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ABSTRACT

A newborn child can identify impressions by means of the sense organs with the help of "non-visible" sensory impressions such as tactile and kinesthetic. A communication arises early between different modalities and muscle activities, which make possible an early synchronization, and identity between the infant and its surroundings. Studies indicate that the infant is entirely dominated by sensory impressions through reciprocal coordination and muscular process. For development to occur, the infant's effort must be directed toward separating and identifying differing impressions and activities. Other research suggests that newborns can identify and imitate the movement of points of light on moving models. Imitation has been demonstrated in children less than 1 hour old, suggesting to some researchers that imitation and intermodality are congenital abilities. Furthermore, imitation can come to be anticipatory, in that imitation begins before the model has begun to conduct its model action. In this phase, the infant learns to recognize the situation in which the imitated model is acting and to produce the imitated action without a preceding model. Imitation has an impact on the infant's communicative development. (Seven figures and two tables of data are included; 33 references are attached.) (SG)

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A Theoretical Approach to Imitation, Intermodality and Suggestion In the Child's Early Communicative Actions

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Carin Holmlund

Institute of Education
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Introduction

Communication is a characteristic vital to life which distinguishes different species whose chances of survival depend on the social care and solidarity to be found in society's primary and secondary groupings. The development of mankind, both as a species and a member of society, is to a greater degree than inthe case of any other species, the product of a system of communication adjusted to changing circumstances of life.

The new born child is for a considerable period of time helpless without this care. This helplessness is both a strength and a weakness. It provides the child with rich opportunities for contact as it appeals to social caring and solidarity within the social community. Emotional and material prerequisites for contact between the new born child and people in its surroundings are built into the biological characteristics which lay the responsibility for the survival and development of the child entirely on the shoulders of the child's caregiver.

Studies of early child-mother contact made during the 70's and 80's have, thanks to modern observation techniques (film and video) to a large extent contributed to the fact that our view of the early relationship between the child and those around it is now beginning to change. Social contact does not merely serve the biological needs of the child through physical care but it also serves mental needs which are quite fundamental to human development and which later research has shown to be necessary if communication and thinking are to be developed.

In contrast to earlier research on infants, mainly behaviouristic and cognitively oriented, this research tells of biologically anchored cognitions (preconcepts), which makes it possible for the "helpless" child to establish contact with those in its surroundings and from the very beginning to make use of the social contacts it is offered. The idea that the child might be equipped with a "consciousness" which in part orientates it(and in part orientates it) and in part establishes connections between motor and sensory organs had already been presented at the end of the 19th. century by one of

the pioneers of cognitivism, namely J.M. Baldwin. He stressed partly the importance of the child's orientation towards social contacts, partly the fundatmental importance of imitation for its development. Piaget (whose thought was influenced by Baldwin) and the strong influence of behaviouristic research during the 20th. century repressed the ideas presented by Baldwin and 19th. century thought, which meant instead that the view of the child as being mainly equipped with reflexes and "trial-and-error" strivings (behaviourism) dominated thinking. The view of the child as "egocentric" and non-social from its beginnings has through the influence of Piaget characterized developmental and research efforts.

Research about the early communication of the child assigns the social and communicative competence of the child to biological equipment anchored in its phylogenes. Trevarthen (1978) even writes about a "congenital talent for shared experience". A communicative pattern has been found to exist at an early age between the child and its surroundings. Specific expressions of movements, facial gestures of different kinds and speech, are interwoven with the child's own movements and emotions to form an early system of meaning. A connection between sensory and motor experiences provides according to Baldwin the prerequisite for "conscious directed sensory-motor suggestion".

The aim of this report is mainly to try, with the help of modern research, to describe the earliest characteristics of communication. The selection of material is limited to studies of the absolutely first phase in the child's life, the hours and days immediately after birth. A further limit is to be found in my theoretical approach. Communication is assumed to be a process in which different experiences are held in common with others, or shared (communicare = to share, to make together). Communication presupposes representation and imitation. Imitation and prerepresentational capacity are thus assumed to compose the foundation of both the origins and the development of communication.

With mainly experimental studies as my point of departure, I have wished in this report to describe the foundations of communication in the infant's early capacity for <u>biorythmicity</u>, <u>imitation</u>, <u>intermodality</u> and <u>suggestion</u>.

Chapter I

REGULATION OF ACTIONS DURING THE NEW BORN PERIOD

Biorhythmicity in the child's capacity for time sequencing

The relationship between mother (exchangeable with father or others close to the child) and child is characterized from the start by an attempt to organize the time sequences which are connected with the child's varying states of sleep and wakefulness. The waking period can during the first weeks be divided into periods of half-sleep or drowsiness, alert wakefulness, alert acitivity, awkwardness and crying.[1/] In order to examine whether the condition of the child in the wakeful period is changed by the position in which the mother holds the baby as well as by the direction this change takes, a doctor and a psychologist, Lois Sander and Patricia Chappell, studied 4 mother-child pairs during their stay at the maternity hospital for a period of 8 days. They found that the time in which the child is in an alert and lively state increased markedly during these 8 days from 44% of their waking hours on the second day up to 79% on the eighth. This increase of liveliness covaried with a proportional increase in the number of occasions when the mother holds the child close to herself (greatest proximity).

The researchers found that the increased liveliness during the child's first 8 days coincided with the increased frequency in which the mother holds the child in the greatest possible proximity and with the mother's increased verbal contact with the child (from 1% the first day up to 16% on the eight day).

The interesting question is then whether it is the child or the mother who controls and regulates this increased coordination. In order to find an answer to this question the researchers studied the relationship between changes in the child's condition and changes of position in the mother's way of holding the baby either upright, sitting or lying. A change of position was asumed to have occurred if the baby's position changed on two occasions with an interval of 15 seconds between the occasions. First they studied whether a change in the child's condition in itself could lead to the mother changing the child's position. They found that a change in the child's condition in itself does not lead to the mother changing the child's position.

On the question of whether the mother's changing of the child's position can lead to changes in the child's condition the opposite result was reached. It was shown that changes of position could provide evidence of immediate changes in the state of the child, if

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1/ Brazelton, T.B. (1973)

the child was not in a state of drowsiness, awkwardness and crying. The child's own ability to maintain a state of liveliness and activity, an "endogenic" condition, increases also during these eight days. The research team also wished to test whether the position changes made by the mother had an effect which could be seen to be desirable and suitable with regards to the biological rhythmicity between wakefulness and sleep. By constructing a hypothetical model of such rhythmicity one could determine the child's optimal condition during the different phases of the period. They found that the manipulations which could be seen to have an effect on the child's optimal condition amounted to 40.5% of the mother's total manipulations on the second day and increased to 71% at the end of the period.

To judge from the above results we can establish that the relationship between mother-child early has a *regulating effect mainly on the wakeful state of the child*. This effect is according to researchers the result of a "biorhythmic process" with co-operation between endogenic (inner) and erogenic (outer) factors. The child's relationship to his surroundings can thus be said to resemble a passenger who climbs on to a train, "entrainment". Biologically given characteristics co-operate here to form a *synchronised* activity with the outer world. This study shows that the inner control of permanency and sequencing which regulates the child's waking state strives towards synchronization with rhythmical patterns outside. Adjustment to periodical patterns in the outer world begins thus at the moment of birth. The child takes gradually into use other details in its vicinity, such as light-darkness, food schedule etc. as regulating indicators.1/

The basic characteristics of communication of sharing or having something in common can thus be discerned at the earliest stage of the mother-child relationship. Analysis with the help of the hypothetical model which shows the optimal condition provides an understanding that a reality shared by a mother and child has to do with the form or structure that the *directing* itself has. The co-ordination between the mother's way of holding the baby and the baby's experiences of its own condition are integrated into an organized wholeness as a communication content is formed against the background of shared and commonly accepted actions. The child learns in this connection to understand *intentional meanings* in the mother's actions, which even provide a basis for making their own.

The research referred to above shows that the child already when new born can co-ordinate or synchronize outer actions with its own experiences and activities. This is accomplished by a congenital "biorhythmicity" which implies the ability of organizing one's own activity according to a pattern of perception (entrainment). Why the child adapts his own movements to his mother's and what importance entrainment has for the child's development are interesting questions

1/ In Baldwin's (1894) terminology "fysical suggestion".

which researchers have not clearly answered. Kato et.al. (1983) have replicated a project conducted by Condon & Sander (cf. below). Their results were the opposite of Campbell & Sanders. They showed that the children even at an early stage can have a decisive influence over their mother's actions towards themselves. This is also confirmed by Bower (1985).

Interactional synchronization

The child's ability to synchronize is of decisive importance for the child's way of perceiving and interpreting the speech it hears. William Condon, psychiatrist at the Boston University Medical School has developed a technique of studying the micro-structure in the behaviour of mammals and specifically of human beings. By analyzing sound films with up to 94 pictures per second (24 and 48 pictures/ sec. have also been analyzed) he has been able to study how different movements covary with each other when two people talk to each other.

During the tempo-like and intonation-like sequences which the speaker utters, there is a parallel and accompanying movement pattern. This is the case both when the person in question is the speaker (so-called "self-synchronization") and when the speaker is another person (so-called "interactional synchronization"). These movements are so imperceptible that they can only be studied with the help of microanalysis.

Micro movements occur in so-called units, in bunches of small movements. The analysis of three words in the sentence "I was gonna ask you, why do you... um... have difficulty *keeping* your late appointments?" (Condon 1979) shows that onthe immediate annunciation of the word /kkkiiipppiinn/ the following movements are made: During the first time unit (48 pictures per sec.) the head is moved to the right and then bent down towards the left; the left elbow and the wrist are turned in a movement. When the first /i/ is pronounced the head is turned to the right and then bends down to the left; the right elbow and the wrist are movable, right fingers 1, 2, 3, 4 are pointed forward. At the first /p/ the head is turned to the right then down to the left. The right elbow is movable, the mouth is drawn together and closed. On the last /p/ the head is bent down, the right elbow and wrist are movable and the mouth is opened... At the first /n/ the head is bent down and turned to the right; the right elbow is still, fingers 1, 2, 3, 4 and the thumb are streched out and the mouth is opened.

This example is an analysis of what Condon calls "self-synchronization". Condon has also showed that a listener follows the speech of another person with nearly as great precision in tempo and changes as in his own speech ("interactional synchronization").

Condon's studies, later confirmed by Kendon (1972), Hall /1976) and Kato et.al. (1983) also include infant studies. The organized pattern of movements which accompanies the speech of adults appears to be not unimportant part of human equipment. According to Condon & Sander (1979) we can talk about a "precognitive entrainment phase" which builds the foundation of human auditory perception and articulation. Such an "entrainment" or "synchronization phase" could be studied in the infant studies which Condon and Sander engaged in together. Sixteen 1-4 day old babies were filmed in their cribs while a male and a female person talked to them. A nurse from Thailand talked to them on one occasion in her own language. To eliminate visual synchronization the child was also allowed to listen to an audiotape with adult speech in its own mother tongue as well as in Chinese.

The results show that infants synchronize their movements in relation to the adult's speech nearly as perfectly as the adult speaker does. The child's movements are parallel and change when spontaneous sound variations occur. The only perceptible difference between the infant's and the adult's bodily movements concerns the grade of stylization, i.e. the number of firm connections between certain bodily movements. The adult has in contrast to the child a firmer structure in the relationships between different movements. The adult's movements often follow each other in certain fixed sequences, as *units*. The child's synchronisation is on the other hand flexible in its mutual and sequential relationships, but nevertheless it shows a high degree of organization in relation to the rhythm and accentuation of speech.

Condon has found that a new born baby is able a mere 20 minutes after birth to organize its movements in a tempo an rhythm which synchronizes with the speech in its vicinity. There are therefore grounds for supposing that the child possesses this ability as early as in the foetal stage, the child's ear being adapted to receive sound in the last foetal stage. Studies show that sound penetrates the wall of the womb so that the child can perceive both speech and music. The synchronization of the child in the womb has however not as yet been filmed. On the other hand two American researchers have been able to show effects on new born babies of pregnant mothers reading aloud from a rhymed children's book. Sixteen mothers read for a total of 5 hours from the same children's book. The day after its birth the child listened to the story read by its mother through headphones as well as to another story. To test whether the child preferred to listen to one of the two stories, the child was allowed to suck. By its way of sucking, quickly-slowly, or with long-short sucks, the child could itself manipulate so that it got the story it wanted to hear.[1/]

[1/] Hwang & Schaller (1985)

The result was that the children preferred to listen to the story they had heard while in the womb. Thus we can see that the child is well-equipped when it takes its place in the social community. The child's ability to "climb onto" a structured pattern of sound with the help of body movements, bears witness to an early integration of the speech in its surroundings. How important this early synchronization phase is and how long it exists are questions to which we can as yet only guess the answers. The first three month period seems to be of basic worth for so-called "entrainment" of the rhythmical patterns of language. What happens if the child does not "entrain" and "synchronize"? Causes can be e.g. a lack of communicative stimulus due to congenital damage to hearing or a lack of verbal and emotional contact with the child by those in its surroundings.

In order to understand how entrainment and synchronization are possible it is feasible to connect to what Baldwin (1895) names "senso-motor suggestion" (cf. figure on page 21).

The direct connection between sound sensations and one's own motor acitivity which "entrainment" gives rise to, provides a basis for the relationship between the perceptual activity and communication, of which the production of speech is a part.

Sander's and Condon's research shows a very early network of interactions between mother and child which follows an organized pattern, basically biorhythmically regulated. In this organized system significant messages can be developed and integrated in the child.

Very little is to date known about how the child integrates movements and develops their importance. In all probability it occurs, as I have found in my studies of early imitation by my daugther (Holmlund, during production), in three different phases, through: *imitation*, *anticipation*[1], *manipulation*[2].

A neurological model of explanation

The absolute first activities of the child seem to be built up of a complicated network of connections between sensory and motor organs. Through later findings in biology, which have to do with our "internal communication system" it is made clear what a developed structure the "neuronic circuit" has.[3] Research with revolutionary results has been made with the aid of electronic microscopes and this has made possible the discovery of synaptical organization which no-one earlier believed to be possible.

It has been found that information between the nerve cells does not only pass through the long leading axons but also through a "dendrodendritic system" inside of what is called the "local circuits".

1/ Anticipation means here "an anticipatory imitative action".

2/ Manipulation means "an action controlled by the child's own needs and creativity"

3/ In Schmitt, et.al.(1976)

Information occurs here directly via electronic impulses *between the dendrites* and causes a synchronization in the "discharge" of neurons which are coupled together. A signal which is received by the Central Nervous System can thus not only result in a so-called "through circuit" (figure 1), but creates a number of connections in the "local circuit" (see figure 2).

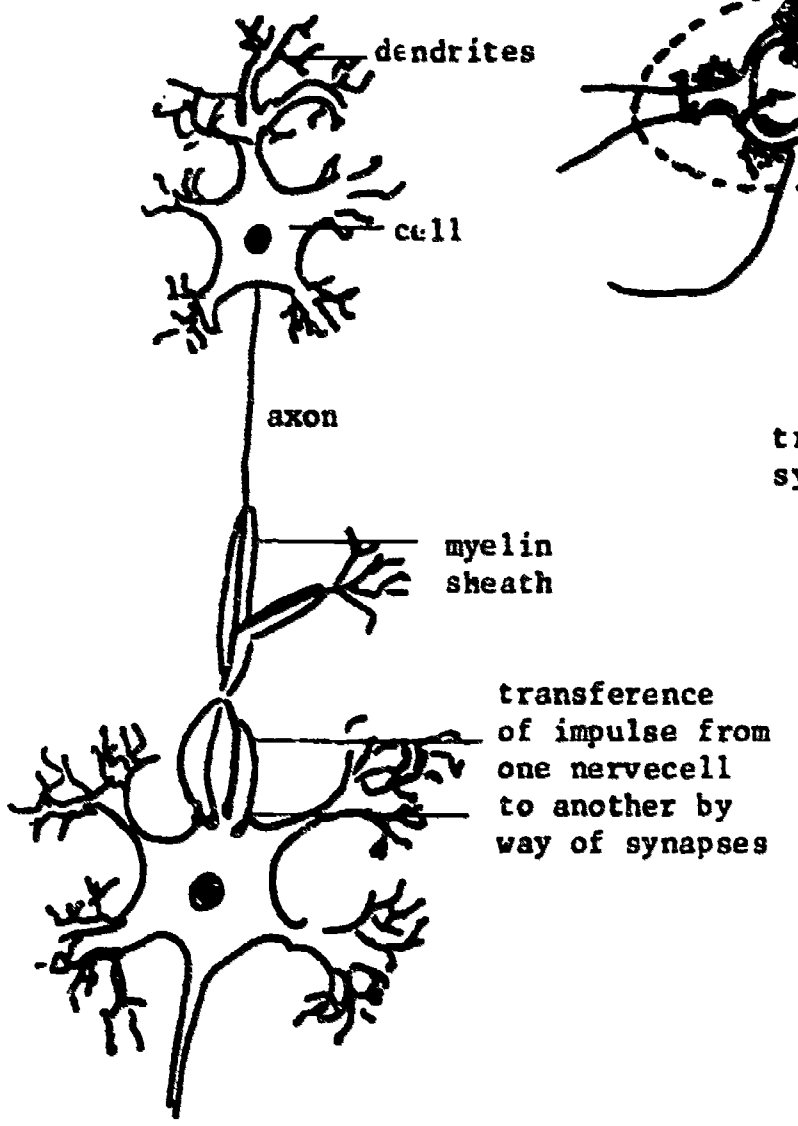


Figure 1.
"Through circuit"
The short outgrowths of the cells, the dendrites, receive information from other nerve cells. This is later conducted further by the long outgrowth, the axon.

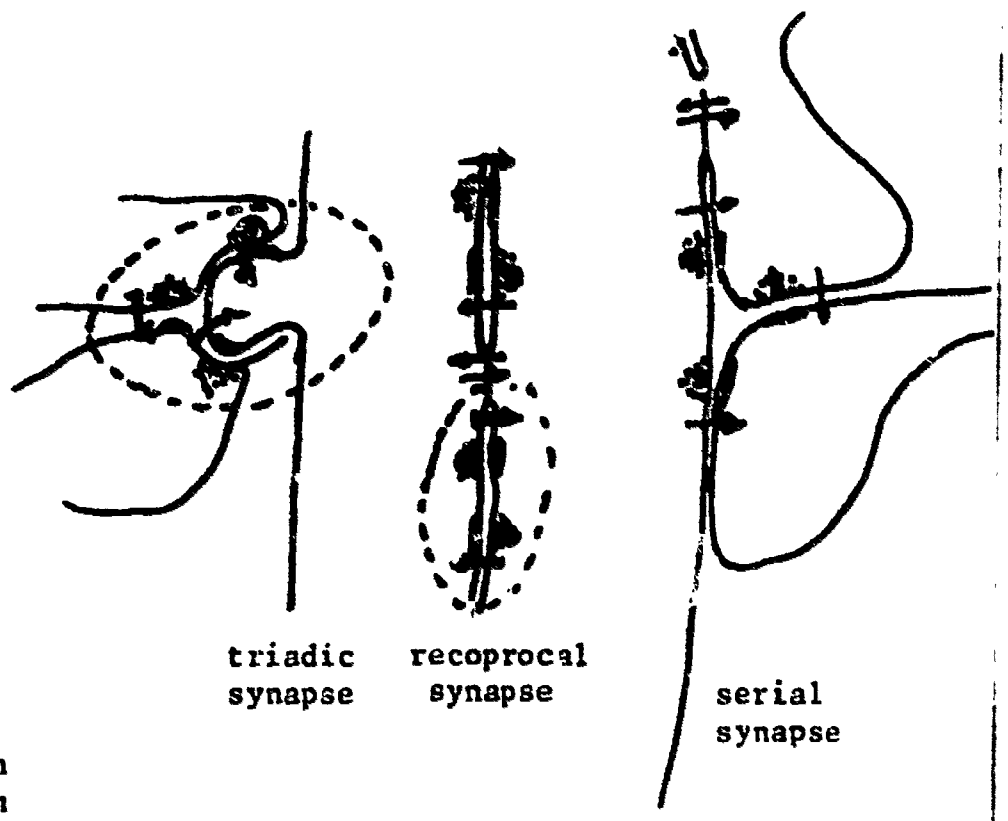


Figure 2. "Local circuit"
The figure illustrates different forms of connections between dendrites. Signals are related partly in triadic, recirprocal and serial synapses, but can also be conducted further by many other connections (dendro-dendritic interaction)

We may interpret these later discoveries of so-called "local circuits" as part of neurological explanation of what Condon and Sander have described as "entrainment". When impulses or information from e.g. the auditory nerve reach the Central Nervous System, information is conducted further via the short dendrites to other new ones which transplant the original information in other nerve paths. Sounds from speech or from other sources give impulses not only to the auditory nerve but also to the motor nerve system, which controls all the body's movements. The rhythmical flow in speech, the speed and intensity of speech, is thus registered and stored for the individual's absolutely first and periphery communication. Even without the very slow tempo demanded by the analysis (1/48 sec.) it is possible to observe rhythmical movements, specially in the movements of the arm (Holmlund, in production). It is apparent in Condon's work that even very small movements in other organs: head, legs, mouth, eyes, fingers etc. covary with speech. These patterns of movement build what Condon calls *Linguistic segmental units*.

A model for the common origins of speech perception and speech production

The studies of Condon and Sander provide strong reasons for presupposing that the child's tendency to give motor expression to it's perception of surrounding speech builds the common ground on which the child both perceives speech sequences and articulates. Held and Freedman (1983) and Hayek (1962)[1/] have noted the correspondence between auditive and auticulatory modalities. Hayek discusses the question of how a person identifies another individual's gesture and points towards the fact that we compare different movements we make ourselves in order to identify other people's movements which we perceive with other senses. Stevens and House (1972) have constructed a speech perception model in which they describe the close relationship which exists between the processes of speech production and speech perception. Although they do not say that the behaviour-related connection has a common origin, the model is built on the fact that there are components of these processes which have a common origin.

[1/] Referred to in Condon & Sander (1978).

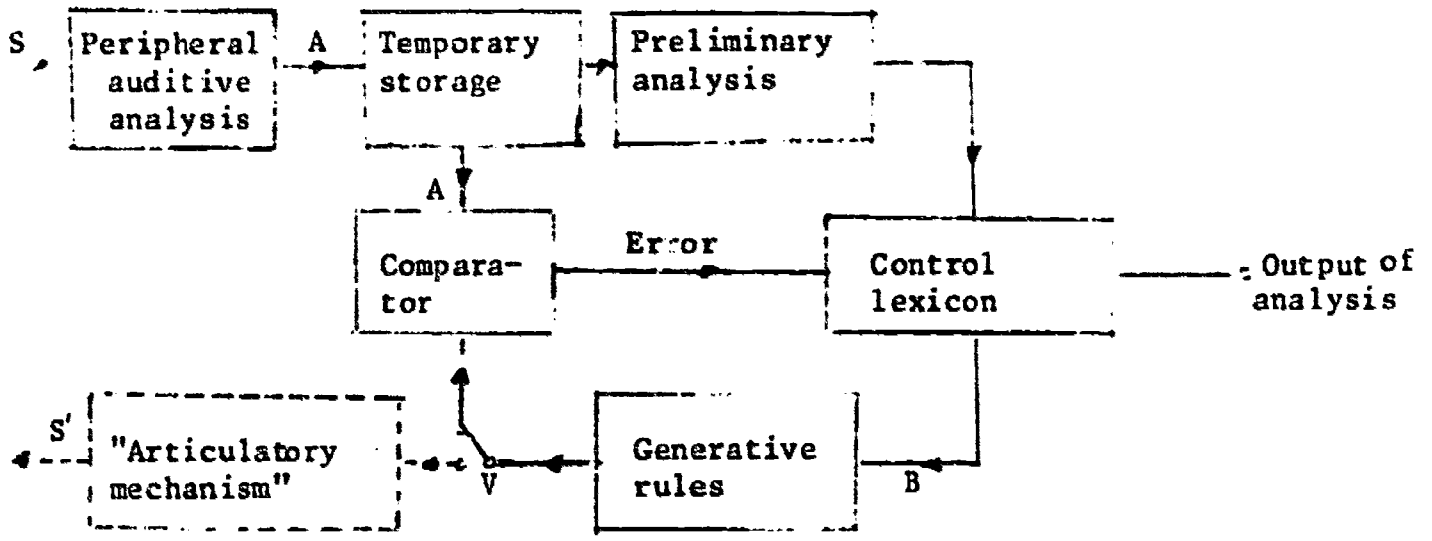


Figure 3. Model for processes of speech perception and speech production (Stevens and House, 1972).

The signal is received by the ear and conducted to the Central Nervous System (A) where it is temporarily stored and goes through a *preliminary analysis, with respect to phonetical aspects. The control component* is that which directs the operations in the system. It has access to 1) the result of the preliminary analysis, 2) the result of the analysis of previous parts of the utterances, including lexical items and their syntactic and semantic aspects, 3) lexicon and 4) comparator's result (see discussion below).

On the basis of this type of information the control component makes a hypothesis concerning the speaker's representation in terms of morpheme strings, which in their turn can be represented in terms of phonetical segments and characterizations.

These segments and characterizations are abstract in the sense that they lie behind both the production and perception of speech and are not necessarily identified directly or only either with acoustic attributes of the signal or articulatory gestures which are used to generate the signal.

The hypothetical representation in terms of morphemes, segments and characteristics (B) form the input which is then the starting point for a collection of *generative rules*. The generative rules operate on the abstract matrix of different features (B) and result in a representation (V) of instructions on the articulation mechanism necessary to bring this sequence of segments and characteristics

to the fore. The calculated patterns (V) are compared (in the comparator) to the attribute A of the analyzed signal which is temporarily stored and after that an indication of the degree of the comparator's matching[1/] is communicated to the control component. The result of the comparison either confirms that the hypothetical sequence (B) is correct, or further conducts, by way of errors which are discovered through the comparator, information to the control component which will make an addition or change the hypothesis.

The comparator has the function of comparing auditive patterns (A) to articulatory instructions (V) which give rise to these types of auditive patterns. The degree of agreement between these must be decided. It is however assumed that in this model there is a catalogue of relations between patterns which make up the result of the peripheral auditive system and descriptions of the articulatory gestures which give rise to these patterns. These articulatory gestures can have several components including *tactile and kinetic sensations as well as motor order, it is possible that all these components together form the description of an articulatory gesture. Items in this catalogue probably represent gestures of approximate syllabic length - of the same length as the segment which can be assumed to form a unit for peripheral analysis 1965*
(Ibid. page 53, own italics.)

Stevens and House, on the basis of their own studies, make the assumption that a catalogue of relationships are built up at a very early age. Condon and Sander's microanalyses have shown that even when new born the child can be seen to be "catalogizing" its sensory impressions (in this case via hearing) with the help of its movement schedule. Stevens and House presuppose that the child's articulatory patterns form the basis of the perceptive auditive process. The Piaget inspired constructivistic model, which Stevens and House present (cf. criticism of Piaget on pages 17 and 22), does not take into account the matching, which the baby performs even when new born, between its own movements and auditive perception. The imitative character in a rhythmical movement pattern bears witness to the fact that auditive perception, regulated by consciousness, is of defintive motivational importance for the development of movements. These results are in contrast to Piaget's assumption that the child's activity is a mainly assimilative enterprise. The importance of perception and motivation is plainly apparent in research about early imitation and representation which is presented in the following section.

[1/] (Cf. discussion on intermodality on page 10)

Chapter II

STUDIES OF IMITATION DURING THE NEW BORN PERIOD

Ability for complex discrimination and interpersonality as a characteristic of early imitation

The argument presented in the previous section led to the idea that the child has a congenital ability to co-ordinate its movements with auditive impressions (interactional synchronization and self synchronization see page 3), which neurologically can be derived in the dendro-dendritic system's "local circuit". We can thus presume that the child early in life transfers impressions from the outside world to equivalent experiences within itself. These comparisons are a kind of matching between that the child *hears*, regardless of whether the auditive signals come from the child itself or from someone else, and movements it *feels itself perform (kinetic experiences)*.

It is a connection of this kind which Baldwin calls "dynamogenes" (cf. page 21). Meltzoff (1982) has shown that there is also such an automatic connection between visual impressions and kinetic experiences. The matching which the child performs between what it *sees* and what it *feels* is *imitative* in nature.

Maratos (1973) has shown in a study how three month old children imitate adults who stick their tongues out. Meltzoff & Moore (1977) demonstrated in their study with the help of video that babies imitate mouth movements and sticking out of the tongue in a model. The imitation is at the first attempt approximative but it becomes more and more accurate the longer it persists.

Piaget who also noted this early imitation (Piaget 1962), maintains that it is spontaneous and that there are no signs of the child attempting to try to correct its movements in order to reach greater accuracy. Meltzoffs et.al. have however as a result of superior methods of observation been able to contradict these assumptions of Piaget and thus they have formed the basis of a new view of the early relationships between the child and those around it. The child's active imitation of facial expressions is according to Trevarthen (1979) a sign of the child's congenital ability of "shared experiences".

Although Baldwin rejects the idea that the child wilfully imitates and that it makes efforts to correct its actions towards accuracy, the concepts "personality suggestion" and "interpersonal relationship" and "synchronization" can be interpreted as different expressions of one and the same phenomenon, namely the child's striving towards an identity with the surrounding world through the movement schedule

and emotionality. This striving towards identity is dictated by the child's desire to find agreement between what the child sees, hears and feels and its experience of movement. When the child experiences parallelism between what it hears, sees and feels and its own movements it wants simply to repeat the movement which then is experienced as a contact medium between the child and its surroundings. I should wish to maintain that it is in the child's early imitative movements that the first communicative contact is taken with its surroundings. Field,et.a. (1982) has in a study of 72 new born babies (medium age was 36 hours), given us further support for a congenital systematic imitative capacity. Every child took part in several trials, in which the "model" either had a "happy face", a "surprised face" or an "unhappy face". The result of the judgments made by an observer who could only see the child's face and not the model's, shows significant differences with regard to the child's fixation of movements in mouth, eyes, eyebrows and parts of the model's face, which were the same as the different movements which could be noted in the model's face during the three different facial expressions.

A Significantly greater proportion of children opened both their eyes and mouths widely during the trial when they were confronted by the "surprized face", whereas raising of the corners of mouths was proportionally more usual when they say a "happy face". Frown eyebrows were significantly more usual when the model had an "unhappy face" (see figure 4).

Fig. 4

Sample photograps of a model's happy(a), sad(b) and surprised (c) expressions and an infant's corresponding expressions. (Field m fl 1982)

Fig 5. Sample photographs from videotape recordings of 2-to 3-week-old infants imiatating(a) tongue protrusion, (b) mouth opening, and lip protrusion demonstrated by an adult experimenter.

A similar study was made by Meltzoff & Moore (1979). It shows partly the child's imitation of mouth movements and protruding tongue (figure 5) and partly the child's corrective attempts to imitate tongue protrusion. Other studies (Burd & Milewski, 1981 and Dunkeld, 1978) have duplicated Meltzoff & Moore's results and also reported on early imitation of non-oral actions.

Taken together these studies give the impression that the imitative orientation of the new born is centred on expressions which reveal fundamental emotional attitudes of the other person. The child's "helplessness" as a baby motivates us to presume that the possibility of being able to discriminate and express fundamental emotions is of decisive importance. By way of this the child partly learns to understand what will happen to it, i.e. to anticipate or forestall reality, partly the imitated expressions create responses in the surroundings which give the child verbal, tactile, and emotional stimulation.

Ability for early identification experience

Bower (1985) who for two decades studied the phenomenon of imitation in babies conducted with Kujawski (1985) a study of babies' perception of sex. Lewis & Brooks (1974) were able to show that babies can do what adults cannot, namely they can determine the sex of other babies. Baby boys were seen to look more at baby boys than at baby girls and vice versa. Bower and Kujawski wanted to see if that was the case even when movements of babies which were filmed were substituted by points of light every time they were put together. Babies were thus not allowed to see the filmed babies, a boy and a girl, but only the points of light which abstractly reproduced the children's movements. Nonetheless, however, it was shown that both baby boys and baby girls looked significantly more often at children of the same sex. The average number of seconds which the babies looked at the boy and the girl respectively was 5.59 for the same sex and 2.23 for the opposite sex. Points of light were also used in order abstractly to reproduce facial movements on film. Two-week old babies were presented with a pattern of 15 points of light in a sequence of 90 seconds immobile face, 30 seconds mobile face, 60 seconds immobile face, 30 seconds mobile face, 60 seconds immobile face, 30 seconds immobile face and 60 seconds mobile face. Three gestures were presented; wide open mouth, projecting mouth and wide open eyes. During the 30 seconds mobile presentation the model made 5 different gestures. The baby's face was recorded on video and was later assessed by two different judges. The result shows that the baby during the test period, i.e. during the following 60 seconds strikingly increased its activity frequency of similar sorts of activities which it could at that very moment have seen the model engaging in (cf. basic frequency with test frequency, where basic frequency stands for spontaneous activity of

current gestures without a model and test frequency stands for activity of currents gestures in the presence of a model).

Table 1. Gesture frequency compared to light point model.

	Average Frequency	
Gesture	Base period	Test period
Wide open mouth	1.66	5.33
Projecting mouth	0.66	4.0
Wide open eyes	2.66	6.0

(Bower, 1985)

Imitation as a congenital, non-reflexive activity

In a more extensive study conducted as a doctoral thesis by John Kugiumutzakis (Kugiumutzakis, 1985), 170 children were studied during the first hour after birth (the children having an average age of 27 minutes). In four sub-studies empirical support is presented for the baby's congenital imitative ability. With the help of video new born babies were filmed when confronted by a model, which at 20 cm. distance from the child made three facial movements (mouth opening = MO, tongue protrusion = TP and blinking = EM). The children could also hear their models make three different vocalizations (M-, A- and Ang-sound). Among the children studied there were also babies delivered by Caesarean section (11 children) and premature babies (12 children). The study was made in a private maternity hospital on the island of Crete. The conditions for the study were adapted to the child (no distractive sound, a temperate temperature, and regulated light in relation to the needs of the child).

The imitation model was presented 5 times in succession with a so-called response interval of 10 seconds between each presentation. The next imitation model followed immediately afterwards or as soon as the new born baby lay completely still without moving and without making any sound.

All studies were compared to the so-called base response (BR) which was the value of the number of expressions in which the children spontaneously made the movements in question without a model, and the result with the model (P/R/M). The result of the four studies is apparent in the table below.

Table 2. Comparison of BRs and p(R/M)s during the experimental conditions for each response and each study.

Responses	Study	BR	p(R/M)	t	p
Tongue Protrusion	I	.38	.63	-3.57	.0005
	II	.30	.67	-1.88	.05
	III	.33	.71	-2.02	.05
	IV	.28	.53	-2.36	.025
	I	.37	.61	-3.43	.0005
	II	.33	.69	-1.818	.05
	III	.29	.66	-1.96	.05
	IV	.24	.53	-2.81	.005
Eye Movement	IV	.21	.48	-2.67	.01
Sound M	IV	.26	.27	- .11	NS
Sound A	IV	.41	.60	-1.91	.05
Sound ANG	IV	.25	.26	- .11	NS

Assessment was made by three observers independently of each other (judge reliability was 1.0 in all the studies). Intrajudge reliability was .888 - .96, .97 - .98 and .87 - .91. The majority of all the babies (79%) imitated after the 5th. presentation alone, some after the second, third and fourth.

The results (cf. the table) demonstrate that imitative responses, although present in the new born baby's spontaneous actions, are made to a significantly greater extent when the model is present than when it is absent in a comparison between BR and p(R/M).

The premature babies were shown to be as imitative as normal babies and babies delivered by Caesarean section. An important difference could however be observed between the two last named groups and the premature babies. The premature children required longer time for orientation in their perception of the model. This difference depends in all probability on the fact that the ability to co-ordinate had not yet reached the same degree of speed as in the case of the fully-developed children.

Chapter III

STUDIES OF INTERMODALITY DURING THE NEW BORN PERIOD

Transference of information between different sense modalities

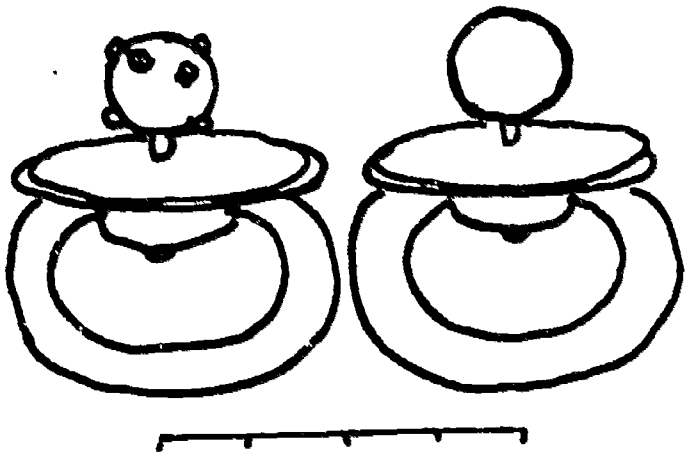
Meltzoff (1982) calls the activity, through which the child "recognizes" an object or an activity by the movements it perceives through the muscle activity in different organs, "intermodality". In order for a little child to be able to perform imitating movements, the child must match the movements he *sees*, to identical movements of his own. The child can when it sees either the mouth opening, the tongue being stuck out, the eyes widening etc., identify these movements as movements of its own in exactly the same organs.

Piaget (1952), studied the child's imitation during the first two years. The ability to be able to identify and imitate a movement, e.g. a mouth movement of another person, i.e. a movement not visible on the child's own body, he found in his own children first at the age of approximately 12 months. Only when it had first made spontaneous and then systematic reproductions of its own actions, could the child, according to Piaget, first spontaneously and later systematecally imitate different models ("intermodal" actions). Later research points to the fact that development is the opposite, that the child's ability of "intermodality" occurs ontogenetically earlier than the ability of "intramodality".

Meltzoff & Borton (1979) studied 32 babies with an average age of 29.4 days, with the intention of penetrating the child's ability to "recognize" objects etc. on the basis of its earlier experiences which are not "visible" to the child.

The children were allowed to suck a dummy for 90 seconds. The dummy had in certain cases small knobs on it and in other cases was quite smooth (figure 6). This phase was judged to be "familiarization". After this phase the dummies were taken away, without the children having the opportunity to see them. Both the dummies were then shown to each child, and during this time the child's eye fixations were registrered.

Figure 6.



Of the 32 children who were tested 24 showed a clear preference for the object they had come into tactile contact with during the familiarization phase. They looked significantly ($p<.01$) longer at the form which matched the tactile object than at the non-matching form. The average value of the total time which was directed towards the matching form was 71.8% (50% is the chance level). Several control measures had been taken to counteract the influence of other factors on the result (such as sex, the placing of the dummies and their sequence as well as the influence of the judges). The experiment was replicated by another team of researchers, who were also able to find significant differences in the preferences of 22 of the children above the chance level. This can indicate that a matching between the two modalities as well as a transfer of information between the two has occurred.

Chapter IV

IMITATION AS THE FOUNDATION OF COMMUNICATION

Imitation in phylogenesis

Baldwin's thinking in "Mental Development in the child and the race" (1895), has become most known through Piaget's application of Baldwin's theory of "circle relations" in his own intelligence theory. Baldwin's theoretical attempt is biological in that he tries to describe the adaption process through a phylogenetic perspective.

He describes the adaption development generally as an "imitation process", by which he means the organism's *effort to reinstate pleasant stimuli and the opposite to avoid unpleasant stimuli*. What are experienced as pleasant stimuli and what are experienced as unpleasant is mediated by the congenital representation (in a general sense) which is built into every species and serves the survival possibilities of the species. Baldwin has called this the species' so-called "hedonistic consciousness". The plant which orientates itself towards a place which is either protected from too much sun or spreads itself out in a sunny position has a preprogrammed orientation consciousness which, dependent on the plant's development and survival needs, regulates the plant's movements in relation to the stimuli in its surroundings which have a definitive influence over its survival and development. The movements which give the plant the best conditions, in a given situation, i.e. shade or sunlight, are reproduced whereas the movements which provide the plant with unfavourable conditions are avoided. A unique example of the strength of these survival mechanisms is the potato plant, which in extremely unfavourable conditions reproduces its genetical capacity in a large number of seeds. When the plant is covered with hard earth or asphalt it bursts through the covering barrier and grows up with seeds which on being planted guarantee the survival of the species. Every seed contains here the material for a new kind of potato...

Imitation in ontogenesis - "senso-motor suggestion"

Baldwin describes human development as a process which in the same way as in all organic phenomena is characterized by imitation. Whereas the imitation of plants and animals is most often on the instinctual level (e.g. the building of beavers) or of a reflex nature (as in the imitating bird) imitation in the case of man is characterized by "suggestion" (as in the little child) and by will-directed imitation (as in developed man). Common for all levels of imitation is, according to Baldwin, the fact that there is "some

kind of constructive idea, a 'copy' in a more or less conscious clarity, which gives rise to action". We should be able to interpret this to mean that in every species there is a "representation" of pleasant, desirable and in contrast unpleasant stimuli. The individual's actions are thus controlled by an *intention towards imitation*. The little child is controlled by its "hedonistic consciousness" to the orientation and imitation of in the first case social stimuli. Trevarthen (1978; 1985) and Kugiumutzakis (1985), (cf. page 15) have actualized the question of the child's early consciousness. Trevarthen talks about an innate ability to "share the social reality". Kugiumutzakis is of the opinion that the identification of the correspondence between movements in the surroundings and its own movements are mediated by a so-called "memory engram" which is a congenital representation of the desirable.

Suggestion is described as "from the side of consciousness... the tendency of a sensory or idea state to be followed by a motor state" (Baldwin 1895,p.105). Baldwin's most interesting observations with regard to his own children have to do with what he calls "personality suggestion".

> At first it is note the face alone but the personality the presence, to which the child reponds: and of more special suggestion, the voice is first effectual, then touch (as in sleep above) and the sight. Such suggestions are among the most important of infancy, serving as important elements of growth of the consciousness of self and of external reality.
>
> (Baldwin 1891, page 115)

The relationship between the consciously controlled sensory experiences and motor acitivities connected to these is illustrated by the so-called "motor square". Senso-motor suggestion is illustrated by the following figure.

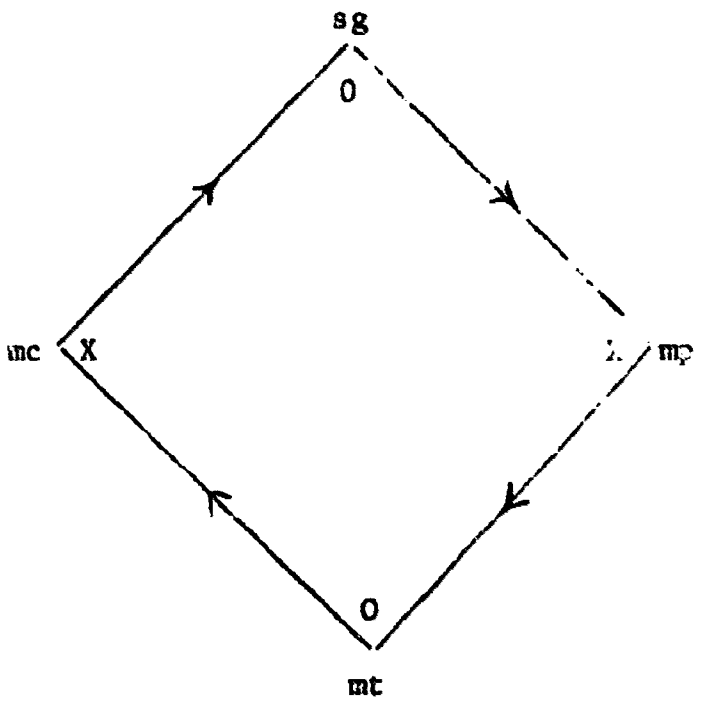


Figure 7. Senso-motor suggestion

Let sg = suggestion (sensory process); mp = seat of motor process; mt = movement of muscle; mc = consciousness of movement (kinaesthetic process).

The sides of the square are connections between the seats of these processes... The stimulans (sg), in which crosses at the corner indicate nervous processes only and circles indicate vague states of consciousness starts the motor process (mp) leads to movement (mt) which is reported to consciousness (mc).

(Baldwin 1894, page 114)

The relationship between the sensory and the motor process is regulated partly by the so-called "dynamogenetic process" i.e. an immediate link between sensory and motor process established in the human phylogenesis, partly the tendency to as a result of a so-called "heightened nervous energy"[1/] reproduce the pleasant stimuli. (A more detailed presentation of Baldwin's imitation theory can be found in Holmlund 1986).

Discussion

The child's actions are according to Baldwin conscious controlled. The actions are mediated by an inner consciousness about what is pleasant etc. They are directed outwards with the aim of joining

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[1/] The concept has been developed on the basis of Spencer's (Princip. of Psychology) and Bain's (Emotion and Will, 1888) theories, whose ideas of reinforcement of chance actions in the child's early development (association theory) are however criticized.

together or reaching the *outer* stimuli which the child on an *inner* level recognizes within itself; on the inner level a form of "projection" and on the outer level "imitation". The child's understanding of the world surrounding it becomes therefore a kind of "projects" in which the child interprets its own conceptions into its perception of the world.

In the child's consciousness the conscious controlled sensory experiences (in figure 7 (sg)) become thus identified with the child's experiences of its own movements which become conscious through the kinaesthetic processes (mc). In contrast to Piaget and the constructivistic view based on his work, the innate consciousness plays, according to Baldwin, an important role in specifically directing the child towards social activity as early as during the first months. In Baldwin's theory the child's actions become suggestions as a result of acitivity in the child's proximity. This activity is accomodating.

According to Piaget the child's early actions are the result of a desire to reproduce its own actions (reproductive assimilation). The difference in view is mainly the conception of the child's early ability for "co-activity" in social processes. Baldwin's view prepares the ground for the idea that the child's actions are intermentally related. Piaget's point of departure is the congenital reflex activity of the child, in which the conscious aspect in the circle reaction has been entirely peeled away. Piaget maintains that the child does not place greater emphasis on its social world during the first months than it does on the physical objects around it (Piaget 1947), as the child lacks the ability for a systematic imitation of actions which are not visible on the child's own body. Baldwin's "suggestion theory" has certain likenesses to "entrainment" thinking (cf. p.1 ff.). The child is stimulated by its surroundings to "climb onto" the communication patterns around it.

Summary

Current research about early ability for imitation is expressed in interactional- or synchronized activity, in intermodal activity, or as purely imitative activity in the new born. This research gives actuality to the concept of suggestion; a congenital social consciousness (Trevarthen 1978, 1981, 1985 and Kugiumutzakis 1985); a "dynamogenetical" relationship between sensory and motor centres (Condon & Sander 1974, Trevarthen 1975, Bower 1985, Meltzoff 1981, Kugiumutzakis 1985); as well as the tendency towards reinforcement of social phenomena (imitation), (Guillaume 1925, Maratos 1973, Meltzoff & Moore 1977, Pawlby 1977, Trevarthen 1978, Dunkeld 1978, Meltzoff & Borton 1979, Field et.al. 1982, Fontaine 1984, Bower 1985).

The advantage of Baldwin's theory for the interpretation of early communication consists in its relating the sensory and motor activity to an innate consciousness and through this giving possibilities for describing the child's interaction with the world around it on an experiential level as well. The child is seen as a "co-actor" in which for the child desirable (recognizable) actions are mixed together with its own experiences and activity. This co-activity is a result of the child's "adualistic" relationship to the world around it, in which the child does not yet separate itself as acting independently (for a discussion of the child's early relation to the world around it, see Holmlund 1985).

Baldwin's imitation concept emphasizes in contrast to behaviouristic thinking (Bandura 1962) the organism's congenital active effort to reproduce stimuli which increase survival possibilites (cf. p. 19) and that therefore the child's first actions are not random in nature or of a "trial-and-error" kind. The early communication can therefore be seen as a consequence of a conscious active co-acting in a social context.

Chapter V

DISCUSSION

The studies which have been referred to above have shown that the child already during the new born period can identify impressions via different sense organs with the help of early non "visible" sensory impressions, such as tactile and kinaesthetic. A communication arises early between different modalities and muscle activities, which make possible an early "synchronization", and an early identity relationship between the child and its surroundings.

What is thus the point of departure itself for a communicative relationship between the child and its surroundings is seen to lie in the fact that from the moment of birth it is equipped with the ability to relate expressions of communicativity in others to expressions of an identical nature in itself. Baldwin's assumption (see page) about a conscious-directed orientating towards the stimuli pleasant for a particular species and an effort bound in phylogenesis to establish these (imitation), gains, through the mentioned research efforts, renewed topicality and value for a developmental view of communication and sociability in the child's early years.

The new born baby's different organs build, as these projects show, a reciprocal *dependence* context and form together a *totality*. The studies can also be compared with the results within nerve physiology, which have been reported as electronic information processes between brain cells within "local circuits" in a dendro-dendritic system (page 9 ff). From these discoveries we should be able to draw the conclusions that "the orchestration" in the child's movements when it listens to speech, as Condon & Sander have shown, is caused by the immediate coupling between nerve cells through the dendrites. Even on the *visual* level it is possible early to differentiate effects of motor and sensory "synchronizations". In my current video analysis it is noted that Maline, while watching an object that is swaying back and forth, at the same time moves her left hand in rhythmical movements upwards and downwards.

These studies which have been referred to indicate that the child is entirely dominated by its sensory impressions through their reciprocal coordination and muscular process. In order for development to take place it seems as though the child's effort must be directed towards separating and identifying these different impressions and activities. Even as adults we can sometimes let ourselves be guided by certain impressions. Special scents, appearances, sounds, make us sometimes react with all ours senses and nevertheless with

changes in our moods and our actions which are not logically motivated. The only reasonable explanation for such a total influence through impressions via one of our senses, as when we listen to beautiful music, recognize a special scent, etc., is that we ignore acquired distinctions of different impressions and return to a primary state of sensory domination. It is in this state that the child is said by Baldwin to stand under the influence of "the suggestion" (cf. page 23).

Bower and Kujawski's experiments aim at specifically studying identification and imitation of the movements of models, which can be achieved with points of light on the moving parts. The results support the discovery of Lewis and Brooks and clarify the importance of the child being able to identify the movements of the models. How is this identification possible? Bower's explanation (Bower 1985) is that the child has a representation of the movements it sees the model make. By a matching process the child identifies the movements corresponding to these representations. The reactions are that their attention, in this case their seeing, is concentrated on the moving pictures which match their conception and that the baby imitates these movements which it can make itself. These movements are reported to the kinaesthetic centres and the consciousness. Bower's explanation is to be looked upon as a strict association theory, in which the motor processes are registred and represented and then make the model against which sensory processes are later matched. What is *primary* and releasing is seen to be the information which the baby gets by the registering of its own movements. This explanation is also to a great extent in accordance with Piaget's view of the child's action schedule being a measuring rod and the grounds for its activities.

Another explanation is to be found in Meltzoff's writings (Meltzoff 1979). He eliminates by his experiments that imitation and intermodality might be the result of either *reinforcement* or *a congenital releasing mechanism*. Reinforcement is made possible by the child being rewarded in some way, e.g. by the mother's smiling, hugging etc., every time it imitates the mother's facial expressions etc. The children which Meltzoff tested were 12 days old, Field's children were on an average 36 hours old, Kugiumutzaki's study showed imitation skills in children younger than an hour. Children so young can hardly have been able to acquire a reperoire of action patterns which has been reinforced by people in their surroundings. Experiments which the children took part in had built in antireinforcement. The adult model was never allowed to give a positive response to imitated action. The facial gesture made by the model was always followed by a passive facial pose. We can thus eliminate that the experiment in itself led to the children's actions being reinforced. The other alternative explanation implies that imitation and intermodal actions are caused by an automaticized congenital behaviour, with instinctual characteristics, as in certain animals. Meltzoff

presents two arguments against this. The first is that the child's imitative behaviour consists not only of one or a few imitative patterns but of several.

> Clearly, one cannot postulate a Lorenzian r easing mechanism for 'imitation in general' and it would be 'ad hoc' in the extreme simply to declare that every new behavior that is shown to be imitated represents another, released response.
>
> (Ibid. page 101)

The other argument focuses on flexibility in imitative activity. The child's imitative actions are self-correcting. The child strives towards better and better agreement between its own and other's actions, by changing its own actions on repeated occations in the direction of greater and greater agreement. The reactions to a so-called releasing reaction in certain animals are, however, stereotype and rigid. The variations in these patterns of action are minimal and not adapted to feedback or changes in the environment.

Meltzoff's view of imitation and intermodality as a congenital ability to match the outer to the inner, is based on the fact that in the individual there is a representative ability present from birth, which is the starting point for both types of actions we mention.

> Instead of seeing mental representation as an outgrowth of sensory-motor imitation, I think representation underlies imitation. In my view, neonatal imitation and intermodal matching are both mediated by the representational capacities available at birth.
>
> (Ibid. page 109)

Bower and Meltzoff who studied the same phenomenon, namely early imitative actions, have a fundamental difference in their assumptions about what it is that makes the starting point in the child's matching of its own representation and the outer model. Bower's outlook beds for a behaviouristic view. Meltzoff's conception holds onto the prospect of a biologically determined action pattern in the initial course of events. Both talk however of the baby's perception as an intermodal process, in which impressions which are arranged via *one* sense organ are also presented as impressions via other sense organs.

This activity is direkted by what Bower calls amodal[1/] variables

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[1/] The concept "amodal variables" is taken from Gibson, J.J. (1968).

(variables on higher levels) which do not register sense-specific elements, but according to Meltzoff "rather utilizes what can be called "supra modal" or "transmodal information" (Meltzoff 1982, page 102).

From what has been said above we may agree that the new born baby not only has the ability to transfer information, which is common to different modalities, from one modality to another (the child's recognition /visual/ of the dummy is conditioned by previous tactile information) but that *this process is recreative. The child strives to establish stimuli through other modalities*. From this it follows that when a child sees a face moving, a body moving, hears speech or rhythmical sound, sees rhythmical movements etc., there occurs a matching between these and other kinematic knowledge. This matching results in motor activity whic! re-established these experiences. The motor activities are the only instruments whith which the child as yet is able not only to control stimuli outside itself but also within itself (e.g. the child tries to control pain by muscle contraction). The identification which a child experiences with, e.g. people in its surroundings, occurs on the basis of the intermodal acitivity, in which the perfect agreement (as in the case of imitation) presupposes advanced coordination between sensory and motor nerve processes. Kugiumuzaki's interesting study shows that imitation already exists at birth and eliminates thus the possibility that imitation might be a learned phenomenon. It also shows clearly that the imitation phenomenon cannot be a form of a "releasing mechanism" which we are able to see in different species of animals (cf. discussion on page). The result of MO and TP would, if imitation has been caused by a "releasing mechanism" have been one and the same. In both MO and TP there is mouth-opening.

That it is not either a question of reflex activity is shown by the child's "successive correcting" of its actions. The existence of imitation during the first six months gives further support to the idea of the imitation's early functional importance.

Even the absence of imitation during certain periods bears witness to the fact that imitation cannot be a question of "releasing activity" or reflex activity. Kugiumutzaki's broadly based study shows also that imitation does not only exist in a few chosen children, who because of their specific intelligence have unique gifts of understanding, but that imitation has a *general* existence and is part of man's "intelligence equipment".

In a longitudinal study of imitation an experimentally designed study is not sufficient. In a natural study however it is possible to see how the imitative movements are integrated and become instruments in the child's communicative actions. In the on-going analysis of video films of Maline's communicative development (Holmlund, in production) an early integration of her imitative actions can be

discerned. The integration of imitation occurs firstly through "anticipation", i.e. imitation of the model even before the model has managed to conduct its model action. The child learns in this phase to recognize the situation in which the imitated model is in action and itself to produce the imitated movement (the sound) without a preceding model. After this comes a phase of "manipulation" in which the child uses an imitated action to express its own purpose or intention.

The devlopment of imitation serves the communicative development and is not only an instrument for the development of representations in speech (Piaget, 1962). In a longitudinal study (Holmlund, 1985) in which Baldwin's imitation theory is applied there is a description of a model which shows the effects of imitation on the child's communicative development.

Baldwin J.M., 1894, Mental development in the child and the race, methods and processes.Macmilland and Co. N.Y.

Baldwin,J.M.,1891, Suggestion in infancy, 1891, Science, 27, 113-117.

Brazelton,T.,1973, Neonatal behavioral assessment scale, Clinics in Developmental Medicin spastic International Medical Publ.

Bandura, A.,1962, Social learning through imitation, Nebraska Symposium on Motivation, 211-269.

Bower, T.G.R., 1985, The development of imitation, Paper presented at the preceedings of A.A.A.S May 1985

Burd, A.P., & Milewski,A. E., 1981, Matching of facial gestures by young infants: Imitation or releasers? Paper pres at the S.R.C.D.,Boston MA

Campell,P.,& Sander,L.W.1979,Mutual regulation of the neonatal-maternal interactive procerss:context for the origins of communication,i Bullowa,M., Before speech.Camebridge University Press,Camebridge.

Condon,W.S.& Sander,L.W.1974,Neonate movement is synchronized with adult speech,Science,183,99-101.

Condon,W.S.1979,Neonatal entrainment and enculturation, i Bullowa(ed)

DeCasper,A.J.&Pfeifer,W.P.,1980, Of human bonding: Newborns prefer their mothers' voices, Science,' 208,1174-76.

Condon,W.S.& Sander L.W.,1974, Neonate movement is synchronised with adult speech, Science, 183, 99-101.

Dunkeld,J., 1978, The function of imitation in infancy, Unpubl. diss.,Univ. of Edinburg.

Field, T., Woodson,R.,Greenberg,R.,& Cohen,D., 1982,.Discrimination and imitation of facial expressions by neonates. Science, 218,179-181.

Fontaine, R., 1984.,Imitative skills between birth and six month,Infant behaviour and Development, 7,223-334.

Guillaume,P.,1925, Imitation in children, The University of Chicago Press, 1971. Chicago.

Gibson.J.J..1968, The senses considered as perceptual systems,Houghton Mifflin, Boston.

Holmlund,C., 1985, Den tidiga kommunikationens betydelse för språkförmågan: En longitudinell studie av ett barns intentionella och imitativa handlingar i kommunikation med omvärlden. Ped. inst. Stocknolms Universitet.

Holmlund. C.. 1986 a) Mentala processer och kommunikationsförmåga: till frågan om genetiska antaganden i Baldwins tänkande.Ped.inst.Stockh U.(under utgivning).

Holmlund.C.. 1986 b), Studier av imitation i Malines kommunikation,0-3 mån, Ped.inst. Stoch. U. (pågående)

Hwang, p.,& Schaller, J.,1983, Det kompetenta spädbarnet, Forskning och Framsteg,3.

Kato,T., m fl 1983, A computer analysis of infant movements synchronized with adult speech, Pediatr Res 17:625-28,

Kugiumutzatkis, J., 1985, The origin, development and function of the early infant imitation.Ph Thesis, Uppsala.

Meltzoff,A., 1982, Imitation intermodal co-ordination and representation in early infancy, i Butterworth,G.,(ed)Infancy and epistemology: An evaluation of Piaget's theory. The Harvester Press.

Meltzoff,A.,& Moore,M.K.1977, Imitation of facial and manual gestures by human neonates.Science,198,75-8.

Meltzoff,A.,& Borton,R.W1979,Intermodal matches by human neonates,.Nature,282, 403-4.

Murray,L,& Trevarthen,C.,1985, Emotional regulation of interactions between two month-olds and their mothers. i Field,T.,&Fox,N.,(eds)Social perception in infantsj.Ablex,Norwood,New Versey.

Pawlby,S.,J.,1977, Imitaive interaction, i Schaffer H.R.,(ed),Studies in mother infant interaction,Academic Press N.Y.

Piaget,J.,1952, Origin of intelligence in children,Norton, N.Y.

Piaget,J.,1962, Play,dreams and imitation in childhood, Norton, N.Y.

Schmitt,F.O..Dev,P.,Smith,B.H.,1976, Electronic processing of information by brain cells,Science,193,114-20.

Trevarthen,C.,& Hubley,P., Secondary intersubjectivity, i Lock,A.,Action,gesture and symbol. Academic Press.1978

Trevarthen,C.,1982, The primary motives for cooperative understanding, i Butterworth,G.,& Light,P.,(eds)Social cognition :studies of the development of understanding, Harvester Press,Brighton.

Trevarthen,C.,1975, The role of midbrain visuo-motor centers in man . i Ingle D. & Sprague, J., Sensorimotor function of the midbrain tectum, Neurosciences Res.Program Bull, 13) Camebridge: Neurosciences Res.Program