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## *Parent-Infant Interaction*

### **Progress in Interaction Models**

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Over the last few years the subject of interaction has progressively become a fundamental theme in psychology not only in psychology - but also in the human sciences, even general biology; in fact one talks of interaction in cellular biology and immunology, of tissular interaction in causal embryology, of early interaction in child psychology, of interaction and communication in animal ethology and human psychology. It seems that all these processes are perhaps not as different from one another as their different fields of study would make it seem; in any case they have a large degree of isomorphism and. perhaps in the not too distant future, we will discover some common formulations and concepts.

It is true we cannot claim this today, and given the title of this meeting, I will cautiously limit myself to the aspects of interaction between parent and child, keeping in mind however, that this is only one example of the regulatory and adaptory activities of all living matter. On the other hand, I will try more in this review to situate the problems and the concepts which appear fundamental than to try to be exhaustive in an area where references have become too numerous to mention. To do this I shall divide my presentation into three sections: the first using an animal model, the second based on several recent observations in humans, the third will consist of a brief discussion.

#### *A Compararative Model: Mother/Infant Interaction in the Rat*

Why the rat ? Because it is a laboratory animal of which the general biology is well known, the behavior is simple, and of which the mother/infant interactions have been particularly studied over the last 2 decades. Moreover, I myself have been taking part in these studies since their commencement in the 1960s.

#### *Ethological Reminder*

At the moment of parturition the female rat builds a nest, practically closed in. where she places her newborn offspring. Her presence in the nest diminishes progressively until about the 20th day (weaning), and the nest deteriorates in a parallel fashion. In the nest the mother carries out the "nursing": care of the offspring, in particular licking and feeding. Outside of the nest she will pick up any lost little one and bring it back to the nest ("retrieving"). As it concerns the offspring: the pups are blind and deaf at birth, have no fur. and their movements are reduced, consisting mainly of crawling. Their mobility gradually evolves, and at about the 12th day, with the opening of the palpebral fissures, the little ones are capable of excursions outside the nest, which become more and more numerous and long-lasting.

Such a picture known for a long time by anyone having manipulated rats could make it seem that everything is simple and the interactions quite limited: the mother, because of her hormonal state, inclines to her maternal instinct, and the little ones are passively placed, because of the nesting and retrieving, in a favourable position for survival. Then with the physical return to normal of the female, and the neurosensorial maturation of the offspring, they both separate at the phase of weaning; in fact a series of observations and experiments have shown rather more subtle processes of which I will quote a few examples.

### *From the Point of View of the Offspring*

Firstly, we should note the active role of the newborn: from birth, in fact, it presents a "burying reaction" [9, 10, 12]. I have thus labelled the tendency of the young to go towards and pass under every object which stimulates the area around the snout: the maximum stimulation being realized by the association of a tactile stimulus with a thermal stimulus.

This reaction permits the offspring to pass under the abdomen of the mother and find the mamilla. Equally, it permits the young to remain with its peers and to thus obtain thermal protection.

The stimulating properties of the newborn are a second fact to be underlined: by its form, its skin texture and its temperature. the newborn elicits the maternal retrieving and nursing. But a chemical stimulation (pheromone) also intervenes: the newborn secretes a substance which is very

attractive to the mother. it seems to activate and focalize the act of licking in the penneal region [6].

Although he appears to be ungifted, the newborn is capable of giving out very specific signals (whether passive or active), and he is capable of reacting in a way just as well adapted to stimulations from the environment by replies which permit him to be in contact with his mother and/or the group. Let us say that he is already capable of using vital information and of organizing his environment.

#### *From the Mother's (and Adult's) Viewpoint*

We have indicated the progressive regression of maternal behaviour from 0 to 90 days: but if one renews the precedent litter by a new one every 2 or 3 days, the maternal behaviour continues indefinitely. On the other hand, a nulliparous female which has never been in contact with newborn, presents at her first contact with them, an indifferent or even aggressive attitude: but a multiparous female delivered by caesarean section at the end of her pregnancy will display completely maternal behaviour immediately after waking up. Moreover, if one persists in putting newborns into contact with a virgin female one observes the progressive installation of maternal behaviour with nest building, retrieving, and nursing (with the exception of course, of breast feeding) [9-11].

These events have since been studied more exhaustively by *Rosenblatt* [9-11] who has well established that maternal behaviour at the moment of parturition is dependent on hormonal factors, but that the continuation of this behaviour is based on the presence of the young animals.

The mother herself gives out different signals, in particular tactile and thermal, but also chemical, and the "pheromonal bond" has been described: olfactive attraction of the offspring towards the mother who secretes a pheromone produced in the caecum and called "cecotrophe" by *Leon* [26]. We could thus say that the mother also possesses a perfectly adapted competence for the offspring.

However, several remarks should be added as to the very multiple effects of interaction. Firstly, interaction assures the feeding of the offspring: but the pups are very immature at birth from a physiological point of view: in particular during the first 10 days their capacity to retain body heat

depends completely on the temperature of the nest which is in itself dependent on the presence of the mother and the group, which thus assure the heat regulation of the young.

The mother and the group are also the permanent source of tactile stimulation of which the trophic role appears to be important. We have thus shown that the animals separated from their mothers for 4 h every day present growth curves and time of opening of the palpebral fissures, which vary according to different experimental conditions: the animals which are given to females with a provoked maternal behaviour, receiving heat and contact, are comparable with the control group (which remains permanently with the mother). Animals which are isolated in a warm environment (warmth but no contact) are less developed than the preceding groups: and finally those isolated with a normal surrounding temperature (no warmth or contact) have the lowest indices. We have also observed the effects of the group on metabolism and its protective role against starvation. These considerations have led us to consider the physiology of the young rat as a "*social physiology*". This notion was developed most recently by the works of Hofer [20]. There seems, therefore, to exist in these interactions exchanges of "visible" stimulations: visual and auditive signals, and others exchanges which are more "hidden": chemical, tactile, thermal, and vestibular. Some of these stimulations elicit immediate or "phasic reactions", but others (and sometimes the same) have more remote effects often linked to cumulative actions: "tonic effects".

Up to now we have indicated middle-term effects: the activating effect on maternal behaviour by the offspring, trophic and metabolic effects of the mother and the group on the offspring, but to this we must also add the more long-term effects: on resistance to aggression [4], on interspecific aggressivity, on emotional stability, etc. This is the important chapter of the effects of "early experience" on the ulterior behaviour of adults [12], and it is also that of the attachment of the little one to his mother, and of the mother to her infant, a well-known phenomenon which I am just recalling.

### *Early Interaction in Human Beings*

Many of the preceding observations and remarks are, at least in part, transposable to human beings. I will underline just two points which appear to be characteristic of the many works undertaken in this domain over the

last few years and which have drawn attention to themselves: which are: (I) the precocious competence of the newborn and (9) the precocious synchronization of the parent-child dyad.

### *Precocious Competence of the Newborn*

One can say that the newborn was, up until the last few years, considered as being very little competent: he was schematically described as being a digestive tube associated with a rudimentary sensorimotor system having the possibility of central integration limited to subcortical reflex activity. **However, this picture is very much changed** today. **Without emphasizing** the prenatal capacities which appear to be more and more certain, it is well established today that newborn children have astonishing aptitudes. They are capable of distinguishing the human voice, of following human forms with their eyes, of recognizing the smell of milk, of coordinating their gaze with hearing a sound, and of moving their hand upon a visual perception.

Their capacity for learning is no less astonishing, quite early on they are capable of operant conditioning and appear to take a "cognitive" pleasure in it, they can also identify the maternal odour from the 3rd day on and recognize the voice of their mother at the end of the 1st week. One can find details of the forementioned in many scientific reviews published over the last years [1, 14, 15, 16, 23, 27, 35]. However, another element appears to be of great importance: these aptitudes are closely tributary to the state of vigilance and motivation of the newborn. They therefore need, in order to be revealed and utilized in an exchange with the mother, a possibility for her to be very receptive to the emissions of the newborn and to be capable of modulating her replies very subtly.

This, therefore underlines the necessary existence of maternal competence in perfect harmony with the competence of the newborn.

### *Precocious Synchronisation of the Dyad Mother-Child*

This translates and results from the conjunction of these two competences. This has been verified by numerous authors under diverse denominations. Let us mention the "Intersubjective dialogue" of *Stern* [32-34], the "primary intersubjectivity" of *Trevarthen* [30], the "biological mirror" of *Papoušek and Papoušek* [27], "the system of reciprocity" of *Brazelton et al.* [2, 3], the "interactional synchronization" of *Condon et al.* [7, 8]. This new accent on interactions seems to be linked to the development of the techniques of

ethological observations: by definition, an interaction cannot be studied on an isolated baby in experimental conditions, but supposes, on

the contrary, a natural or seminatural setting of exchange. These naturalistic observations also benefit from the new technical facilities offered by video recording.

The very numerous observations which have been accumulated over the last few years, therefore, concern development considered not as a linear process which is practically independent of every context, but on the contrary what one can call the "diachronic evolution of the dyad baby-adult".

Interactional synchrony has been particularly described by Condon and Sander [8]. This term was originally applied to conversational interactions between adults [7]. The frame-by-frame microanalysis of sound films of two interactants had demonstrated an interactional synchrony between the movements of the listener and the voice and movements of the speaker.

Now, the observations effected on the dyad mother-newborn with the same methods lead to the same results. There is a very fine synchronization between the organization of the movements of the child and the vocal emissions of the adult from the first days of life. Trevarthen [35] has demonstrated the capacity which develops during the first 3 months to perceive the expression of others and to express his own intentions. This author has demonstrated the great variety of mimics of the newborn as well as the frequent exchange of mimics between mother and child as from the age of 6-7 weeks.

A reciprocal induction of mimics which we shall call "echoization" (in order to avoid the terms of imitation or identification which are too problematic) has given place to many remarks (e.g. the imitation of sticking out one's tongue). This applies just as well to the parent as to the baby - the banal example of mouth opening and lip movements of the mother is classic, she does it spontaneously, when she feeds her child.

But interaction does not necessarily imply mirror imitation ("biological mirror") [27]. The exchanges can be "cross-modal": the baby can react just as well to maternal activity by the emission of a sound, movement of the eyes or of the eyebrows, a smile, or an arm movement, etc. Stern [34] has

underlined the importance of this "affect attunement" which consists of an empathic location of the affective disposition of the partner by an integration which is at the same time vocal, acoustic, and coenaesthetic.

Cuckier-Memeury et al. [17] have insisted, in particular, on the importance of the tonic adjustments of the mother and her child. The temporal dynamics of the question have also attracted the attention of researchers. After Wolff's [38, 39] works on the biological rhythms of development and the temporal organization of the sucking reflex, recent researchers have

brought to the fore the importance of the temporal organization of the exchange between the child and his environment. *Stern* [39] and *Stern and Gibbon* [33] have demonstrated the alternability of episodes of interactional engagements and pauses. Each episode is characterized by its tempo and control of the intensity and the frequency of the stimulations. Thus, the expectations of a rhythmic nature that the baby will test are rendered possible, in relationship to which he will evaluate the deviations. *Brazelton* et al. [2] in observing children from 9 to 94 weeks described the same attention curves of babies in **the presence of an attractive object**, of the mother, and of the father. They showed how their attention fluctuates in cycles (of about 4/min) but also depends on the partner. This "system of reciprocity" provides the child with the necessary information to continue his development and to return to a model **to which we will refer further on**.

Finally, it is fitting to also indicate the more long-term diachronic aspects of interactions. As with animals, one finds, next to the synchronic or "phasic" aspects which we have described until now, diachronic aspects which are "tonic". This brings to the fore the problem of the middle- and long-term effects of interactions, and in this respect one should mention the famous question of attachment illustrated by the well-known work of *Bowlby* [41].

.As a complement, I should like to mention the work by *Klaus and Kennell* [22] on the importance of precocious links ("bonding"). According to their observations, these authors maintain that just after giving birth, the mother is in a sensitive period where she exteriorizes the specific conduct of corporal closeness (touching, caressing, hugging, seeking eye-to-eye contact, etc.) which are as important for her as for her child. If the contact is sufficiently frequent in this initial stage, it influences the ulterior organization of maternal behaviour and at the same time has a beneficial effect on the development of the baby. Thus, mothers who benefited from an intimate

contact with their newborn just after birth had, 1 year later, a more stable an affective contact than the reference group, and at the age of 5 the intellectual coefficient of their children was superior to that of the others.

These findings have been confirmed by the same authors in Guatemala. However, the interpretation of these facts is certainly complex. *Leiderman* [24, 95], in other longitudinal studies, has shown that long-term effects depend on a multitude of factors, amongst which he has isolated the economic status of the family, the sex, and the games played. These factors appear to be just as important as the simple early contact in the critical period, just after birth.

### *Theoretical Models of Interaction*

All models of the child's development in an interactional perspective should take into account both the facts enumerated above, and the conceptual backgrounds on which these observations develop, i.e. the adoption of ethological methods of naturalistic observation and the renewal of contemporary biological conceptions about cellular biology and general ecology, renewal which permits to surpass the classical opposition between what is innate and what is acquired, and which allows the understanding of evolution and vital regulations in ecosystemic terms. To simplify, I should divide the models into two groups which are in fact quite complementary, the first using a more biological conceptualization which I would call an "interactional epigenesis model", the second using a more physical formulation which I would call a "systemic model".

### *Interactional Epigenesis Model*

For the first group I should like to pay homage to Spitz who was a leader in this field. Firstly, in his explicit reference to ethology: in 1968 he wrote in a personal correspondence referring to his work « apart from the psycho-analytical basis, the mode of approach, the way of seeing the problems are tightly linked to those of the ethologists'»: and he knew Lorenz

whom he visited on several occasions. He was also a forerunner as concerns reference to developmental biology: his concepts of "critical periods" and his theory of "organizers" are well known, but we have less knowledge of his first formulations on this topic, entitled "a genetic field theory of ego



formation" [31 ], where he uses the discoveries done in the field of causal embryology, in particular by Spemann [43], Waddington [44], and Weiss [45]. The notions of induction and organization, of critical periods, of cellular and tissular competence (which Spitz [31] called "compliance") have been reinforced since his time, and the notion of epigenesis which resulted has imposed itself upon the field of developmental biology.

We know the famous experiment by Spemann [41]: if one removes a fragment of the upper lip of the blastopore of a young amphibian gastrula, and if one implants it in the ventral wall of another embryo of the same age, this transplant induces a new development of the surrounding regions: the ectodermis which 'normally' would have given an ordinary cutaneous epiderm will transform itself into a neural plate, then it induces the development of an axial system and a neural tube.

The blastoporal organization has revealed by its induction the competences of the ectodermic and neurodermic tissues. One could describe in this way the complementary chain inductions: primary and secondary inductions, etc. The developmental chains are also composed of reciprocal inductions: the induced tissue can in its turn influence the organizer tissue, etc. I shall not insist today on these well-known phenomena, at each stage the tissues present a certain competence which depends on their genetic code and their history, and their evolution will thus depend on the inductions of neighbouring tissues, on which they often play a role of inductor. It is thus by these processes of successive and reciprocal inductions which are now known under the name of "epigenesis", that the organism will constitute itself in all its complexity and realize the somatic phenotype.

We know that *Spitz* [31], when applying this embryologic model to psychical development, proposed a series of organizers: a primary organizer, the pre-object of which the index is the interactive smile of 3 months, a secondary organizer, the libidinal object of which the index is the reaction of the fear of strangers of the 8-month old, and a tertiary organizer: the language linked to the semiotic function, of which the index is "negation" (gestural and verbal). For *Spitz* [31 ] this evolutive organization results from the interaction of maturation and psychical development, the latter under the action of the organizers which are fundamentally relational in nature.

In a general way. one could say that contemporary studies have amply confirmed and spread the way opened by *Spitz*, permitting, however, the precision of certain aspects and to give a formulation which is more satis-

fyng and probably more exact by a better control of homeostatic models and a more fine appreciation of interactive processes.

From birth the anatomophysiological structures of relational systems present a certain level of competence. But the revelation and the development of this competence necessitates the participation of environmental organizers - the revelation of neonatal competences,. their organization and their perpetuation are induced and shaped by the parental activities, these activities being themselves induced by the child's. This evolutive transactional spiral constitutes a model which converges at the same time with the conceptions of the neurologists [5,21] and the genetic psychosociologists [18,28], the former drawing attention to the neuronal and neurosensorial development, the latter to the construction of the cognitive ability, all in relation to interactions with the human environment.

The feedback model of gratification by *Brazelton and als* [3] constitutes an illustration of these conceptions. For these authors the child has the

capacity for homeostatic control of its systems of " input" and "output", he can refuse or search the stimuli in agreement with his internal needs. With the help of this control system he can perceive and use the social signals to prolong his moments of attention. The parents themselves have the competence to adapt to this function. Also, thanks to this system of mutual feedback, the baby and the parent enlarge the limits of the two systems of the child: (1) his system of reaction and assimilation and (2) his system of protection and recuperation.

In this way, the autonomy of the child will manifest itself and become integrated: the parent permits the baby to give out his own signals, and this thus reinforces the baby's sense of competence in his possibilities to voluntarily control his environment. This general model covers the numerous facts observed in mammals as well as in humans [12].

### *Systemic Models*

In order to be clear, I have separated these models from the precedent ones, but in fact they are not only compatible but often related to them. Certain authors such as Wertheim [36,37] model epigenesis in an explicitly systemic conceptualization. Thus, the family is a system F.A., composed of several subsystems: mother-child (MC), father-child (FC). mother-father (MF). The family system (FA) is defined by the relationships which exist between the

subsystems MC, FC. and MF. Each subsystem is itself defined by its relationships with the components of its subsystems: for example MC is defined by its relationship with its subsystems mother (M) and child (C).

Thus, we are confronted by a complex and orderly network composed of at least three hierarchical levels: the family, the dyads, the individuals. and according to the basic principal of system theory, each modification of one of its components will have an effect on the whole of the system.

The team from the "Centre d'Etude de la Famille" from Lausanne has precised several characters of the subsystem parent-child, in particular with the notion of "context" [19].

Three levels of exchange can thus be described in the dyad: the postural level ('holding') being the context for face-to-face interaction (mimic and gaze), itself being the context for dialogue. The parental behaviour assures the constance of exterior fields and offers in the case of families with normal exchanges a context which is sufficiently stable, predictable, variable, and adjusted to be capable of framing the child's activity and to permit his normal development. The study of families with pathological transactions

has allowed these authors to precise, thanks to their model, the different points of weakness in interaction and to propose various techniques to measure and characterize these weaknesses at different levels.

I shall not insist any longer on this very elaborated model, of which the application seems promising, in particular by the extension of the concept of framing to the formalization of the therapeutic and paedagogic relationships.

### *Conclusion*

A lot remains to be said about this important, ever-evolving subject of early interactions and their models. But **some notions should** be mentioned again in conclusion: (1) the notion of social physiology and homeostasis which implies those of complementary infantile and parental competences: (2) the notion of reciprocal evolutivity of this double set of competences which allows for the development of the child's behavioural phenotype, and (3) the double determinism of this phenotypical construction under the action of somatic maturative organizers linked to the action of environmental organizers.

These few notions largely developed by very numerous contemporary authors allows us to envisage the child's development in a process of interactional epigenesis which finally probably surpasses the old and very difficult problem of the relationship between innate and acquired characteristics.

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