo	Uav	Dvo	R
A	11.2	9.6	3.2	0	10.4	33	8.8	23.3	0
B	9.6	7.6	0	4.8	16.3	26.9	6.7	27.8	0
10-12	Mar	Cr	Mo	Pco	Vco	Cvo	Uav	Dvo	R
A	0	8.1	5.4	1.8	4.5	32.7	2.7	18.1	26.3
B	1.6	1.6	4.3	1	2.7	5.1	7.1	21.4	8.7



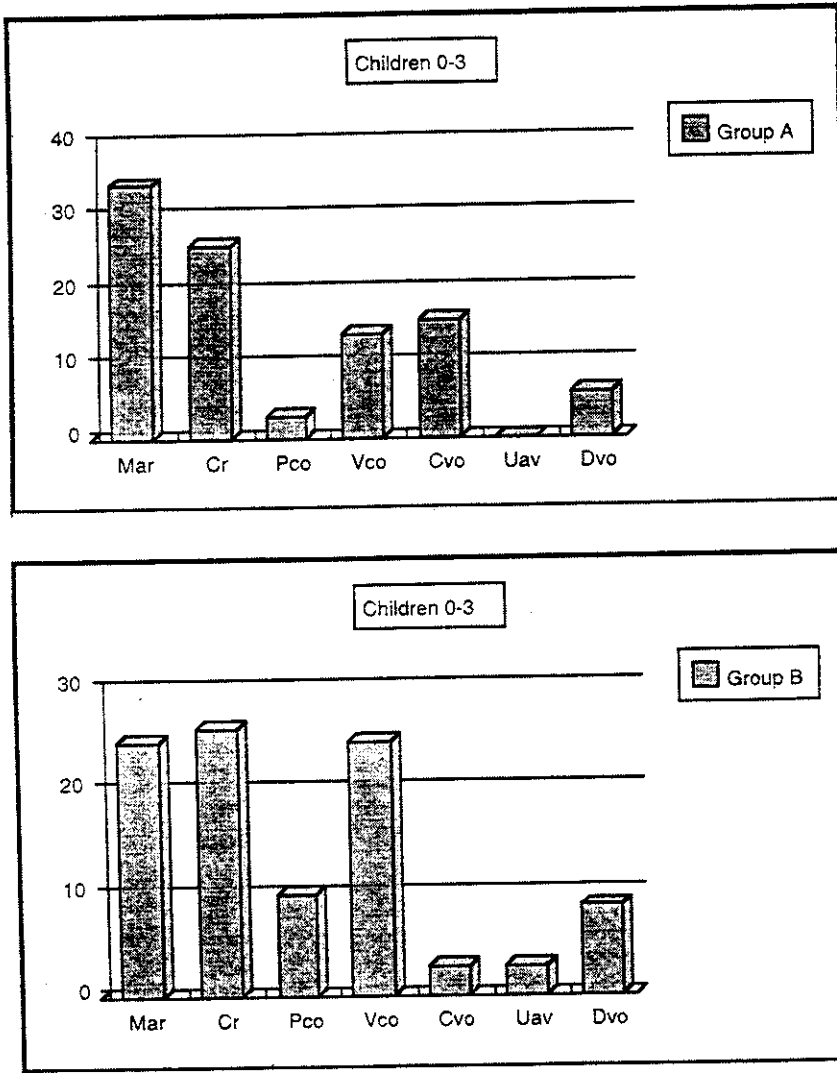


Figure 5. Vocal reflex responses, vocal respondent responses and vocal operant responses recording during mother-child interaction in the course of weekly samples along the first three months of life. Two groups were made "a posteriori". Children with fast acquisition (Group 1) and children with slow acquisition (Group B). Mar: Motor agitation responses; Cr: Cry reflex; Mo: Mand operants; Pco: Physical contact operants; Vco: Visual contact operants; Cvo: Calling verbal operants; Uav: Upholding attention vocal operants; Dvo: Discriminated vocal operants; R: verbal referentials.

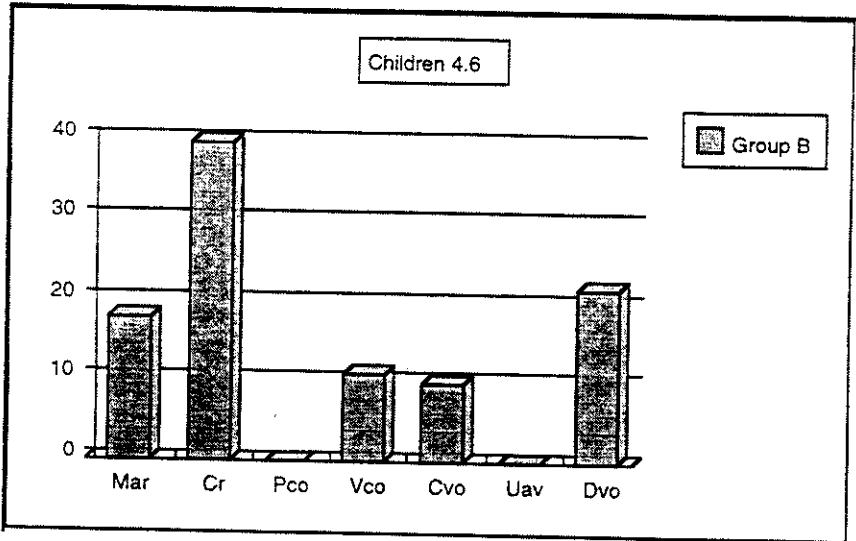
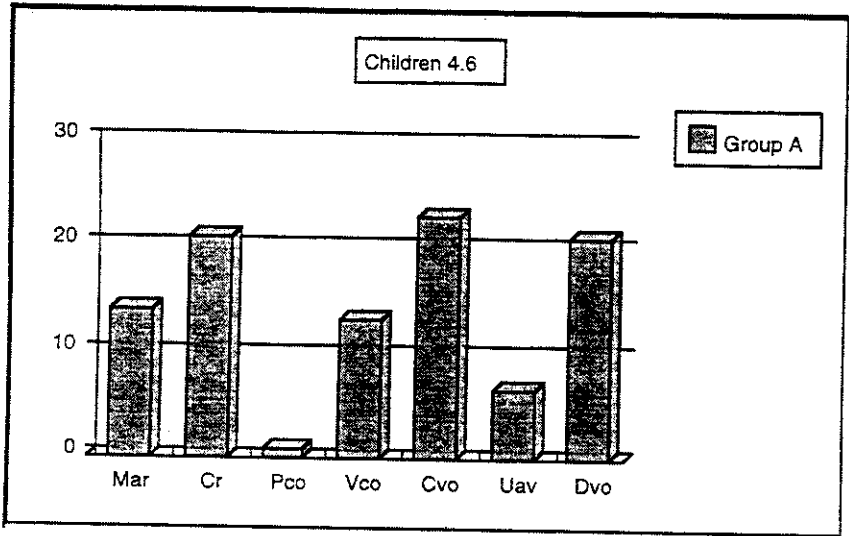


Figure 6. Vocal reflex responses, vocal respondent responses and vocal operant responses recording during mother-child interaction in the course of weekly samples along the second quarter of life.

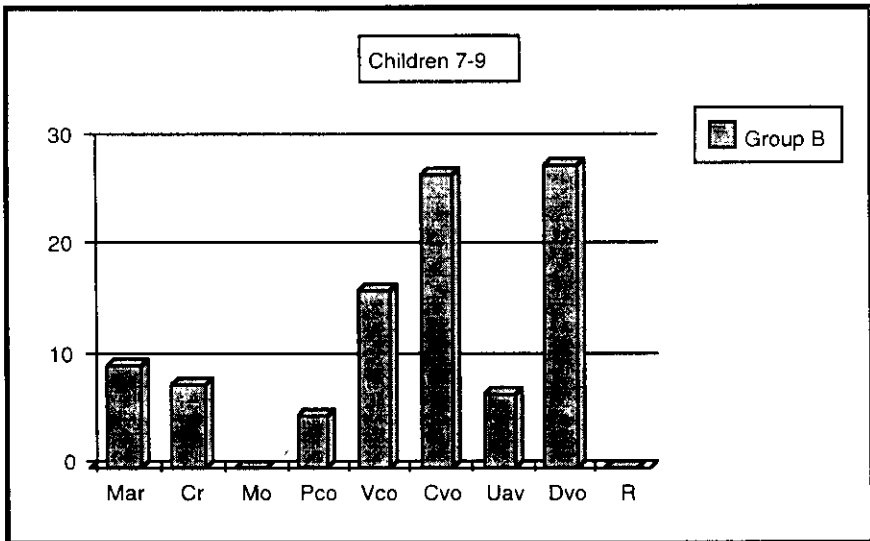
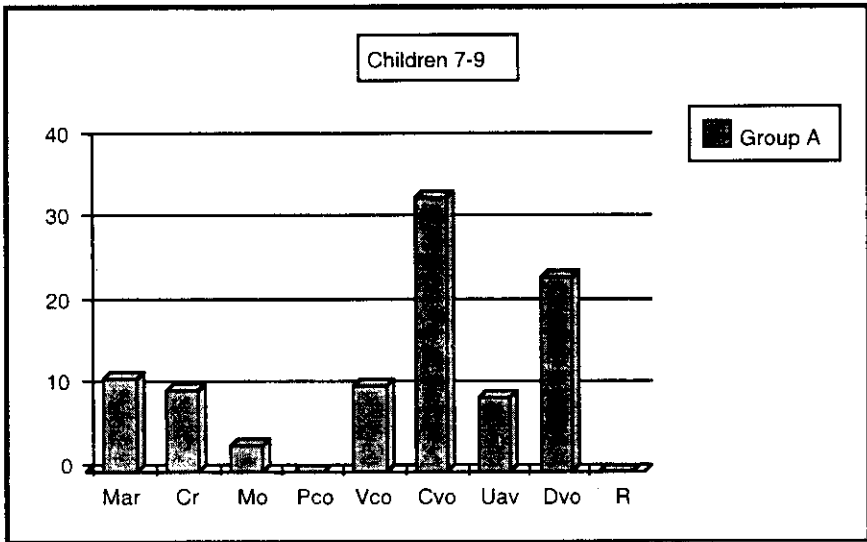


Figure 7. Vocal reflex responses, vocal respondent responses and vocal operant responses recording during mother-child interaction in the course of weekly samples along the third quarter of life.

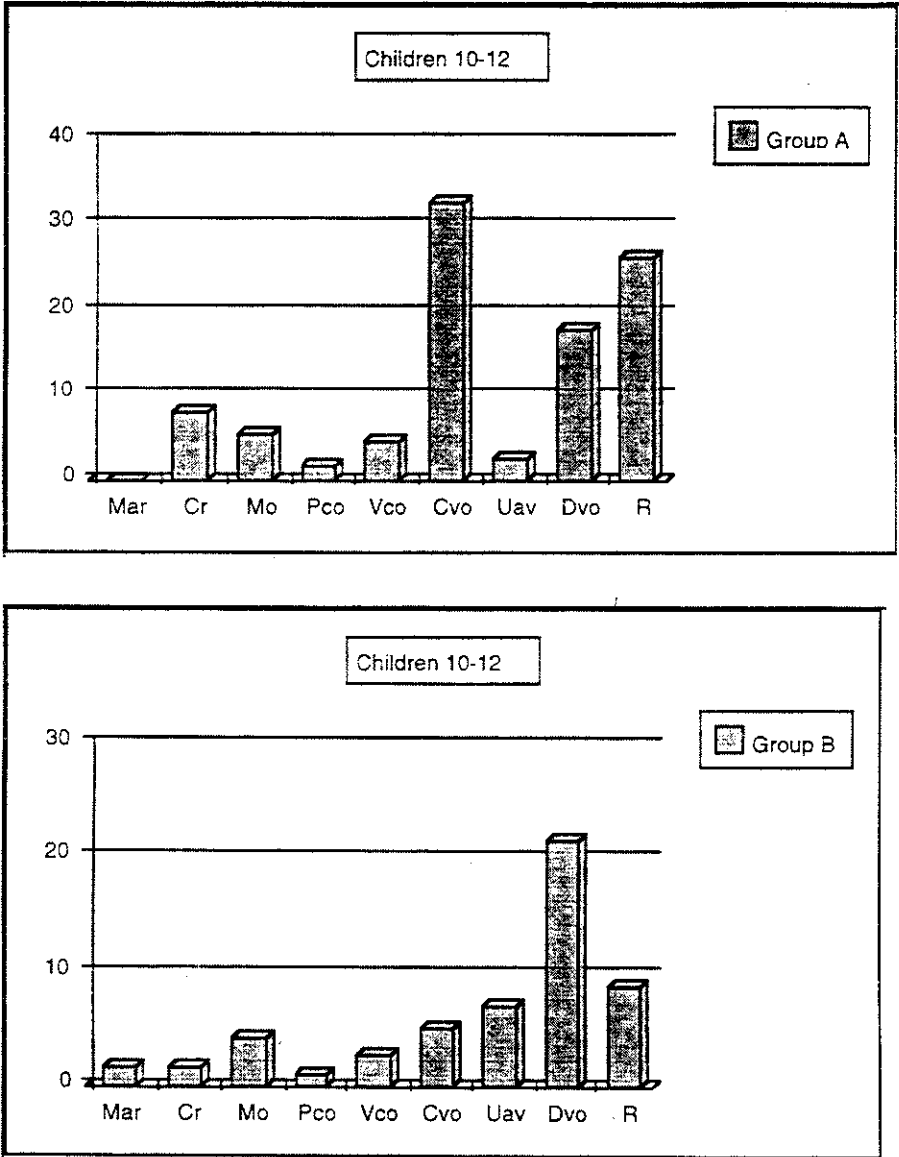


Figure 8. Vocal reflex responses, vocal respondent responses and vocal operant responses recording during mother-child interaction in the course of weekly samples along the fourth quarter of life.

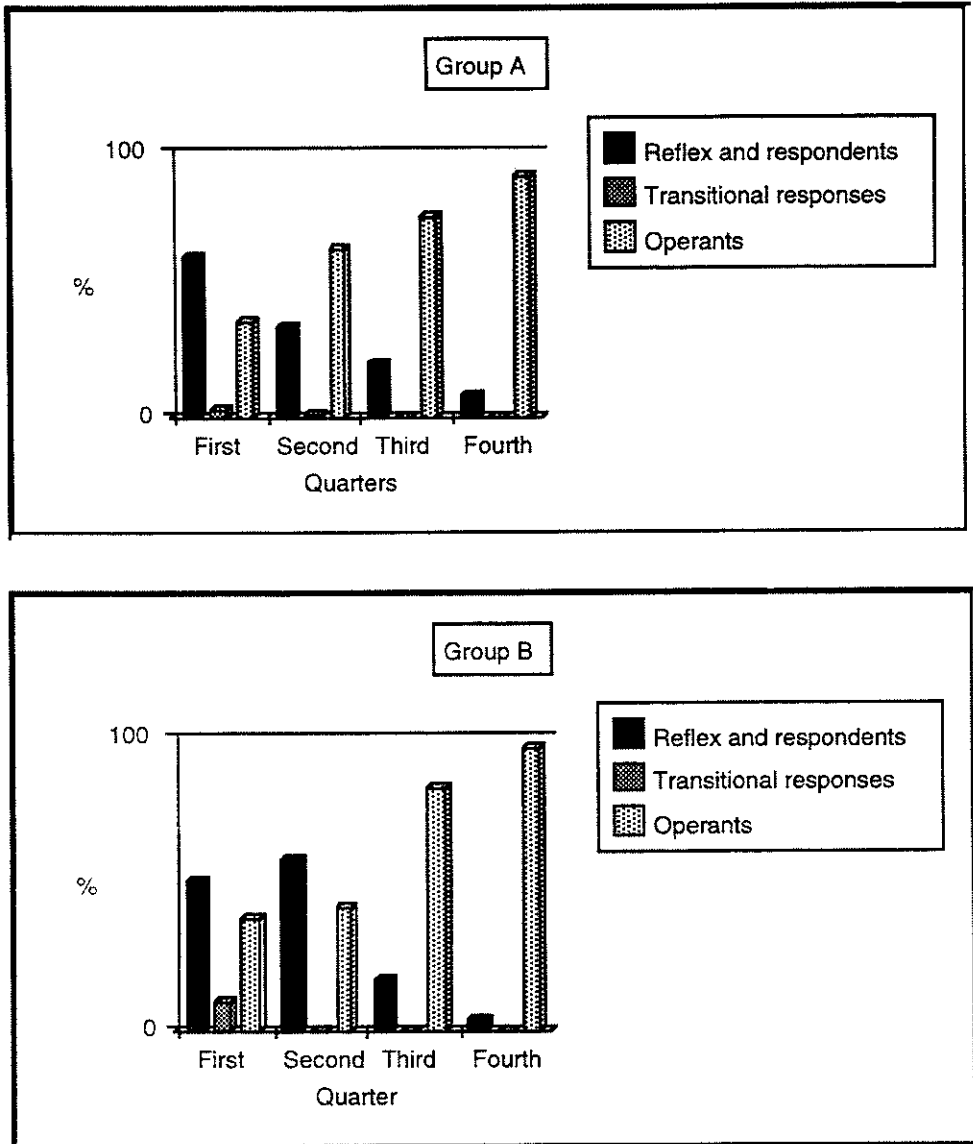


Figure 9. Development of reflex, respondents and operants during the first year of life. The group A shows an early extinction of some reflex reactions and a fast acquisition of verbal operants, meanwhile group B presents a more long permanence of reflex reactions and respondents.

## DISCUSSION

An interesting dimension of this work is the finding of two types of mothers and two different rates of language learning in children. Children of conative mothers exhibited slower language development and several other specific behavior characteristics. First, they seem to have more reflex and respondent responses during the initial quarters of life. Second, they emit more crying responses during the second quarter, while the proportion of reflex reactions and of respondents in children of phatic-referential mothers is lower. Third, children of conative mothers seem to more acutely seek physical contacts. Fourth, visual contact operants are exhibited by these children during the first and fourth quarters in greater proportion than in children who learn language faster. By the end of the first quarter and throughout the second quarter of life, when vocal behaviors that will end in the first words start appearing, Group B children tend to emit operant crying more frequently. Reflex crying is converted, then, to operant crying, leaving no place for other types of vocalizations linked to language production.

Mothers of children with a slower rate of language learning show three characteristics. Their verbal responses are mainly conative; they take an important portion of the dyad interaction, and they seem to show little flexibility in their behavior. As a result of the latter, they resort to ready made-responses, which we classified as ritualized phatic response. They try to shape their child's vocal behavior at an early stage, but when facing apparent failure, they extinguish this behavior and do not restart it until the second half of the first year of life. Their referential responses in the presence of their children also is very low.

In contrast, phatic referential mothers make references to their children at an early stage. Then, they decrease such references during the second quarter and again increase them during the second half of the first year of life, during which period, responses destined to shape the vocal behavior increase. In general, these mothers maintain sharing with their children and seem to better adjust to the changing demands of their children. Moreover, they constantly refer to the stare of their children and to the children's responses, as shown by their phatic-referential expressions.

We cannot determine from this observational study the critical factors for the differences between the groups. Is the predominant irritability in children of conative mothers, expressed by their crying responses which makes their mothers give a greater number of commands? Or is the apparent indifference of mothers, when having few physical contacts with their children that makes them cry more and emit more operants reinforced by physical contact? Gewirtz & Peláez-Nogueras (1992) have shown how the mothers'

behavior contributes to increasing infantile operant responses of this type. Based on their data, we could assume, in principle, that some components of the responses we have observed in our study result from maternal contingencies. In our case, it is possible for the mothers to establish programs of intermittent reinforcement, in which they sometimes attend to the child when she cries and at other times they ignore her.

In fact, the conative pattern seem to represent this type of attention to crying, because when facing such crying mothers tend to emit verbalizations aimed to suppressing the crying. However, the opposite relation, in which the child's behavior extinguishes more adequate responses from the mother, remains a possibility.

Concerning the phatic-referential mothers, one could ask whether it is their phatic behavior that diminishes the negative emotional expressions in their children or whether the children lead their mother to give more phatic responses when they present that type of motor agitation often labeled "joy." What is clear is that greater attention to vocal emissions in the conative proto-referential behavior to language during periods when the child can control its vocal articulating muscles facilitates learning the first words.

Some of the data concerning the relation between types of mothers and rate of language development coincide with other investigations identifying descriptive referential mothers, which correspond to what we describe here as referential or conative mothers (Dellacorte, Benedict, & Klein, 1983; Hampson & Nelson, 1993; Lieven, Pine, & Dresner, 1992). In these earlier investigations two dimensions have been proposed: A referential dimension associated with the designation of external stimuli and an emotional dimension which leads children to learn social formulas instead of making references. In an earlier paper (Martínez-Casas & Alcaraz, 1997) we characterized the functions of the first words based on the type of mother. Here we emphasize that, regardless of whether the words are referential or phatic, children learn to use language and other aspects of their own behavior as a means of assuring interactions with others.

We previously noted that language emerges from crying that has been turned into an operant by the mother's shaping of it (Alcaraz & Martínez-Casas, 1994, 1996). We also noted that verbal operants emerge from reflexive behavior through shaping. The change from respondent to operant occurs when tangible reinforcements, like food or cutaneous stimuli, are discontinued and the child's behavior is reinforced by stimuli such as a parent's look or verbal behavior. Children of conative mothers change more slowly from primary to vicarious reinforcements. Furthermore, the verbal behavior of such children is not adequately shaped because the mother reinforces crying or the expression of undifferentiated sounds like the ones composed of operants

(which we label attention-maintaining) but she does not reinforce approximations to vocal articulations that will allow the production of words of the adult language. This latter occurs later than it does with phatic referential mothers, which may be the reason why their children's language is delayed.

The effect of reinforcement on children's vocal behavior was originally demonstrated by Reinghold, Gewirtz, and Ross (1959). Subsequent studies have shown how shaping influences the acquisition processes (Kymissis & Poulson, 1990; Poulson & Kimissis, 1988; Poulson, Kymissis, Reeve, Andreatos, & Reeve, 1991). This also can be seen in our work with the appearance of conative protoreferential and referential language behavior, through which mothers shape, model, and reinforce vocal emissions of their children to convert them into words.

From our analysis of the mothers' language behavior and the children's vocal emissions into functional components, we have identified a process, prior to learning of the first words, which seems to abruptly emerge without precedents and as a result of vocal muscular maturity, that allows the shaping of language. The smallest analytical units we have used for suggestions about fine grain analytical strategy reveals how, in the course of mother-child interactions, different operant behaviors are established (see Gewirtz & Peláez-Nogueras, 1996a, 1996b). Such infant vocalizations can be established by contingent maternal vocal imitation and contingent maternal speech (Peláez-Nogueras, 1997). Some units facilitate language learning while others seem to retard emergence of the first words. The important issue is that the child not only learns vocal patterns, but also interactive behaviors which can be reinforced. To talk is then a special type of interaction in which the interlocutors' responses, through Pavlovian and operant processes, are converted to referential signs that favor the occurrence of social reinforcement.

The observational study we have conducted yielded useful results. Some of the variables we have suggested play a role in language acquisition mechanisms will require further experimental analysis to isolate controlling variables. This task is a future challenge for us. At this stage of our analysis, we have attempted only to describe the language learning process because it is largely unexamined as a unified whole. Such a failure to examine language acquisition as a unified whole is based on the false assumption that language is only a vocal behavior, when in reality we have shown it to be a complex interactive pattern comprising a number of functions.

## REFERENCES

- Alcaraz, V. M. (1979). El condicionamiento y el reflejo de orientación. In V. M. Alcaraz



- (Ed.), *El condicionamiento de los sistemas internos de respuesta* (pp. 21-43). México: Trillas.
- Alcaraz, V. M. (1980). *La función de síntesis del lenguaje*. México: Trillas.
- Alcaraz, V. M., & Martínez-Casas, R. (1994). Algunos elementos para la formulación de una teoría del lenguaje. *Revista Latina de Pensamiento y Lenguaje*, 2, 57-103.
- Alcaraz, V. M., & Martínez-Casas, R. (1996). Mecanismos del lenguaje. Un ejercicio de integración teórica y de registro del comportamiento verbal. *Acta comportamentalia*, 1, 23-57.
- Dellacorte, M., Benedict, H., & Klein, D. (1983). The relationship of pragmatic dimensions of mother's speech to the referential expressive distinction. *Journal of Child Language*, 10, 35-43.
- Gewirtz, J. L., & Peláez-Nogueras, M. (1992). Infants' separation difficulties and distress due to misplaced maternal contingencies. In T. Field, P. McCabe, & N. Schneiderman (Eds.), *Stress and coping in infancy and childhood* (pp. 19-46). Hillsdale, NJ: Erlbaum.
- Gewirtz, J. L., & Peláez-Nogueras, M. (1996a). In the context of gross environmental and organismic changes, learning provides the main basis for behavioral development. In S. W. Bijou & E. Ribes (Eds.), *New directions in behavior development* (pp. 15-34). Reno, NV: Context Press.
- Gewirtz, J. L., & Peláez-Nogueras, M. (1996b). El análisis conductual del desarrollo. In S. W. Bijou & E. Ribes (Eds.), *El desarrollo del comportamiento* (pp. 77-106). México: Universidad de Guadalajara Press.
- Hampson, J., & Nelson, K. (1993). The relation of maternal language to variation in rate and style of language acquisition. *Journal of Child Language*, 20, 313-342.
- Kymissis, E., & Poulson, C. L. (1990). The history of imitation in learning theory: The language acquisition process. *Journal of the Experimental Analysis of Behavior*, 54, 113-127.
- Jakobson, R. (1963). *Linguistique et poétique in Essais de linguistique générale*. Paris, Éditions de Minuit, 209-248.
- Lieven, E., Pine, J., & Dresner, H. (1992). Individual differences in early vocabulary development: Redefining the referential-expressive distinction. *Journal of Child Language*, 19, 287-310.
- Martínez-Casas, R., & Alcaraz, V. M. (1997). La fonología de las primeras palabras del Español de la ciudad de México: Una relectura a lo propuesto por Roman Jakobson. *Función*, 16.
- Pavlov, I. P. *Oeuvres choisies*. Moscú, Editions en langues étrangères, 2a. edición.
- Peláez-Nogueras, M. (1997). The role of maternal vocal imitation and motherese speech on infant vocalizations. In M. Cigales (Chair), *Behavior analysis of imitation*, symposium conducted at the annual meeting of the Association for Behavior Analysis, Chicago, IL.
- Poulson, C. L., & Kymissis, E. (1988). Generalized imitation in infants. *Journal of Experimental Child Psychology*, 46, 324-336.

- Poulson, C. L., Kymissis, E., Reeve, K. F., Andreatos, M., & Reeve, L. (1991). Generalized vocal imitation in infants. *Journal of Experimental Child Psychology, 51*, 267-279.
- Reinghold, H., Gewirtz, J. L., & Ross, H. W. (1959). Social conditioning of vocalization in the infant. *Journal of Comparative and Physiological Psychology, 52*, 68-73.
- Skinner, B. F. (1957). *Verbal behavior*. NY: Appleton Century Crofts.
- Skinner, B. F. (1937/1972). Two types of conditioned reflex: A reply to Konorski and Miller. *Cumulative Record* (pp. 489-497). NY: Appleton Century Crofts.